Attachment A: Shotover WWTP Disposal Short List Options Report

Short List Report

Shotover WWTP Disposal Field Alternative Discharge

Queenstown Lakes District Council

25 November 2025

→ **The Power of Commitment**

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The Power of Commitment

Executive summary

Purpose

This report outlines the short list of options that were considered for the disposal of treated effluent from the Queenstown Lakes District Council (QLDC) Shotover Wastewater Treatment Plant (WWTP). The report also summarises the process and methodology that was applied to assess the options using a Multi Criteria Analysis (MCA) framework and to identify the preferred option to be further developed and refined.

This report is subject to, and must be read in conjunction with, the position statement of Kāi Tahu in Section 9, the limitations set out in Section 1.3 and the assumptions and qualifications contained throughout the Report.

Background

The QLDC Shotover WWTP treats wastewater from the wider Queenstown urban area. The existing treatment process includes inlet screens, Modified Ludzac-Ettinger (MLE) reactors, clarifiers, sludge treatment system, UV treatment and disposal. The plant has recently (October 2025) been upgraded with a second MLE reactor tank and clarifier.

Currently, a small portion of wastewater is processed through the existing oxidation pond system rather than the MLE and clarifier system, with effluent from both systems combined prior to UV treatment and disposal. This practice is anticipated to conclude by the end of 2025, at which point the oxidation pond system (Ponds 2 and 3) will be decommissioned. Once these ponds are removed from service, a significant improvement in treated effluent quality is expected.

Before March 2025, the treatment plant discharged effluent via a Dose and Drain (DAD) disposal field on the Shotover delta, south of the WWTP. Commissioned in 2019, the field experienced significant performance deterioration and several instances of non-compliance. After multiple abatement and infringement notices, the Otago Regional Council (ORC) applied for an enforcement order in January 2025, agreed by consent and subsequently issued by the Environment Court in June 2025. The enforcement order requires that consent for a long-term effluent disposal solution is lodged by May 2026. It also stipulates that engineering design for the selected option be completed by 31 December 2027, with construction and implementation by 31 December 2030.

Due to the significant environmental issues and failures with the DAD disposal field, including increased ponding that led to a rise in waterfowl numbers within the ponded areas and an associated bird strike risk for airport operations, immediate steps were taken to reduce this risk. As such, emergency works were undertaken on 31 March 2025 to commence the discharge of treated effluent through the historic discharge channel to the Kimi-ākau/Shotover River under section 330 of the Resource Management Act 1991 (RMA).

Accordingly, as required by section 330A a short-term (5-year) resource consent application to ORC for discharge of treated effluent to the Kimi-ākau/Shotover River was lodged in April 2025 and is currently (as of November 2025) being processed by ORC before referral to the Environment Court. QLDC is seeking that this short-term consent be processed via direct referral to the Environment Court and is currently awaiting ORC's report under section 87F of the RMA.

QLDC commenced the business case including investigations and option development for a new long-term disposal solution in October 2024 (this project). The disposal solution will replace the current effluent discharge to the Kimi-ākau/Shotover River and will cater for the long-term effluent disposal requirements (to Year 2060). QLDC's Long Term Plan (LTP) has allocated $77.5M in funding for the replacement disposal field solution.

QLDC engaged GHD to develop the alternative discharge solution for treated effluent. LandPro are engaged by QLDC as the specialist planner for this project. Additionally, Aukaha and Te Ao Mārama (TAMI) are representing the iwi partners in this project.

Options development

The following diagram describes the options development process.

A comprehensive list of potential solutions (options) was developed at the beginning of the project, in late 2024, covering possible disposal methods and discharge locations. This list was refined by excluding options with obvious constraints or fatal flaws (aside from options considered fatally flawed by iwi, discussed below). The assessment considered constraints which included: distance from the WWTP, residential zones, geology, slope, distance from water supply wells and surface water locations, funding availability, legislative standards, and other considerations. Rationale for this is recorded in the Long List Options Report (GHD, 2025). The development and preliminary refinement of these options produced a long list of 13 options.

MCA framework

The long list options were assessed by iwi representatives and technical specialists using a Multi Criteria Assessment (MCA). The MCA enables a wide range of aspects to be taken into consideration in evaluating options and provides a holistic assessment of options, considering different technical, economic, social and environmental factors.

The framework was developed in February 2025 and agreed by QLDC, Aukaha, Te Ao Marama, LandPro, and GHD. The long list options were assessed by technical specialists against the criteria as defined in the Long List Report. This framework was updated during the short list workshop (October 2025), agreed by QLDC, LandPro, and GHD; and this is documented in the MCA Framework located in Appendix C. The changes included updates to the critical success factors to better incorporate the achievability of the options and ability to meet timeframes. The framework and short list assessment criteria are shown in Table i below.

Table i   MCA framework summary

	Criteria
Investment Objectives	IO1 - The health and well-being of the surrounding waterways are maintained, protected, and improved where practicable to support water quality.
	IO2 - The disposal of treated wastewater aligns with tikanga as guided by mana whenua.
	IO3 - Ability to service the community’s and visitor wastewater needs now and into the future up to the equivalent flows projected for 2060.
Social and Environmental Factors	S&E1 - Mō tātou, ā, mō kā uri ā muri ake nei / For us and our children after us.
	S&E2 - Cultural impacts to sites of significance and access to sites for cultural activities.
	S&E3 - Impacts to the surrounding environment.
	S&E4 - Environmental impacts to surrounding catchment land, soil and groundwater.
	S&E5 - Visual effects.
	S&E6 - Amenity effects.
Critical Success Factors	CSF1 - Constructability and technical feasibility.
	CSF2 - Sustainability - Carbon emissions and sustainable use of resources supporting organisational goals.
	CSF3 - Operational reliability and maintainability.
	CSF4 - Property difficulties and impacts.
	CSF5a – Achievability of indicated outcomes.
	CSF5b – Consent, design, construction, and implementation timeline.
	CSF6 - Costs and affordability.

Long list options workshop and refinement to short list options

An MCA scoring workshop was held in person at QLDC on Thursday, March 13th, 2025, with key representatives from QLDC, Te Ao Mārama (TAMI), Aukaha, LandPro, and the GHD project team. The workshop presented the initial MCA scores, gathered input from the workshop group, and confirmed the short list options. Following the workshop, further information was provided by GHD on some of the options to enable final scoring and selection of the short list of options.

The long list options were initially refined down to five options (plus a Base Case for comparison) to carry forward to the short list stage (this report), as follows:

- Option 4b: Land flow path to Kawarau River (Short list Option A)
- Option 7a: Subsurface Wetland on the Delta (Short list Option B)
- Option 5a: Deep well injections on Frankton (Short list Option C)
- Option 8a: Well Point or Soak holes on Frankton (Short list Option D)
- Option 2e: Moderate rate land disposal to Airport and surrounding area (supplementary option).

Short list options additional refinement

After the long-list MCA assessment and identification of five short list options, the project team advanced these options by conducting additional desktop analysis, engaging with landowners, performing modelling, and making further refinements. Technical assessments were carried out to review relevant assumptions and considerations, including potential constraints, to refine the shortlist of options. This process occurred before developing component sizing and included the following steps:

- Reviewing the land availability at the Frankton Flats area
- Determining areas potentially available for irrigation at Frankton Flats
- Calculating the probabilities of disposal capacity of bore and soak holes at Frankton Flats via statistical modelling
- Determining additional treatment requirements related to bore and soakhole disposal options on Frankton Flats
- Considering effluent reuse opportunities
- Confirming potential disposal locations on the Kawarau River
- Considering the influence of the Kimi-ākau/Shotover training line and revetment on flooding and basis of design of these features.

Further assessment of the short list options concluded that limitations on the aquifer capacity to accommodate wastewater disposal coupled with constrained land availability meant that there was very low confidence that a stand-alone land based disposal option could be achieved in the Frankton Flats area. All the Frankton Flats land-based options would need to be combined with a river discharge to be able to meet the required future flow rates and would need to be staged with a trial process initially before full development.

The following table presents the refinement of the short list options based on the ability to consent the option in the available timeframes, and the current understanding of disposal capacity. In respect to the Kāi Tahu position, the land disposal options were all considered to be partial solutions that could not be assessed independently of a river discharge.

Table ii Short list option refinement

Options as presented for long list	Suitable as a standalone option	Short list option refinement
Option 4 a – Land flow path to Kimi-ākau/Shotover River	No. Current case of Shotover River discharge, is retained for comparison purposes only	This is the Current Case and used as the base case for short list comparative scoring
Option 4 b – Land flow path to Kawarau River	Yes	**Option A –** Disharge to water via land flow path to Kawarau River. Includes supplementary option of recycled water for reuse.
Option 7 a – Subsurface Wetland on Delta with disposal to Kawarau River	Yes	**Option B –** Disharge to water via subsurface wetland and land flow path to Kawarau River. Includes supplementary option of recycled water for reuse.

Options as presented for long list	Suitable as a standalone option	Short list option refinement
Option 5 a – Well injections Frankton	No – further investigations are required to provide an understanding of the groundwater. Staged approach needed	**Option C –** Partial discharge to land via boreholes at Frankton with remaining flow to river via wetland. Includes supplementary options of recycled water for reuse and sports field irrigation.
Option 8 a – Soak holes Frankton	No – further investigations are required to provide an understanding of the groundwater. Staged approach needed	**Option D –** Partial discharge to land via soakholes at Frankton with remaining flow to river via wetland. Includes supplementary options of recycled water for reuse and sports field irrigation.
Option 2 a – Moderate rate land disposal Frankton	No – there is insufficient land available. Only suitable as a supplementary option	This disposal solution is included as a supplementary option as part of Option C and D for irrigation of sports fields and golf course.

Common elements

Following the shortlist options confirmation and refinement process, there are items that are now common to all the options. These include:

- **Calamity pond:** For storage of treated effluent during adverse events. This is not in the scope of this project but is underway as a stand-alone project; though is important to note as there is integration with it and the proposed infrastructure in this project (i.e. tertiary filters).
- **Tertiary filters:** Tertiary filtration will improve the effluent quality in terms of suspended solids and clarity, prior to it being disposed of. This is separate to the membrane filtration required for land disposal options.
- **Reuse:** A recycled water supply collected by water tankers for dust suppression is included as a supplementary option. It is not required for treated effluent disposal to occur; however, it can be added to all solutions to provide the benefit of reuse. Currently all options have been costed to include recycled water, though it should be noted that if this is deemed not commercially viable (i.e. insufficient demand) or cost effective, this would not be undertaken.
- **Discharge to Kawarau River:** The currently proposed common discharge method to the Kawarau River for all options is a land flow path or rock outfall. This is a structure located on the delta that allows the treated effluent to pass through and disperse into the Kawarau River. It is intended to provide aeration and land contact prior to the effluent entering the river. It is recognised that this form of land contact is inadequate to meet the cultural requirements for a land-based discharge as requested by iwi.

  Alternative discharge method: An alternative solution to the land flow path is a submerged diffuser pipe which offers several advantages, including greater separation of public from the point of discharge, enhanced mixing, greater resilience to flood flows, and reduced visual impact. The costs would likely be similar to the rock outfall, and the final selection of the preferred discharge method will be determined during the decision-making process in consultation with Council, the community, and iwi stakeholders.

Option A

Option A, indicatively illustrated in Figure i, includes tertiary filtration, 1.35 km conveyance via a pipe (or suitable alternative) and a land flow path (rock outfall) to the Kawarau River. This option is expected to comply with the proposed draft national wastewater environmental performance standards[1,2] as presented for consultation by Taumata Arowai in March 2025.

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[1] https://www.taumataarowai.govt.nz/assets/Uploads/Wastewater-consultation/Information-Sheet-Proposed-discharge-to-water-wastewater-standard.pdf?vid=3

[2] The final standards were issued in November this year and will come into effect on 19 December 2025 (with the exception of regulation 8 and Part 2 which will come into force in December 2028). This report was prepared prior to the release of the final standards and therefore does not take into account any changes since the March 2025 proposed standards.

This option has lower capital and operational costs compared to other options and involves less technical complexity and fewer risks. The required infrastructure is wholly on QLDC land and is expected to be able to be designed and delivered within the required timeframes.

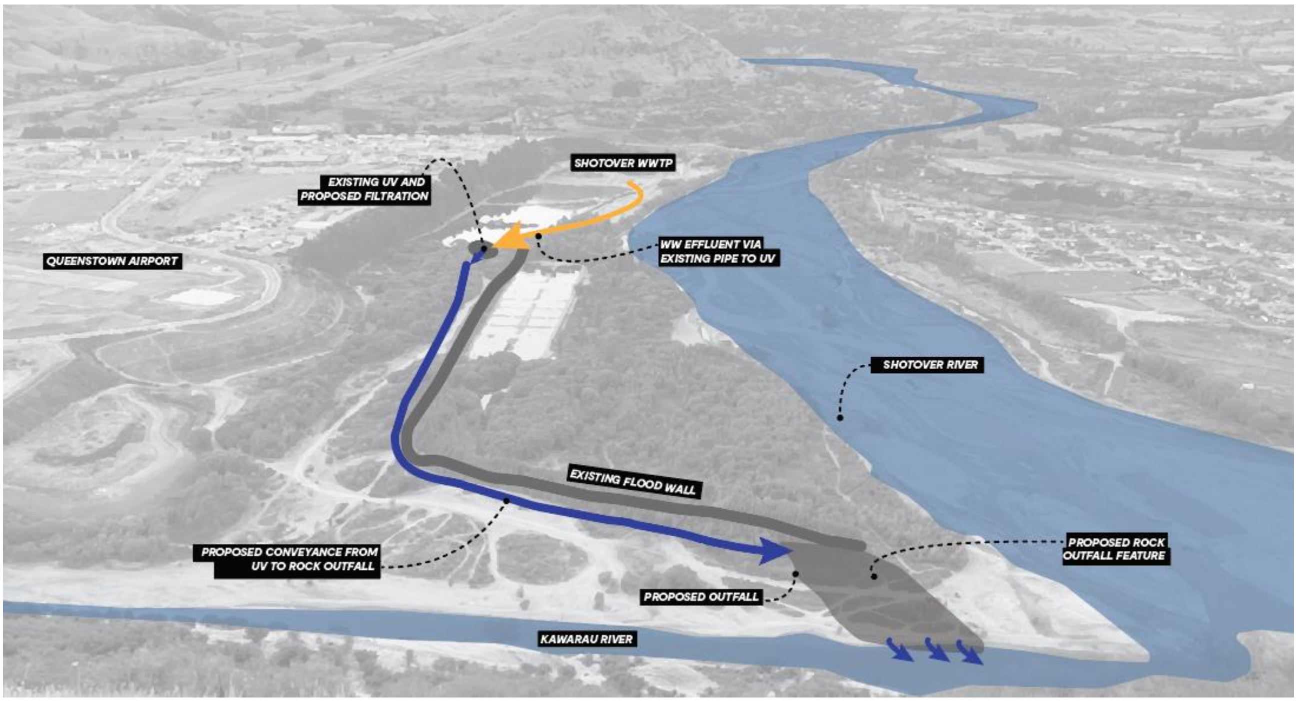

Figure i ***Option A indicative sketch***

Option B

Option B, indicatively illustrated in the following figure, includes tertiary filtration, pipeline conveyance to a 3 ha subsurface wetland, 550 m conveyance via a pipe (or suitable alternative) to a land flow path (rock outfall) to the Kawarau River.

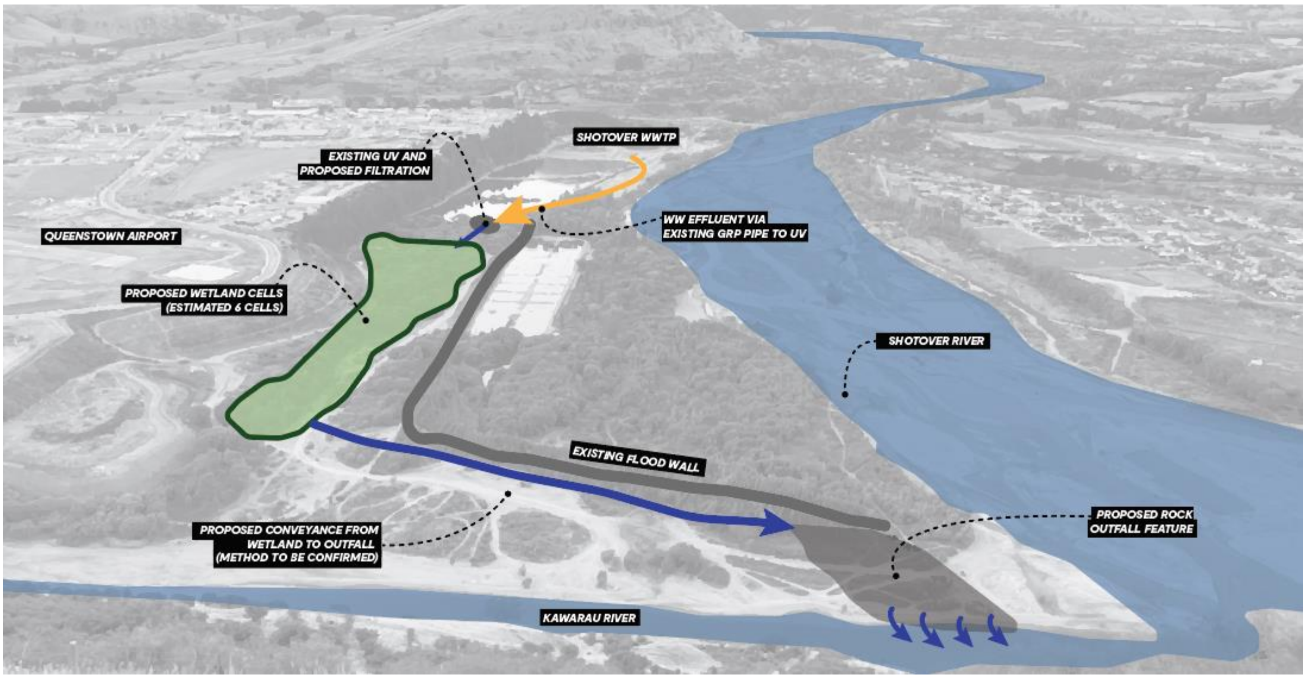

Figure ii ***Option B indicative sketch***

The option includes a horizontal flow subsurface wetland in the area south of the UV outlet. The purpose of constructed wetlands is to provide land contact (as opposed to a land-based discharge as requested by iwi), and is located between the tertiary treated effluent (from the UV) and the land flow path (rock outfall) discharge to the Kawarau River. Although the wetland is not required for treatment purposes, the constructed wetlands utilise biological processes to further polish already highly treated effluent quality prior to discharge.

The use of subsurface wetland avoids the risk of contact with treated wastewater. The effluent will enter via the inlet forebay and percolate horizontally beneath the surface through the rock media within the plant root zone. Beyond the forebay, surface water will not be visible under normal operating conditions.

The wetland will have the ability to operate all year round and the flexibility to take one cell offline for maintenance if required. Plant species will be determined at preliminary design phase, with an invitation for input from mana whenua and stakeholders and would be selected to minimise birdlife.

Boardwalks and other amenity features could be added to further enhance the aesthetic and recreation value of the wetlands and the delta.

This option is expected to comply with the proposed national wastewater environmental performance standards as consulted on in March 2025. The option has relatively low technical complexity or risks. Capital and operational costs are considerable and could possibly be staged relative to the flows. The required infrastructure is wholly on QLDC land and is expected to be able to be designed and delivered within the required timeframes.

Note: As for all options, the discharge method to the river was assumed to be a rock outfall for the cost estimating and scoring assessment.

Option C

Option C considers the disposal of wastewater to land via boreholes in the Frankton Flats area. A staged approach is required to determine if disposal capacity can be achieved.

During the Stage 1 trial period, a large portion (80%) of the 2030 average daily flow of treated wastewater would be disposed of as outlined in Option B. The remaining volume (3,200 m^3/d) would be managed through deep bore discharge, irrigation, and recycled water reuse.

If the trial demonstrates that substantial disposal of wastewater via boreholes is achievable in the long term, Stage 2 will proceed. For the long-term Stage 2, part of the 2060 average daily flow of treated wastewater would continue to follow Option B to the river (11,900 m^3/day). The balance (14,100 m^3/d) would be disposed of via deep bore discharge, irrigation, and recycled water reuse. These flows are based on the assumption that 12,500 m^3/d is able to be disposed of via the boreholes, which was estimated to have a 25% probability of achieving.

This includes:

- A containerised membrane filtration plant to produce a very high-quality treated effluent in the short term and new permanent membrane filtration system within a new building in the longer term.
- For Stage 1, transfer pumps and approximately 3.2 km pipeline to two 400 kL storage tanks located in Frankton Flats (Northern location and Southern location) in the short term. For Stage 2 an upsized transfer pump-set and a second rising main with a larger diameter to the existing and an additional storage tank in Frankton Flats (Southern location). The tanks will include connections to the soakholes and existing irrigation infrastructure at the sports fields and golf course.
- 2 bores in Stage 1 for the short term and increasing to 10 bores in the long term (nominal allowance and subject to successful investigations and trials). Note: the location and total number of the bores is not confirmed, but assumed to be dispersed across southeastern areas of Frankton Flats, using QLDC land such as road reserves.
- Additional UV treatment and storage in two smaller 30m^3 tanks will provide reuse water for dust suppression.

If Stage 1 demonstrates that Option C is not feasible then disposal would revert back to Option B.

Option D

Option D considers the disposal of wastewater to land via boreholes in the soakholes area. A staged approach is required to confirm if disposal capacity can be achieved.

During the Stage 1 trial period, a large portion (86%) of the 2030 average daily flow of treated wastewater would be disposed of as outlined in Option B. The remaining volume (2,100 m^3/d) would be managed through soakhole discharge, irrigation, and recycled water reuse.

If the trial demonstrates that substantial disposal of wastewater via soakholes is achievable in the long term, Stage 2 will proceed. For the long-term Stage 2, part of the 2060 average daily flow of treated wastewater would continue to follow Option B to the river (11,900m^3/day). The balance (14,100 m^3/d) would be disposed of via soakhole discharge, irrigation, and recycled water reuse. These flows assume that 12,500 m^3/d is able to be disposed of via the soakholes, which was estimated to have a 13% probability of being achieved.

This includes:

- Containerised membrane filtration plant to produce a very high-quality treated effluent in the short term and new permanent membrane filtration system within a new building in the longer term.
- For Stage 1, transfer pumps and approximately 3.2 km pipeline to two 400 kL storage tanks located in Frankton Flats (Northern location and Southern location) in the short term. For Stage 2 an upsized transfer pump-set and a second rising main with a larger diameter to the existing and an additional storage tank in Frankton Flats (Southern location). The tanks will include connections to the soakholes and existing irrigation infrastructure at the sports fields and golf course.
- Two test soakholes in Stage 1 for the short-term and increasing to 50 soakholes in the long term (nominal allowance and subject to successful investigations and trials). Note: the location and total number of soak holes are not confirmed but assumed to be dispersed across southeastern areas of Frankton Flats, using QLDC land such as road reserves.
- Additional UV treatment and storage in two smaller 30 m^3 tanks will provide reuse water for dust suppression.

If Stage 1 demonstrates that Option D is not feasible the option will revert back to Option B.

Cost Summary

Cost estimates were prepared by Alta Consulting Limited for each option. The estimates were prepared to Class 4 requirements[5] and have an expected accuracy range of -30% to +50%. The following table summarises the capital and operating costs for each option.

Table iii Cost summary

	Option A Land flow path to river via Kawarau	Option B Wetland on Delta + Land Flow Path to Kawarau	Option C Boreholes at Frankton (+ Option B)	Option D Soakholes at Frankton (+ Option B)
Stage 1 Construction Cost	$33 to 38 M	$64 to 73 M	$97 to 111 M	$96 to 109 M
Stage 2 Construction Cost (applicable to Option C and D only)	-	-	$51 to 58 M	$70 to 80 M
Consent, investigations, and design (includes both stages)	$6 M	$7 M	$17 M	$17 M
Total CAPEX (P50 to P90)	**$39 to 44 M**	**$71 to 80 M**	**$165 to 186 M**	**$183 to 206 M**
Estimates annual operating cost including Stage 2 (-10% to +30%)	**$320 to 460k**	**$430 to 620k**	**$1.4 to 2.1M**	**$1.5 to 2.2M**

Note: The Cost Estimate has been prepared for the purpose of options comparison and must not be used for any other purpose. Once the preferred option is selected, further investigations and preliminary design will be undertaken to develop the preliminary cost estimates of the selected option.

[5] Association for the Advancement of Cost Engineering (AACE) Class 4 estimates, typically prepared for option comparison purposes.

Kāi Tahu involvement in short list MCA scoring workshop and Rūnaka statement [6]

Rūnaka, through their representatives from Aukaha and Te Ao Marama Inc retained their position that they could not support any options that continue to rely on a discharge to the Shotover or Kawarau River. As the MCA scoring process for the short-listed options does not allow exclusion of those options on the basis of the cultural concern (as reflected in the earlier 'fatally flawed' scoring), both Aukaha and Te Ao Marama Inc questioned the appropriateness of the MCA methodology for the short list assessment. Although Aukaha and Te Ao Marama Inc provided commentary on the short list options relating to each scoring criteria, they chose not to participate in the 8th October 2025 Short List MCA scoring workshop as by that stage it was clear that the short list land based options were not feasible on their own and mana whenua had determined that all options were therefore fatally flawed. The implication of this was that a numerical score could not be assigned against factors relating to tikanga and cultural impacts .

Due to the difficulties of reflecting the Kāi Tahu position through a scoring approach, Aukaha and Te Ao Marama requested the opportunity to include a clear statement endorsed by the seven Kāi Tahu papatipu rūnaka with interests in the Kimiākau/ Shotover and Kawarau rivers and the greater Whakātipu area. Their position statement is included in this report and will be used in subsequent briefings that will be prepared for the Council. Aukaha and Te Ao Marama Inc have restated their position that they do not support any options that continue to rely on a discharge to the Kimi-ākau/Shotover or Kawarau Rivers. The full statement is provided in Section 9 of this report and includes the following points:

1. Kāi Tahu consider the direct discharge of human waste to natural water unacceptable from the perspective of cultural values.
2. The Kawarau and Kimiākau/ Shotover rivers are culturally significant to Kāi Tahu, with long held associations reflected in ancestral trails, mahika kai and nohoaka entitlements.
3. Since at least 1998 Kā Rūnaka have expressed:
   - their opposition to wastewater discharges to the Kimiākau/ Shotover River;
   - their preference for land-based discharge; and
   - their view that the Shotover Delta is an unsuitable location for land disposal.
4. The position of Kā Rūnaka is that a more holistic investigation of wastewater needs and alternatives for Queenstown is required that is not constrained by continuing to rely on treatment at this location.

Short list assessment MCA framework

Overall, the assessment approach undertaken for the short-list assessment was the same as the long-list scoring process, except for the following changes.

- Following feedback at the short-list MCA scoring workshop, there were two changes to the criteria used in the final short list assessment.
  - For the long-list assessment, a criteria called 'Implementation Timeframe' was used, this has been updated to 'Consent, Design, Construction, and Implementation Timeframe' criteria to better reflect the consenting and design timeframe requirements.
  - During the short list option development, the ability to achieve the required flows became an increasingly important factor. As a result a new criteria named 'Achievability of Indicated Outcomes' was developed and used in the short list assessments.
- The fatally flawed score has been removed for the short list assessment scoring system. Short list options were only included if they could feasibly be implemented and are expected to meet the proposed wastewater environmental performance standards and other relevant policies. In respect of the Kāi Tahu position, the land disposal options were considered to be partial solutions that could not be assessed independently of a river discharge. Therefore iwi considered all short list option unacceptable and the iwi based criteria have not been scored.

[6] Provided by Aukaha and Te Ao Marama Inc, on 28 October 2025

- At the long-list stage, the MCA assessment was compared against a base case where the DAD was operating as designed. During the project period, the wastewater discharge was changed to redirect flow through an existing channel into the Kimi-ākau/Shotover River. After discussions at the shortlist MCA Workshop, the base case used for scoring during the Short List MCA assessment was updated to reflect the current short-term discharge. This current case was included for comparative scoring purposes only.

Short list assessment summary

The following table summarises the scores for the different options with the comparator base case being the current discharge to the Kimi-ākau/Shotover River. As stated earlier, the three criteria relating to Kāi Tahu values have not been scored. All short list options are considered by Aukaha and Te Ao Marama to be culturally unacceptable and they do not support any options that continue to rely on a discharge to the Kimi-ākau/Shotover or Kawarau Rivers. Aukaha and Te Ao Marama have each provided commentary about the options in relation to the criteria which is contained in the report. The short list assessment scores are provided in Table iv below.

Table iv Short list assessment summary

Criteria	**Base Case** Current short-term discharge to Shotover River	**Option A** Land flow path to Kawarau	**Option B** Wetland + land flow path to Kawarau	**Option C** Boreholes at Frankton (+ Option B)	**Option D** Soakholes at Frankton (+ Option B)
Investment objectives					
The health and well-being of waterways	0	2	2	3	3
Alignment with tikanga	No score	No score	No score	No score	No score
Ability to service future wastewater needs	0	2	2	2	2
Environmental and social impacts					
For us and our children after us	No score	No score	No score	No score	No score
Cultural impacts	No score	No score	No score	No score	No score
Impacts to the surrounding environment	0	2	2	2	2
Environmental impacts	0	2	2	1	1
Visual effects	0	-1	0	-1	-2
Amenity effects	0	0	1	1	1
Impacts to the surrounding environment					
Constructability and technical feasibility	0	0	0	-2	-3
Sustainability	0	-1	-2	-4	-4
Operational reliability and maintainability	0	1	0	-2	-3
Property difficulties and impacts	0	0	0	-2	-3
Achievability of Indicated outcomes	0	2	2	-3	-4
Consent, design, construction, and implementation timeframe	0	1	-1	-3	-3
Costs and affordability	0	-1	-2	-4	-5

Investment objective summary

All options, as described are an improvement on the Current Case and the health and wellbeing of the waterways. These improvements are reflected in the scores with +2 (Options A and B) and +3 (Options C and D).

All options received a score of +2 for the investment objective in relation to the ability to service the required flows in the longer term.

Environmental and social impacts (effects) summary

Three effects criteria (impacts to the surrounding environment, and environmental impacts to surrounding catchment land, soil and groundwater, and amenity effects) had similar scores (within 1 point) across each of the options. These effects are all considered manageable and in some cases an improvement on the current short-term situation. For the visual effects criteria Option B scored highest (0) with options A and C (-1) having minor negative effects and Option D (-2) with more effects. These criteria are not considered to be key differentiators in the decision-making process but are important to acknowledge and understand in relation to the consent process and how to improve or mitigate these during the design, construction and operational phases.

Critical success factors (design, delivery and operation) summary

Options A and B received neutral scores for constructability, reflecting the use of established methods such as land flow paths and constructed wetlands. In contrast, Options C and D scored negatively as they carry uncertainties around disposal capacity and require further investigation.

From a sustainability perspective, Options C and D are the least favourable, scoring -4 due to additional pumping and chemicals related to membrane filtration treatment. Option B also has impacts due to material use (-2), while Option A is only marginally less sustainable than the current short-term situation (-1). Option A scored positively for operational reliability (+1), which requires less operations and maintenance input. Option B is comparable to the current short-term situation, while Options C (-2) and D (-3) demand more operational input.

In terms of property impacts, Options A and B scored neutral, with infrastructure located on QLDC-owned land. Options C and D scored negatively as multiple landowner approvals are required. Achievability of outcomes is highest for Options A and B (+2), which offer higher certainty in meeting the desired disposal capacity. Options C and D are far less reliable with low certainty in being able to achieve the target disposal volume. Low disposal levels would either require additional costs to dispose the indicated levels on Frankton Flat or the volumes would be increased through the wetlands to the Kawarau River. Delivery timeframes are most favourable for Option A (+1), which is likely to meet the December 2030 deadline. Option B is still within the timeframe. Options C and D, while operational by 2030 in Stage 1, will take much longer as an overall programme to complete (-3).Cost and affordability show that Option A has higher whole of life costs to the current short-term situation with a score of -1. Option B incurs further increase in whole of life costs (-2), while Options C (-4) and D (-5) are significantly higher.

Weighting scenario summary

To assess the robustness of the short list outcomes, seven sensitivity tests were undertaken. Each test involved adjusting the weightings applied to the MCA framework to explore how different emphases on criteria influence the ranking of options within the short list assessment. Due to there being no scores associated with the three criteria based on Kāi Tahu cultural values, these sensitivity tests should be considered alongside the position statement of Kāi Tahu on short list options (Section 9) and the commentary in that statement provided for each of the options. Table v below summarises the rankings of the options using the sensitivity tests.

Table v Weighting scenario summary for short list options

Scenario	Option A Land flow path to Kawarau	Option B Wetland + land flow path to Kawarau	Option C Boreholes at Frankton (+ Option B)	Option D Soakholes at Frankton (+ Option B)
Scenario 1 Investment objectives focused	1st	2nd	3rd	4th
Scenario 2 Effects focused	1st	2nd	3rd	4th
Scenario 3 Water quality and environment focused	1st	2nd	3rd	4th
Scenario 4 Iwi outcomes focused	No scoring provided for criteria relating to Kai Tahu values – Scenario not used			
Scenario 5 Implementability focused	1st	2nd	3rd	4th
Scenario 6 Even weighted	1st	2nd	3rd	4th
Scenario 7 National standards and cost focused	1st	2nd	3rd	4th

The following summary outlines the relative rankings and performance trends observed across the nine scenarios.

- **Option A** performs strongly across all scenarios. It is the top-ranked option in all of the weighting scenarios and has a strong relative performance in scenarios where weightings are focused on water quality and environmental focus and investment objectives.
- **Option B** consistently performs well across all scenarios, ranking second under all scenarios.
- Unweighted, **Option C** was the highest scoring option across four of the criteria. However, it drops significantly in the weighted assessment, ranking third in all scenarios.
- **Option D** is frequently the lowest scoring option in both unweighted and weighted scoring, ranking the lowest option in all weighting scenarios.

Preferred short list option

Decision making context

When considering investment decisions elected officials and their officers must consider a range of factors in addition to those undertaken through technical analysis such as the legal and statutory requirements i.e. the Local Government Act, community and stakeholder engagement, and the Resource Management Act. Otago Regional Council's 'Regional Plan: Water for Otago' is the current operable policy which prefers discharges to land over direct discharge to water.

The MCA Framework used for this project has sought to where practicable, include the most appropriate criteria to reflect these. These criteria may have different levels of importance and influence throughout the project development stage, such as increased importance on effects during the consenting process.

Key aspects of the Local Government (Water Services) Act 2025 that must be considered are in relation to the obligation for water service providers to consider cost-effectiveness of wastewater solutions, specifically that council "*must choose the option it considers to be the most cost-effective option for providing wastewater services over the life of the infrastructure assets*" [7].

Public, stakeholder, and partner views and considerations should also be taken into account, and it should be noted that no specific engagement on the options has been undertaken to date to inform the technical analysis in this report.

[7] Local Government (Water Serviced) Act 2025, Clause 254

The RMA and associated consenting processes have been considered in the development of the MCA Framework and its application.

Short list options C and D not recommended for further consideration

Options C and D were progressed from the long list stage based on their suitability to offer a discharge to land solution. After evaluating both options, it was determined that only a portion of the flow can be discharged to land. This limited discharge to land is associated with significant capital and operational costs, as well as various implementation and operational challenges. Due to the level of uncertainty on disposal rates and constraints in available land at Frankton Flats and surrounding areas, both options were developed as partial discharge to land solutions, with the remaining discharge handled by the Option B solution.

These options are not recommended to be progressed further for technical analysis and have significant deficiencies in relation to achieving the requirements of the Local Government (Water Services) Act 2025, especially in relation to cost-effectiveness.

Option A as the technically preferred option

When assessing across the criteria and undertaking a wide range of sensitivity tests, Option A presents as the most technically preferred option. It has a relatively low capital and operational costs and therefore a low whole of life cost when compared to Option B. Option A is expected to comply with the future national water environmental performance standards and has the ability to accommodate the growth in wastewater flows for the longer term.

Option B has areas where it performs better than Option A in relation to visual and amenity effects (though both are considered fatally flawed by Te Ao Marama Inc and Aukaha). An important consideration is that the flow from the wetland will still become a discharge to water where it enters the river.

Option A should be progressed as the technically preferred option for consideration by QLDC officers and elected members. It is noted that the conclusions of this process are based on the assumptions, constraints and criteria described in this report, and the technical preference will need to be considered in relation to other decision-making factors, including the expressed concerns.

It is also noted that other considerations may also be relevant to decision-making. In addition to the MCA results and the position of iwi contained in this report it is recommended that the views of the community, stakeholders, and partners be considered alongside the legislative requirements.

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Appendices

1 Introduction

Queenstown Lakes District Council (QLDC) engaged GHD to develop a business case, which seeks to identify a long-term solution for the disposal of treated effluent from the Shotover Wastewater Treatment Plant (WWTP). LandPro are engaged by QLDC as the specialist planner of this project and have assisted in the options assessment. Additionally, Aukaha and Te Ao Mārama (TAMI) are representing the iwi partners in this project. The business case is being prepared in accordance with the Treasury Better Business Case approach. The business case will be finalised once a preferred option is determined by QLDC.

1.1 Purpose of this report

This report outlines the short list of options that were considered to address the identified problems and realise the benefits from investment. The report also summarises the process and methodology that was applied to assess the options using a Multi Criteria Analysis (MCA) framework, to identify the preferred option(s) to be further developed and refined.

This report forms part of the Economic Case within the five case model framework for investments using the Department of Treasury's Better Business Case approach. The five cases are summarised as being:

- Strategic case – is there a need for investment?
- Economic case – does the investment offer value for money?
- Commercial case – is the investment viable?
- Financial case – is the investment affordable?
- Management case – is the investment achievable?

The remainder of this report is structured as follows

- **Section 1** provides an introduction and context for the project and purpose of the report
- **Section 2** outlines the long list assessment summary
- **Section 3** outlines the basis of design
- **Section 4** outlines the short list options selected and the refinement of these
- **Section 5** provides policy context for the short listed options
- **Section 6** provides technical descriptions for the elements of the short list options
- **Section 7** provides the cost estimates for the short list options
- **Section 8** provides a summary of the short list options
- **Section 9** provides the Kāi Tahu position statement on the short list options
- **Section 10** provides a summary of the MCA assessment
- **Section 11** outlines the preferred short list option.

1.2 Project background

The Queenstown Lakes District Council (QLDC) Shotover Wastewater Treatment Plant treats wastewater from the wider Queenstown urban area. The existing treatment process includes inlet screens, a Modified Ludzac-Ettinger (MLE) reactor, clarifier, sludge treatment system, UV treatment, and disposal. The plant was in final stages of commissioning during October 2025 with the second MLE reactor tank and clarifier online.

In October 2025, a small amount of wastewater was still being treated via an oxidation pond system instead of the MLE and clarifier system and the effluent stream from the plant and pond was combined before UV treatment and disposal. This is expected to stop (by end of 2025) and the oxidation pond system (Ponds 2 and 3) will then be fully decommissioned. Once the ponds are fully offline, this is expected to significantly improve the treated effluent quality.

Prior to March 2025, discharge of effluent from the treatment plant was occurring via the Dose and Drain (DAD) disposal field. The field was commissioned in 2019, and experienced significant performance deterioration and several non-compliances. Following a number of abatement and infringement notices an enforcement order was applied for by ORC in January 2025 and approved in June 2025. The enforcement order includes a requirement for a consent to be lodged for a long-term effluent disposal solution by May 2026. The engineering design for the preferred solution is to be completed by 31 December 2027 with construction and implementation by 31 December 2030.

Due to the significant environmental issues and failures with the DAD disposal field, including increased ponding that led to a rise in waterfowl numbers within the ponded areas and an associated bird strike risk for airport operations, immediate steps were taken to reduce this risk. As such, emergency works were undertaken on 31 March 2025 to commence the discharge of treated effluent through the historic discharge channel to the Kimi-ākau/Shotover River under section 330 of the Resource Management Act 1991 (RMA).

A short-term (5-year) resource consent application to ORC for discharge of treated effluent to the Kimi-ākau/Shotover River was lodged in April 2025 and is currently being processed by ORC (as of October 2025).

QLDC commenced the business case including investigations and option development for a new long-term disposal solution in October 2024 (this project). The disposal solution will replace the current effluent discharge to the Kimi-ākau/Shotover River and will cater for the long-term effluent disposal requirements (to Year 2060). QLDC's Long Term Plan (LTP) has allocated $77.5M of funding for the replacement disposal field solution.

This report summarises the assessment and evaluation of the short-listed options, including the refinement since the March 2025 long list options workshop as part of the option development process as described in Figure 1 below.

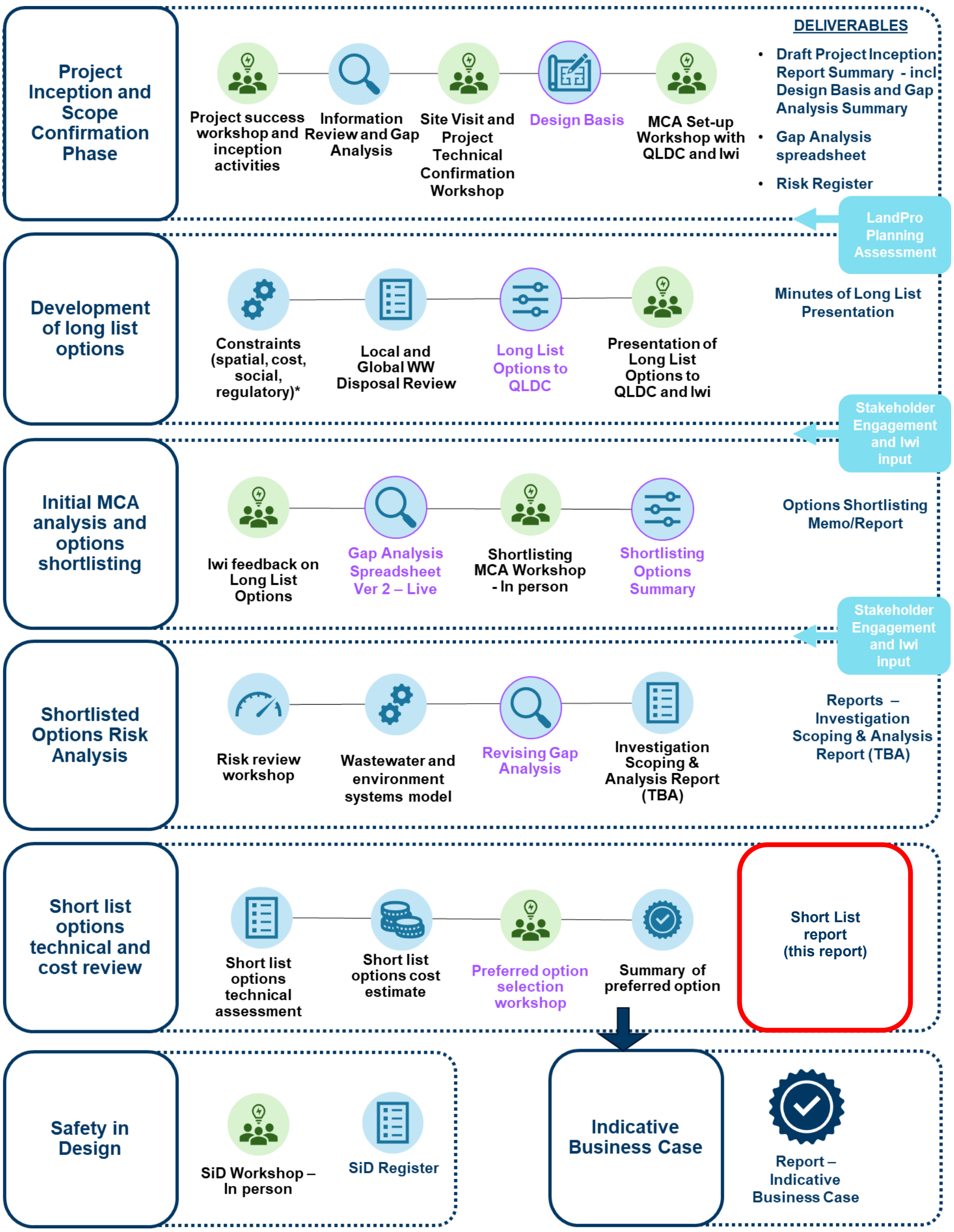

Figure 1 QLDC Shotover WWTP disposal field option development process

1.3 Scope and limitations

This report: has been prepared by GHD for Queenstown Lakes District Council and may only be used and relied on by Queenstown Lakes District Council for the purpose agreed between GHD and Queenstown Lakes District Council as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Queenstown Lakes District Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

GHD has prepared the various models ("Model") for, and for the benefit and sole use of, Queenstown Lakes District Council to support estimation of wastewater disposal performance and outcomes at Frankton Flats and must not be used for any other purpose or by any other person.

The Model is a representation only and does not reflect reality in every aspect. The Model contains simplified assumptions to derive a modelled outcome. The actual variables will inevitably be different to those used to prepare the Model. Accordingly, the outputs of the Model cannot be relied upon to represent actual conditions without due consideration of the inherent and expected inaccuracies. Such considerations are beyond GHD's scope.

The information, data and assumptions ("Inputs") used as inputs into the Model are from publicly available sources or provided by or on behalf of the Queenstown Lakes District Council, (including possibly through stakeholder engagements). GHD has not independently verified or checked Inputs beyond its agreed scope of work. GHD's scope of work does not include review or update of the Model as further Inputs becomes available.

The Model is limited by the mathematical rules and assumptions that are set out in the Report or included in the Model and by the software environment in which the Model is developed.

The Model is a customised model and not intended to be amended in any form or extracted to other software for amending. Any change made to the Model, other than by GHD, is undertaken on the express understanding that GHD is not responsible, and has no liability, for the changed Model including any outputs.

GHD has prepared this report on the basis of information provided by Queenstown Lakes District Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

GHD has prepared preliminary cost estimates set out in section 7 of this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD based on conceptual sizing and information available at the time of report writing. An external quantity estimator [Alta] has been engaged to support the cost estimates, nonetheless the construction cost of infrastructure is subject to wide fluctuation and cost escalation.

The Cost Estimate has been prepared for the purpose of options comparison and must not be used for any other purpose. Once the preferred option is selected, further investigations and preliminary design will be undertaken to develop the preliminary cost estimates of the selected option.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the project can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

1.4 Assumptions

This report is based on assumptions which are provided in further detail within the report. The following are key assumptions made as part of the short list assessment process:

- The long-term effluent disposal is designed for 35 years approximately until 2060.
- Consenting for all options is assumed to be under the current Resource Management Act (1991), prior to any RMA reforms.
- The future demand has been estimated using the provided population and flow estimates from QLDC (formally released by QLDC on 17 April 2025) which includes flows from the southern corridor area.
- The provided sizing for the proposed options are estimates only and have a level of uncertainty associated and will require further evaluation at the next design phase.
- Cost estimates are solely for the purpose of disposal options comparison, and the estimate is not intended for budgeting purposes. Cost accuracy is anticipated to be -30% to +50%. Assumptions made during the development of the estimates are detailed in Section 7.
- The treated calamity pond will be delivered under a separate QLDC project. It is assumed that the design from that project will meet the requirements of this project. However, this project may influence the final storage volume of the calamity pond—particularly if part of Pond 3 is needed for reclamation.
- The stage 3 expansion of Shotover WWTP has been designed to the 2048 demand, treating an average flow of 19,100 m^3/day. Capacity upgrades to the treatment plant will be required when wastewater flows reach the WWTP stage 3 design capacity. This is not in the scope of this project, and it is assumed that there will be future funding for this to occur when it is required.
- Locations indicated are assumed for the purpose of pricing and option comparison only.
- Understanding of Frankton Flats ground conditions is informed by analysis of limited available information. The achievable rate for wastewater disposal and effects of disposal on Frankton Flats and surrounding surface water, has been assessed using a range of assumptions regarding potential aquifer transmissivity, soil hydraulic properties, groundwater levels and potential long-term reduction in discharge capacity due to clogging.
- The total capacity of the aquifer, dictated by the potential for excessive groundwater mounding and changes to the groundwater flow regime has similarly been assessed using assumptions regarding the existing groundwater levels and groundwater level increases that may result in adverse effects.
- The potential for ongoing wastewater disposal to ground on the Shotover Delta using the existing DAD has been considered based on its performance immediately prior to emergency works to divert wastewater to the Kimi-ākau/Shotover River. The ongoing potential for wastewater disposal to ground on the Shotover delta has been considered using readily available information and analytical methods only.
- It is assumed that wastewater disposal infrastructure can be adequately protected from river, erosion and flood damage, through the proposed engineering design. Refinement of this assumption will be progressed through later stages of assessment and design.
- The availability of land for disposal of wastewater via moderate rate and irrigation practices in the vicinity of Queenstown is limited, and it is assumed that only land owned and operated by QLDC has this potential.

2 Long list options assessment summary

A comprehensive list of potential solutions (options) was developed at the beginning of the project, in late 2024, covering possible disposal methods and discharge locations. This list was refined by excluding options with obvious constraints or fatal flaws. Constraints such as distance from the WWTP, residential zones, geology, slope, water supply wells, surface water, funding availability, legislative standards, and other considerations were factored into the assessment.

The full list of options was subject to an initial screening. Options which were considered to be unfeasible or have a significant barrier to implementation were not progressed further with rationale recorded in the Long List Options Report (GHD, 2025).

If options were technically viable, within budget and otherwise achievable there was consideration at the long list MCA workshop (13 March 2025) to carry them forward to the long list phase for further development. This included options that were not deemed culturally acceptable. The exception to this was options which were a direct discharge to the river with no prior land contact and these options were not carried forward as summarised in Table 1. The full details of why each option progressed or did not are outlined in the Long List Options Report (GHD, 2025).

Table 1 Full list of options assessed

Discharge method	Locations	Long listed	Long list ID	Short listed	Reasoning summary
High rate land disposal	Delta basins or trenches	Yes	1a) Delta basins 1b) trenches	No	High visual effects, impact on Delta recreation, excessive construction materal required, high cost, and not supported by iwi.
Moderate rate land disposal	Airport, southern corridor, across river	Yes	2a) Airport 2b) Southern Corridor 2c) across river	Yes (Option 2a only)	Strong support from Iwi, constrained by land availability, minimal visual impact, and further investigation required.
Low rate land disposal	Doc land at Coronet Peak (Option 3)	Yes	3a) Doc land	No	Not suitable in winter, poor slope suitability, and excessive cost.
Land flow path to river	Shotover	Yes	4a) Shotover River	Yes	**Current case:** Not supported by iwi, retained as the current case for comparative purposes.
Land flow path to river (Rock outfall)	Kawarau	Yes	4b) Kawarau River	Yes	Not supported by iwi, retained as it is a cost effective option and expected to reduce environmental impacts relative to current case.
Direct pipe to river	Shotover or Kawarau River	No	N/A	N/A-	Assumed to be culturally and socially unacceptable. Not progressed.
Deep well injection	Frankton or Bridesdale	Yes	5a) Frankton 5b) Bridesdale	Yes (Option 5a only)	Bridesdale not progressed due to cost of bridges and available land area. Frankton preferred by iwi but more information needed.
Shallow well injection	Delta	Yes	6a) Delta	No	Not supported by iwi due to connection to surface water.
Surface weltand	Delta	No	N/A	N/A	A supplementary treatment option. Large open water not considered suitable due to the potential for attracting birds.
Subsurface weltands	Delta	Yes	7a) Delta	Yes	A supplementary treatment option. Additional treatment and amenity value without creating habitat for water fowl.
Soak holes	Frankton, airport and vicinity	Yes	8a) Frankton	Yes	Iwi support. Likely cost effective,but high uncertainty in disposal rates and maintenance. More investigations required.

Spray irrigation	Any location	No	N/A	N/A	Very large land area required, negative public perception.
Direct potable reuse		No	N/A	N/A	Excessive cost, public perception, and feasibility.
Relocation of WWTP		No	N/A	N/A-	Excessive cost, feasibility, and beyond project scope.

The development of options resulted in a long list of 13 options. The long list options were assessed by iwi representatives and technical specialists using the MCA. The MCA enables a wide range of different aspects to be taken into consideration in evaluating options and provides a systematic framework for working through and assessing each option. As a comparator a base case of the DAD disposal field operating as intended was used at the long list stage. This was compared against the current case, which at the time of assessment was the poorly performing DAD disposal field.

An MCA scoring workshop was held in person at QLDC on Thursday, March 13th, 2025, with key representatives from QLDC, Te Ao Mārama (TAMI), Aukaha, LandPro, and the GHD project team. The workshop presented the initial MCA scores, gathered input from the workshop group, and confirmed the short list options. Following the workshop, further information was provided on some of the options to enable final scoring (and selection) of the long list of options.

This scoring is summarised in Table 2 below with each criteria given a score from -5 to +5 relative to the base case. An additional fatally flawed (FF) score was provided by the scorers if the option had extreme difficulties, extremely high cost or substantial impact on which could not be mitigated by reasonable measures and may not be mitigated by extraordinary mitigation. Additionally, iwi representatives scored options that would not align with their cultural values as fatally flawed. Further detail on the scoring grades is available in the Long List Options Report (GHD, 2025).

The long list options were initially refined down to five options (plus a Base Case for comparison) to carry forward to the short list stage (this report), as follows:

- Option 4b: Land flow path to Kawarau River (Short list Option A)
- Option 7a: Subsurface Wetland on the Delta (Short list Option B)
- Option 5a: Deep well injections on Frankton (Short list Option C)
- Option 8a: Well Point or Soak holes on Frankton (Short list Option D)
- Option 2e: Moderate rate land disposal to Airport and surrounding area (supplementary)[8]

Following the long-list MCA assessment and identification of the five short list options, the project team continued to develop these options through further desktop analysis, engagement with landowners, modelling, and refinements to the concept designs. This led to a refinement of the remaining shortlist, described further in Section 4.

[8] Refer to Section 4 on details for why this option could not be progressed as a standalone option (i.e. land constraints).

Table 2 Long list MCA assessment score summary

Option	Investment objectives					Social and environmental factors					Critical success factors				
	IO1 Health and well-being of waterways	IO2 treated wastewater aligns with tikanga	IO3 Ability to service the future flows	S&E1 Mō tātou, ā, mō kā uri ā muri ake nei	S&E2 Cultural impacts and access to sites	S&E3 Impacts to enviro	S&E4 Impacts to land, soil and GW	S&E5 Visual effects	S&E6 Amenity effects	CSF1 Technical feasibility	CSF2 Sustainable	CSF3 Operation	CSF4 Property	CSF5 Timeframe	CSF6 Costs
Base case (DAD operating as intended)[9]	0	FF	-1	FF	FF	0	0	0	0	0	0	-1	0	0	0
Current Case (DAD as currently performing)	-4	FF	FF	FF	FF	-3	-3	-3	-3	-3	-2	-3	0	-5	-3
Option 1 – High-rate land disposal a) Delta infiltration basins	+2	FF	+1	FF	FF	-2	+2	-2	-2	-3	-3	0	-2	-2	-4
Option 1 – High-rate land disposal b) Delta trenches	+3	FF	+1	FF	FF	-2	+2	-2	-3	-3	-3	0	-2	-2	-5
Option 2 – Moderate rate land disposal a) Airport and vicinity area	+4	+4	+1	+4	+4	+4	+4	+2	+3	-4	-2	-2	-4	-2	-5
Option 2 – Moderate rate land disposal b) Southern corridor	0	-4	+1	-4	-3	+2	0	-1	-1	-4	-4	-1	-3	-4	-3
Option 2 – Moderate rate c) land disposal alternate locations	+3	-3	0	-4	-3	+2	+3	-1	-1	-5	-5	-3	-3	-5	-5
Option 3 – Low-rate disposal a) Doc land / Coronet peak	+4	-4	-3	-4	-1	0	+4	-3	-3	-5	-4	-4	-3	-2	-5
Option 4 – Land flow path to river a) Shotover	-1	FF	+1	FF	FF	0	+1	+2	+2	+1	+2	+2	0	+1	+2
Option 4 – Land flow path to river b) Kawarau	+2	FF	+2	FF	FF	+2	+2	+1	+1	+2	+1	+1	0	+1	+2
Option 5 – Deep well injections a) Frankton	+3	-4	+2	-4	-3	+3	+3	+2	+3	No score[10]	-1	-2	-1	-2	0
Option 5 – Deep well injections b) Bridesdale	+2	-3	+2	-3	-2	+3	+2	+2	+3	No score[10]	-3	-2	-1	-5	-2
Option 6 – Shallow well injections a) Delta	+2	FF	+2	FF	FF	+2	+2	+1	+2	No score[10]	-1	-2	0	-2	+1
Option 7 – Subsurface Wetland on a) Delta	+3	FF	+2	FF	FF	+2	+3	+2	+1	+2	-1	+1	0	0	0
Option 8 – Well Point or Soak holes a) Frankton	+3	+5	+1	+5	+5	+3	+3	+2	+3	No score[10]	-1	-2	-1	-2	0

[9] The base case for the long list MCA scoring was the DAD as operating as intended. This is different to the Short List Assessment where the base case was updated to be the current case which at the time of scoring was the short term discharge to the Shotover River.
[10] Criteria were not scored as they required further technical investigations to confirm some of the site-specific key parameters.

3 Basis of design

This section outlines parameters and criteria that will form the basis of the design for the disposal solution. It includes information on plant capacity, design flows based on projected population growth, and the effluent requirements.

3.1 Design horizon

The design horizon for the alternative effluent disposal solution is 35 years (i.e. 2060), based on obtaining a long-term resource consent. To optimise capital expenditure, the disposal option evaluation will include consideration of staged expansion.

3.2 Design flows

GHD has assessed the recent QLDC flow data and the latest population forecast estimate (April 2025). This provides a comparison of the updated wastewater flow estimates with the original Basis of Design used during the long-term options stage and the Stage 3 upgrades.

The following approach was taken to develop the revised flow estimates:

- Wastewater flows from 2023 and 2024 (supplied by QLDC and Veolia) were used to estimate the current ratios of peak dry weather flow to average daily flow (PDWF:ADF), peak wet weather flow to average daily flow (PWWF:ADF) and the per capita rate at average daily flow (ADF) and peak dry weather flow (PDWF).
- The selected peaking factors and per capita flow rates were applied to update the estimated wastewater flows, using the most recent population forecast.

The following Table 3 summarises the updated flow estimates for the 2060 design horizon and is compared with the population and flows for the Stage 3 MLE design basis.

Table 3 Revised flow estimates(GHD, 2025)

	Recent WW Flows (Discharge Flow)		Updated Wastewater Flow Estimations				Stage 3 MLE2 Design Basis	
Year	**2023**	**2024**	**2030**	**2040**	**2048**	**2060**	**2038**	**2048**
Average Population	46,002	49,359	57,265	69,892	82,325	94,887	66,000	70,000
Peak Day Population	65,685	72,565	84,830	103,759	122,399	141,233	110,000	125,000
ADF (m^3/d)	9,995	12,060	15,061	19,080	22,475	25,904	16,900	19,100
PDWF (m^3/d)	13,388	15,934	18,675	22,897	26,970	31,085	19,700	22,300
PWWF (m^3/d)	18,861	32,724	34,640	43,885	51,692	59,579	29,100	39,800

It should be noted that the peak wet weather flows were revised based on the recent ratios of PWWF to ADF. In the absence of understanding whether QLDC will implement “demand reduction” measures such as mandating pressure sewer systems in new and/or existing developments, a more prudent approach has been adopted for estimating future flows.

3.3 Shotover WWTP capacity

The Shotover WWTP Stage 3 MLE2 expansion has been designed to accommodate the WWTP growth up to 2048. Based on the Stage 3 design report (Beca, April 2022), the treatment plant is assumed to have adequate capacity to treat and handle:

– Design ADF and PDWF of 19,100 m^3/day and 22,300 m^3/day respectively.

– The secondary clarifiers will treat up to 34,560 m^3/day (~400 L/s).

The WWTP will require another capacity upgrade when the Stage 3 design capacity (refer to Table 3) is reached. This could be in the form of additional trains (e.g. MLE3) or process intensification, and the exact upgrade requirements and design will be developed closer to the time.

3.3.1 Shotover WWTP stage 3 expansion summary

Stage 3 expansion of the Shotover WWTP is currently underway, and intended to be complete late 2025, to accommodate growth in the wastewater catchment.

Stage 3 upgrades are split two portions, these include:

1. WWTP upgrades:
   - Addition of a third screen to the inlet works.
   - Decommissioning of oxidation Pond 1.
   - Construction of a second MLE reactor and a second clarifier to increase the plant capacity to 19,100 m^3/day (as an average daily flow).
   - Installation of other plant items including additional blowers, Wastewater Activated Sludge (WAS) Tank #2, return activated sludge (RAS) pumps and others.
   - Electrical and mechanical installations.
2. Construction of a raw wastewater calamity pond where Pond 1 was previously located.

The plant was in final stages of the WWTP upgrade commissioning during October 2025 with the second MLE reactor tank and clarifier online.

In October 2025 only a small amount of wastewater was still being treated via the oxidation pond system (Ponds 2 and 3) instead of the MLE and clarifier system and the effluent stream from the plant and pond was combined before UV treatment and disposal. This is expected to stop by end of 2025 and the oxidation pond system (Ponds 2 and 3) will then be fully decommissioned. Once the ponds are fully offline, this is expected to significantly improve the treated effluent quality.

The following Figure 2 is based off the Shotover WWTP Stage 3 Expansion Process Schematic (Beca, April 2022), and modified to provide an overview of the current set up, the system upgrade and the project extent. The existing infrastructure is shown in blue, Stage 3 upgrade components in red, future planned works (out of this scope) in grey. Items in green relate to this project.

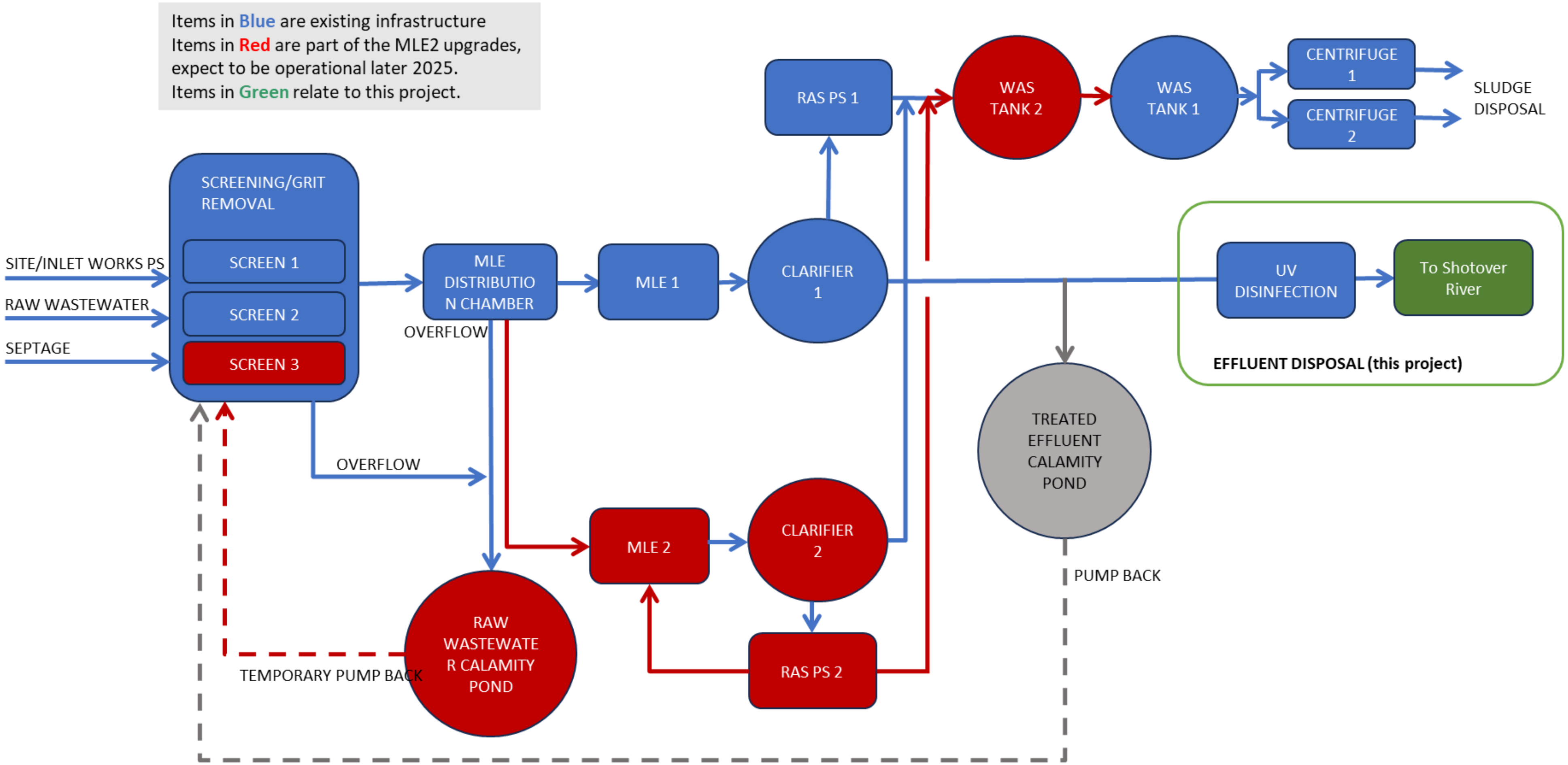

Figure 2 ***Shotover WWTP existing set up, Stage 3 upgrade, and project extent schematic***

3.3.2 Treated effluent calamity pond upgrade

The Enforcement Order requires a treated effluent calamity pond upgrade to be completed by December 2027. QLDC is undertaking the treated effluent calamity pond as a separate project to this long-term effluent disposal project.

The calamity pond will require decommissioning of the existing oxidation pond 3, including sludge removal, reshaping of the pond base, topsoil spreading with grass seeds, similar to the raw wastewater calamity pond conversion from Pond 1. This calamity pond will be kept dry most of the time, and any stored treated effluent will be returned back to the WWTP inlet works. From the experience with Pond 1, decommissioning and sludge removal will take 18 to 24 months to complete.

Section 6.1 provides a more detailed description of the treated water calamity pond.

3.3.3 Existing UV system capacity

The existing UV system is a Xylem Duron channel system with 84 lamps, displayed in Figure 3 below. Liaison with Xylem in August 2025 confirmed that the UV system is limited to a maximum capacity of approximately 40,000 m^3/day, in order to achieve the disinfection targets of 10 cfu/100mL (30 days geomean) and 100 cfu/100mL (95th percentile), based on E.coli as the microbial indicator and a minimum UV-Transmissivity (UV-T) of 60% [11].

As a result, a future capacity upgrade involving the construction of a second UV channel is anticipated after 2040 to accommodate the expected increase in treated effluent volume. Xylem advised that the addition of further lamps would result in increased hydraulic head loss. For the purpose of this report, provision for a future additional UV channel has been allowed for in lieu of making an assumption that the existing UV channel can be intensified further for higher treatment capacity. The additional UV channel has not been included in the costing for this project.

The upgrade is currently out of scope for this project. However, this is a common future upgrade that must be considered in all options.

Figure 3 Current UV site at Shotover WWTP, photo taken 2024

3.4 Effluent discharge quality requirements

3.4.1 Proposed discharge targets

The short-term consent application lodged in April 2025 has largely followed the Stage 3 WWTP expansion discharge quality requirement (Discharge Permit 2008.238.V1) with the inclusion of more stringent total

[11] Email with Xylem, dated on 28th August 2025

ammoniacal nitrogen (TAN), dissolved reactive phosphorus (DRP), and total phosphorus (TP) limits as summarised in the following table.

All short-listed options involve discharging to the Kawarau River, with Options C and D also including partial discharge of treated effluent to Frankton Flat. As a result, the proposed discharge targets are consistent across all options, with additional treatment required for disposal to bores and soakholes, as outlined in Section 7. For all options, tertiary filtration is incorporated to further improve discharge quality regarding biochemical oxygen demand (BOD5) and total suspended solids (TSS), as detailed in Table 4 below.

Table 4 Shotover treatment plant effluent disposal limits

Parameter	Unit	Long Term Consent Proposed Limits		Long Term Consent Proposed Limits	
		90%ile	Annual Mean	90%ile	Annual Mean
BOD_5	g/m^3	20	10	10	5
TSS	g/m^3	20	10	10	5
TAN	g/m^3	5*	1.5*	5	1.5
TN	g/m^3	15	10	15	10
TP	g/m^3	5* (95%ile)	1.5*	5 (95%ile)	1.5
DRP	g/m^3	3* (95%ile)	1*	3 (95%ile)	1
E.coli	Cfu/100mL	100 (95%ile)	10 (geomean)	100 (95%ile)	10 (geomean)

** The total ammoniacal nitrogen (TAN), DRP, and TP limits in the short-term consent application and subsequent Section 92 queries.*

The proposed discharge targets of the selected option will be confirmed with further environmental investigations as part of the long-term effluent disposal consent application process.

3.4.2 National wastewater environmental performance standards

Taumata Arowai is in the process of finalising the national wastewater discharge standards for the discharge of wastewater, with these due to be implemented during the timeline[12] of this project before the consent application.

The draft proposal for national wastewater environmental performance standards[13] was consulted on in March 2025 and includes limits for treated effluent discharging into surface water and for land-based discharges. For water-based discharges, the limits depend on the category of water body that the treated wastewater discharges to. The proposed standards for land-based discharges are limited to low-rate land discharge methods such as irrigation. Methods such as high-rate disposal trenches, rapid infiltration basins, and bore injection are not, at the time of writing, considered in the proposed standards.

If the National Wastewater Environment Performance Standards are adopted as proposed, in March 2025, the receiving environment is categorised based on high-level environmental context (sea, rivers or streams, lakes and estuaries, land). In the case of rivers and streams, sub-categories are provided based on a potential dilution ratio (DR). For land environments, subcategories are provided based on-site suitability. The categories for rivers or streams include:

- River or stream with dilution ratio < 10 (very low)
- River or Stream with dilution ratio >10 and <50 (low)

[12] The final standards were issued in November this year and will come into effect on 19 December 2025 (with the exception of regulation 8 and Part 2 which will come into force in December 2028). This report was prepared prior to the release of the final standards and therefore does not take into account any changes since the March 2025 proposed standards.

[13] https://www.taumataarowai.govt.nz/assets/Uploads/Wastewater-consultation/Information-Sheet-Proposed-discharge-to-water-wastewater-standard.pdf

- River or stream with dilution ratio >50 and <250 (moderate)
- River or stream with dilution ratio > 250 (high).

The Shotover River discharge could be in the low dilution range (DR >10 and <50). Without the proposed river diversion, the current discharge to the Shotover river could be considered as Very Low dilution ratio (<10). The dilution ratio for the Kawarau River would meet the high dilution category.

Figure 4 shows the proposed limits for contaminants as consulted on in March 2025 for the National Environmental Performance Standards for different dilution ratio categories.

Contaminant/measure	Measurement approach	Lakes and wetlands	Rivers and streams (low dilution)	Rivers and streams (moderate dilution)	Rivers and streams (high dilution)
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	Annual median	15 mg/L	10 mg/L	15 mg/L	20 mg/L
Total Suspended Solids (TSS)	Annual median	15 mg/L	10 mg/L	15 mg/L	30 mg/L
Total Nitrogen	Annual median	10 mgN/L	5 mgN/L	10 mgN/L	35 mgN/L
Total Phosphorus	Annual median	3 mgP/L	1 mgP/L	3 mgP/L	10 mgP/L
Ammoniacal-nitrogen (ammonia)	Annual 90th percentile	3 mgN/L	1 mgN/L	3 mgN/L	25 mgN/L
E. coli	Annual 90th percentile	6,500 cfu/100mL	1,300 cfu/100mL	6,500 cfu/100mL	32,500 cfu/100mL

Figure 4 Proposed limits for contaminants as presented in wastewater discharge standards information sheet, March 2025 [14]

The standards as currently proposed do not apply to discharges to natural, undegraded water bodies that meet the requirements of Attribute Band A of the National Policy Statement for Freshwater Management (NPS-FM). The Kawarau River receiving water category may be considered as pristine water and so not covered under the standards as currently drafted. There remains uncertainty around the consenting pathway until the final version of the standards are released.

The draft standards for flow also exhibit several inconsistencies that could affect how the receiving environment is assessed. These issues may be addressed prior to finalisation of the standards, but their application by Regional Council remains uncertain at this stage.

3.4.3 Local Government (Water Services) Act 2025

Recent legislation changes to the Local Government (Water Services) bill were enacted at the end of August 2025. Section 254 includes the following statement:

> **Obligation to consider cost-effectiveness of wastewater options**
>
> (1) This section applies when a water service provider makes a decision relating to -
>
> (a) options for providing wastewater infrastructure,
>
> (b) options for treating wastewater.

[14]Source: https://www.taumataarowai.govt.nz/assets/Uploads/Wastewater-consultation/Information-Sheet-Proposed-discharge-to-water-wastewater-standard.pdf?vid=3

(2) The water service provider must, when making a decision under subsection (1), choose the option it considers to be the most cost-effective option for providing wastewater services over the life of the infrastructure assets required to implement that option.

While this may provide a clearer decision-making pathway, it may also lead to more challenging outcomes, including potentially greater environmental and cultural impacts.

4 Short list options refinement

4.1 Key assumptions and considerations for options development

Following the long list options evaluation, a review of key assumptions and considerations was undertaken including potential constraints to enable refinement of the short list options. This was undertaken prior to developing component sizing and MCA scoring and included:

- Reviewing the land suitability and availability at Frankton Flat.
- Determining areas potentially available for irrigation at Frankton Flat.
- Calculating the probabilities of disposal capacity of bore and soak holes at Frankton Flats via statistical modelling.
- Determining additional treatment requirements related to bore and soakhole disposal options on Frankton Flat.
- Considering effluent reuse opportunities.
- Confirming potential disposal locations to the Kawarau River.
- Considering the influence of the Kimi-ākau/Shotover River training line and revetment on flooding and basis of design of these features.

4.1.1 Land availability at Frankton

Land availability on the Frankton Flats is limited. Areas potentially suitable for treated wastewater disposal include Queenstown Airport (QAC) owned land and QLDC owned land that is part of the Queenstown Events Centre (QEC).

Meetings were held on the 16th May and 8th of August 2025 between QLDC and QAC to discuss land availability. QAC's primary concern was aviation safety and any operational impacts the Frankton disposal options may create as a result of construction and/or operation of new disposal infrastructure. QAC also expressed concern that installing discharge infrastructure could make the land unsuitable for construction and undevelopable in the future. The meeting also noted that:

- QAC have master plans for the majority of their land, as outlined in their response letter dated 16 June 2025
- QAC indicated that medium trenching is not viable due to space constraints, but wells may be a more suitable option. QAC requested more details on the number and type of bores, required footprint, surface infrastructure and pipe routes.
- Any land use proposals for QAC land need to be taken to the QAC board for approval.
- QAC advised that any works within the Runway Protection Zone (150 m either side of the runway centre line) must be scheduled outside aircraft operations. Their current operating hours are 7am to 10pm, and they prefer to allow a six-hour work window to avoid overlap. They are planning to reduce the protection zone to 75 m either side of the centre line.

Discussions between QEC and QLDC took place 26th May 2025 and noted that there are development plans for the area. The QEC concept masterplan (Figure 5) includes plans to extend the sports fields and introduce additional infrastructure, buildings, and facilities on the site, this will support the community's future recreational needs. The uncertainty around the future of golf course was noted. There is existing irrigation infrastructure for the tees and greens at the golf course, and for some of the sports fields. The constraints to disposing of wastewater via moderate rate methods in this location are discussed in Section 4.1.2.

There is also some overlay between the QAC and QEC plans with the south side of the QEC master plan overlapping with the north side of the QAC master plan. The following Figure 5 shows the master plans for the QEC developments.

Figure 5 *Queenstown events centre concept masterplan*

4.1.2 Irrigation areas at Frankton

Long list Option 2a was originally proposed as a standalone disposal solution via moderate-rate land infiltration, but land constraints now prevent its independent implementation. Some potentially available land in Frankton has been identified for irrigation use, as outlined below, and this option is now considered to be supplementary to other disposal options at Frankton Flats.

Irrigation has been proposed for grassed fields and sports grounds, including the golf course which is owned by DoC and managed by QLDC and an area owned by QAC to the south at Frankton, with potential areas indicated in Figure 5. The use of wastewater for irrigation in these areas has been evaluated as a supplementary option to increase wastewater disposal capacity through land application in the Frankton area.

Figure 6 Estimated irrigation area in the golf course and sport fields

The QLDC potable water supply currently provides irrigation water to the golf course and the sport fields. GHD understands that there is already irrigation infrastructure in these areas and the preference would be to reuse the existing irrigation infrastructure for the proposed irrigation solutions. However, for costing purposes new infrastructure has been assumed.

The total potential irrigable area is approximately 20 hectares, though this is subjected to land availability and future use of the golf course. While it is unclear whether the full extent of the area identified would all be available to use for treated effluent irrigation, or the suitability of any existing infrastructure, for the purpose of option comparison, the maximum irrigation potential capacity is assumed to be 1,500 m^3/day.

This assumes:

- Design loading rate of 10 to 15 mm/day.
- Alternating operation of land disposal areas to provide resting between periods of irrigation.
- Buffer areas equating to 20% of available land area, to accommodate separation from particular infrastructure or buildings.
- Applying treated effluent (recycled water) as irrigation water requires physical and operational changes, including:
  - Connections to the recycled water supply. This would be to a new storage tank installed in the QEC area (an indicative location is indicated in Figure 6.
  - Application of recycled water during unused hours with access restriction in place to minimise impact of spray drifts.

At this application rate, this option is not suitable as a stand-alone option, and is included as a supplementary re-use method with Options C and D.

4.1.3 Bore and soak hole disposal capacity at Frankton

Due to high investigation costs ($500k - $1M) and uncertainty about bore and soak hole disposal capacity at Frankton based on desktop assessments, physical ground investigations and monitoring at Frankton Flat were not conducted during the Short List Stage.

Comprehensive investigations are needed to obtain information for refining the understanding of discharge capacity potential for boreholes and soak holes to meet disposal needs and to determine environmental effects for consenting purposes. This should be over all seasons, so an investigation period of at least 12 – 18 months is required.

Recognising the potential risk and uncertainty this introduced to the consideration of these options, further analysis of the range of possible outcomes was carried out with the assistance of a water balance model and Monte Carlo analysis of select aquifer and well parameters. The upper bound for discharge has been assessed as being constrained by the potential for adverse outcomes of disposing large volumes of treated wastewater to Frankton Flats. These potential adverse outcomes include:

- Changes in groundwater levels and groundwater flow regime causing nutrient rich waters to discharge to nearshore areas of the Frankton Arm of Lake Wakatipu, via the shallow lake sediments. This outcome is assumed to introduce significant potential for algal growth in shallow sediments.
- Changes in groundwater levels causing springs to form on the Kawarau riverbank, potentially causing erosion and bank instability.

To reduce the potential for these outcomes to occur, disposal rates were assessed using analytical solutions and limited to those that would likely result in no more than 1 m of groundwater level increase at a distance of approximately 150 m. This and siting of the disposal locations to not result in significant cumulative mounding effects, provided a preliminary upper aquifer limit of 20,000 m^3/day. Investigations and more detailed assessment are required to confirm this upper limit.

This analysis is summarised below with a detailed outline of the modelling approach and assumptions provided in Appendix E:

- **Boreholes**
  - Assumptions and constraints were made regarding the working head, ground water mounding, bore spacing, aquifer transmissivity and clogging potential.
  - It was modelled that up to 10 boreholes could be accommodated, with nine operating at any one time.
  - The modelling showed a median probability (50%) of achieving a disposal rate via boreholes of **8,000 m^3/day**, with the potential range of outcomes being in the range 2,000 m^3/day to 20,000 m^3/day.
  - The probability of achieving a long-term disposal rate of at least 12,500 m^3/day from a bore field of ten bores is estimated to be 25%.
- **Soak holes**
  - Modelled as wide-diameter bores to 20 m depth, discharging to the vadose zone.
  - It was modelled that up to 50 soak holes could be accommodated, spaced 10 m apart.
  - The modelling showed a median probability (50%) of achieving a disposal rate via soak holes of **1,450 m^3/day** with a broad potential range of outcomes from 100 m^3/day to 20,000 m^3/day.
  - The probability of achieving a long-term disposal rate of at least 12,500 m^3/day from a field of 50 soak holes is estimated to be 13%.

These results are illustrated in the box and whisker diagram provided below, where:

- The yellow middle lines represent the median probability (50% probability of flows being lower or higher than this value).
- The lower and upper extents of the box represent the estimated lower quartile (25% probability that flows will be less than this) and upper quartile (75% probability flows will be less than this) respectively.
- The whisker lines, which extend out from the box, show the low probability flows, with the chance of being as large or as small as the outer whisker points being in the order of 1-5%.

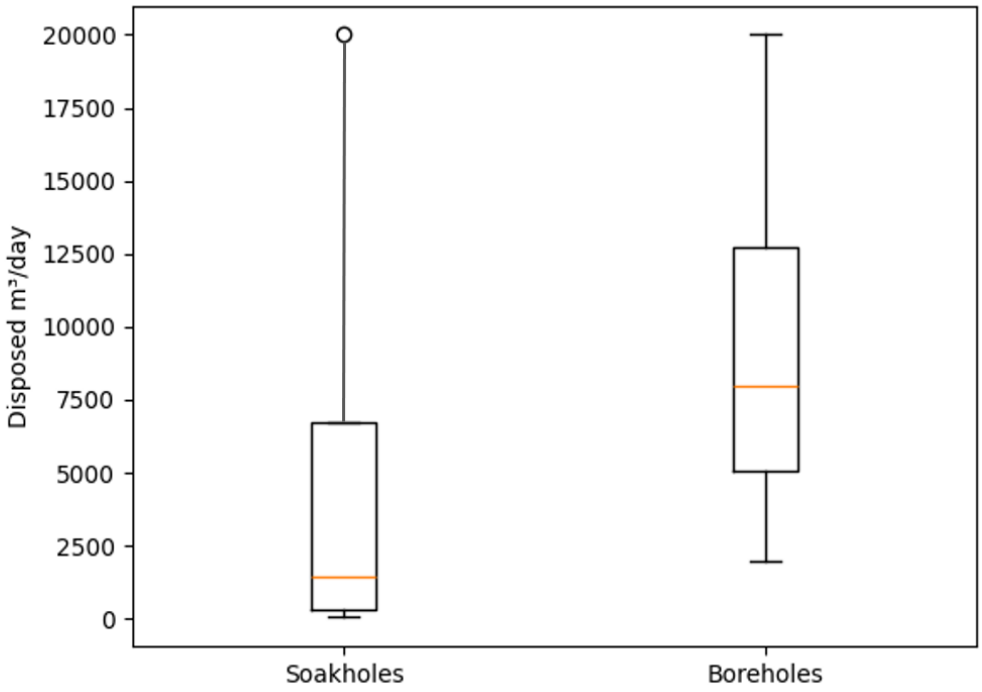

Figure 7 ***Estimated discharge rates for soak holes and boreholes and the probability of achieving this***

This modelling has shown that even with the most optimistic scenario, full disposal of the 2060 average daily flow (26,000 m^3/day) is unlikely to be possible in the Frankton Flats area, and an additional discharge method will also be required. Disposal of the even the current peak dry weather flow (15,900 m^3/day) via boreholes or soak holes would also be challenging.

Significant refinement of these estimates, including the range and probability of outcomes, could be achieved through site investigations and subsequent trialling of the disposal approach. Demonstration that an option can provide disposal sustainably and for a meaningful proportion of the total wastewater volume is expected to be required before proceeding to large scale implementation. For the purpose of assessment, this threshold for progressing is assumed to be 12,500 m^3/day or more.

Clogging and blinding of bores and soak holes represents a major risk to the performance of these inground disposal options. Additional risk mitigation can be provided through:

- Provision of membrane filtration (bore size <0.4 mm) to remove all but the finest of suspended solids in the treated effluent prior to bore or soak hole disposal.
- Dosing of sodium hypochlorite for biofouling inhibition.
- Back flushing pumps have also been included in the bore disposal option, to provide frequent removal of accumulated sediment, refer to Section 6.4 for details. Back washing is not possible for the soak hole option.

4.2 Effluent quality requirements for reuse

At the long list stage, it was proposed that a supplementary option of disposing of a portion of the treated effluent via non-potable reuse methods was further assessed to identify the infrastructure requirements and the demand for recycled water in the near to medium future in the Frankton Flats area.

Recycled water reuse applications come in a range of forms:

- **Direct or indirect potable reuse** – this requires extensive additional treatment of the WWTP treated effluent to drinking water standards. At the long list stage this was considered *not feasible* due to the very high cost and social and cultural acceptance challenges.
- **Dual water reticulation** – this requires additional treatment of the effluent to a very high quality, through an advanced water treatment system and then distribution of the recycled water via a new 'purple pipe' network for non-potable uses such as garden irrigation and toilet flushing. It also requires a significant

change in regulations, social acceptance, and significant infrastructure investment. This is considered *not feasible* based on the knowledge of current constraints.

- **Dust suppression** – this option provides recycled water for tanker collection for uses such as dust suppression at roading and construction sites. This is considered a *feasible* recycled water use, however its demand is likely to be insignificant compared to the total volume of treated wastewater produced at the WWTP. For further detail refer to Section 6.1.3.
- **Irrigation** to sports fields and golf course using highly treated wastewater is considered *feasible* and proposed as a supplementary method for disposal options at Frankton Flats (refer to Sections 4.1.2 and 6.4.6).

In the absence of a national recycled water guideline in New Zealand, the Australian Guidelines for Water Recycled (AGWR) was consulted, which sets targets for reduction of microbiological hazards and those targets are expressed as log reduction values (LRVs) and are dependent on the type of end use, as shown in the Table 5 below.

Table 5 Recycled Water Microbiological Reduction Targets (LRVs) for selected reuse purposes (extract from AGWR Table 3.8)

	Virus LRV	Protozoa LRV	Bacteria LRV
Municipal irrigation – e.g. ovals, parks, golf courses and dust suppression	5.0 via Treatment	3.5 via Treatment	4.0 via Treatment
Municipal irrigation with restricted access and application (e.g. no access after irrigation until dry, e.g. 1-4 hrs, or spray drift control)	5.0 Total*	3.5 Total*	4.0 Total*

Notes:

** - Total refers to LRV targets, to be achieved by treatment and exposure reduction (e.g. no public access when the field is wet, or subsurface drip irrigation)*

For this project, the supplementary option assumes that the recycled water will be supplied for water tanker collection and for irrigation to sports fields and golf course, replacing potable water.

4.3 Shortlist option refinement

The short list options investigation and constraint considerations (as described in Section 4.1), and uncertainties about bore and soak hole disposal capacity at Frankton (Section 4.1.3) resulted in refinement of the options proposed for assessment.

Due to the limited capacity at Frankton, a re-evaluation of possible land disposal options was conducted to determine whether any alternative land disposal areas were appropriate. Detail of the land disposal spatial constraints assessment can be found in Appendix G.

Figure 8 following shows the results of the constraints assessment visually. Areas with the lowest constraints scores are shown darker blue than areas with higher constraints which are yellow and orange and are less suitable. Areas with scores greater than 250 are considered not suitable. Note that areas shown in green are reserve land. Appendix G provides further detail on the scoring and constraints applied.

The spatial assessment showed a limited number of potential land areas suitable for long term disposal of treated wastewater at the projected 2060 volumes and reinforced the identification and selection of potential land disposal options provided as part of the long list options assessment. The assessment indicates that, despite certain limitations and uncertainties with the Frankton Flats disposal options, there were no other viable land disposal solution identified.

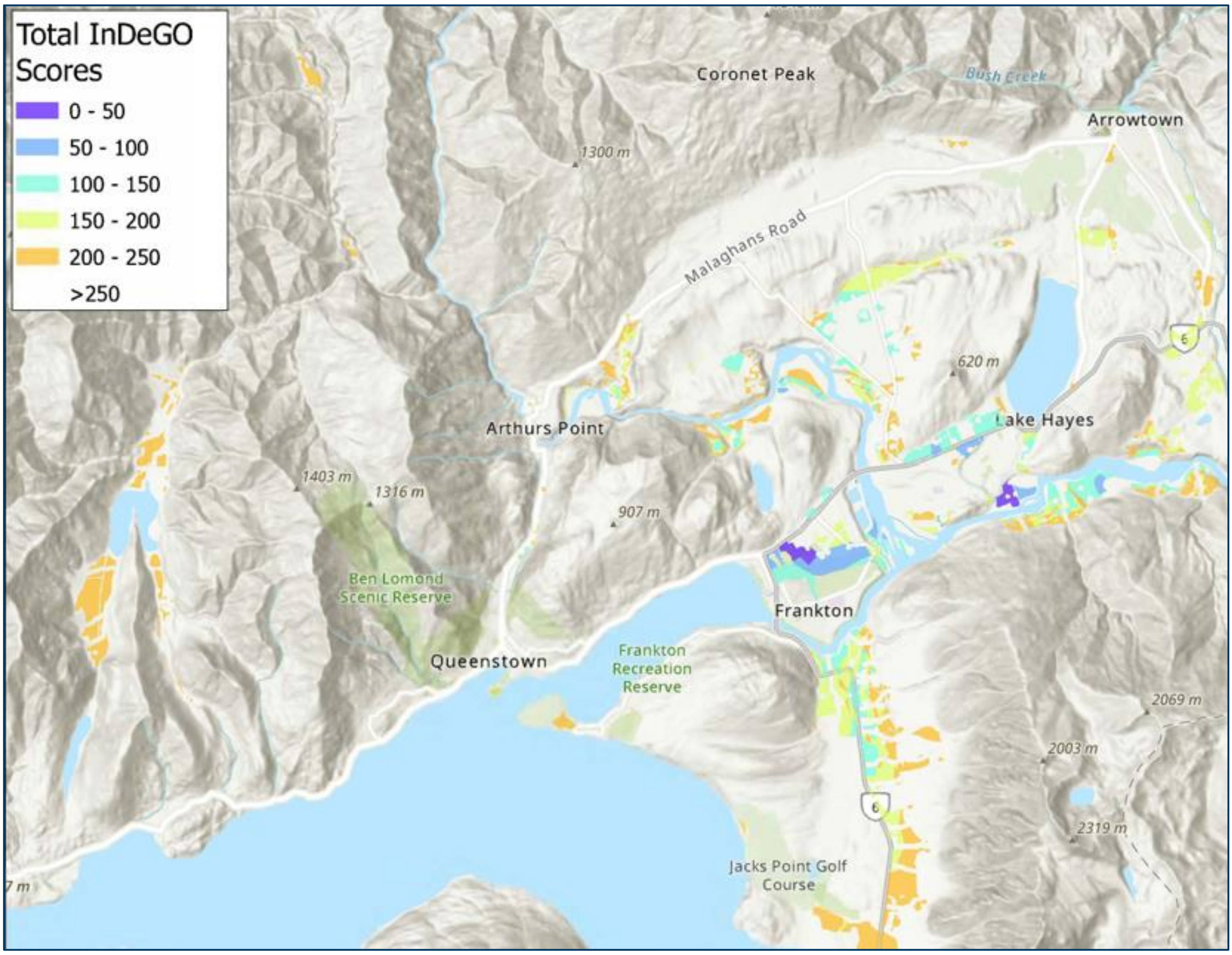

Figure 8 **Constraints assessment scoring with distance and elevation considerations**

To allow options involving disposal to Frankton Flats to proceed as part of the project, a staged approach to both the consenting and the development of the Frankton Flats disposal to land solutions was the agreed approach in the project. Demonstration of suitability at each stage would be required for progressing to the next stage. This staged approach is assumed to include the following:

1) Initial hydrogeological investigations to characterise and allow a detailed assessment of the Frankton Flats aquifer and groundwater/surface water interactions. This may require obtaining a resource consent for specific investigations and could make use of freshwater to test potential disposal rates.
2) Following favourable investigations, the development and operation of a treated wastewater disposal trial would be carried out at Frankton Flats. This trial would include construction of infrastructure to provide treated wastewater to Frankton Flats, and operation of treated wastewater disposal at an assumed two disposal locations. It is also assumed that such a trial would be undertaken for a period of approximately 2-5 years, to provide sufficient information to confirm large scale scheme appropriateness, design and operational requirements.
3) Following a favourable treated wastewater disposal trial and relevant consenting, the disposal infrastructure on Frankton Flats would be expanded for long term disposal, to an extent appropriate to maximise the land disposal potential whilst managing adverse effects. Option C and Option D assume for option comparison purposes that disposal rates are such that a large-scale disposal scheme would be implemented.

In addition to the above process for disposal to land, irrigation of treated wastewater to land to readily available sports fields and green areas would be implemented as a supplementary disposal approach. While it has been determined that moderate rate disposal to land (such as irrigation) is unable to provide a standalone option for disposal, due to limited available land at the airport and surrounds, beneficial use of what land is potentially available on Frankton Flats is included in with Options C and Option D.

Assessments conducted to estimate the capacity of the Frankton Flats aquifer for treated wastewater disposal, as detailed in Appendix E, show that the maximum estimated disposal limit for Frankton Flats (approximately 20,000 m^3/day) is less than the projected future average daily volumes of wastewater. As a result, Option C and Option D include provisions for treated wastewater that cannot be disposed of on land to follow the process outlined in Option B, where it passes through a subsurface wetland before being discharged to the Kawarau River.

Due to the potential for unfavourable ground conditions to preclude large scale disposal via boreholes or soak holes, Option C and Option D allow for the infrastructure on the Shotover Delta to be sized to accommodate the full volume of treated wastewater, as per Option B. The following Table 6 presents the refinement of the short list options based on the ability to consent the option in the available timeframes, the current understanding of disposal capacity and other constraints as described in Section 4.1.

Table 6 Short list option refinement

Options as presented for long list	Suitable as a standalone option	Short list option refinement
Option 4 a – Land flow path to Kimi-ākau/Shotover River	No. Current case of Shotover River discharge, is retained for comparison purposes only	This is the Current Case and used as the base case for short list comparative scoring
Option 4 b – Land flow path to Kawarau River	Yes	**Option A –** Disharge to water via land flow path to Kawarau River. Includes supplementary option of recycled water for reuse.
Option 7 a – Subsurface Wetland on Delta with disposal to Kawarau River	Yes	**Option B –** Disharge to water via subsurface wetland and land flow path to Kawarau River. Includes supplementary option of recycled water for reuse.
Option 5 a – Well injections Frankton	No – further investigations are required to provide an understanding of the groundwater. Staged approach needed	**Option C –** Partial discharge to land via boreholes at Frankton with remaining flow to river via wetland. Includes supplementary options of recycled water for reuse and sports field irrigation.
Option 8 a – Soak holes Frankton	No – further investigations are required to provide an understanding of the groundwater. Staged approach needed	**Option D –** Partial discharge to land via soakholes at Frankton with remaining flow to river via wetland. Includes supplementary options of recycled water for reuse and sports field irrigation.
Option 2 a – Moderate rate land disposal Frankton	No – there is insufficient land available. Only suitable as a supplementary option	This disposal solution is included as a supplementary option as part of Option C and D for irrigation of sports fields and golf course.

The options to be presented for scoring are summarised in the following Table 7 and component common to all options described in Section 6 and each option presented in Section 8.

Table 7 Refined short list options summary

Parameter	Option A Land flow path to Kawarau	Option B Wetland + **l**and **f**low **p**ath to Kawarau	Option C Boreholes at Frankton (+ Option B)	Option D Soakholes at Frankton (+ Option B)
Description	Discharge to water via land flow path to Kawarau River. Includes supplementary option of recycled water for reuse.	Discharge to water via a subsurface wetland and land flow path to Kawarau River. Includes supplementary option of recycled water for reuse.	Partial discharge to land via boreholes at Frankton with remaining flow to river via wetland. Includes supplementary options of recycled water for reuse and sports field irrigation Staged approach required.	Partial discharge to land via soakholes at Frankton with remaining flow to river via wetland. Includes supplementary options of recycled water for reuse and sports field irrigation Staged approach required.
Stage 1 - **2030 volumes (ADF)**	15,000 m^3/day to Kawarau river 100 m^3/day reuse Total – 15,100 m^3/day	15,000 m^3/day to Kawarau river 100 m^3/day reuse Total – 15,100 m^3/day	1,600 m^3/day to boreholes 1,500 m^3/day to sports field 100 m^3/day reuse 11,900 m^3/day to Kawarau River Total – 15,100 m^3/day	500 m^3/day to soak holes 1,500 m^3/day to sports field 100 m^3/day reuse 13,000 m^3/day to Kawarau River Total – 15,100 m^3/day
Stage 2 **2060 volumes (ADF)**	25,900 m^3/day to Kawarau River 100 m^3/day reuse Total – 26,000 m^3/day	25,900 m^3/day to Kawarau River 100 m^3/day reuse Total – 26,000 m^3/day	*Note: Option would not proceed to stage 2 if flows of at least 12,500 m^3/day were not achievable. Probability of achieving this discharge capacity estimated to be 25%.* 12,500 m^3/day to boreholes 1,500 m^3/day to sports field 100 m^3/day reuse 11,900 m^3/day to river Total – 26,000 m^3/day	*Note: Option would not proceed to stage 2 if flows of at least 12,500 m^3/day were not achievable. Probability of achieving this discharge capacity estimated to be 13%.* 12,500 m^3/day to soak holes 1,500 m^3/day to sports fields 100 m^3/day reuse 11,900 m^3/day to river Total – 26,000 m^3/day
Comment	*For all options, there is the opportunity for refinement of the discharge method which includes the possibility of a pipe diffuser to improve mixing and water quality in the Kawarau River as well as visual effects. Engagement with the community and iwi is proposed prior to finalisation of the discharge method.*			

5 Policy context

5.1 National direction

Water conservation orders

The Water Conservation (Kawarau) Order 1997 (WCO) recognises and protects outstanding values attributed to the Kawarau River and its key tributaries, including the reach of the Shotover River proximal to the existing and proposed treated wastewater discharges. Any discharge or land-use change that could degrade the Kawarau or Shotover River's outstanding characteristics will be assessed against the WCO protections. The Kawarau WCO focuses primarily on maintaining the natural state, water quality, and outstanding scenic, recreational and fishery values of the Kawarau and key tributaries.

The Kawarau WCO requires waters of the Kawarau River and lower Shotover River to be managed to 'Class CR standard'. This means maintaining contact recreation quality, specifically as it relates to swimming and wading activities. Schedule 3(5) of the RMA states that water being managed for contact recreation purposes must have visual clarity and quality suitable for bathing, and no undesirable biological growths as a result of any discharge of a contaminant to water. The short-listed options, pending further design of the outfall, are expected to be able to comply with the water quality standards required by the WCO after reasonable mixing.

The WCO and NPSFM (discussed below) operate concurrently. While the provisions of the NPSFM cannot directly override protections provided in a WCO, the NPSFM can raise the baseline for environmental protection if its national objectives are more stringent than the WCO provisions. This is discussed further below.

National Policy Statement for Freshwater Management (NPSFM)

The NPSFM sets clear national objectives and policies that local councils must give effect to, specifically with regard to freshwater and how it is managed. Key elements of the NPSFM include Te Mana o te Wai (prioritising the health of freshwater and associated ecosystems above social, economic and cultural needs), maintaining or improving water quality and freshwater ecosystem health, and setting water quality limits to ensure freshwater objectives are met.

The NPSFM's National Objectives Framework (NOF) requires regional councils to set water quality, ecosystem health and human contact baseline and target values in regional planning documents. These values are of direct relevance to the present short list options assessment and provide a basis for future changes to regional plans (discussed below).

Central government-driven reform continues to modify statutory obligations at the national level, which has and will continue to influence objectives and policies of the NPSFM. For example, the recently enacted Resource Management (Freshwater and Other Matters) Amendment Bill requires that consent authorities must not have regard to clauses 1.3(5) and 2.1 of the NPSFM, which relate to the hierarchy of obligations. This enables a potential trade-off between freshwater outcomes (i.e. maintaining or improving water quality, hydrology or freshwater habitats) and activities that effect freshwater – in this case, wastewater treatment and disposal.

Further changes to the NPSFM will continue to occur as national resource management direction evolves, however under the current NPSFM, the short-listed options are expected to be able to be designed to ensure the NOF target values can be met after reasonable mixing.

5.2 Regional policy

Otago Regional Policy Statement 2019 (ORPS) and Proposed Otago Regional Policy Statement 2021 (PORPS)

The ORPS provides the region's existing higher-level objectives and policies that regional and district plans must give effect to. Core themes driving objectives and policies in the ORPS include integrated management, protection of freshwater and groundwater values, and iwi involvement in decision making. The PORPS (Decisions version) further strengthens freshwater direction, directly giving effect to Te Mana o te Wai, increases emphasis on avoiding further degradation, managing connectivity between groundwater and surface water, and prioritising iwi partnership. Key policy drivers in relation to the short list options are explored in the below Table 8.

Table 8 Key policy drivers

Policy driver	Overview of intent	Relevant ORPS objectives & policies	Relevant PORPS objectives & policies	Assessment against options
Te Mana o te Wai	The PORPS requires that Te Mana o te Wai must be recognised and given effect to in decisions affecting freshwater but includes identification of use of water for personal hygiene (such as toilet flushing) under the second priority. The ORPS includes comparable obligations to maintain or enhance water quality and ecosystem health.	Obj 1.1, Pol 5.4.1 – Maintain and enhance freshwater quality and ecosystem health.	LF–WAI–O1, O2, LF-WAI-P1, LF–FW–P2 – Prioritise the health of water bodies and ecosystems.	Discharge of treated wastewater to the Kawarau River (all options) must be able to demonstrate that the freshwater values of the river will at least be maintained – no degradation may occur. Deep well injection and soak hole disposal options will also need to demonstrate no direct degradation to groundwater resources, and secondarily to the river via hydraulically connected groundwater. If comparing to the status quo and consented baseline from DAD disposal, consistency with the relevant policies and objectives is possible.
Protect outstanding and regionally significant values	Both RPS's require avoiding significant adverse effects on water bodies (including groundwater-surface water interactions) and protecting key values such as mahika kai, aquatic ecology, recreation and natural character. The PORPS includes specific direction for wastewater discharges that encourages phasing out of disposal to water to the extent practicable.	Obj 5.3.1, Pol 5.4.2 – Avoid, remedy or mitigate adverse effects on the natural and human use values of water.	LF–FW–P6, LF–FW–P7 – Avoid further loss or degradation of aquatic ecosystems and habitats and LF-FW-P16 – impacts of wastewater discharges	To be consistent with the relevant RPS objectives and policies, each option will need to provide the following: – Exceptional water quality modelling, showing no adverse effects on freshwater objectives; – Robust ecological and recreation assessments showing negligible impact on these values; – Meaningful cultural impact assessment co-developed with Aukaha, Te Ao Marama and papatipu Rūnaka; – Adaptive management and consent compliance monitoring that satisfies the ORPS precautionary approach; – Robust assessment of alternative that considers and practical land disposal options.
Recognise and provide for mana whenua involvement	The ORPS requires active involvement of Kāi Tahu and recognition of iwi values, while the PORPS expands on iwi partnership mechanisms and involvement in freshwater governance.	Obj 2.1, Pol 2.2.1 – Recognise and provide for Kāi Tahu values and involvement in resource management.	MW–O1, MW–P1–P6 – Require partnership with mana whenua and protection of mahinga kai, wāhi tapu, and mauri.	Iwi involvement is already being provided for via the long list and short list workshops and ongoing reviews and correspondence. This partnership is proposed to continue throughout the option selection and consenting process. Despite iwi involvement throughout the process, achieving consistency with Kāi Tahu expectations will prove very difficult, particularly with regards to direct discharge to culturally significant rivers.
Integrated management and	Both RPS's require integrated consideration of water, land, air and iwi values. Where	Obj 1.2, Pol 1.5.1 – Manage land and water	IM–O1, IM–P2 – Adopt ki uta ki tai (mountains to	Ensuring consistency with these policies will hinge on the existing wastewater treatment literature (particularly with regards to

precautionary approach	uncertainty of effects exists, apply a precautionary approach via monitoring and adaptive management.	in an integrated way.	sea) approach; integrate management across domains.	alternative disposal methodologies like deep well injection), history of wastewater discharges and associated monitoring in the Shotover River, and ensuring robust assessments that consider cumulative impacts on land, water, air and cultural values.
Regionally significant infrastructure	The RPSs recognise the need for regionally significant infrastructure to be provided for where the effects can be managed that account for their functional and operational needs.	Obj 4.3, Pol 4.3.3, 4.3.4 - Managing infrastructure activities.	EIT-INF-O4, EIT-ENF-P10, EIT-ENF-P13, EIT-ENF-P14 – Provide for infrastructure while managing effects.	The significance of the WWTP system and disposal for the region is clear. Consideration of alternative disposal methods as shown through the optioneering and the functional and operational need to locate the disposal system at any of the short-listed options will ensure consistency with these provisions.

Integrating the above key policy considerations from the ORPS and the PORPS into the feasibility stage of the selection process and carrying this through the consultation and application processes that follow, will be essential to ensuring consistency with regional policy direction, to the extent possible. Evaluating the short-listed options against the relevant policies above indicates that in general they are likely to be able to demonstrate consistency with the overall policy direction in respect of instream effects on water quality and ecology values, pending further design. Notwithstanding this, providing for Kāi Tahu values as mandated in the various policies will prove difficult, on the basis of where discussions with iwi currently are.

Note that PORPS Objective LF-FW-01A(8) advocates for the phase out of direct discharges of wastewater to water bodies within each Otago FMU, to the extent reasonably practicable. While this is directly relevant to the shortlist options being considered, significant weight can be afforded to the 'to the extent reasonably practicable' part of the Objective. Given that the long list and short list selection process is seeking the most environmentally, economically, and socially-feasible solution to treated wastewater disposal, it can be considered that this objective will have been given effect to as it is not reasonably practicable, in these circumstances to completely phase out direct discharges of wastewater to water bodies.

Regional Plan: Water for Otago (RPW)

The RPW was made operative on 1 January 2004 and is the primary document that manages water within the Otago region's boundaries. Due to the age of this plan, many of the objectives and policies do not accurately reflect the provisions of more recent, higher-order environmental legislation. For this reason, more weight should be afforded to the Otago RPS's than the provisions of the RPW.

Included in Table 9 below is an assessment of the relevant objectives and policies in the RPW that relate to the short list options being considered.

Table 9 RPW objectives assessment

RPW provision	Provision wording	Assessment
Issue 4.13.5	Discharge of human waste and other contaminants to Otago's water bodies from point and non-point sources is an affront to Kāi Tahu.	All of the options being considered involve the direct discharge of treated human wastewater to the Kawarau River. This has the potential to undermine the strong cultural relationship that iwi have with fresh water, and to negatively impact mahika kai opportunities associated with the river (from a cultural perspective).
Objectives 7.A.1 to 7.A.3	7.A.1 To maintain water quality in Otago lakes, rivers, wetlands, and groundwater, but enhance water quality where it is degraded. 7.A.2 To enable the discharge of water or contaminants to water or land, in a way that maintains water quality and supports natural and human use values, including Kāi Tahu values.	The treated wastewater disposal options are being considered with a view to maintaining the water quality of and avoiding adverse effects on the Shotover and Kawarau Rivers to the extent practicable. Direct discharge to the Kawarau River has the potential to adversely affect human use values (i.e. recreation uses in the river) as a result of the

RPW provision	Provision wording	Assessment
	7.A.3 To have individuals and communities manage their discharges to reduce adverse effects, including cumulative effects, on water quality.	perception associated with the discharge of treated wastewater into the river environment, and is not consistent with Kāi Tahu values.
Policy 7.C.1	When considering applications for resource consents to discharge contaminants to water, to have regard to opportunities to enhance the existing water quality of the receiving water body at any location for which the existing water quality can be considered degraded in terms of its capacity to support its natural and human use values.	The explanation for this policy states that there is an opportunity to achieve an enhancement in water quality where an existing discharge may be subject to a new resource consent. All of the options being considered are likely to provide for this, by utilising newer, more efficient wastewater treatment technologies. An analysis of historic water quality monitoring records from the receiving water bodies against anticipated receiving water quality under any new or upgraded treatment and disposal system being considered will help to demonstrate the potential for water quality improvements in a consent application.
Policy 7.C.2	When considering applications for resource consents to discharge contaminants to water, or onto or into land in circumstances which may result in any contaminant entering water, to have regard to: (a) The nature of the discharge and the sensitivity of the receiving environment to adverse effects; (b) The financial implications, and the effects on the environment of the proposed method of discharge when compared with alternative means; and (c) The current state of technical knowledge and the likelihood that the proposed method of discharge can be successfully applied.	The explanation to this policy states that when considering the avoidance, remedy or mitigation of adverse effects of any discharge, consideration of the matters in (a) to (c) will ensure that financial and technical constraints of alternative discharge methods will be recognised alongside the sensitivity of the receiving environment. The technical and financial constraints of the short-listed and long-listed options have been summarised in this and previous reports This will support the alternatives assessment required as part of the future consenting process, with further analysis needed of the preferred option in respect of the sensitivity of the environment receiving the discharge.
Policy 7.C.3	When considering any resource consent to discharge a contaminant to water, to have regard to any relevant standards and guidelines in imposing conditions on the discharge consent.	Rather than setting numerical standards for given contaminants, the RPW identifies specific natural and human-use values that must not be compromised by any wastewater disposal option being considered. Relevant standards are expected to be able to be met under the short-listed options but further work may be required in terms of how the discharge is introduced to the receiving environment to encourage rapid mixing.
Policy 7.C.4	The duration of any new resource consent for an existing discharge of contaminants will take account of the anticipated adverse effects of the discharge on any natural and human use value supported by an affected water body, and: (a) Will be up to 35 years where the discharge will meet the water quality standard required to support that value for the duration of the resource consent; (b) Will be no more than 15 years where the discharge does not meet the water quality standard required to support that value but will progressively meet that standard within the duration of the resource consent; (c) Will be no more than 5 years where the discharge does not meet the water quality standard required to support that value; and	While this policy remains relevant, it is largely superseded by amendments to the RMA via the Local Government (Water Services) (Repeals and Amendments) Act 2025, which mandates a 35-year term for eligible infrastructure – particularly public schemes operated by local councils. This provides councils with the long-term certainty needed for significant investment in wastewater treatment infrastructure.

RPW provision	Provision wording	Assessment
	(d) No resource consent, subsequent to one issued under (c), will be issued if the discharge still does not meet the water quality standard required to support that value.	
Policy 7.C.12	Reduce the adverse effects of discharges of human sewage from existing reticulated wastewater systems, including extensions to those systems, by: (a) Preferring discharges to land over discharges to water, unless adverse effects associated with a discharge to land are greater than a discharge to water; and (b) Requiring systems to be operated, maintained and monitored in accordance with recognised industry standards; and (c) Promoting the progressive upgrading of existing systems; and (d) Requiring the implementation of appropriate: (i) Measures to progressively reduce the frequency and volume of wet weather overflows; and (ii) Measures to minimise the likelihood of dry weather overflows occurring; and (iii) Contingency measures to minimise the effects of discharges of wastewater as a result of system failure or overloading of the system; and (e) Recognising and providing for the relationship of Kāi Tahu with the water body, and having particular regard to any adverse effects on Kāi Tahu cultural and spiritual beliefs, values, and uses.	The – Discharges to land are being considered, noting that all options will have at least a portion of treated wastewater discharging to water; – All options represent significant upgrades in the existing treatment and disposal system, and will be maintained and monitored in accordance with industry standards; and – Wet weather, system failure and overload contingencies are being factored into system design. As discussed earlier, the strong relationship that mana whenua have with the Kawarau and Shotover Rivers is recognised, and is helping to shape the options being considered. Notwithstanding this, adverse effects on Kāi Tahu cultural and spiritual beliefs, values and uses will be more than minor for all options.

5.3 Consenting strategy

Option A and Option B are assumed to require only a single wastewater discharge consent, reflecting long term discharge to water (Kawarau River).

For Option C and Option D, the staged implementation of land disposal and likely land disposal capacity constraints, are expected to result in wastewater discharge consents being required for both discharge to land (Frankton Flats) and discharge to water (Kawarau River). For discharges to land, a staged approach that consents an envelope of effects, with limits and environmental performance standards, is proposed. Progression through the consent stages, as with progression through the stages of testing land disposal capacity, is premised on demonstrating that effects remain within the acceptable envelope.

Two general approaches may be available for consenting of Option C and Option D, depending on acceptance by ORC:

1. Consenting of discharges to water (Kawarau River) and discharges to land separately, providing time for investigations of Frankton Flats aquifer to inform the viability and likely environmental effects of land disposal via bores or soak holes, and subsequent demonstration of long term viability via trial.
2. Consenting of discharges to water (Kawarau River) and discharge to land, with conditions of consent providing the requirements and performance standards around the investigations, trialling and long term disposal to land at Frankton Flats.

The following Figure 9 outlines these possible consenting pathways which could be applied.

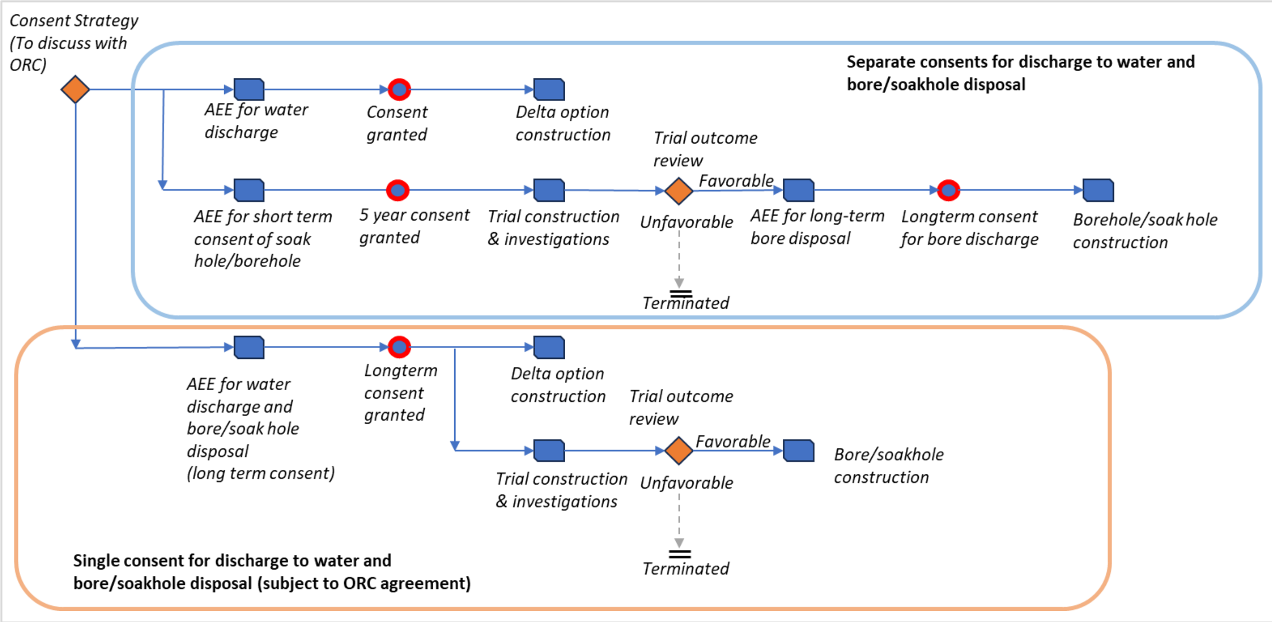

Figure 9 Possible consenting pathways

6 Technical description of key components

This section describes the various components incorporated in the short list options. For each component, the applicable options are noted. The descriptions provided were used for pricing purposes; however, further refinement and design updates may alter some of the components.

6.1 Common components of disposal options

The following are common elements for the overall treatment and effluent disposal systems for the short list stage:

- The treated effluent calamity pond is common to all options and not in the scope of this project although is important to note as there is integration with it and proposed infrastructure in this project (i.e. tertiary filter).
- The tertiary filtration is common for all options and the same size for all options.
- The recycled water supply for tankers differs in location for options A and B vs C and D, however, is common in size for all options. It is considered a supplementary option and is not required for disposal to occur; however, it adds a low percentage of cost to the overall solution and provides the benefit of reuse. Currently all options have been costed to include the recycled water supply.
- Disposal of treated wastewater to the Kawarau River, at the eastern end of the Shotover Delta protected by the training line, is common to all of the options, with sizing to accommodate the potential full flow rate.

A full summary of these common elements is outlined in the following sub-sections.

6.1.1 Treated effluent calamity pond storage

Applicable to:	☑ **Option A**	☑ **Option B**	☑ **Option C**	☑ **Option D**

The treated effluent calamity pond will be delivered under a separate QLDC project and as such this is outside of the design and funding scope for this treated wastewater (effluent) disposal project. The following Figure 10 and Figure 11 present the expected area to be converted into the calamity pond.

A calamity pond has the purpose of storing treated effluent in the event that the final effluent does not meet discharge requirements or the discharge is not operational (i.e. due to high flows or maintenance). The ORC Enforcement Order requires QLDC to complete the conversion of Pond 3 for this purpose by December 2027.

Pond 3 has been part of the Shotover WWTP treatment process. When the second MLE bioreactor and the clarifier are operational in late 2025, Pond 3 will be decommissioned, and the conversion to a calamity pond for treated effluent can commence.

The conversion of Pond 3 to a treated effluent calamity pond will require the following changes:

- Removal of accumulated sludge, approximately 12,300 m^3 and 615 dry tonnes (Beca, 2024).
- Construction of an internal bund to create a storage volume of approximately 40,000 m^3.
- Reshaping the pond base into a grassed base.
- Replacement of existing Pond 3 pumps with new pumps suitable to return flows to the Inlet Works.
- Installation of a new pipeline from the pumps to the WWTP Inlet Works, approximately 1000 m, along the western edge of the pond embankments.

Figure 10 Expected area to be converted into a treated calamity pond (Beca, April 2022)

Figure 11 Pond 3 (future calamity pond), photo taken from the transfer pumps 2024

A design has been previously developed as part of the Stage 3 upgrade (the second MLE), refer to Figure 10 above. The design may require some changes depending on the final storage volume of the calamity pond, the selected long term disposal option, and any requirement for reclamation of part of Pond 3 to house future infrastructure (e.g. membrane filtration system).

For purposes of design considerations for integration with the tertiary filtration, the treated effluent calamity pond volume has been selected based on providing at least 1 day of storage of the 2060 peak dry weather flow. The return pump flow rate selected is 100 L/s or able to return up to 9,000 m^3/day if running continuously. This allows the WWTP to re-process the stored treated effluent while treating the average daily flow without overloading the biological system and the secondary clarifiers.

The return pump station will also receive the backwash stream from the tertiary filtration (Section 6.1.2) and the membrane filtration (Section 6.4.1) as required under the respective options.

The final details of this will need to be confirmed against the scope of a separate QLDC project which covers the calamity pond, this will enable integration of the tertiary backwash system.

Staging potential

Not applicable / out of scope. It is important to note that provision for area to accommodate future flows should be considered during the design to allow for additional flows beyond the 2060 horizon.

6.1.2 Tertiary filtration

Applicable to: ☑ **Option A** ☑ **Option B** ☑ **Option C** ☑ **Option D**

Tertiary filtration is proposed for all options to reduce total suspended solids (TSS), solids-bound organics, and nutrients from the discharge. This will also increase the UV-transmissivity and therefore the UV disinfection efficiency, improving the quality of the final effluent.

There have been a number of successful tertiary filtration installations in New Zealand, including the three Sequencing Batch Reactors (SBRs) followed by tertiary filters in the Thames Coromandel District, operating since 2010. Pile cloth filter media has been selected for its robustness, better operability, and the longevity of the filter media.

The tertiary filters will be sized to achieve median and 90%tile total suspended solids (TSS) limits of 5 and 10 mg/L respectively. The proposed location of the tertiary filters will be adjacent to the UV channel, to take advantage of its close proximity to Pond 3 (to be re-purposed as a treated effluent calamity storage). Because of the hydraulic grades, a lift pump station will be constructed to transfer the flows into the tertiary filters.

The tertiary filter upgrade will consist of the following components:

- Cut-in of the existing GRP pipe upstream of the UV channel.
- Construction of a lift pump station, with an overflow pipe to divert flows to the treated effluent calamity pond.
- Installation of three transfer pumps (duty, assist and standby) to transfer flow into the tertiary filters.
- Installation of two pile cloth disc filter units on a concrete slab. A space provision will be made for a future third unit (to be installed around 2040-2045). Each filter is capable of handling of PDWF in 2060, i.e. 31,000 m^3/day.
- The filters are capable of handling a maximum inlet TSS of 50 mg/L for producing filtered effluent with less than <5mg/L as TSS (as median) at the required flow rate. Typical performance observed is less than 2 mg/L (below detection limit).
- A shed or a carport cover for housing the control cabinet.
- Installation of a filter backwash pipe returning to calamity pond return pump wet well (for returning the filter solids to the inlet works).
- Outlet instrumentation (e.g. turbidity, online TAN analyser) for early detection of potential non-compliance.
- Connection to the UV channel, including a stub pipe for future UV channel.
- Electrical installation and SCADA integration.

An indicative concept arrangement is shown in Figure 12 and Figure 13 shows a photo example of tertiary filter system.

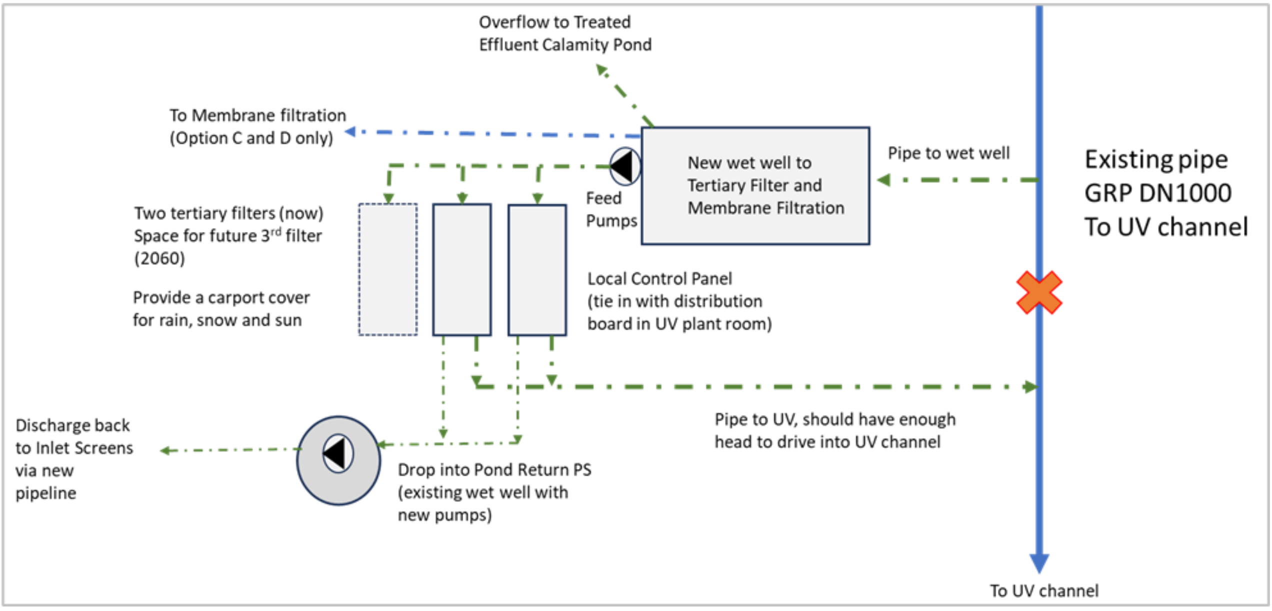

Figure 12 Tertiary filter concept arrangement

Figure 13 Example figure of tertiary filter installation (online photo, from WaterProject)

Alternatives to tertiary filtration have been evaluated, though not incorporated. The primary alternative is membrane filtration; however, this method entails significantly higher costs relative to tertiary filters and does not present a notable advantage for the disposal via the river delta.

Staging potential

Space for a third tertiary filter (for future flows additional to the 2060 design horizon) has been included.

6.1.3 Recycled water supply for tankers

Applicable to:	✅ Option A	✅ Option B	✅ Option C	✅ Option D

A recycled water supply is considered a supplementary option. It is not required for disposal to occur; however, provides the benefit of reuse. Options C and D also include irrigation water for the golf course and sports fields and this is discussed separately in Section 6.4.6.

All options include the use of recycled water for dust suppression, collected by water tankers. This reduces the use of potable water for airborne dust, particularly in dry or high-traffic areas. This would be especially useful for gravel works near the Shotover WWTP, where frequent truck movements generate significant dust. It should be noted that if this is deemed not commercially viable (i.e. insufficient demand) this would not be undertaken.

The recycled water will be expected to meet the requirements set out in the Australian Guidelines for Water Recycling. The target virus log reduction value (LRV) is 5.0, achieved by (i) biological treatment (LRV target of 0.5), a dedicated UV system (LRV target of 2.0) and chlorine contact tank via sodium hypochlorite dosing (LRV target 3.0).

For Option A and B, the recycled water system will be located adjacent to secondary clarifier outlet chamber, where the existing site reuse water is also sourced from. This separate system will comprise two transfer pumps, two UV reactors, a chlorine contact tank and a sodium hypochlorite dosing set-up from an IBC storage. The recycled water will be stored in 2x 30 m^3 PE storage tanks) on a concrete plinth, with supply pump(s) connecting to a standpipe for trucks to collect the recycled water. The recycled water demand for dust suppression is assumed to be 100 m^3/day, nonetheless the system is sized for a 30 m^3/hour throughput hence there is additional capacity (up to 720 m^3/d if running for 24 hours) if the dust suppression water demand is actually higher.

Process instrumentation will include flowmeters, a chlorine analyser and a turbidity meter.

For Option C and D, the set-up will be similar, except the system will be supplied with membrane permeate and connected to a large recycled water tank located near the QEC area. For these options, the pipeline, which will already be set up to convey effluent flows to the soakholes or boreholes and sports fields, will also be utilised to convey treated effluent which will then be further disinfected near QEC and used for recycled water supply.

6.1.4 Discharge to Kawarau River via the land flow path structure (rock outfall)

Applicable to: ☑ **Option A** ☑ **Option B** ☑ **Option C** ☑ **Option D**

The land flow path (rock outfall) is a structure located on the delta that allows the treated effluent to pass through and disperse into the Kawarau River. An indicative high-level sketch of this is outlined in Section 8.2. It is intended to minimise the visual impact of the discharge, to provide aeration, land contact prior to the effluent entering the river and to obstruct public contact with the treated effluent. It is recognised that this form of land contact is inadequate to meet the cultural requirements for a land-based discharge as requested by iwi.

The land flow path is to be designed for the full 2060 flow and the details would be refined through the preliminary design stage, but at this stage is assumed to require:

- A pipe (or suitable alternative conveyance structure) to connect the UV outlet or wetland outlet (depending on the option) to the land flow path structure, covering an approximate distance of 1.4 km.
- Manholes to accommodate changes in direction of the discharge pipe.
- The land flow path feature will comprise a culvert, manifold outlet, gabion wall and rip and rap channel. The culvert will convey flow from the pipe outlet to the manifold. The manifold will be approximately 6 m long and will convey the flow to the gabion wall.
- A gabion wall of baskets will be installed using rock media similar to rip rap. Following this a 1900 m^2 rip rap channel to the Kawarau will be supplied and installed, likely using rock with a D50 size of 350–450 mm and an approximate depth of 600 mm, totalling 1,500 m^3 of material (this includes some allowance for contingencies). Additional natural rock may be placed on top to help the structure blend with the surrounding delta environment. The effluent will flow through this into the Kawarau River.
- Excavation will be required, with minimal or no offsite disposal anticipated, as excavated material is expected to be reused for site landscaping. Earthworks will include surface trimming, backfilling, and minor ground improvement. Soft ground conditions are expected, and appropriate ground improvement measures should be implemented.

6.1.4.1 Alternative discharge method to Kawarau River

For all options, there is the opportunity for refinement of the discharge method which includes the possibility of including a diffuser within the Kawarau River. A submerged diffuser pipe offers several advantages, including enhanced mixing, greater resilience to flood flows, and reduced visual impact. The final selection of the preferred discharge method will be determined during the decision-making process in consultation with Council, the community, and iwi stakeholders.

6.1.5 Training line modification

Applicable to: ☑ **Option A** ☑ **Option B** ☑ **Option C** ☑ **Option D**

The purpose of the existing river training lineis to promote the Kimi-ākau/Shotover River to flow in an easterly direction at the confluence with the Kawarau River, which helps prevent upstream flooding at Lake Wakatipu and in Queenstown during high lake events. Because the Kawarau River has a very flat gradient, floodwaters from the Kimi-ākau/Shotover River can act like a hydraulic dam, restricting flow in the Kawarau River and causing lake levels to rise. This increases the risk of flooding upstream of the Kimi-ākau/Shotover River. Sediment build-up from the Shotover also reduces flow capacity in the Kawarau River.

The section of the structure perpendicular to the Kimi-ākau/Shotover River is referred to as the training line and is owned and maintained by ORC. The training line was designed to safeguard the Kimi-ākau/Shotover River flow so that it enters the Kawarau as far downstream as possible. The parallel section is known as the revetment is owned by QLDC but managed by ORC under a Memorandum of Understanding (MOU). Figure 14 and Figure 15 show the modification of the delta from 1976 to 2025, with these modifications resulting predominantly from the construction of the training line.

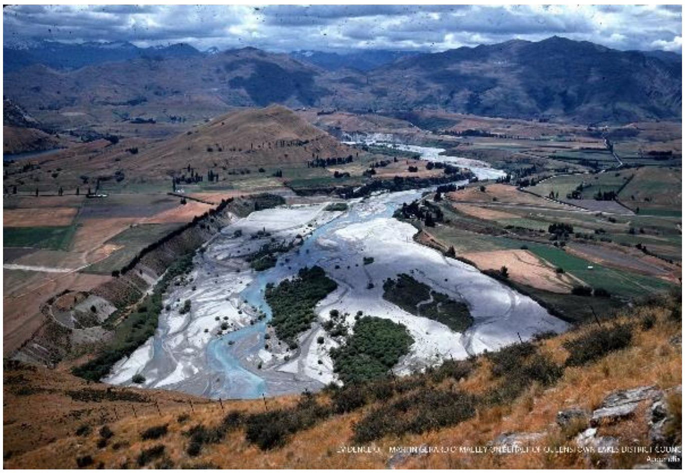

Figure 14 Shotover Delta (ORC, 1976)

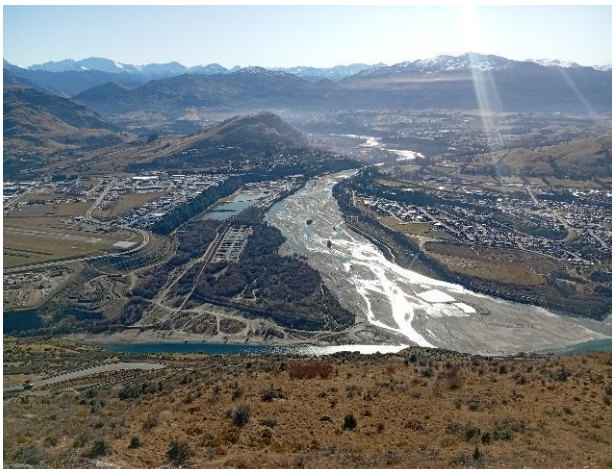

Figure 15 Shotover Delta (ORC, July 2025)

Otago Regional Council (ORC) manage both the training line and revetment, constructed circa 2010, to move the confluence of the Kimi-ākau/Shotover River and Kawarau River further downstream, reducing the hydraulic damming effect. Additionally, the training line aims to improving sediment retention and storage on the delta in the event of an upstream landslide, preventing it from restricting the Kawarau River flow. This is understood to require ongoing management which includes gravel extraction and vegetation clearance.

The overland flow structure that acts as the point of discharge of treated wastewater to the Kawarau River is proposed to be located behind the training line (relative the Kimi-ākau/Shotover River) to provide protection from sediment inundation during flood events. The proposed location is at the furthest eastern extent of the training line, as close to the confluence of the Kawarau and Kimi-ākau/Shotover Rivers as possible. This location provides for:

1- Improved water quality along the accessible Kawarau and Kimi-ākau/Shotover Riverbanks on the delta, with a view to providing improved environments in these areas relative to current conditions.
2- Mixing of any discharge treated wastewater in the more turbulent waters at the confluence of the two rivers. The inflow of Kimi-ākau/Shotover River immediately downstream of the discharge is expected push any discharged treated wastewater more centrally within the Kawarau River channel and provide relatively rapid mixing.

To provide for discharge at the confluence itself, an extension of the training line, or similar structure to protect the overland flow path from sediment inundation would be required, with this in the order of 125 m long.

Any extension or modification of the training line requires consultation and approval from Otago Regional Council (ORC). For costing purposes, an extension of the training line to the point of river confluence, approximately 125 m, has been included in the cost estimate for the land flow path estimation.

6.2 Variable components of disposal options

6.3 Subsurface wetland

Applicable to: ❌ **Option A** ✅ **Option B** ✅ **Option C** ✅ **Option D**

The horizontal sub surface wetland is to be designed for the full 2060 flow and is included in Options B, and would be an optional addition for Options C and D, and for the purposes of option comparison has been included. The wetland provides land contact and some treated effluent polishing prior to discharge into the Kawarau River. As it is a natural system there is more variation in the level of treatment and so cannot be as well controlled or quantified. The required effluent quality for discharge will be achieved at the UV outlet therefore the wetland is designed primarily for land contact and hydraulic performance.

There are limited number of horizontal flow subsurface installations in New Zealand, however it has been used overseas, particularly in China for polishing the highly treated effluent further before returning to the receiving environment. The recent renewal of the Featherston WWTP discharge consent also has included horizontal flow sub-surface wetlands as part of the planned upgrades in the next few years.

Figure 16 Two subsurface wetland examples - Jian Li City (2.4ha) in China and Cedar Grove WWTP (7.7ha) in Queensland

The features of the subsurface wetland would be refined through preliminary design, but are assumed to consist of:

- Pipe connection from the UV outlet to a forebay cell (approximately 500 m^2).
- Wetland (approximately 3 ha in total) will be located at the area west of the training wall and near the southern end of the delta.
- Wetlands will be divided into four cells, in a two-by-two arrangement.
- The wetland cells will be surrounded by raised embankments to prevent surface run-off and flood waters from entering the cells.
- Wetlands will be lined with high density polyethylene (HDPE) liner and Bidim to prevent seepage into the ground and clogging of media with in-situ sediments.
- Each wetland cell will have inlet distribution pipe to distribute UV disinfected effluent across the width, and outlet manifold pipes collect the treated effluent, as shown in Figure 17.
- The wetlands will be filled with two grades of rock media, with the below ground and above ground total thickness of approximately 1.3m. Plant vegetation (species to be selected with consultation with mana whenua and QAC) will be planted in the top segment of the rock media, which will provide some nutrient uptake.
- A by-pass will be provided to accommodate exceptionally high flows events; this protects wetlands from being overwhelmed hydraulically or damaged during these periods.
- Landscape features such as boardwalks and others has been allowed in the preliminary cost estimates to enhance aesthetic and recreational values.
- Wetland outlet pipe will connect to the land flow path (rock outfall) discharge, as in Option A.

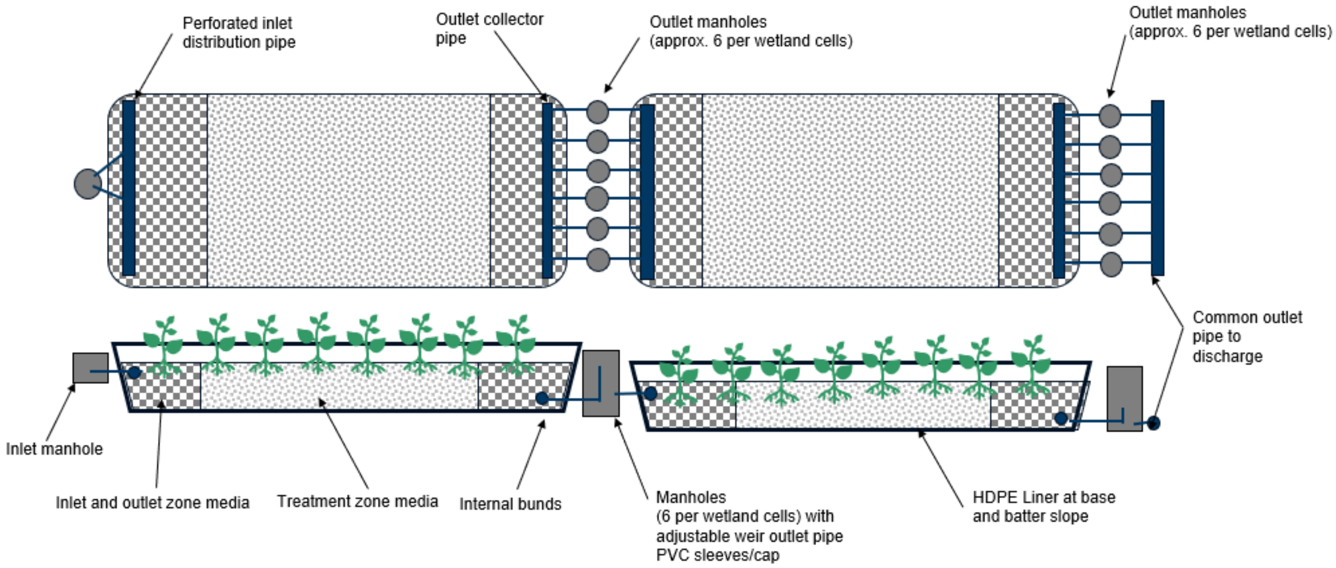

Figure 17 Subsurface wetland conceptual schematic

A subsurface wetland methodology has been chosen to avoid surface water ponding in this location which has the risk of attracting birds and waterfowl to the area, which is located beneath the Queenstown Airport. Plants and vegetation will also be selected so as not to attract birds or provide habitat for species which encourage bird activity in this area.

As noted, this wetland design is based primarily on technically achieving land contact of highly treated effluent prior to discharge to the Kawarau River, rather than designing to achieve significant secondary treatment efficiency (e.g. removal of nutrients). Hence, the surface loading rate of this wetland is higher than typically used where treatment is the primary objective. However, some degree of additional treatment may be realised, particularly during periods of lower flow when longer residence times will be achieved. It should also be noted that iwi partners do not consider this to provide culturally sufficient land contact and provided a position of statement of Kāi Tahu on short list options. This includes the statement “all options rely on discharge of significant volumes of wastewater to the Kawarau River, none of them can be considered culturally appropriate”. The full position statement is located in Section 9.9.

The wetland construction will require tree clearance and earthworks prior to wetland construction. Excavated materials would be used elsewhere, either in wetland bund or base construction, or in any areas requiring elevation, such as the tertiary filter area.

The functional design provided is indicative, and there is opportunity for the final wetland design to reflect input from iwi partners and stakeholders.

Staging potential

Staging of the wetlands will offer flexibility in the implementation and operations. Future additions could increase the wetlands size or include new plantings based on consultation with iwi partners, stakeholders and community.

6.4 Conveyance and effluent disposal to Frankton Flat

Applicable to:	❌ **Option A**	❌ **Option B**	✅ **Option C**	✅ **Option D**

In Option C and D, part of the treated effluent will be conveyed into the Frankton Flats area for land-based discharge (bores and soakholes) and recycled water supply. This section describes different components related to these two options:

- Membrane filtration for additional treatment of suspended solids (Section 6.4.1)
- Permeate storage and transfer pumps to Frankton Flats (Section 6.4.2)
- Conveyance including the pipeline to Frankton Flats (Section 6.4)
- Bore disposal for Option C only (Section 6.4.4)
- Soakhole disposal (Section 6.4.5)
- Supplementary irrigation to golf course and sport field (Section 6.4.6).

6.4.1 Membrane filtration

Applicable to:	✗ **Option A**	✗ **Option B**	✓ **Option C**	✓ **Option D**

Membrane filtration provides the benefit of complete removal of suspended solids to mitigate the risk of soakhole and bore clogging in the two Frankton Flats disposal options. Compared to tertiary filtration, membrane filtration offers higher virus, protozoa and bacteria removal efficiency through physical separation.

Membrane filtration has been applied in a number of wastewater schemes in New Zealand, particularly in oxidation pond effluent tertiary treatment in Te Anau, Cromwell and others. For example, the membrane filtration system in Te Anau produces a solids-free treated effluent suitable for subsurface drip irrigation, and has been in operation since 2021.

Hollow-fibre membranes are often used in membrane treatment applications. The images in Figure 18 present a pressure hollow-fibre membrane system installed in the Te Anau WWTP. Membrane filtration will reduce the TSS level in the permeate to < 2mg/L (the detection limit).

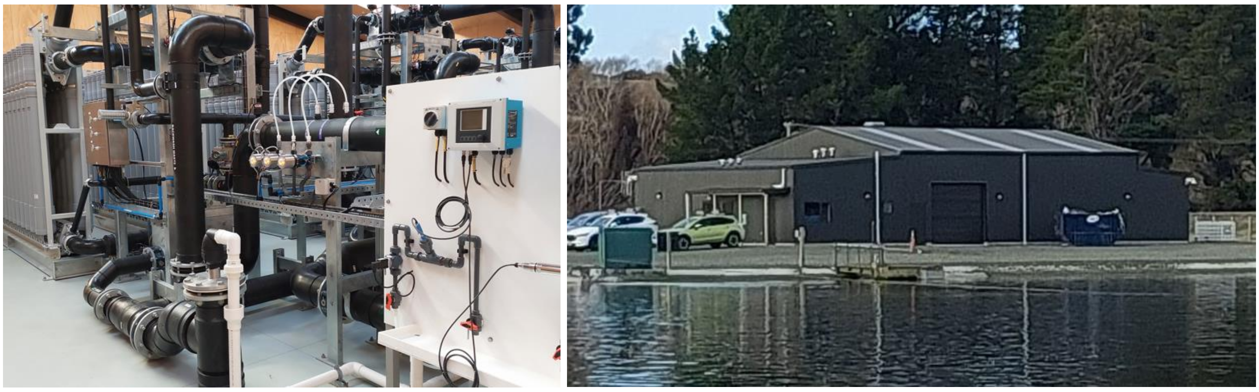

Figure 18 Membrane filtration example installation (Te Anau WWTP)

The features of the membrane filtration system will comprise:

- Feed pipe(s) from the tertiary filter wet well to membrane feed pumps located inside the membrane building
- Membrane feed pumps for pumping secondary clarifier effluent through the membrane filtration units
- Membrane filtration system (containerised system for Stage 1, membrane filtration building for Stage 2)
- Permeate storage tank
- Backwash pumps
- Membrane clean-in-place (CIP) chemical storage and dosing
- Membrane system control and SCADA integration
- Power supply and generator upgrade.

Staging potential

The membrane system will be implemented in two stages, in line with the stages proposed as part of Options C and D. Stage 1 flows will be approximately 3,200 m^3/d and Stage 2 approximately 16,000 m^3/d, subject to favourable Stage 1 outcomes. More details on the stages for Option C and D is outlined in Section 8.4.2 and 8.5.2.

6.4.2 Permeate storage and transfer pumps

Applicable to:	✗ Option A	✗ Option B	☑ Option C	☑ Option D

The highly treated effluent produced from the membrane filtration system will be stored in a 400 m^3 permeate tank. The permeate tank will be a bolted steel tank with a roof cover to protect the integrity of the recycled water. The tank will have two outlets, one for transfer pumps to the Frankton Flat, and the other for membrane backwash.

Figure 19 Example of bolted steel storage tank (Reliant Solutions)

Similar to the membrane filtration upgrade, the transfer pumps will be installed in two stages:

- Stage 1 transfer pumps to convey the permeate to new recycled water storage tanks up on the Frankton Flats area. Preliminary pump selection was to provide 4 ML/d conveyance capacity.
- Two additional pumps will be added in Stage 2, operating in parallel to the Stage 1 pump and pipeline, to increase the total transfer capacity to 16 ML/d.

Detailed pump selection will be undertaken once the disposal capacity and pipe route are confirmed.

Staging Potential

As discussed above, the permeate storage and transfer pumps will be implemented in two stages.

6.4.3 Pipe conveyance to Frankton Flat

Applicable to:	✗ Option A	✗ Option B	☑ Option C	☑ Option D

Transfer pumps and pipelines will be installed to convey the treated effluent from the membrane system to Frankton Flats for land disposal or beneficial reuse. The following Figure 20 illustrates indicative pipe conveyance routes from proposed membrane to the Frankton Flats. Other QLDC projects (i.e. Frankton to SWWTP Conveyance) are also considering pipe alignment through the Frankton Flats area. Correspondence with these other projects is ongoing to co-ordinate excavations and pipe alignment where possible, hence the below indicative routes are subject to change.

The pipeline conveyance and associated infrastructure will be implemented over the two stages, as follows:

Stage 1 upgrade

- Approximately 3.2 km of DN200 pipeline to be installed through Frankton to convey the Stage 1 flows.
- A 400 m^3 storage tank for irrigation and bores is proposed near the sports and golf courses.
- A 400 m^3 storage tank is proposed for bore injections on the southern side of Frankton.
- UV for recycled water supply as irrigation water and dust suppression adjacent to the recycled water storage tank in the northern side of Frankton.
- A chemical storage for adding sodium hypochlorite solution to irrigation water and bore/soakhole disposal.

Stage 2 upgrade

- Subject to the Stage 1 extended trial outcome, potentially adding up to 3.2 km of DN350 pipeline to convey the Stage 2 flows.
- Additional 400 m^3 storage tank on the southern side of Frankton.

Figure 20 Indicative pipe routes (blue) from WWTP to Frankton Flats (exact locations to be confirmed)

6.4.4 Bore disposal on Frankton Flat

Applicable to: ❌ **Option A** ❌ **Option B** ✅ **Option C** ❌ **Option D**

In Option C, disposal of treated effluent will initially be primarily via the land flow path (rock outfall), with a small portion of the treated effluent initially pumped to the Frankton area for a bore hole disposal trial. In the longer term the flow up to the Frankton area will discharge an estimated 12,500 m^3/d via bore holes.

Bore injection is a disposal method that involves discharging highly treated wastewater into deep underground aquifers via bores. This approach is particularly suitable for areas where surface disposal options are limited or where land application is constrained by seasonal or spatial factors. Refer to Section 4.1.3 for further details on the desktop assessment of bore disposal capacity assumed in this report.

Prior to undertaking implementation of bore disposal, detailed site investigations would be completed to confirm the option viability. Subsequently, the option will be delivered in two stages:

- Stage 1: Trial discharge to confirm requirements for long term operation. Exact volumes to be confirmed:
  - Construct two bores, with an estimated 1,600 m^3/d disposed capacity via bore injections
  - Up to 1,500 m^3/d disposed via irrigation
  - Up to 100 m^3/d disposed via recycle water
  - Remaining flow (~11,900 m^3/day, 2030 average daily flow) disposed via the wetland to the Kawarau River.
- Stage 2: Full-volume discharge, subject to successful Stage 1 outcomes:
  - Construct 8 more bores (10 in total), to increase the disposal capacity in the vicinity of 12,500 m^3/d disposed. The potential disposal range is 3,000 to 20,000 m^3/day and based off the analysis outlined in Appendix E, there is an estimated 25% probability of achieving a disposal rate of 12,500 m^3/day.
  - Up to 1,500 m^3/d disposed via irrigation
  - Up to 100 m^3/d disposed via recycle water
  - Remaining flow (~11,900 m^3/day, 2060 average daily flow) disposed via the wetland to the Kawarau River
  - A second resource consent application is likely be needed for the second stage bore construction and treated effluent disposal.

From the desktop assessment, described in Section 4.1.3, the bores will be 300mm in diameter and 100m deep to reach the groundwater aquifer. The following Figure 21 provides a diagram of a typical bore construction.

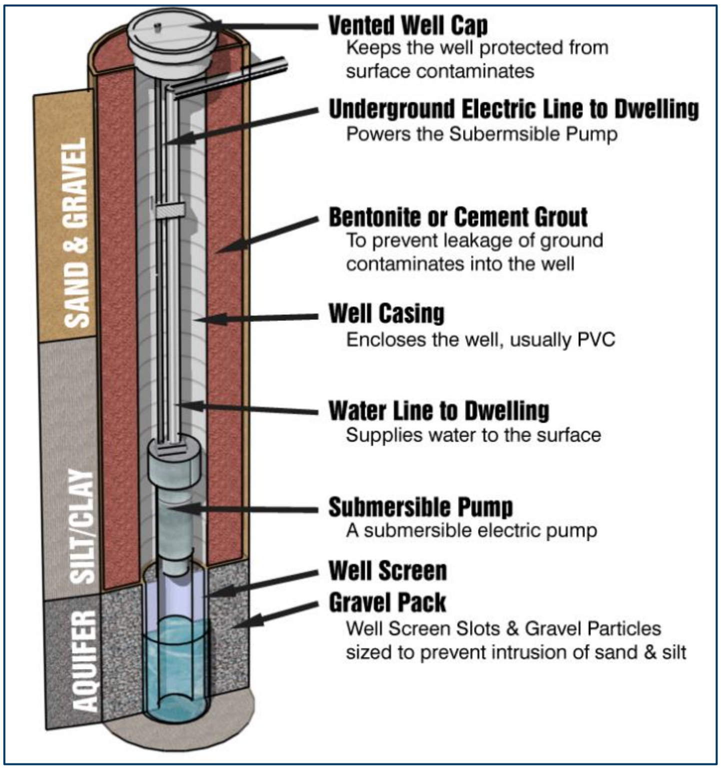

Figure 21 Typical bore construction (Harvard University, 2016), details to be confirmed in preliminary design phase

6.4.5 Soakhole disposal on Frankton Flat

Applicable to:	❌ **Option A**	❌ **Option B**	❌ **Option C**	✅ **Option D**

In Option D, disposal of treated effluent will initially be primarily via the land flow path (rock outfall), with a portion of the treated effluent pumped to the Frankton area for a soakhole disposal trial. In the longer term the flow up to the Frankton area will discharge an estimated 12,500 m^3/d via soakholes.

Soak holes is a method of effluent disposal that involves discharging highly treated wastewater into the ground via soak holes. This approach is particularly suitable for areas where surface disposal options are limited or where land application is constrained by seasonal or spatial factors.

Prior to undertaking implementation of disposal via soakhole, detailed site investigations would be completed to confirm the option viability. Subsequently, the option will be delivered in two stages:

- Stage 1: Trial discharge to confirm requirements for long term operation. Exact volumes to be confirmed:
  - Construct two soak holes, with an estimated disposal capacity of 500 m^3/d.
  - Up to 1,500 m^3/d disposed via irrigation
  - Up to 100 m^3/d disposed via recycle water
  - Remaining flow approximately 13,000 m^3/d on average (2030 flows) to the Kawarau River through the constructed wetland.
- Stage 2: Full-volume discharge, subject to successful Stage 1 outcomes:
  - Construct up to 50 soakholes, with assumed 12,500 m^3/d disposal capacity.Though possible range could be 100 to 20,000 m^3/d, based off the analysis outlined in Appendix E, there is an estimated 13% probability of achieving a disposal rate of 12,500 m^3/day.
  - Up to 1,500 m^3/d disposed of via irrigation
  - Up to 100 m^3/d disposed via recycled water
  - Remaining approximately 11,900 m^3/d on average (2060 flows) to the Kawarau River.

From the desktop assessment, described in Section 4.1.3, the soak holes will be 300 mm in diameter and 20 m deep.

6.4.6 Irrigation supply to golf course and sports fields

Applicable to:	❌ **Option A**	❌ **Option B**	✅ **Option C**	✅ **Option D**

As discussed in Section 4.1.2, approximately up to 20 ha of Queenstown Events Centre (QEC) sports fields and golf course (Frankton Golf Centre) in the Frankton area could be available for irrigation with recycled water, with an assumed disposal capacity of 1,500 m^3/day, with a seasonal demand (higher irrigation water demand in summer months). Figure 22 below shows the location of the fields.

A storage tank will be installed for the irrigation supply, as the irrigation will generally be undertaken in the evenings, with public access restriction. The storage tank will also be used to provide storage and head for the treated effluent discharge to either the boreholes (Option C) or soak holes (Option D).

Figure 22 ***Indicative pipe route and estimated potential irrigation area in the golf course and sportfields***

7 Cost estimates

7.1 Preliminary capital cost estimates

7.1.1 Summary

Preliminary capital cost estimates for the short list options were prepared based on the conceptual sizing outlined earlier in this report. The cost estimating consultancy ALTA was engaged to support the development of Class 4 cost estimates, as defined by the Association for the Advancement of Cost Engineering (AACE International). Class 4 estimates are typically utilised during feasibility studies for comparing options, as in this report, and have an expected accuracy range of -30% to +50%.

Table 10 below presents a summary of the preliminary capital cost estimates of the four options, with further detail provided in Appendix A. These costs are presented in 2025-dollar terms and do not include annualised cost escalations.

Table 10 Preliminary capital cost estimates (CAPEX) for effluent disposal options

	Option A Land flow path to Kawarau	Option B Wetland + land flow path to Kawarau	Option C Boreholes at Frankton (+ Option	Option D Soakholes at Frankton (+ Option B)
Stage 1 Construction Cost	$33 to 38 M	$64 to 73 M	$97 to 111 M	$96 to 109 M
Stage 2 Construction Cost (applicable to Option C and D only)	--	--	$51 to 58 M	$70 to 80 M
Consent, Investigations and design (includes both stages)	$6 M	$7 M	$17 M	$17 M
Option Total CAPEX (P50 to P90)	**$39 to 44 M**	**$71 to 80 M**	**$165 to 186 M**	**$183 to 206 M**

7.1.2 Component costs summary

High level cost breakdown of the major groups of upgrade components, inclusive of ancillary equipment, installation, contractor's cost, commissioning, traffic management and P50 contingency:

- Tertiary filtration and new pumps for treated water calamity pond $15M
- Recycled water supply for water tanker on dust suppression $2.7M
- Land flow path discharge structure including 1.4 km discharge pipe $16M
- Subsurface wetland $38M
- Additional treatment, conveyance and disposal assets for Stage 1 Frankton Flats $30M

7.1.3 Assumptions, inclusions, and exclusions

The following assumptions are applicable to the preliminary cost estimates:

- Preliminary capital cost estimates presented in this report are solely for the purpose of options comparison, and the estimate is not intended for budgeting purposes. Once the preferred option has been selected, further design development at preliminary design level and detailed estimating will be necessary to establish more definitive cost estimates for project budgeting.
- GHD provided a preliminary schedule of quantities based on conceptual sizing and information provided by several suppliers on proprietary plant equipment such as membrane filtration, tertiary filtration and UV systems, to assist ALTA compiling the preliminary cost estimates.

- ALTA has adopted a simple method to determine contingency uplifts, by applying 40% and 60% to the base estimates to work out P50 and P95 allowance.

The following items are not included in the above capital cost estimates:

- Capacity upgrade to the existing UV channel, in 2040 circa, pending future capacity review.
- Calamity pond sludge removal and pond base reshaping, as this will be separately executed as another project by QLDC, for completion by December 2027 or earlier.
- Power supply to site is assumed to be adequate, subject to future consultation with the line company.
- Land purchase related to Frankton Flats disposal options is excluded, as bores, soakholes, and associated infrastructure (including small plant buildings and storage tanks) are assumed to be located within QLDC owned land such as QEC or road verges.

Significant unit rates adopted in the preliminary capital cost estimates include (contractor's onsite and offsite margins excluded):

- Effluent discharge pipe to the land flow path (rock outfall) structure (GRP or HDPE pipe, diameter of 900 to 1,000 mm) is $3,300 to $3,900 per m.
- Wetland rock media is $150 to $185 per m^3.
- 500 m length board walk in the wetland is $2,500 per m.
- Wetland polyethylene liner inclusive of underlay is $82 per m^2.
- Bore injection (300 mm and 100 m deep) is assumed $500,000 each.
- Soak hole construction (300 mm and 20 m deep) is assumed $250,000 each.

- Other inclusions and assumptions are:
  - Traffic management costs are between 0.5 to 2% of the construction cost.
  - Contractor's onsite, offsite and risk percentage values to the option's construction cost are 25%, 12% and 5% respectively.
  - Testing and commissioning of new assets are set as 2% of the construction cost.
  - Consent including legal support will be between $1M and $1.5M.
  - Engineering design will be between 3 to 7% of the construction cost.
  - Construction contract administration cost is assumed to be 2% of the construction cost.
  - Annualised cost escalation has not been applied to Stage 2 upgrade works (applicable to Option C and D only).

7.2 Operating cost estimates

7.2.1 Operating cost summary

Preliminary operating costs have been compiled to estimate the relative operational and maintenance costs associated with the effluent disposal options. These estimates are presented in Table 11, with an accuracy range a range of -10%/+30%. The primary components considered are:

- Power cost – e.g. pumping to tertiary filters, transfer pumps to Frankton Flats disposal, membrane filtration and additional UV disinfection.
- Chemicals – such as membrane cleaning chemicals and hypochlorite dosing for bores and soak holes.
- Labour cost – reflects the additional operator's input needed to undertake routine inspection and maintenance activities.
- Operational costs for maintenance items – these have been estimated as a percentage of the construction cost.
- All costs are at current price (2025) and do not include annualised cost escalations.

Table 11 Preliminary operating cost estimates related to the disposal options

	Option A Land flow path to Kawarau	Option B Wetland + land flow path to Kawarau	Option C Boreholes at Frankton (+ Option B)		Option D Soakholes at Frankton (+ Option B)	
Stage			**Stage 1**	**Stage2**	**Stage 1**	**Stage2**
Power	$71,000	$66,000	$140,000	$370,000	$97,000	$366,000
Chemicals and other	$4,700	$4,700	$20,000	$53,000	$17,000	$53,000
Labour (additional)	$10,000	$30,000	$80,000	$170,000	$80,000	$170,000
Civil and mechanical maintenance costs*	$260,000	$370,000	$640,000	$1,033,330	$630,000	$1,125,000
Annual Operating cost	$350,000	$480,000	$880,000	$1.6M	$830,000	$1.7M
Range (-10% to +30%)	**$320 to 460k**	**$430 to 620k**	**$790k to 1.1M**	**$1.4 to 2.1M**	**$740k to 1.1M**	**$1.5 to 2.2M**

* *(assumed 1% of civil and 3% of mech items pa)*

The above cost estimates identify that Option C and D would result in a significant increase in operating costs due to additional treatment and pumping to disposal areas on Frankton Flat.

7.2.2 Operating cost assumptions

Similar to the capital cost estimates, the operating cost estimates are for the purpose of disposal options comparison only, and the estimates are not intended for budgeting purpose. Operating cost estimates only cover effluent disposal, i.e. existing WWTP operation and maintenance cost (from inlet screens to the secondary clarifier, the UV channel and the sludge dewatering) are excluded and assumed to be the same or similar for all options.

The following assumptions are applicable to the preliminary operating cost estimates:

- All costs are at current price (2025) and do not include annualised cost escalation.
- Sludge production is assumed negligible (most sludge produced at the front end, not included in OPEX).
- Specific unit rates used in operating cost estimates (to be confirmed in detailed design):
  - Electricity rate at $0.22/kWh
  - Labour rate of $48/hr
  - Chemical costs (as advised by a chemical supplier):
    - Citric Acid 50%: $785 per 200L drum
    - Sodium Hypo 13–15%: $1,650 per 1000L IBC
    - Sulphuric Acid 98%: $1,950 per 900L IBC
- Additional operator input to Option A, B, C and D are estimated to be 0.1 (4 hrs/week), 0.3 (12 hrs/week), 0.8 (32 hrs/week), and 0.8 (32 hrs/week) FTE respectively.
- Civil and mechanical maintenance operational costs are estimated to be 1% and 3% of the construction cost per annum.
- Some of the soak holes might require reconstruction if the disposal capacity drops significantly within the asset life. The cost of constructing new soak hole in the vicinity has not been factored into the operating cost estimates, as the frequency of the occurrence is difficult to establish without running a trial.
- Membrane module renewal cost is estimated, based on an assumed asset life of 7 years. Disposal cost of used membrane module has not been included.

Membrane system power cost and chemical consumption are based on preliminary estimates provided by a supplier. If Option C or D is selected as the preferred option, a preliminary design by the vendor is necessary to achieve a better accuracy of the operating cost

A whole of life cost has been evaluated for each option by calculating the net present value (NPV) and is presented in Table 12 below. The assumptions for this estimate include:

- Council discount rate of 2%.
- 30-year period for the net present value.
- 50% of depreciation funded, assuming average 60-year asset life
- Capital costs used is outlined in Section 7.1.
- Operating costs used is outlined in Section 7.2.

Table 12 ***Net Present Value (NPV) for the short list options***

	Option A Land flow path to Kawarau	Option B Wetland + land flow path to Kawarau	Option C Boreholes at Frankton (+ Option	Option D Soakholes at Frankton (+ Option B)
NPV	$48M	$85M	$188M	$209M

8 Shortlist options

The following section summarises the base case, and short list options. Details of the main components within each of the four options were covered in Section 6.

8.1 Base case

For the short-list MCA scoring assessment the base case is the current case and is used for comparative scoring purposes only as it is not considered a feasible long term option. The base case is the discharge infrastructure and operation at the time of the short list assessment. It also assumes any ongoing maintenance of that operation. At the time of the initial short list assessment (8th October 2025), this involves discharge of treated effluent to the Kimi-ākau/Shotover River via a discharge channel as shown in Figure 23. A short-term consent has been applied for the discharge of treated effluent to the Shotover and is currently at the stage of undergoing public notification to consent the discharge through to 2030.

Figure 23 Discharge channel, October 2025, (prior to planned installation of permanent fencing).

8.2 Option A – rock outfall (land flow path) to Kawarau River

8.2.1 Option A overview

The following Figure 24 shows a high-level process diagram of the effluent disposal method proposed for Option A (shown in green). Existing infrastructure is shown in blue, and future works which fall outside the scope of this effluent disposal project are shown in grey. The option is schematically illustrated in Figure 25.

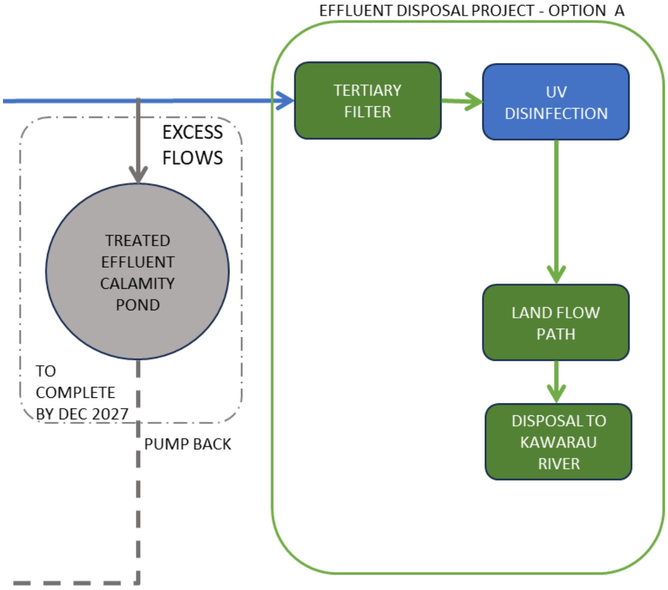

Figure 24 *Process diagram for Option A*

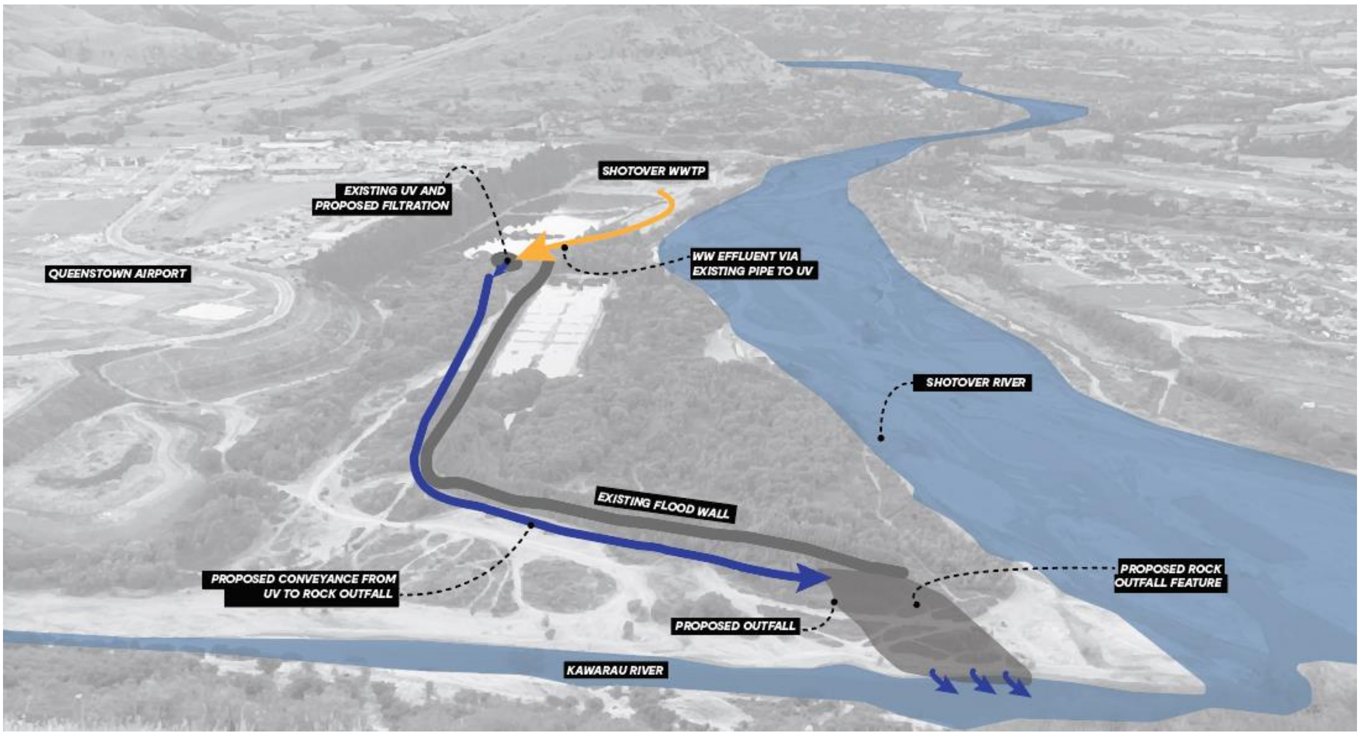

Figure 25 *Option A Rock outfall schematic illustration*

Option A includes tertiary filtration, conveyance to the end of delta and a land flow path (rock outfall) to the Kawarau River. This option is expected to comply with the proposed draft national wastewater environmental performance standards[15],[16] as presented for consultation by Taumata Arowai in March 2025.

This option is located near the Shotover WWTP and is constructed on QLDC owned land.

This option includes a 1,350 m long conveyance from the UV outlet to the southeast corner of the delta, and an approximate 1,900 m^2 area for a land flow path structure (rock outfall). The land flow path is constructed in natural depressions and former river channels on the southeast corner of Shotover Delta and engineered with

[15] https://www.taumataarowai.govt.nz/assets/Uploads/Wastewater-consultation/Information-Sheet-Proposed-discharge-to-water-wastewater-standard.pdf?vid=3
[16] The final standards were issued in November this year and will come into effect on 19 December 2025 (with the exception of regulation 8 and Part 2 which will come into force in December 2028). This report was prepared prior to the release of the final standards and therefore does not take into account any changes since the March 2025 proposed standards

local rock to provide a naturalised means of directing treated wastewater and any intercepted stormwater to the environment. The engineered flow path on the Delta would merge with the Kawarau River providing the means for flow to disperse into the river.

The option includes constructing a sufficient rock outfall to accommodate flood flows. River mixing locations are not commonly used, but this option uses the natural Delta environment and historical river channels for flow. Renewal of rock is likely needed in places following future major flood events.

The following Table 13 provides an option summary for the land flow path disposal. All costs are in present day terms (2025) and do not include annualised cost escalation.

Table 13 Option A summary

Elements	Option A details
UV treatment upgrade	After 2040
Pond 3 calamity storage	By Dec 2027, 40 ML volume
Tertiary Filtration	Two units, capable of handling up to 60 ML/d
Recycle water for tanker reuse	Located near the secondary clarifier, Assumed demand of 100 m^3/day
Conveyance	OD 1000 Pipe 1.4km
Discharge	Land flow path (rock outfall) to Kawarau
2030 discharge volumes	15,000 m^3/day to Kawarau River 100 m^3/day reuse
2060 discharge volumes	25,900 m^3/day to Kawarau River 100 m^3/day reuse
Financial summary	**Option A details**
Capex	$39M to $44M
OpEx (-10% to +30%)	$320k to $460k pa
Whole of life (NPV)	$48M

8.2.2 Option A risks

This option has elements that are relevant to all the options presented, so the following risks are common to all other options.

The following key risks are noted with regard to Option A.

- Negative public perception around the discharge to water results in low public acceptance
- Environmental impact of works on the delta needed to provide protection during flood events
- Option does not align with cultural values and is considered to be fatally flawed by iwi
- The land flow path (rock outfall) is susceptible to river sediments accumulation and clogging from floods and offers minimal in-ground treatment.

8.3 Option B – wetlands and land flow path to Kawarau River

8.3.1 Option B overview

Figure 26 shows a high-level process diagram of the Shotover WWTP and the proposed Option B, shown in green. Existing infrastructure is shown in blue, and future works which fall outside the scope of this effluent disposal project are shown in grey. The option is presented schematically in Figure 27.

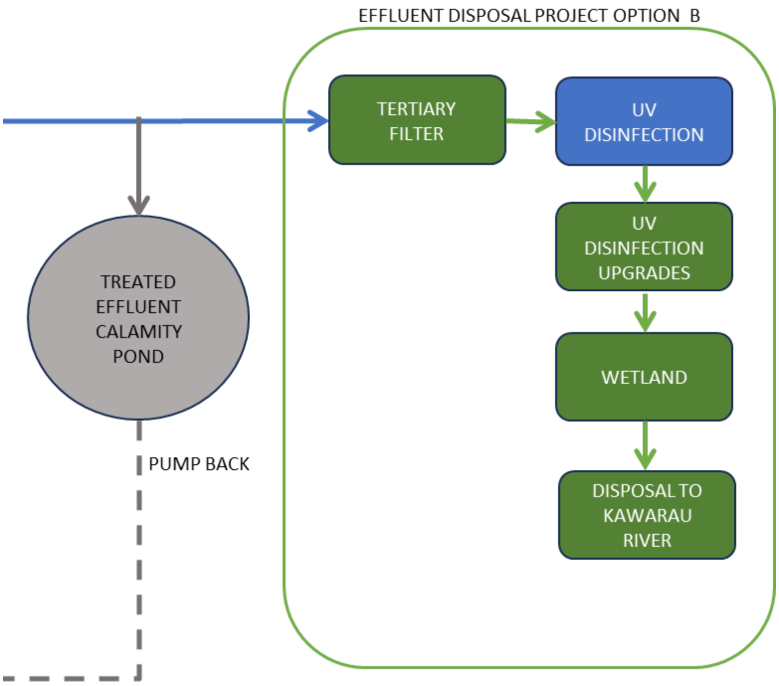

Figure 26 *Shotover WWTP process including the Option B disposal*

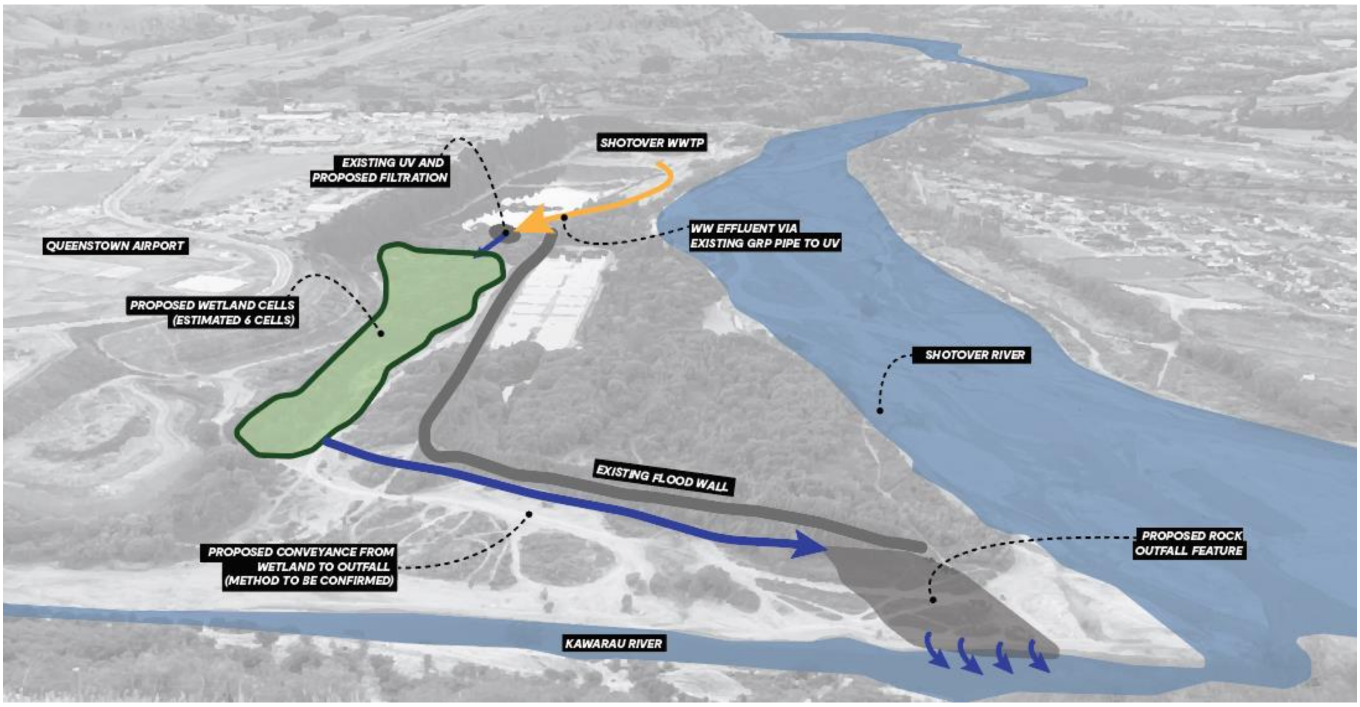

Figure 27 *Option B - Wetland schematic illustration*

In addition to the infrastructure in Option A, this option includes a horizontal flow subsurface wetland in the area south of the UV outlet. The purpose of constructed subsurface wetlands is to provide land contact (as opposed to a land-based discharge as requested by iwi), between the tertiary treated effluent (from the UV) and the land flow path (rock outfall) discharge to the Kawarau River. Although the wetland is not required for treatment purposes, the constructed wetlands will utilise physical, chemical and biological processes to further polish already highly treated effluent quality prior to discharge.

The use of subsurface wetland avoids the risk of human contact with treated wastewater. The effluent will enter via the inlet forebay and percolate horizontally beneath the surface through the rock media within the plant root zone. Beyond the forebay, surface water will not be visible under normal operating conditions.

The wetland will have the ability to operate all year round and the flexibility to take one cell offline for maintenance if required. Plant species will be determined at preliminary design phase, with an invitation for input from mana whenua and stakeholders such as QAC and would be selected to minimise birdlife.

Boardwalks and other amenity features could be added to further enhance the aesthetic and recreation value of the wetlands and the delta.

8.3.2 Option B summary

Table 14 provides a summary for the wetland and land flow path disposal for option B. All costs are in present day terms (2025) and do not include annualised cost escalation.

Table 14 Option B summary

Elements	Option B details
UV treatment upgrade	After 2040
Pond 3 calamity storage	By Dec 2027, 40 ML volume
Tertiary Filtration	Two units, capable of handling up to 60 ML/d
Recycle water for tanker use	Located near the secondary clarifier, Assumed demand of 100 m^3/day
Subsurface wetland	Approx. 3 ha
Conveyance	OD 1000 Pipe, 550 m
Discharge	Land flow path (rock outfall) to Kawarau
2030 discharge volumes	15,000 m^3/day to Kawarau River 100 m^3/day reuse
2060 discharge volumes	25,900 m^3/day to Kawarau River 100 m^3/day reuse
Financial summary	**Option B details**
CapEx	$71 to 80M
OpEx (-10% to +30%)	$430 to 620k pa
Whole of life cost (NPV)	$85M

8.3.3 Option B risks

In addition to the risks outlined for Option A (Section 8.2.2). The following key risks are associated with Option B:

- Plant species would need to be carefully considered to reduce the risk of attracting birds that might be hazardous to airport operations
- Subsurface wetlands have fixed hydraulic capacity and under extreme flow events may cause overloading
- Routine maintenance and upkeeping of wetland vegetation is essential
- Infrequent rejuvenation of rock filter media at the front zone of the wetlands, say every 8 to 10 years
- Mitigation of ground seepage risks (which would appear elsewhere on the delta), through installation of a HDPE liner.

8.4 Option C – bore injection at Frankton

8.4.1 Option overview

The following Figure 28 shows a high-level process diagram of the Shotover WWTP and the proposed Option C, shown in green. Existing infrastructure is shown in blue, and future works which fall outside the scope of this effluent disposal project are shown in grey. The proposed effluent disposal improvements include bore injection (Option C), wetland (Option B), and land flow path (rock outfall) (Option A).

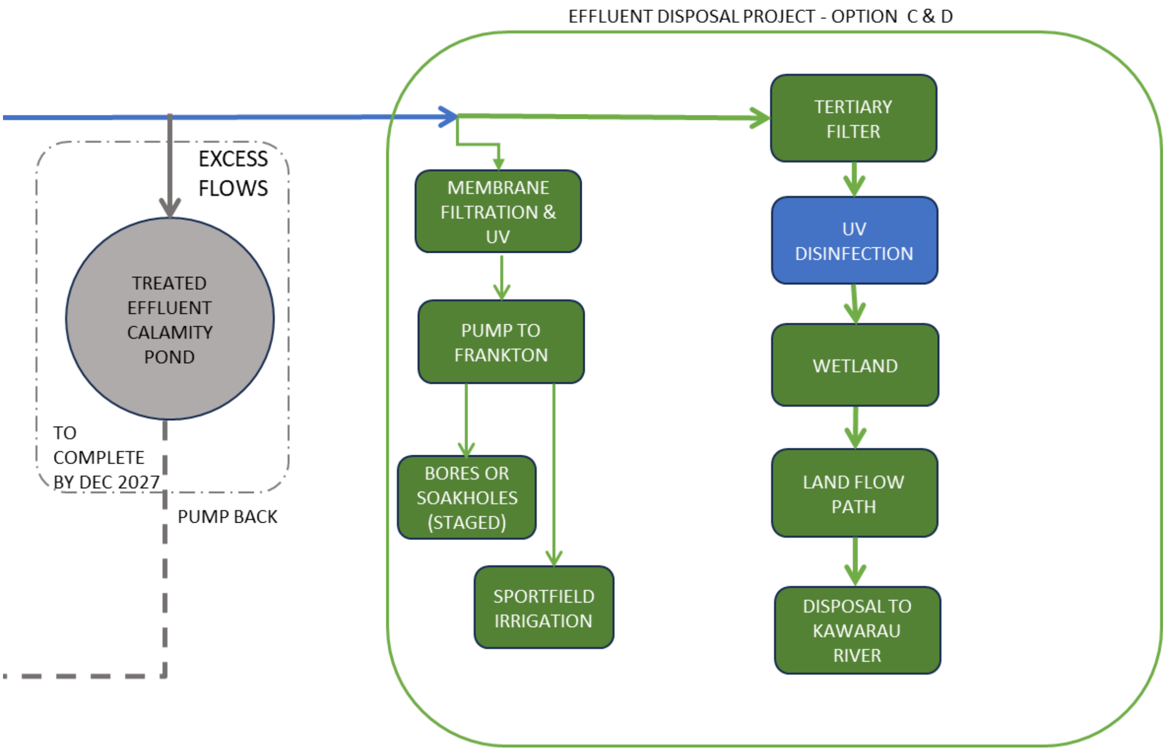

Figure 28 Shotover WWTP process including the Option C disposal.

As part of Option C, the majority of treated wastewater disposal would initially be directed to the Delta area. A portion of highly treated effluent would be disposed in a bore injection trial at Frankton. Subject to favourable results from the Stage 1 bore injection trial result, additional bores will be constructed with the potential to expand this method in the longer term. Figure 29 below shows possible borehole location areas.

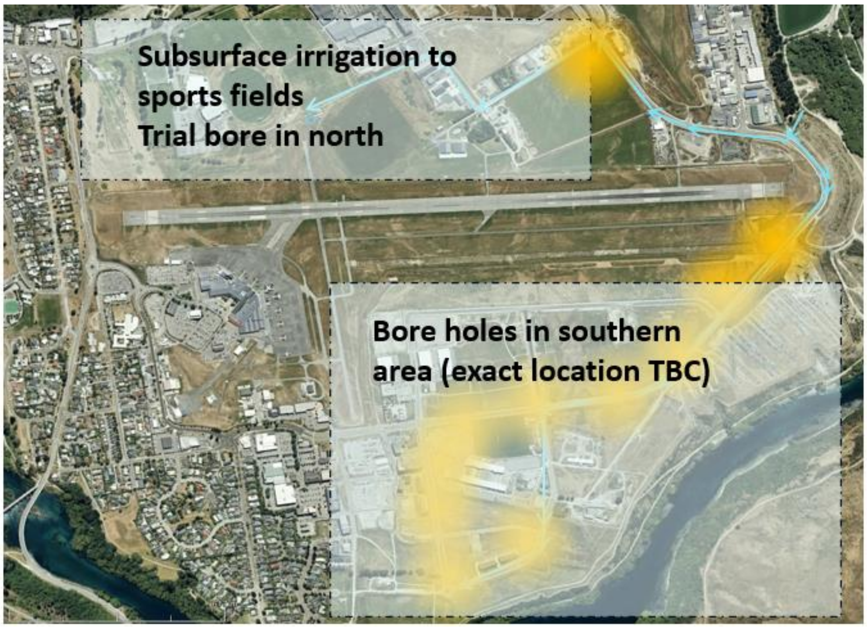

Figure 29 Option C Bore injection indicative location

This option also incorporates beneficial reuse of treated effluent for dust suppression, and substitution of potable water in the Queenstown Event Centre (QEC) sports fields and the golf course.

The physical infrastructure will be delivered in two stages, as summarised below:

- Stage 1 - Bore trial (two trial bores):
  - Two trial boreholes at Frankton Flats
  - Containerised membrane filtration plant to produce a very high-quality treated effluent
  - Transfer pumps and approximately 3.2 km pipeline to two storage tanks located in Frankton Flat.
  - Storage tanks provide storage and the head to discharge into the two test bores
  - Each test bore will be fitted with a submersible pump to back flush periodically to remove any accumulation of solids/fine particles
  - Recycled water for dust suppression and irrigation water supplies will receive additional UV treatment (2 LRV for virus)
- Stage 2 – Long term
  - Expanded to 10 bores total (nominal allowance), subject to successful Stage 1 outcomes
  - Recycled water for reuse by tankers for dust suppression ~ up to 100 m^3/day
  - Containerised membrane filtration plant will be replaced with a new permanent membrane filtration system within a new building
  - Additional transfer pumps and a second rising main with larger diameter to additional storage tanks in Frankton Flats
  - Stage 2 operation and maintenance is similar to Stage 1, except that the bores will be operated in groups to allow rotation
  - Recycled water for dust suppression and irrigation water supplies will remain the same

If Stage 1 demonstrates that Option C is not feasible the option will revert back to Option B.

8.4.2 Option summary

The following Table 15 provides an option summary for the bore injections disposal option. All costs are in present day terms (2025) and do not include annualised cost escalation.

Table 15 Option C summary

Elements	Option C details	
UV treatment upgrade	After 2040	
Pond 3 calamity storage	By Dec 2027, 40 ML volume	
Tertiary Filtration	Two units, capable of handling up to 60 ML/d	
Recycle water for tanker use	Located near the recycled water storage tank at QEC site, Assumed demand of 100 m^3/day	
Subsurface wetland	Approx. 3 ha	
Land flow path to Kawarau	Yes	
	Stage 1 details	**Stage 2 details**
Membrane filtration	3,200 m^3/day	Increase to 9,600 m^3/day (potential range: 4000 to 16000 m^3/day)
Tank storage	2 x 400 m^3 tanks	Add 1 x 400 m^3 tank
Transfer Pumps	Two pumps, 46L/s	Additional pumps to increase capacity
Conveyance	DN250 pipeline of approx. 3.2km	Additional DN350 pipeline
Bore disposal	2 bores, assumed capacity of 1,600 m^3	10 bores, assumed capacity of 12,500 m^{3*}
Sportsfield and golf course irrigation demand	1,500 m^3	1,500 m^3
Kawarau river disposal	11,900 m^3 (2030 average flow)	11,900 m^3 (2060 average flow)
Financial	**Stage 1 details**	**Stage 2 details**
CapEx	$107 to 121M	$58 to 65M
OpEx (-10% to +30%)	$800k to 1.1M pa	$1.4 to 2.0M pa
Whole of life (NPV)		$188M

8.4.3 Option C risks

In addition to the risks outlined for Option B (Section 8.3.3). The following key risks are specific to Options C:

- Requires comprehensive field investigations and technical assessments to support the consent application.
- Less straightfoward consenting pathway when compared to Option A and B.
- Constrained by undefined aquifer capacity and groundwater flow direction, which could limit disposal capacity to avoid effects, such as increased nutrient load to Lake Wakatipu and causing Kawarau riverbank instability.
- Performance of bores may degrade over time due to biofouling and clogging of the aquifer, regardless of the maintenance regime.
- A second consent application may be required to permit the treated effluent disposal in a much larger quantity once the trial is successful.

8.5 Option D – Soak holes at Frankton

The following Figure 30 shows a high-level process diagram of the Shotover WWTP and the proposed Option D disposal.

8.5.1 Option D overview

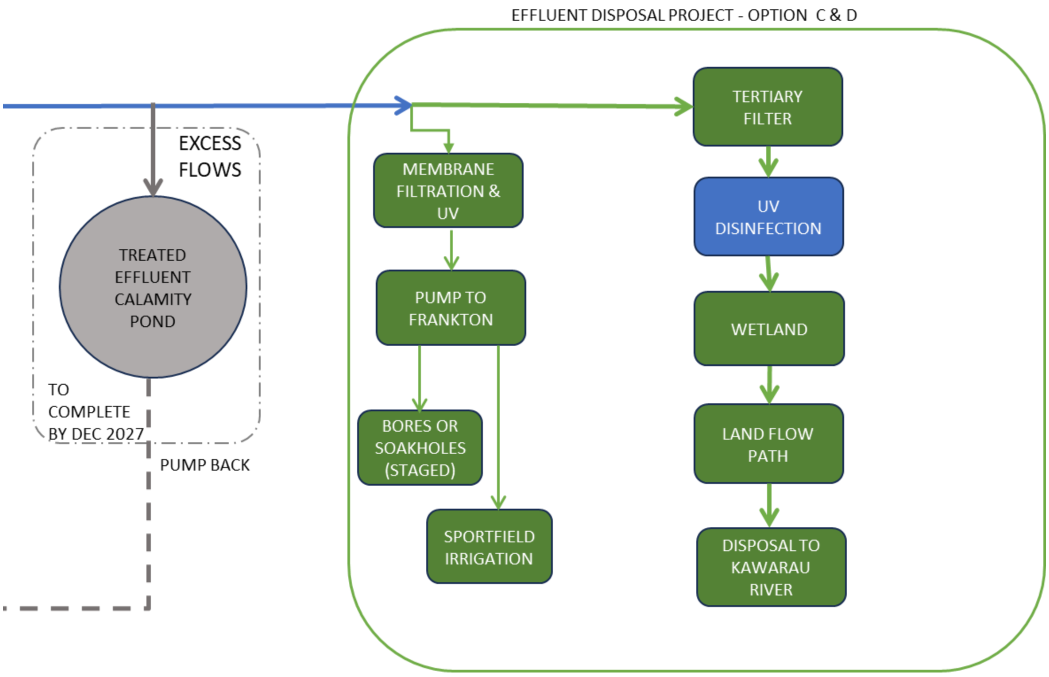

Figure 30 Shotover WWTP process including Option D disposal

Similar to Option C, Option D will also be executed in two stages, with the first stage as a trial to confirm the feasibility of soakhole disposal. Based on the preliminary desktop assessment in Section 4.1.3, it has been assumed that up to 50 soakholes could be built in the Frankton Flats area for treated effluent disposal.

This option also incorporates beneficial reuse of treated effluent for dust suppression and substitution of potable water in the Queenstown Event Centre (QEC) sports fields and the golf course.

The physical infrastructure will be delivered in two stages, as summarised below, with indicative locations shown in yellow in Figure 31:

- Stage 1 Soakholes Trial (two soakholes):
  - Disposal volume to Frankton Flats approximately 2100 m^3/day on average, with the remaining flow to the Kawarau River.
  - Containerised membrane filtration plant to produce a very high quality treated effluent .
  - Transfer pumps and approximately 3.2 km pipeline to two storage tanks located in Frankton Flat.
  - Storage tanks provide storage and the head to discharge into the two testing soakholes (20 m deep, 300 mm in diameter).
  - Each soakhole will be fitted with level monitoring measurement and automatic valves to regulate flow introduction. Unlike bores, there will be no submersible pump for periodic back flush and removal of fine solids accumulated.
  - Recycled water for dust suppression and irrigation water supplies will receive additional UV treatment (2 LRV for virus).
- Stage 2: Long Term – subject to successful Stage 1 outcomes:
  - Expanded to 50 soakholes (nominal allowance).
  - Disposal volume to Frankton Flats ~ 14,100 m^3/day on average, with the remaining flow to the Kawarau River.

- Replace the containerised membrane filtration plant with a new permanent membrane filtration system within a new building.
- Install additional transfer pumps and a second rising main with a larger diameter to the Frankton Flats storage tanks.
- Soakholes will be operated in groups to allow rotation.
- Recycled water for dust suppression and irrigation water supplies will remain the same.

If Stage 1 demonstrates that Option D is not feasible the option will revert back to Option B.

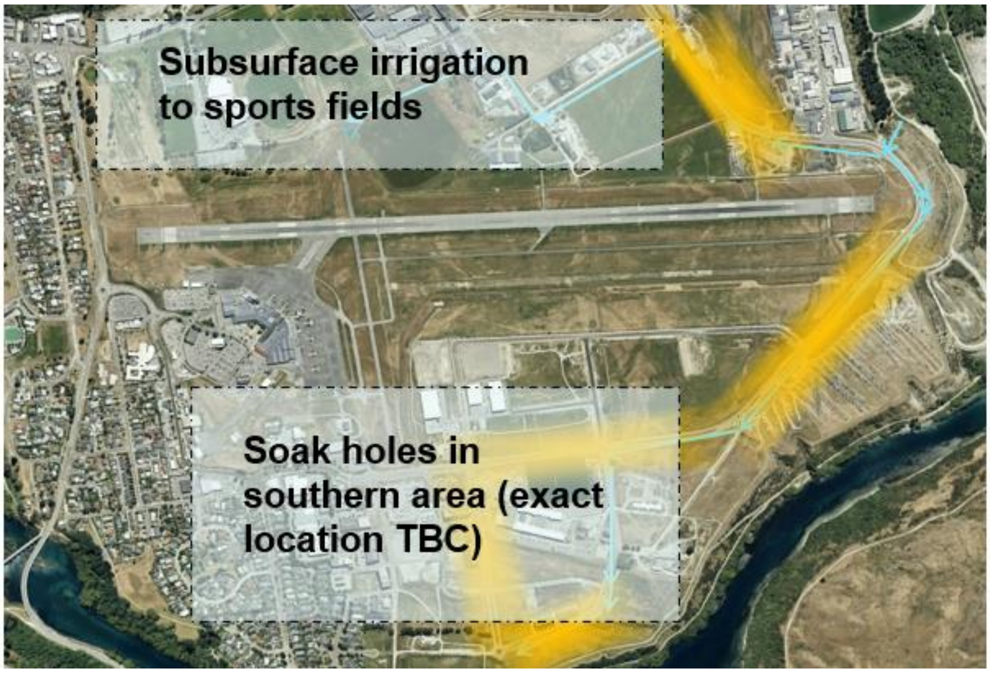

Figure 31 Option D Soakhole indicative location plan

8.5.2 Option D summary

The following Table 16 provides an option summary for the soak hole disposal option. All costs are in present day terms (2025) and do not include annualised cost escalation.

Table 16 Option D summary

Elements	Option D details	
UV treatment upgrade	After 2040	
Pond 3 calamity storage	By Dec 2027, 40 ML volume	
Tertiary Filtration	Two units, capable of handling up to 60 ML/d	
Recycle water for tanker use	Located near the recycled water storage tank at QEC site, Assumed demand of 100 m^3/day	
Subsurface wetland	Approx. 3 ha	
Land flow path to Kawarau	Yes	
	Stage 1 details	**Stage 2 details**
Membrane filtration	2,100 m^3/day	Increase to 14,100 m^3/day (if required)
Tank storage	2 x 400 m^3 tanks	3 x 400 m^3 tanks
Pumping	Two pumps, 46 L/s	Additional pumps for higher capacity

Conveyance	DN250 pipeline of approximately 3.2km length	Adding a second pipeline of DN350
Soakhole disposal	2 holes 500 m^3	50 holes 12,500m^3/day
Sportsfield disposal	1,500 m^3	1,500 m^3
Kawarau river disposal (at 2060 volumes)	17,000 m^3 (2030 average flow)	23,000 m^3 (2060 average flow)
Financial		
CapEx	$106 to 120 M	$76 to 86 M
OpEx (-10% to +30%)	$750k to 1.1M pa	$1.5M to 2.2M pa
Whole of life		$209M

8.5.3 Option D risks

In addition to the risks outlined for Option B (Section 8.3.3). The following risks are applicable to Option D (soakholes):

- Lower probability of achieving acceptable disposal rates, as suggested by occurrence of low permeability sediments near surface.
- Requires comprehensive field investigations and technical assessments to support the consent application (Also applicable to Option C).
- Less straightfoward consenting pathway when compared to Option A and B (also applicable to Option C).
- Constrained by undefined aquifer capacity and groundwater flow direction, which could limit disposal capacity to avoid effects, such as increased nutrient load to Lake Wakatipu and causing Kawarau riverbank instability.
- Performance of soakholes may degrade significantly over time due to biofouling and clogging of the aquifer, with soak hole replacement requiring additional land access and infrastructure.
- A second consent application may be required to permit the treated effluent disposal in a much larger quantity once the trial is successful (Also applicable to Option C).
- Provides additional land contact and polishing prior to discharge, though does not meet iwi's requirement for land contact

9 Kāi Tahu position statement

Through Aukaha and Te Ao Marama Inc, iwi were involved early on in the project, and provided input, feedback and scoring for the long listed options. When further development of the short listed land based options indicated that only a partial discharge of wastewater to land would be possible, and therefore all options would include a portion of wastewater discharge to the Kawarau River, Iwi representatives declined to attend the short-list scoring workshop. They have restated their position that they will not support any options that continue to rely on a discharge to the Kimi-ākau/Shotover or Kawarau Rivers and requested to include the following statement of the rūnaka position. This position statement was submitted to QLDC by the iwi partners involved in this project, Aukaha and Te Ao Marama Inc, on 28 October 2025.

"SHOTOVER DISPOSAL FIELD ALTERNATIVE OPTIONS: POSITION STATEMENT OF KĀI TAHU ON SHORTLISTED OPTIONS

(This position statement has been endorsed by the seven Kāi Tahu papatipu rūnaka with interests in the Kimiākau/ Shotover and Kawarau rivers and the greater Whakātipu area.)

Cultural position on discharge of human wastes

Kāi Tahu consider the direct discharge of human waste to natural water abhorrent.

In traditional Māori knowledge, wai (water) was classified in accordance with its characteristics and ceremonial use. These categories determined how the water could or could not be used. The mixing of water from separate categories was, and still is, considered unacceptable to Māori. In this regard, wastewater which is classified as waikino (polluted water) should not be mixed with other categories of water. Instead, natural mixing of wastewater through land, or a similar environment that provides a natural buffer or transition zone is supported by Kā Rūnaka. To reiterate, the wastewater leaving a treatment plant is considered tapu (prohibited, restricted, forbidden, to be approached with caution). Treatment through natural processes in the land to reach a state of being noa (free from extensions of tapu, ordinary, unrestricted) is the preferred option.

Kāi Tahu associations with the Kimiākau/ Shotover and Kawarau rivers

The Kawarau and Kimiākau/ Shotover rivers are of great cultural significance to coastal Otago hapū as important parts of the network of ara tawhito (trails) that connected them with Lake Wakatipu/Whakatipu-wai-Māori and the greater Wakātipu/Whakātipu pounamu fields. The Kawarau River connected many ara tāwhito, and the name Kimiākau, meaning 'to look for the coast', suggests that the Kimiākau/ Shotover River was a main route to the pounamu fields on Te Tai Poutini/West Coast.

The importance of the Kimiākau/ Shotover River for both its mahika kai values and its place in the great system of ara tawhito seasonally traversed by Kāi Tahu whānui is demonstrated by the establishment, through the Ngāi Tahu Claims Settlement Act (1998), of two nohoaka entitlements along the river. One of these entitlements is located at Tucker Beach, a short distance upstream of the Shotover Delta.

The shores of the Kawarau River were a known and well-frequented moa hunting site, and weka, kākāpō, kea and tuna were also readily available here. Two pā, potentially kāika mahika kai, were located downstream near present-day Gibbston.

Position on shortlisted options for wastewater disposal

Since at least 1998 Kā Rūnaka have expressed:

- *their opposition to wastewater discharges to the Kimiākau/ Shotover River;*
- *their preference for land-based discharge; and*
- *their view that the Shotover Delta is an unsuitable location for land disposal.*

In respect to land-based disposal options, Kā Rūnaka support options that will use natural processes to treat the wastewater and absorb and remove contaminants. A superficial or token contact with the whenua that does not have any additional treatment effect beyond that offered by the treatment plant itself is not sufficient. In order for the mauri of the water to be fully restored it needs to be cleaned and revitalised through *interactions with the forces of nature and Papatūānuku:*

- *Water passes through Papatūānuku (the earth) to transform and cleanse the polluted water which feeds the surrounding biota and in turn begins to re-invigorate its mauri;*
- *Tāne (the Atua of the forest and all that dwells within it), uses plants, roots, micro-organisms, birds, and insects that form the natural biological processes to absorb and remove contaminants with the added benefit of significant carbon sequestration and a natural increase in biodiversity;*
- *Tāwhirimātea (the wind) acts to oxygenate and agitate the water; and*
- *Tama-nui-te-Rā (the sun) acts to add UV light.*

Through the agency of Aukaha and Te Ao Marama Limited, Kā Rūnaka have provided input to the process of assessing and scoring options for disposal of wastewater from the Shotover Wastewater Treatment Plant. Specifically, Aukaha and Te Ao Marama were invited to score options in terms of three criteria:

- *The disposal of treated wastewater aligns with tikaka as guided by mana whenua;*
- *Mō tātou, ā, mō kā uri ā muri ake nei - For us and our children after us; and*
- *Cultural impacts to sites of significance and access to sites for cultural activities.*

As described above, any options relying on discharge to the river without effective land-based treatment are contrary to tikaka. Discharge of wastewater to the river would not uphold the intergenerational obligation to uphold the mauri of the awa and would have a significant negative impact on mahika kai values associated with the awa. Accordingly, it was concluded that such options could only be scored as “fatally flawed” from the cultural perspective.

The shortlisted options comprise:

- *Discharge to the Kawarau River via depressions and former river channels in the Delta;*
- *Discharge via subsurface wetlands in a historical river channel in the Delta into rock-filled flow paths to the Kawarau River; or*
- *Disposal to land in the adjacent Frankton Flats area by either deep well injection or shallow injection. These options would not provide sufficient capacity to absorb the full wastewater volume and so could not operate independently of the subsurface wetlands option, which would be used to discharge a major portion of the modelled wastewater flow.*

Kā Rūnaka understand that the subsurface wetlands would not provide substantive additional treatment of wastewater before it is discharged to the river.

Because all options rely on discharge of significant volumes of wastewater to the Kawarau River, none of them can be considered culturally appropriate.

The consideration of options has been constrained by exclusion of any solutions that do not involve continued use and expansion of the treatment plant in the Shotover Delta. Ongoing reliance on this location is of concern to Kā Rūnaka, particularly due to the proximity to the Kimiākau and Kawarau rivers and uncertainty about flood hazards arising from climate change. The position of Kā Rūnaka is that a more holistic investigation of wastewater needs and alternatives for Queenstown is required that is not constrained by continuing to rely on treatment at this location.”

10 Multi-criteria assessment

Multi criteria assessment (MCA) enables a wide range of different aspects to be taken into consideration in evaluating options and provides a systematic framework for working through the merits and disadvantages of each option. It is a tool that can help decision making, but it does not make the decision. Done well, it provides an open, traceable, and repeatable process. It enables consideration of a range of criteria which are both qualitative and quantitative.

Project options were scored against the MCA criteria using a 11-point scoring system. The scoring system for the long list phase and updated for the short list phase are outlined in Table 17 below and the MCA framework is detailed in Appendix B.

Table 17 MCA scoring system

Score	Scoring description – long list phase	Scoring description – short list phase
+ 5	Substantial benefits and a high degree of confidence of benefits being realised and/or long term / permanent benefits	Substantial benefits and a high degree of confidence of benefits being realised and/or long term / permanent benefits
+ 4	High extent of benefits and confidence of benefit being realised and/or medium – long term benefits	High extent of benefits and confidence of benefit being realised and/or medium – long term benefits
+ 3	Good benefits and/or medium term	Good benefits and/or medium term
+ 2	Low or localised benefits and/or short term	Low or localised benefits and/or short term
+ 1	Very low benefits and/or very short term	Very low benefits and/or very short term
0	Base case – the DAD disposal field as if it were working as designed and meeting the consent requirements.	Base Case - the current situation in which treated effluent is discharged to the Kimi-ākau/Shotover River via a discharge channel as emergency works
- 1	Few difficulties, very low cost or low impact on some resources/values and/or very short term	Few difficulties, very low cost or low impact on some resources/values and/or very short term
- 2	Minor difficulties, low cost or minor impacts on resources/values and/or short term	Minor difficulties, low cost or minor impacts on resources/values and/or short term
- 3	Some difficulties, moderate cost or some impact on resources/values and/or medium term	Some difficulties, moderate cost or some impact on resources/values and/or medium term
- 4	Clear difficulties, high cost or high impact on resources/values and/or medium – long term	Clear difficulties, high cost or high impact on resources/values and/or medium – long term
- 5	Substantial difficulties, very high cost or substantial impact on resources/values and/or long term / permanent	Substantial difficulties, very high and extremely high cost or substantial impact on resources/values and/or long term / permanent including effects which cannot be mitigated by reasonable measures and may not be able to be mitigated by extraordinary mitigation
FF	Fatally Flawed. Extreme difficulties, extremely high cost or substantial impact on resources/values and/or long term / permanent which cannot be mitigated by reasonable measures and may not be able to be mitigated by extraordinary mitigation	N/A

Similar to the long list stage, the short list options were scored against each criteria of the MCA Framework to allow the options to be ranked based on the MCA assessment results and decision makers to understand the relative trade-offs between options. The short list MCA assessment results are intended to be considered alongside the option's costs, risks, and other key organisational considerations to inform the selection of the recommended option for further design refinement.

Rūnaka, through their representatives from Aukaha and Te Ao Marama Inc retained their position that they could not support any options that continue to rely on a discharge to the Shotover or Kawarau River. As the MCA scoring process for the short-listed options does not allow exclusion of those options on the basis of the cultural concern (as reflected in the earlier 'fatally flawed' scoring), both Aukaha and Te Ao Marama Inc questioned the appropriateness of the MCA methodology for the short list assessment. Although Aukaha and Te Ao Marama Inc provided commentary on the short list options relating to each scoring criteria, they chose not to participate in the 8th October 2025 Short List MCA scoring workshop as by that stage it was clear that the short listed land based options were not feasible on their own and mana whenua had determined that all options were therefore fatally flawed. The implication of this was that a numerical score could not be assigned against factors relating to tikanga and cultural impacts

Due to the difficulties of reflecting the Kāi Tahu position through a scoring approach, Aukaha and Te Ao Marama Inc requested the opportunity to include a clear statement endorsed by the seven Kāi Tahu papatipu rūnaka with interests in the Kimiākau/ Shotover and Kawarau rivers and the greater Whakātipu area. Their position statement is included in this report and will be used in subsequent briefings that will be prepared for the Council. Aukaha and Te Ao Marama Inc have restated their position that they do not support any options that continue to rely on a discharge to the Kimi-ākau/Shotover or Kawarau Rivers. The full statement is provided in Section 4 of this report and includes the following points.

1. Kāi Tahu consider the direct discharge of human waste to natural water unacceptable from the perspective of cultural values.
2. The Kawarau and Kimiākau/ Shotover rivers are culturally significant to Kāi Tahu, with long held associations reflected in ancestral trails, mahika kai and nohoaka entitlements.
3. Since at least 1998 Kā Rūnaka have expressed:
   - their opposition to wastewater discharges to the Kimiākau/ Shotover River;
   - their preference for land-based discharge; and
   - their view that the Shotover Delta is an unsuitable location for land disposal.
4. The position of Kā Rūnaka is that a more holistic investigation of wastewater needs and alternatives for Queenstown is required that is not constrained by continuing to rely on treatment at this location.

The differences between the scoring framework for the two phases are:

- The fatally flawed score has been removed for the short list assessment scoring system. Short list options were only included if they could feasibly be implemented and are expected to meet waste disposal discharge standards and other relevant policies. In respect of the Kāi Tahu position, the land disposal options were considered to be partial solutions that could not be assessed independently of a continued river discharge. Therefore iwi considered all options unacceptable and the iwi based criteria have not been scored.
- At the long-list stage, the MCA assessment was compared against a base case where the DAD was operating as designed. During the project period, the wastewater discharge was changed to redirect flow through an existing channel into the Kimi-ākau/Shotover River. After discussions at the shortlist MCA Workshop, the base case used for scoring during the Short List MCA assessment was updated to reflect the current short-term discharge. This current case was included for comparative scoring purposes only.

10.1 Framework

The MCA framework consists of four categories of assessment criteria as are outlined in the following Figure 32.

Figure 32 MCA framework

The key and notable features of this bespoke MCA framework include:

- Cultural considerations are often within the social and environmental effects, however for this project some of the cultural considerations are captured as investment objectives as well as the effects.
- Consentability is not a separate criterion, it is captured in each specific criteria (e.g. visual impact) and their impact on the ability of an option to be consented.

10.2 MCA investment objectives and criteria

The framework was developed in February 2025 and agreed by QLDC, Aukaha, Te Ao Marama Inc, LandPro, and GHD. This framework was updated during the short list workshop (October 2025) as summarised in Section 10.2.1, agreed by QLDC, LandPro, and GHD; and the updated version is located in the MCA Framework located in Appendix D. Each investment objective and criteria include key performance indicators or measures that are to be used in the assessment process; these are outlined in Table 18, Table 19 and

Table 20, as follows:

Table 18 MCA investment objectives

Investment Objectives	Key Performance Indicators	Scoring lead
IO1 - The health and well-being of the surrounding waterways are maintained, protected, and improved where practicable to support water quality.	– Ecosystem / Aquatic health effects – Human health effects – Nuisance growth – Recreation impacts	– Anthony Kirk
IO2 - The disposal of treated wastewater aligns with tikanga as guided by mana whenua.	– Mana whenua values and knowledge – Alignment with mana whenua cultural practices, protocols and values.	– TAMI and Aukaha Representatives
IO3 - Ability to service the community's and visitor wastewater needs now and into the future up to the equivalent flows projected for 2060.	– Can accommodate forecast population or economic growth over time – Can accommodate peak day inflows – Can be resilient to extreme climate events, climate change and natural disasters	– Ian Ho and Anthony Kirk

Table 19 MCA social and environmental factors

Social and Environmental Factors	Considerations	Scoring lead
S&E1 - Mō tātou, ā, mō kā uri ā muri ake nei For us and our children after us.	– Integration of whakapapa Intergenerational equity, innovation, and knowledge. – Te mana o te wai Mauri of the water is upheld or enhanced – Ki uta ki tai Whole of catchment impact and holistic consideration.	– TAMI and Aukaha Representatives
S&E2 - Cultural impacts to sites of significance and access to sites for cultural activities.	– Sites of cultural significance impacts – Physical access to site for cultural and recreational activities.	– TAMI and Aukaha Representatives
S&E3 - Impacts to the surrounding environment.	– Natural waterway impacts – Biodiversity	– Anthony Kirk
S&E4 - Environmental impacts to surrounding catchment land, soil and groundwater.	– Surface water effects – Soil health effects – Groundwater effects	– Anthony Kirk
S&E5 - Visual effects	– The extent to which there is a visual impact from options that differ from existing land use or impact the surrounding natural environment	– Claire Perkins and Anthony Kirk
S&E6 - Amenity effects	– Noise impacts – Risk to potential receptors – Recreational access – Air quality / odour risk	– Claire Perkins and Anthony Kirk

Table 20 MCA critical success factors

Critical Success Factors	Considerations	Scoring lead
CSF1 - Constructability and technical feasibility	– Technical feasibility – Technical / constructability risks – Compatibility – Technical robustness and operational resilience	– Ian Ho
CSF2 - Sustainability - Carbon emissions and sustainable use of resources supporting organisational goals	– Carbon emissions (operation carbon included) – Beneficial reuse	– Ian Ho
CSF3 - Operational reliability and maintainability	– Ease of operations / maintenance – Operational complexity and risks – Functionality	– Ian Ho
CSF4 - Property difficulties and impacts	– Property requirements, impacts and difficulties.	– Claire Perkins and Ian Ho

CSF5a - Achievability of Indicated Outcomes	– Likelihood of achieving the indicated outcomes	– Ian Ho / Anthony Kirk
CSF5b - Consent, Design, Construction, and Implementation Timeframe	– Timeline	– Ian Ho
CSF7 - Costs and affordability	– Capital costs – Operation costs (annual) – Whole of life costs (NPV) – Stage ability	– Ian Ho

10.2.1 Amendments to MCA

During the scoring workshop held (8 October 2025), discussion was held around criteria CSF5 – implementation timeframe. To better differentiate between the achievability of outcomes, and the constructability and timeframe, this criteria was separated into:

> **CSF5a** – Achievability of indicated outcomes. This includes the level of confidence in achieving the necessary capacity (disposal flow) for any disposal component of the option. This is to recognise that the options will be assessed under the assumption that they are able to accommodate the proposed disposal volumes, and this criteria will reflect the relative risk of achieving this
>
> **CSF5b** – Consent, design, construction, and implementation timeframe.

These updated criteria are reflected in the tables outlined in Section 10.2 above.

10.2.2 Short list scores summary

A summary of the technical specialist scores for each short list option is presented in Table 21 below. Commentary and rationale supporting these scores are provided in the section that follows. As stated earlier, the three criteria relating to Kāi Tahu values have not been scored. All short list options are considered by Aukaha and Te Ao Marama to be culturally unacceptable and they do not support any options that continue to rely on a discharge to the Kimi-ākau/Shotover or Kawarau Rivers. Aukaha and Te Ao Marama have each provided commentary about the options in relation to the criteria and this is contained in the report. The short list assessment scores are provided in Table 21 below.

Table 21 Short list assessment summary

Investment Objectives	**Current short-term situation** - Discharge to Shotover River	**Option A** Land flow path to river via Kawarau	**Option B** Wetland on Delta + Land Flow Path to Kawarau	**Option C** Boreholes at Frankton (+ Option B)	**Option D** Soakholes at Frankton (+ Option B)
The health and well-being of the surrounding waterways are maintained, protected, and improved where practicable to support water quality.	0	2	2	3	3
The disposal of treated wastewater aligns with tikanga as guided by mana whenua. (Aukaha)[17]	No score	No score	No score	No score	No score
The disposal of treated wastewater aligns with tikanga as guided by mana whenua. (TAMI)	No score	No score	No score	No score	No score
Ability to service the community's and visitor wastewater needs now and into the future up to the equivalent flows projected for 2060.	0	2	2	2	2
Environmental and Social Impacts					
Mō tātou, ā, mō kā uri ā muri ake nei For us and our children after us (Aukaha)	No score	No score	No score	No score	No score
Mō tātou, ā, mō kā uri ā muri ake nei For us and our children after us (TAMI)	No score	No score	No score	No score	No score
Cultural impacts to sites of significance and access to sites for cultural activities. (Aukaha)	No score	No score	No score	No score	No score
Cultural impacts to sites of significance and access to sites for cultural activities. (TAMI)	No score	No score	No score	No score	No score
Impacts to the surrounding environment	0	2	2	2	2
Environmental impacts to surrounding catchment land, soil and groundwater	0	2	2	1	1
Visual effects - The extent to which there is a visual impact from options that differ from existing land use or impact the surrounding natural environment.	0	-1	0	-1	-2
Amenity effects - The extent to which there is a receptor or social impact from options.	0	0	1	1	1
Design, Delivery and Operation					
Constructability and technical feasibility	0	0	0	-2	-3
Sustainability - Carbon emissions and sustainable use of resources supporting organisational goals.	0	-1	-2	-4	-4
Operational reliability and maintainability	0	1	0	-2	-3
Property difficulties and impacts	0	0	0	-2	-3
Achievability of indicated outcomes	0	2	2	-3	-4
Consent, design, and construction, and implementation timeframe	0	1	-1	-3	-3
Costs and affordability	0	-1	-2	-4	-5

[17] Note: Refer to Kai Tahu Position Statement for reasoning for 'no score'

10.3 Investment objectives

10.3.1.1 Investment objective 1

Investment objective 1 – the health and well-being of the surrounding waterways are maintained, protected, and improved where practicable to support water quality.

Table 22 below presents the scores and rationale for each option against this criterion.

Table 22 MCA assessment – Investment Objective 1

Option	Score	Rationale
Current short-term discharge to Shotover River	0	Localised water quality impacts in the Shotover River beyond the mixing zone, resulting in increases in nutrient concentrations in water quality in select parts of river braids. Persistent change in river braids with maintenance of diversion, potentially impacting other braids due to reduced flow. Public health risk being mitigated by exclusion riverbank area (reducing exposure).
Option A - Land flow path to Kawarau River	2	Removes delta groundwater effects. Reduces water quality effects in shallow riverbank areas. Reduces potential for algal growth and nuisance growth. Reduces potential for exposure with recreational land use. Score could be increased where an in-river diffuser allows for immediate mixing centrally within the river.
Option B - Wetland on Delta + land flow path to Kawarau River	2	Removes delta groundwater effects. Reduces water quality effects in shallow riverbank areas. Reduces potential for algal growth and nuisance growth. Reduces potential for exposure with recreational land use. Score could be increased where an in-river diffuser allows for immediate mixing centrally within the river.
Option C - Boreholes at Frankton (+ Option B)	3	Removes delta groundwater effects. Reduces water quality effects in shallow riverbank areas. Reduces potential for algal growth and nuisance growth. Reduces potential for exposure with recreational land use. Score could be increased where an in-river diffuser allows for immediate mixing centrally within the river. More diffuse discharge to Kawarau River, with smaller direct discharge mixing zone.
Option D - Soakholes at Frankton (+ Option B)	3	Removes delta groundwater effects. Reduces water quality effects in shallow riverbank areas. Reduces potential for algal growth and nuisance growth. Reduces potential for exposure with recreational land use. More diffuse discharge to Kawarau River, with smaller direct discharge mixing zone.

10.3.1.2 Investment objective 2

Investment Objective 2 - the disposal of treated wastewater aligns with tikanga as guided by mana whenua. Table 23 below presents the commentary provided by Aukaha and TAMI. As stated earlier, the three iwi based criteria have not been scored. All short list options are considered by Aukaha and Te Ao Marama to be culturally unacceptable and they do not support any options that continue to rely on a discharge to the Kimi-ākau/Shotover or Kawarau Rivers.

Table 23 MCA assessment - Investment Objective 2

Option	Score	Rationale (Aukaha)	Score	Rationale (TAMI)
Current short-term discharge to Shotover River	**No score**	The system is discharging to the Kimiākau and Kawarau rivers. Discharge of human waste to water does not align with mana whenua values and tikanga.	**No score**	Considered direct discharge to water, Culturally unacceptable, please refer to CIA[18] provided for further information
Option A - Land flow path to Kawarau River	**No score**	Disposal beds are in the floodplain, and adjacent to the Kawarau, meaning that there is inadequate land based treatment prior to reaching the receiving waterbody to water. Discharge of human waste to water does not align with mana whenua values and tikanga. Does not give effect to mana whenua aspirations for TMoTW as per the Draft Otago RPS -LF-WAI-01 Through a matauraka Māori lens, this is effectively BAU, or more damaging than BAU. The characteristics of the soils and the extra distance from the current disposal fields are not substantially different enough to classify this solution as distinct from the current disposal field. Minimal in-ground treatment	**No score**	Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information
Option B - Wetland on Delta + land flow path to Kawarau River	**No score**	Does not give effect to mana whenua aspirations for TMoTW as per the Draft Otago RPS -LF-WAI-01 Disposal area is still in the Kawarau. There is inadequate land based treatment prior to reaching the receiving waterbody to water. Discharge of human waste to water does not align with mana whenua values and tikanga. Through a matauraka Māori lens, this is effectively BAU. The characteristics of the soils and the extra distance from the current disposal fields are not substantially different enough to classify this solution as distinct from the current disposal field.	**No score**	Slightly better than current and option A, Fatally flawed.
Option C - Boreholes at Frankton (+ Option B)	**No score**	The risk of system failure and contamination of the groundwater Lack of knowledge about the groundwater aquifer and how it would interact with surface water if contaminated Preference not to trial technology in this area High perceived contamination risk if system is comprised - there is a risk of groundwater mounding and generation of riverbank streams - Discharge directly to groundwater does not align with mana whenua values	**No score**	Better than discharging entirely to water, however still fatally flawed.

[18] Refer to Kai Tahu Position Statement, Section 9

Option	Score	Rationale (Aukaha)	Score	Rationale (TAMI)
		- also it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options.		
Option D - Soakholes at Frankton (+ Option B)	**No score**	-The depth of separation from groundwater is substantially greater than any other considered, minimising the risk of aquifer or surface water contamination. - There is an anticipated 28 - 30 m depth between the injection point and the groundwater table - Out of all options considered, this one is expected to have the least impact on the GW aquifer and on the adjacent surface water bodies, and has the best alignment with mana whenua cultural practices, protocols and values around waste and water. However it does not have sufficient capacity to absorb the full discharge from the WTTP. It is only a partial solution and would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options	**No score**	Better than discharging entirely to water, however still fatally flawed.

Note: Aukaha scored all options as fatally flawed. As this scoring was not included as an option in the MCA short list scoring scale, all scores have been adjusted to –5, representing the lowest possible score within the framework.

10.3.1.3 Investment objective 3

Investment Objective 3 – ability to service the community's and visitor wastewater needs now and into the future up to the equivalent flows projected for 2060. Table 24 below presents the scores and rationale for each option against this criterion.

Table 24 MCA assessment - Investment Objective 3

Option	Score	Rationale
Current short-term discharge to Shotover River	**0**	Base Case
Option A - Land flow path to Kawarau River	**2**	This option changes the disposal location from Shotover River to Kawarau River, and is more resilient to flood damage such as river bank erosion, channel erosion and sedimentation. Can accommodate future flows.
Option B - Wetland on Delta + land flow path to Kawarau River	**2**	This option changes the disposal location from Shotover River to Kawarau River, and is more resilient to flood damage such as river bank erosion, channel erosion and sedimentation. Can accommodate future flows.
Option C - Boreholes at Frankton (+ Option B)	**2**	This option changes the disposal location from Shotover River to the Kawarau River for a portion of the flow, and is more resilient to flood damage such as river bank erosion, channel erosion and sedimentation. Can accommodate future flows.
Option D - Soakholes at Frankton (+ Option B)	**2**	This option changes the disposal location from Shotover River to the Kawarau River for a portion of the flow, and is more resilient to flood damage such as river bank erosion, channel erosion and sedimentation. Can accommodate future flows.

10.4 Social and environmental impacts

10.4.1.1 Social and environmental impacts 1

Social and Environmental Impacts 1 – mō tatou, ā, mō kā uri ā muri ake nei / for us and our children after us. Table 25 below presents the commentary provided by Aukaha and TAMI . As stated earlier, the three iwi based criteria have not been scored. All short list options are considered by Aukaha and Te Ao Marama to be culturally unacceptable and they do not support any options that continue to rely on a discharge to the Kimi-ākau/Shotover or Kawarau Rivers.

Table 25 MCA assessment –Mō tātou, ā, mō kā uri ā muri ake nei For us and our children after us

Option	Score	Rationale (Aukaha)	Score	Rationale (TAMI)
Current short-term discharge to Shotover River	**No score**	The current system does not recognise the intergenerational concerns of mana whenua about discharge of human waste to the awa, does not uphold the mauri of the awa and does not consider the whole-of-catchment effects from the discharge on water.	**No score**	Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information
Option A - Land flow path to Kawarau River	**No score**	Disposal beds are in the floodplain. Susceptible to sedimentation and clogging from floods, therefore not expected to be resilient to natural hazard events. Inappropriate receiving environment. The system does not recognise the intergenerational concerns of mana whenua about discharge of human waste to the awa, does not uphold the mauri of the awa and does not consider the whole-of-catchment effects from the discharge on water.	**No score**	Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information
Option B - Wetland on Delta + land flow path to Kawarau River	**No score**	Disposal beds are partially in the floodplain, and are adjacent to the Kawarau. Misaligned with mō tātou, ā, mō kā uri (pepeha) due to lack of flood resilience being situated in the floodplain, expected to need remedial works after flood. Does not give effect to mana whenua aspirations for TMoTW as per the Draft Otago RPS -LF-WAI-01. Through a matauraka Māori lens, this is effectively BAU, the characteristics of the soils and the extra distance from the current disposal fields are not substantially different enough to classify this solution as distinct from the current disposal field. The primary issue as per the KTKO NRMP 2005 is that this option is not providing adequate land based treatment prior to reaching the receiving waterbody.It does not recognise the intergenerational concerns of mana whenua about discharge of human waste to the awa, does not uphold the mauri of the awa and does not consider the whole-of-catchment effects from the discharge on water.	**No score**	Slightly better than current and option A, Fatally flawed.

Option C - Boreholes at Frankton (+ Option B)	**No score**	The option may cause land instability. Southern edge is close to Kawarau. Highly sensitive to quality of injected water, so not as robust. There is a risk of groundwater contamination, which would not uphold the mauri of that groundwater. Also it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options	**No score**	As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation.
Option D - Soakholes at Frankton (+ Option B)	**No score**	The site is not in a flood prone location or expected to be destabilised with the disposal loading rates. The contaminants are treated and disposed of in catchment. The necessity for a pump-driven solution means that in the event of an emergency where power is out, the system will not be able to operate and will likely result in discharge to the current floodplain area. however it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options	**No score**	Culturally acceptable as Mana Whenua will always advocate for disposal to land

Note: Aukaha scored all options as fatally flawed. As this scoring was not included as an option in the MCA short list scoring scale, all scores have been adjusted to –5, representing the lowest possible score within the framework.

10.4.1.2 Social and environmental impacts 2 - cultural impacts to sites of significance and access to sites for cultural activities

Social and Environmental Impacts 2 – cultural impacts to sites of significance and access to sites for cultural activities. Table 26 below presents the commentary provided by Aukaha and TAMI . As stated earlier, the three iwi based criteria have not been scored. All short list options are considered by Aukaha and Te Ao Marama to be culturally unacceptable and they do not support any options that continue to rely on a discharge to the Kimi-ākau/Shotover or Kawarau Rivers.

Table 26 MCA assessment - Cultural impacts to sites of significance and access to sites for cultural activities

Option	Score	Rationale (Aukaha)	Score	Rationale (TAMI)
Current short-term discharge to Shotover River	**No score**	The current system does not consider effects from the discharge on mahika kai values. - The current system is incompatible with allowing mana whenua to exercise cultural practices around food gathering and inhibits traditional mana whenua associations with the area.	**No score**	Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information
Option A - Land flow path to Kawarau River	**No score**	From a mana whenua perspective it is culturally unacceptable to dispose of wastewater to water bodies, especially so if those waterbodies are associated with mahika kai.	**No score**	Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information

Option B - Wetland on Delta + land flow path to Kawarau River	**No score**	From a mana whenua perspective it is culturally unacceptable to dispose of wastewater to water bodies, especially so if those waterbodies are associated with mahika kai. The extra distance through the wetland does not sufficently alter the disposal route from a mana whenua perspective, and mana whenua preference is to take the disposal area out of the delta	**No score**	Slightly better than current and option A, Fatally flawed.
Option C - Boreholes at Frankton (+ Option B)	**No score**	No river crossings. High risk potential for groundwater and surface water contamination if bore ruptures in seismic event. Highly sensitive to quality of injected water, so not as robust. Also it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options	**No score**	Better than discharging entirely to water, however still fatally flawed.
Option D - Soakholes at Frankton (+ Option B)	**No score**	There are no river crossings, This is seen as culturally appropriate disposal to land This option would help restore the mauri of Kawarau and Kimiākau to allow safe re-establishment of mahika kai practices in the area There is 28 - 30m depth before reaching the GW aquifer, which is through suitably permeable gravels However it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options	**No score**	Better than discharging entirely to water, however still fatally flawed.

Note: Aukaha scored all options as fatally flawed. As this scoring was not included as an option in the MCA short list scoring scale, all scores have been adjusted to –5, representing the lowest possible score within the framework.

10.4.1.3 Social and environmental impacts 3

Social and Environmental Impacts 3 – impacts to the surrounding environment**.** Table 27 below presents the scores and rationale for each option against this criterion.

Table 27 MCA assessment – Impacts to the surrounding environment

Option	Score	Rationale
Current short-term discharge to Shotover River	**0**	Base Case
Option A - Land flow path to Kawarau River	**2**	Area of influence predominantly limited to immediate mixing zone within the Kawarau river. Disposal mechanism (rock structure, diffuser, etc.) will influence mixing. No river diversion required
Option B - Wetland on Delta + land flow path to Kawarau River	**2**	Area of influence predominantly limited to immediate mixing zone within the Kawarau river. Disposal mechanism (rock structure, diffuser, etc.) will influence mixing. No river diversion required

Option C - Boreholes at Frankton (+ Option B)	2	Area of influence predominantly limited to immediate mixing zone within the Kawarau river. Disposal mechanism (rock structure, diffuser, etc.) will influence mixing.
Option D - Soakholes at Frankton (+ Option B)	2	Area of influence predominantly limited to immediate mixing zone within the Kawarau river. Disposal mechanism (rock structure, diffuser, etc.) will influence mixing.

10.4.1.4 Social and environmental impacts 4

Social and Environmental Impacts 4 – environmental impacts to surrounding catchment land, soil and groundwater**.** Table 28 below presents the scores and rationale for each option against this criterion.

Table 28 MCA assessment - Environmental impacts to surrounding catchment land, soil and groundwater

Option	Score	Rationale
Current short-term discharge to Shotover River	0	Improvement on delta groundwater conditions. Localised effects to surface water quality.
Option A - Land flow path to Kawarau River	2	Improvement in delta groundwater conditions. Effects to water quality within relatively small in-river mixing zone
Option B - Wetland on Delta + land flow path to Kawarau River	2	Improvement in delta groundwater conditions. Effects to water quality within relatively small in-river mixing zone
Option C - Boreholes at Frankton (+ Option B)	1	Improvement in delta groundwater conditions. Impact to Frankton Flats groundwater quality Effects to water quality within relatively small in-river mixing zone
Option D - Soakholes at Frankton (+ Option B)	1	Improvement in delta groundwater conditions. Impact to Frankton Flats groundwater quality Effects to water quality within relatively small in-river mixing zone

10.4.1.5 Social and environmental impacts 5

Social and Environmental Impacts 5 – visual effects – the extent to which there is a visual impact from options that differ from existing land use or impact the surrounding natural environment**.** Table 29 below summarises the scores and rationale for each option against this criterion.

Table 29 MCA assessment - Visual effects

Option	Score	Rationale
Current short-term discharge to Shotover River	0	Base Case
Option A - Land flow path to Kawarau River	-1	Land flow path outfall structure will be visible on the Delta, from the Kawarau River and further afield. Land flow path outfall structure will be visible on the Delta, from the Kawarau River and further afield. Score could be improved with subsurface diffuser outfall. Benefit to base case in that discharge will be piped until the outfall point so not visible to majority of users on formed walking/cycling trails
Option B - Wetland on Delta + land flow path to Kawarau River	0	Outfall will be visible to users on the Delta and river, offset by positive visual impact of wetland that can be made accessible for recreational use with boardwalks etc
Option C - Boreholes at Frankton (+ Option B)	-1	Increased visual impact from storage tanks in Frankton Flat, although will be located in area with existing large industrial buildings so not entirely out of keeping with neighbourhood. Cumulative visual effect of visible river outfall along with above-ground well structures, despite wells being not overly incongruous with surrounding land use

Option D - Soakholes at Frankton (+ Option B)	**-2**	Significantly more tanks required at Frankton Flats compared to Option C, with increased ongoing maintenance/relocated wells adding to visual impact.

10.4.1.6 Social and environmental impacts 6

Social and Environmental Impacts 5 – amenity effects – the extent to which there is a receptor or social impact from options. Table 30 below presents the scores and rationale for each option against this criterion.

Table 30 MCA assessment - amenity effects

Option	Score	Rationale
Current short-term discharge to Shotover River	**0**	Base Case
Option A - Land flow path to Kawarau River	**0**	Less exposure to recreational users (e.g. trail users) with buried pipe compared to open channel. This is counteracted by potential more influence on recreational activity (particularly fishing and jet boats) near the Kawarau outfall compared to Base Case outfall location. Possible navigation hazard depending on extent, depending pipedepth and location of rock. Score could be improved with subsurface diffuser outfall, which may alleviate any safety concerns.
Option B - Wetland on Delta + land flow path to Kawarau River	**1**	Provided the wetland can be made publicly accessible via boardwalks etc, this will likely provide a net cumulative amenity benefit, despite the issues with the Kawarau outfall
Option C - Boreholes at Frankton (+ Option B)	**1**	Risk to recreational users around the Kawarau outfall remains as per Option B. Insignificant adverse effects expected from well installation/maintenance at Frankton Flats
Option D - Soakholes at Frankton (+ Option B)	**1**	Risk to recreational users around the Kawarau outfall remains as per Option B. Insignificant adverse effects expected from well installation/maintenance at Frankton Flats

10.5 Critical success factors

10.5.1.1 Critical success factor 1 – constructability and technical feasibility

Critical success factor 1 – constructability and technical feasibility. Table 31 below presents the scores and rationale for each option against this criterion.

Table 31 MCA assessment - Constructability and technical feasibility

Option	Score	Rationale
Current short-term discharge to Shotover River	**0**	Base Case
Option A - Land flow path to Kawarau River	**0**	Good dilution by the Kawarau River, land flow path is an acceptable and established way to discharge treated effluent
Option B - Wetland on Delta + land flow path to Kawarau River	**0**	Good dilution by the Kawarau River and using constructed wetland for highly treated effluent is well established
Option C - Boreholes at Frankton (+ Option B)	**-2**	Uncertainties of the bore disposal capacity, to confirm by future investigations
Option D - Soakholes at Frankton (+ Option B)	**-3**	Uncertainties of the soakhole disposal capacity, to confirm by future investigations. Also require ongoing replacing soakholes as part of long term programme

10.5.1.2 Critical success factor 2 – sustainability – carbon emissions and sustainable use of resources supporting organisational goals.

Critical success factor 2 – sustainability – carbon emissions and sustainable use of resources supporting organisational goals. Table 32 below presents the scores and rationale for each option against this criterion.

Table 32 MCA assessment - Sustainability

Option	Score	Rationale
Current short-term discharge to Shotover River	0	Base Case
Option A - Land flow path to Kawarau River	-1	More construction works than Base Case
Option B - Wetland on Delta + land flow path to Kawarau River	-2	More construction materials than Base Case and Option A
Option C - Boreholes at Frankton (+ Option B)	-4	Much higher construction volume than Base Case, and significant pumping and chemicals related to membrane filtration treatment, on top of pipeline construction
Option D - Soakholes at Frankton (+ Option B)	-4	Much higher construction volume than Base Case, and significant pumping and chemicals related to membrane filtration treatment, on top of pipeline construction

10.5.1.3 Critical success factor 3 – operational reliability and maintainability

Critical success factor 3 – operational reliability and maintainability. Table 33 below presents the scores and rationale for each option against this criterion.

Table 33 MCA assessment - Operational reliability and maintainability

Option	Score	Rationale
Current short-term discharge to Shotover River	0	Base Case
Option A - Land flow path to Kawarau River	1	Reflects on marginally lower O&M input required
Option B - Wetland on Delta + land flow path to Kawarau River	0	Expect similar O&M input to the Base Case
Option C - Boreholes at Frankton (+ Option B)	-2	Higher O&M input than the Base Case associated with bore injection and membrane filtration
Option D - Soakholes at Frankton (+ Option B)	-3	Additional O&M input to the Base Case and Option C, particular in relation of maintaining and infrequent reconstruction of soakholes

10.5.1.4 Critical success factor 4 – property difficulties and impacts

Critical success factor 4 – property difficulties and impacts. Table 34 below presents the scores and rationale for each option against this criterion.

Table 34 MCA assessment - Property difficulties and impacts

Option	Score	Rationale

Current short-term discharge to Shotover River	**0**	Base Case
Option A - Land flow path to Kawarau River	**0**	Similar to Base Case - instead of DOC approvals, LINZ approvals needed
Option B - Wetland on Delta + land flow path to Kawarau River	**0**	Same as Option A, wetland and most of subsurface pipe on QLDC property; end of pipeline and outfall on Crown land
Option C - Boreholes at Frankton (+ Option B)	**-2**	Multiple landowner approvals will be required. If SH6 is utilised for conveyance, NZTA Waka Kotahi approval will also be required. Scoring would be further reduced if additional land beyond QLDC and QEC was required for the system.
Option D - Soakholes at Frankton (+ Option B)	**-3**	Additional difficulties may be presented above Option C due to the large number of soak holes required - obtaining landowner approvals for this many bores could present significant challenges.

10.5.1.5 Critical success factor 5 – achievability of indicated outcomes

Critical success factor 5 – achievability of indicated outcomes. Table 35 below presents the scores and rationale for each option against this criterion.

Table 35 MCA assessment - Achievability of indicated outcomes

Option	Score	Rationale
Current short-term discharge to Shotover River	**0**	Base Case (for comparison only)
Option A - Land flow path to Kawarau River	**2**	Better than Baseline for higher certainty achieving the required disposal capacity (volume and rate)
Option B - Wetland on Delta + land flow path to Kawarau River	**2**	Better than Baseline for higher certainty achieving the required disposal capacity (volume and rate)
Option C - Boreholes at Frankton (+ Option B)	**-3**	Relatively low probability/certainty to achieve the target disposal volume
Option D - Soakholes at Frankton (+ Option B)	**-4**	Low probability/certainty to achieve the target disposal volume

10.5.1.6 Critical success factor 6 – consent, design, construction, and implementation timeframe

Critical success factor 6 – consent, design, construction, and implementation timeframe. Table 36 below summarises the scores and rationale for each option against this criterion.

Table 36 MCA assessment - Consent, Design, Construction, and Implementation timeframe

Option	Score	Rationale
Current short-term discharge to Shotover River	**0**	Completion around end of 2029, potential risk of extended consenting delaying the project
Option A - Land flow path to Kawarau River	**1**	Within Dec 2030 deadline, likely easier programme due to shorter consenting

Option B - Wetland on Delta + land flow path to Kawarau River	-1	While still within Dec 2030 completion. Later than Baseline Option
Option C - Boreholes at Frankton (+ Option B)	-3	While Stage 1 is operation by Dec 2030, but this option will take much longer as an overall programme to complete
Option D - Soakholes at Frankton (+ Option B)	-3	While Stage 1 is operation by Dec 2030, but this option will take much longer as an overall programme to complete

10.5.1.7 Critical success factor 7 – costs and affordability

Critical success factor 7 – costs and affordability. Table 37 below presents the scores and rationale for each option against this criterion.

Table 37 MCA assessment - Costs and affordability

Option	Score	Rationale
Current short-term discharge to Shotover River	0	Base Case
Option A - Land flow path to Kawarau River	-1	Higher CAPEX and OPEX than Base Case
Option B - Wetland on Delta + land flow path to Kawarau River	-2	This option has higher CAPEX, OPEX and NPV
Option C - Boreholes at Frankton (+ Option B)	-4	Significantly higher CAPEX, OPEX and NPV than Base Case
Option D - Soakholes at Frankton (+ Option B)	-5	Significantly higher CAPEX, OPEX and NPV than Base Case

10.5.2 Short list assessment summary

10.5.2.1 Investment objectives summary

All options, as described, if successfully implemented would meet the proposed national wastewater environmental performance standards where applicable, and are an improvement on the Current Case and the health and wellbeing of the waterways. These improvements are reflected in the scores with +2 (Options A and B) and +3 (Options C and D).

All options received a score of +2 for the investment objective relation to the ability to service the required flows in the longer term.

10.5.2.2 Environmental and social impacts (effects) summary

Three effects criteria (impacts to the surrounding environment, and environmental impacts to surrounding catchment land, soil and groundwater, and amenity effects) had similar scores (within 1 point) across each of the options. These effects are all considered manageable and in some cases an improvement on the current short-term situation. For the visual effects criteria Option B scored highest (0) with options A and C (-1) having minor negative effects and Option D (-2) with more effects. These criteria are not considered to be key differentiators in the decision-making process but are important to acknowledge and understand in relation to the consent process and how to improve or mitigate these during the design, construction and operational phases.

10.5.2.3 Critical success factors (design, delivery and operation) summary

Options A and B received neutral scores for constructability, reflecting the use of established methods such as land flow paths and constructed wetlands. In contrast, Options C and D scored negatively as they carry uncertainties around disposal capacity and require further investigation.

From a sustainability perspective, Options C and D are the least favourable, scoring -4 due to additional pumping and chemicals related to membrane filtration treatment. Option B also has impacts due to material use (-2), while Option A is only marginally less sustainable than the current short-term situation (-1).

Option A scored positively for operational reliability (+1), which requires less operations and maintenance input. Option B is comparable to the current short-term situation, while Options C (-2) and D (-3) demand more operational O&M input.

In terms of property impacts, Options A and B scored neutral, with infrastructure located on QLDC-owned land. Options C and D scored negatively as multiple landowner approvals are required.

Achievability of outcomes is highest for Options A and B (+2), which offer higher certainty in meeting the desired disposal capacity. Options C and D are far less reliable with low certainty in being able to achieve the target disposal volume. Low disposal levels would either require additional costs to dispose the indicated levels on Frankton Flat or the volumes would be increased through the wetlands to the Kawarau River.

Delivery timeframes are most favourable for Option A (+1), which is likely to meet the December 2030 deadline. Option B is still within the timeframe. Options C and D, while operational by 2030 in Stage 1, will take much longer as an overall programme to complete (-3).

Cost and affordability show that Option A has higher whole of life costs to the current short-term situation with a score of -1. Option B incurs further increase in whole of life costs (-2), while Options C (-4) and D (-5) are significantly higher.

10.6 Sensitivity analysis

To assess the robustness of the short list outcomes, seven sensitivity tests were undertaken. Each test involved adjusting the weightings applied to the MCA framework to explore how different emphases on criteria influence the ranking of options within the short list assessment. Due to there being no scores associated with the three iwi based criteria these sensitivity tests should be considered alongside the position statement of Kāi Tahu on short list options (Section 4) and the commentary provided for each of the options in Section 10.

To develop weighted scores, the methodology applied a set of predefined weightings to each criterion across multiple scenarios. The breakdown of each criteria weighting scenario is available in Appendix F. The unweighted scores for the short list were then multiplied by their corresponding weightings. This process produced weighted scores that more accurately reflect the significance of each criterion within the context of the scenario being evaluated. These results are shown in the following sections.

10.6.1.1 Scenario 1: investment objectives focused

This scenario prioritised the Investment Objectives, with the highest weighting given to the health and wellbeing of waterways (15%), followed by disposal of treated wastewater aligns with tikanga (10%), and ability to service the community's and visitor wastewater needs (10%). All remaining criteria were assigned a weighting of 5%.

The weighted short list options scores for Scenario 1 are shown in Figure 33. Option A achieved the highest score, followed by Option B. Both options performed considerably better than the current short-term situation (Current Situation). Options C and D scored significantly lower, with Option D being the lowest scoring option. These results show that Options A and B are more favourable when investment objectives are prioritised.

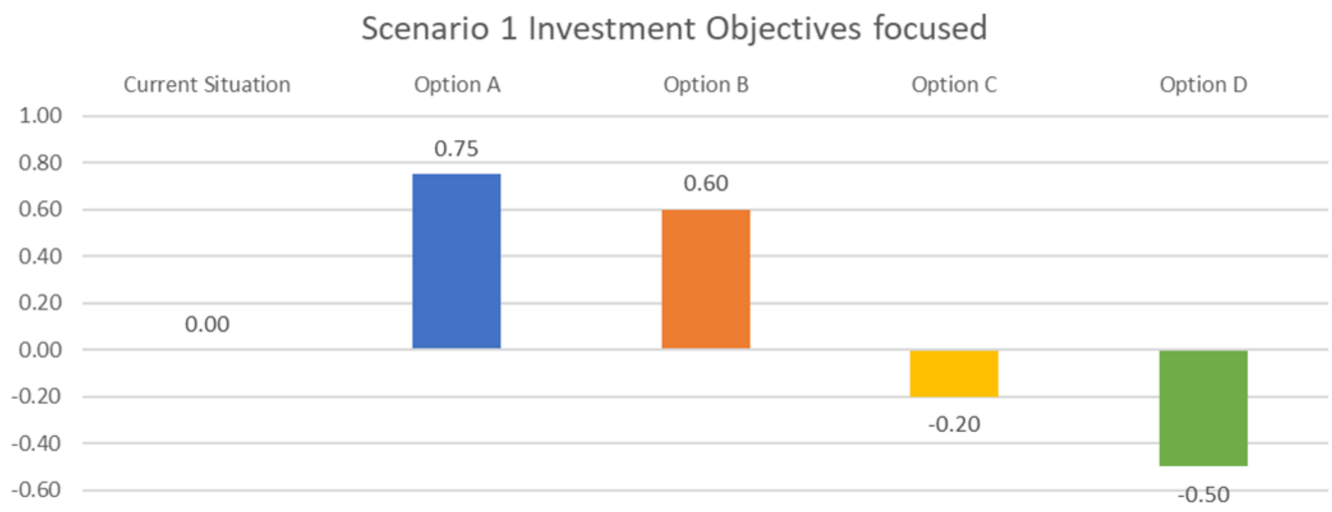

Figure 33 ***Weighted short list scores - Scenario 1: Investment Objectives Focused***

10.6.1.2 Scenario 2: effects focused

This scenario is designed to test sensitivities to the social and environmental effects, this scenario applies a higher weighing of 8% to the Environmental and Social Impacts criteria, followed by health and wellbeing of waterways (7%), and all remaining criteria weighted at 5%.

The weighted short-listed option scores for Scenario 2 are shown in Figure 34. Under Scenario 2, Option A achieved the highest score, followed by Option B. Both options performed better than the current short-term situation (Current Situation). Options C and D scored significantly lower, with Option D being the lowest scoring option. These results suggest that Options A and B are more favourable when effects are prioritised.

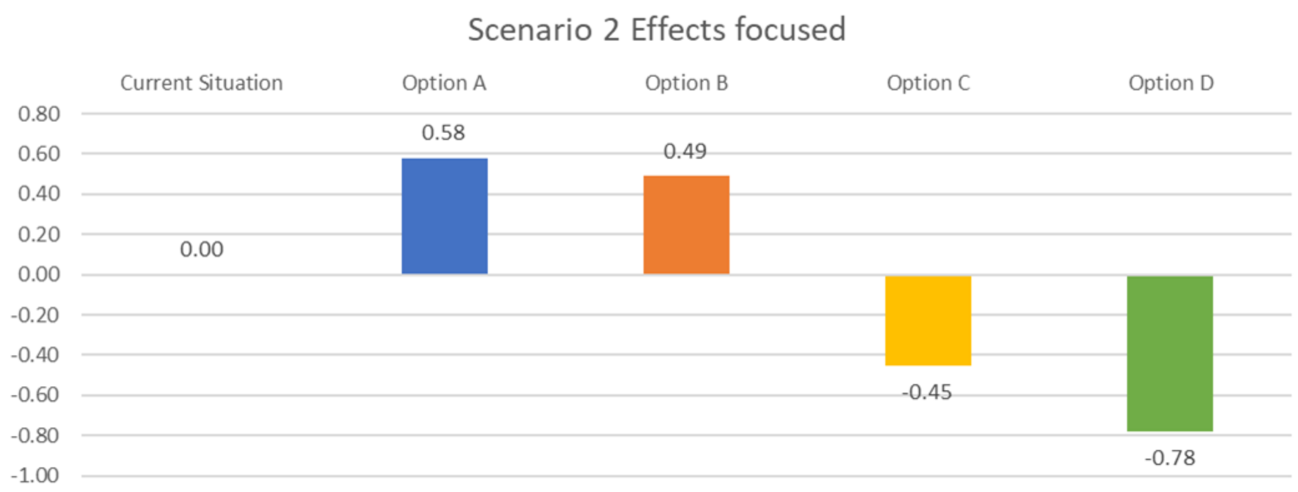

Figure 34 ***Weighted short list scores – Scenario 2: Effects focused***

10.6.1.3 Scenario 3: water quality and environment focused

Scenario 3 elevated the importance of water quality and environment, with the highest weighting given to health and wellbeing of waterways (20%), followed by Impacts to the surrounding environment and Environmental impacts to surrounding catchment land, soil and groundwater (10%). The remaining criteria were assigned weightings of between 3% and 5%.

The weighted short list options scores for Scenario 3 are shown in Figure 35. The results show Option A achieved the highest score, followed by Option B and C. All three options performed better than the current short-term situation (Current Situation). Option D was the lowest scoring option. These results suggest that Options A, B and C are more favourable when water quality and environmental outcomes are prioritised.

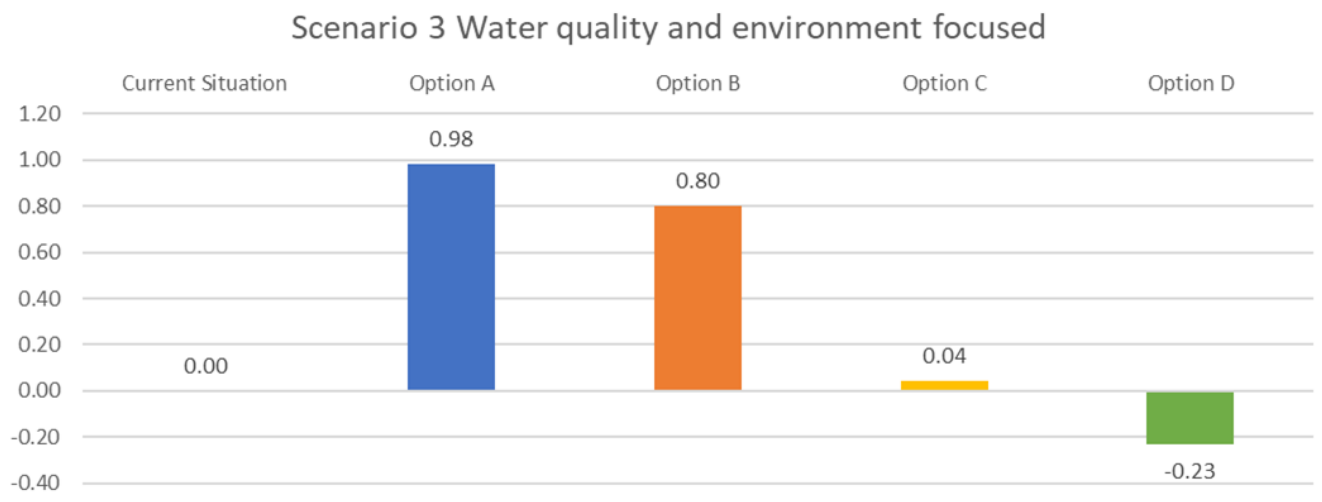

Figure 35 ***Weighted short list scores – Scenario 3: Water quality and environment focused***

10.6.1.4 Scenario 4: iwi outcomes focused

This scenario places greater emphasis on iwi-related outcomes, with the highest weighting given to disposal of treated wastewater aligns with tikanga (15%), followed by Mō tātou, ā, mō kā uri ā muri ake nei For us and our children after us and Cultural impacts to sites of significance and access to sites for cultural activities both assigned 10%. All other criteria were assigned a weighting of 5%.

As scoring was not provided by iwi for the three criteria relating to Kai Tahi values, this scenario was not used. Refer to Kai Tahu position statement (Section 4).

10.6.1.5 Scenario 5: implementability focused

Scenario 5 tests how implementability focussed criteria influence option scoring. The scenario places higher weightings on the Design, Delivery and Operation criteria, with Constructability and technical feasibility at 10%. Operational reliability and maintainability, Property, Achievability, Timeframes, and Costs and affordability were all weighted 8%, with all remaining criteria weighted 5%.

The weighted short list options scores for Scenario 5 are shown in Figure 363637. The results show Option A achieved the highest score, followed by Option B. Both options performed better than the current short-term situation (Current Situation). Options C and D scored significantly lower, with Option D being the lowest scoring option. These results suggest that Options A and B are more favourable when implementability is prioritised.

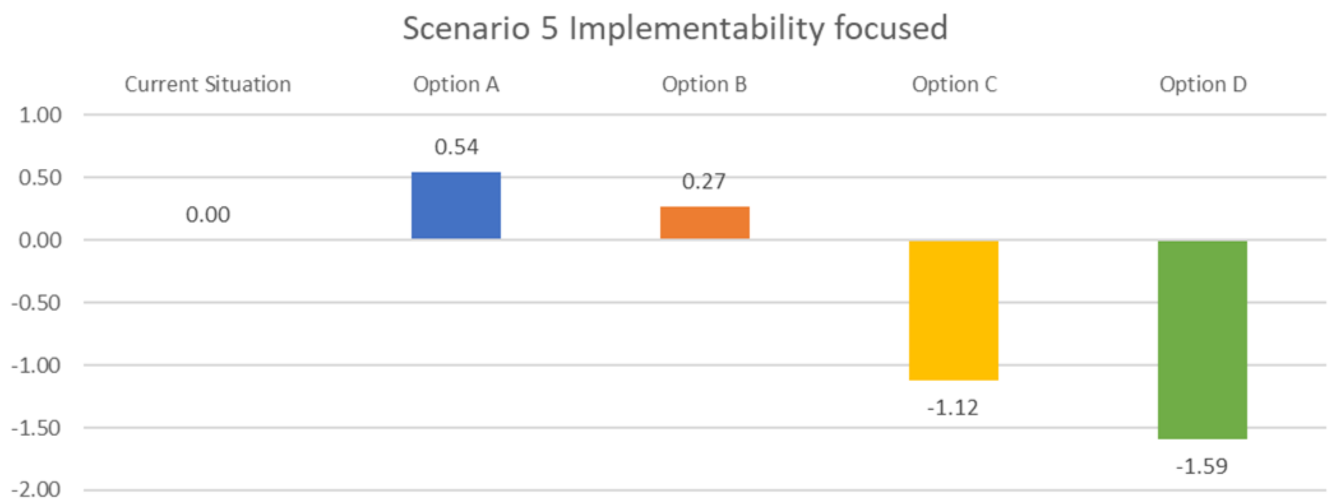

Figure 36 ***Weighted short list scores – Scenario 5: Implementability focused***

10.6.1.6 Scenario 6: even weighted

This scenario applied an even weighting of 6.25% to all criteria.

The weighted short list options scores for Scenario 6 are shown in Figure 373738. Under this scenario, Option A achieved the highest score, followed by Option B. Both performed better than the current short-term situation (Current Situation). Options C and D scored significantly lower, with Option D being the lowest scoring option. These results show that Options A and B perform more favourably when all criteria are weighted evenly.

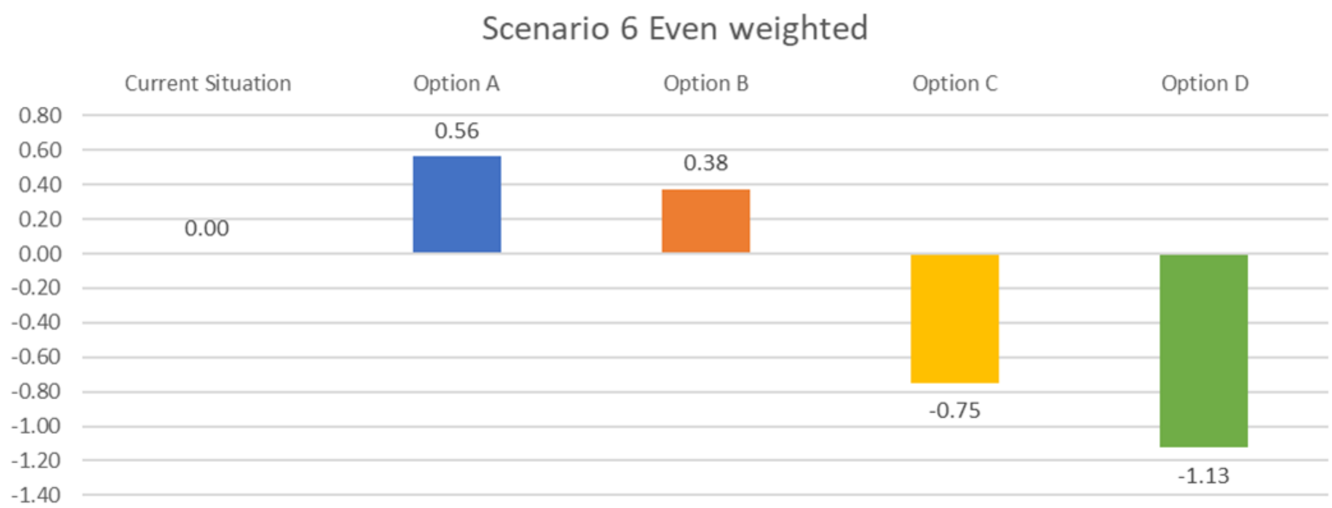

Figure 37 Weighted short list scores – Scenario 6: Even weighted

10.6.1.7 Scenario 7: national water standards and cost focused

Scenario explores how national water standards and cost considerations influence option performance. The highest weightings were assigned to Health and wellbeing of waterways and Cost and affordability (29% each). All other criteria were assigned 3%.

The weighted short list options scores for Scenario 7 are shown in Figure 383839. The results show Option A achieved the highest score, indicating the most favourable outcome. Option B performed slightly better than the current short-term situation (Current Situation). Options C and D scored significantly lower, with Option D being the lowest scoring option primarily due to their high levels of whole of life cost. These results suggest that Option A is the most favourable when national water standards, and cost and affordability outcomes are prioritised.

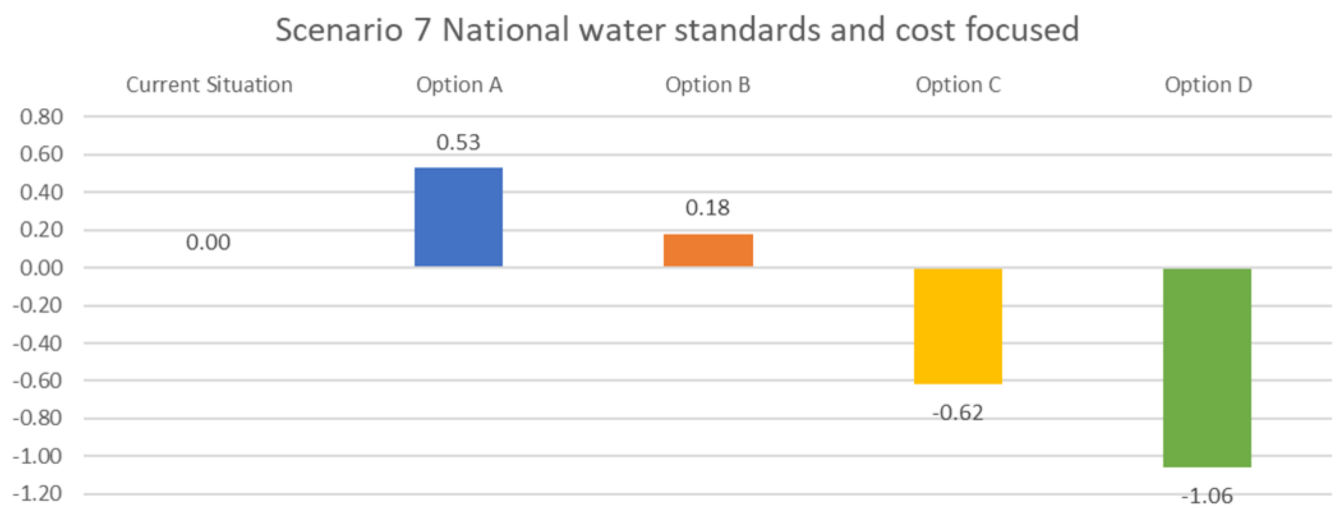

Figure 38 Weighted short list scores – Scenario 7: National water standards and cost focused

10.6.1.8 Weighting scenario summary

To assess the robustness of the short list outcomes, seven sensitivity tests were undertaken. Each test involved adjusting the weightings applied to the MCA framework to explore how different emphases on criteria influence the ranking of options within the short list assessment. Due to there being no scores associated with the three criteria based on Kāi Tahu cultural values, these sensitivity tests should be considered alongside the position statement of Kāi Tahu on short list options (Section 4) and the commentary in that statement provided for each of the options in Section 9.

Table 38 presents the results of the MCA weighting scenarios, showing the rank of each short list option (excluding the Base Case) across different weighting. The following summary outlines the relative rankings and performance trends observed across the nine scenarios.

- **Option A** performs strongly across all scenarios. It is the top-ranked option in all of the weighting scenarios and has a strong relative performance in scenarios where weightings are focused on water quality and environmental focus and investment objectives.
- **Option B** consistently performs well across all scenarios, ranking second under all scenarios.
- Unweighted, **Option C** was the highest scoring option across four of the criteria. However, it drops significantly in the weighted assessment, ranking third in all scenarios.
- **Option D** is frequently the lowest scoring option in both unweighted and weighted scoring, ranking the lowest option in all weighting scenarios.

Table 38 Weighting scenarios overall results

Scenario	**Option A** Land flow path to river via Kawarau	**Option B** Wetland on Delta + Land Flow Path to Kawarau	**Option C** Boreholes at Frankton (+ Option B)	**Option D** Soakholes at Frankton (+ Option B)
Scenario 1 Investment Objectives focused	**1st**	**2nd**	**3rd**	**4th**
Scenario 2 Effects focused	**1st**	**2nd**	**3rd**	**4th**
Scenario 3 Water quality and environment focused	**1st**	**2nd**	**3rd**	**4th**
Scenario 4 Iwi outcomes focused*	No scoring provided for criteria relating to Kai Tahu values – Scenario not used			
Scenario 5 Implementability focused	**1st**	**2nd**	**3rd**	**4th**
Scenario 6 Even weighted	**1st**	**2nd**	**3rd**	**4th**
Scenario 7 National water standards and cost focused	**1st**	**2nd**	**3rd**	**4th**

11 Preferred short list option(s)

11.1.1 Decision making context

When considering investment decisions elected officials and their officers must consider a range of factors in addition to those undertaken through technical analysis such as the legal and statutory requirements i.e. the Local Government Act, community and stakeholder engagement, and the Resource Management Act. Otago Regional Council's 'Regional Plan: Water for Otago' is the current operable policy which prefers discharges to land over direct discharge to water.

The MCA Framework used for this project has sought to where practicable, include the most appropriate criteria to reflect these. These criteria may have different levels of importance and influence through the project development stage, such as increased importance on effects during the consenting process.

Key aspects of the Local Government (Water Services) Act 2025 that must be considered are in relation to the obligation for water service providers to consider cost-effectiveness of wastewater solutions, specifically that council "*must choose the option it considers to be the most cost-effective option for providing wastewater services over the life of the infrastructure assets*"[20].

Public, stakeholder, and partner views and considerations should also be taken into account, and it should be noted that no specific public engagement on the options has been undertaken to date to inform the technical analysis in this report.

The RMA and associated consenting processes have been considered in the development of the MCA Framework and its application.

Short list options C and D not recommended for further consideration

Options C and D were progressed from the long list stage based on their suitability to offer a discharge to land solution. After evaluating both options using a water balance model and Monte Carlo analysis of select aquifer and well parameters, it was determined that only a portion of the flow can be discharged to land. This limited discharge to land is associated with significant capital and operational costs, as well as various implementation and operational challenges. Due to the level of uncertainty on disposal rates and constraints in available land at Frankton Flats and surrounding areas, both options were developed as partial discharge to land solutions, with the remaining discharge handled by the Option B solution.

These options are not recommended to be progressed further for technical analysis and have significant deficiencies in relation to achieving the requirements of the Local Government (Water Services) Act 2025, especially in relation to cost-effectiveness.

Option A as the technically preferred option

When assessing across the criteria and undertaking a wide range of sensitivity tests, Option A presents as the most technically preferred option. It has a relatively low capital and operational costs and therefore a low whole of life cost when compared to Option B. Option A is expected to comply with the future national water environmental standards and has the ability to accommodate the growth in wastewater flows for the longer term.

Option B has areas where it performs better than Option A in relation to visual and amenity effects (though both are considered fatally flawed by Te Ao Marama and Aukaha).

Option A should be progressed as the technically preferred option for consideration by QLDC officers and elected members. It is noted that the conclusions of this process are based on the assumptions, constraints and criteria described in this report, and the technical preference will need to be considered in relation to other decision-making factors, including the expressed concerns.

It is also noted that other considerations may also be relevant to decision-making. In addition to the MCA results and the position of iwi contained in this report it is recommended that the views of the community, stakeholders, and partners be considered alongside the legislative requirements.

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[20] [20]Local Government (Water Serviced) Act 2025, Clause 254

12 References

Beca. (2024). *Shotover Pond Sludge Volume - May 2024 Update.*
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GHD. (2025). *QLDC updated population forecast on Shotover WWTP Disposal (August 2025).*
GHD. (2025). *Shotover Long List Options Report Rev0.* Christchurch.
Harvard University. (2016, November 18). *WellIntel: Smart water for the masses*. Retrieved from Technology and operations management : https://d3.harvard.edu/platform-rctom/submission/wellntel-smart-water-for-the-masses/

Appendices

Appendix A

Capital cost (Alta),
Operating cost,
Net present value

Appendix A - Capital Cost Summary

Prepared by: I.Ho, S.Browne
Reviewed by: H.Barclay
Date updated: 28/10/2025

Item	Option A - Land flow path	Option B - Wetland	Option C - Bore	Option D - Soakholes
CAPEX Stage 1				
Tertiary Filtration	$ 5,954,405	$ 5,954,405	$ 5,954,405	$ 5,954,405
Treated water calamity pond	$ 1,387,352	$ 1,387,352	$ 1,387,352	$ 1,387,352
Recyced Water for truck wash	$ 1,279,910	$ 1,279,910	$ 1,297,368	$ 1,297,368
Land flow path and discharge structure	$ 7,348,413	$ 4,051,279	$ 4,051,279	$ 4,051,279
Wetland (3ha)	$ -	$ 17,805,977	$ 17,805,977	$ 17,805,977
Stage 1 Membrane + Transfer Pump + Pipeline	$ -	$ -	$ 8,615,814	$ 8,615,814
Stage 1 Borefield cost	$ -	$ -	$ 5,988,487	$ 5,400,987
Connection to golf course and sportfields	$ -	$ -	$ 207,000	$ 207,000
Physical works - Sub total	**$ 15,970,079**	**$ 30,478,923**	**$ 45,307,682**	**$ 44,720,182**
Contractor Cost	$ 8,095,185	$ 15,449,674	$ 23,985,343	$ 23,674,328
Construction Cost Base Cost	**$ 24,065,264**	**$ 45,928,597**	**$ 69,293,025**	**$ 68,394,509**
Construction Cost P50	$ 33,691,370	$ 64,300,036	$ 97,010,235	$ 95,752,313
Construction Cost P95	$ 38,504,423	$ 73,485,755	$ 110,868,839	$ 109,431,215
Consent, Investigation and Design Fees	$ 5,619,137	$ 6,751,003	$ 10,320,614	$ 10,245,139
Stage 1 CAPEX Cost P50	**$ 39,310,507**	**$ 71,051,038**	**$ 107,330,849**	**$ 105,997,452**
Stage 1 CAPEX Cost P95	**$ 44,123,560**	**$ 80,236,758**	**$ 121,189,454**	**$ 119,676,353**
CAPEX Stage 2 *(only applicable if discharge capacity greater than 12,500m^3 /day is determined to be acheivable for Option C or D)*				
Membrane filtration upgrade	$ -	$ -	$ 11,555,589	$ 11,555,589
Conveyance	$ -	$ -	$ 5,184,984	$ 5,184,984
Boreholes or Soakholes	$ -	$ -	$ 6,930,045	$ 15,835,545
Physical works - Sub total	**$ -**	**$ -**	**$ 23,670,617**	**$ 32,576,117**
Contractor Cost	$ -	$ -	$ 12,530,941	$ 17,245,406
Construction Cost Base Cost	**$ -**	**$ -**	**$ 36,201,558**	**$ 49,821,523**
Construction Cost P50	$ -	$ -	$ 50,682,181	$ 69,750,132
Construction Cost P95	$ -	$ -	$ 57,922,493	$ 79,714,436
Consent, Investigation and Design Fees	$ -	$ -	$ 6,540,931	$ 6,580,011
Option Cost P50	**$ -**	**$ -**	**$ 57,223,112**	**$ 76,330,142**
Option Cost P95	**$ -**	**$ -**	**$ 64,463,423**	**$ 86,294,447**
Stage 1 + Stage 2 CAPEX Cost P50	**$ 39,310,507**	**$ 71,051,038**	**$ 164,553,960**	**$ 182,327,594**
Stage 1 + Stage 2 CAPEX Cost P95	**$ 44,123,560**	**$ 80,236,758**	**$ 185,652,877**	**$ 205,970,800**
OPEX Costs				
Annual operating costs Stage 1				
Renewals	$ 264,668	$ 373,771	$ 638,793	$ 632,918
Operations	$ 9,984	$ 29,952	$ 79,872	$ 79,872
Electricity	$ 71,034	$ 66,618	$ 141,370	$ 97,179
Other	$ 4,752	$ 4,752	$ 20,424	$ 16,673
Total annual operating costs Stage 1	**$ 350,439**	**$ 475,093**	**$ 880,459**	**$ 826,642**
Annual operating costs Stage 2				
Maintenance costs (assumed 1% civil, 3% mech)	$ 264,668	$ 373,771	$ 1,033,330	$ 1,124,290
Operations	$ 9,984	$ 29,952	$ 167,643	$ 167,643
Electricity	$ 71,034	$ 66,618	$ 369,247	$ 366,623
Other	$ 4,752	$ 4,752	$ 13,174	$ 52,774
Total annual operating costs Stage 2	**$ 350,439**	**$ 475,093**	**$ 1,583,395**	**$ 1,711,331**
Whole of life Cost - *30 year period, assumes discount rate of 2% and depreciation funded 50%* **over 60 years**				
Net present value of CAPEX and OPEX, 30 years	**$ 47,912**	**$ 84,778**	**$ 187,931**	**$ 208,611**

Appendix B

MCA scoring sheet

Multi Criteria Assessment - Scoring with base case as the current case

Investment Objectives	KPIS	Scoring Lead	BASE CASE Current situation *Discharge to Shotover River*	Commentary Discharge into the Shotover River via the historical channel	A *Land flow path to Kawarau River*	Commentary	B *Subsurface wetlands on Delta + Land Flow Path to Kawarau River*	Commentary In 2060, 100% of total treated effluent discharge to Kawarau River via a new rock outfall (land flow path) and subsurface wetland, expected average flow ~ 26,000 m3/d	Options C *Deep well (Bore) injections at Frankton + Excess flow to Kawarau River*	Commentary In 2060, total average flow is 26,000 m3/d, bore discharge at Frankton 8000 m3/d (median probability, pending field investigation confirmation), with remaining flow (~16,000 m3/d on average) discharged to Kawarau River via wetland	D *Shallow well (soakhole) injections at Frankton + excess flow to Kawarau River*	Commentary In 2060, total average flow is 26,000 m3/d, soakhole discharge at Frankton 1,500 m3/d (median probability, pending field investigation confirmation), with remaining flow (~23,000 m3/d on average) discharged to Kawarau River via wetland
The health and well-being of the surrounding waterways are maintained, protected and improved where practicable to support water quality.	• Ecosystem / Aquatic health effects. • Human health effects. • Nuisance growth. • Recreation impacts.	Anthony Kirk (GHD)	0	**Key considerations:** - Discharge solely to Shotover River, with mixing in near riverbank braids. - Diversion of river required to manage water quality. **Assumptions:** - Consistent with short term consent and predicted effects - Maintenance of diversion channel achieved, providing continuous flow for dilution **Rationale for scoring:** - Localised water quality impacts in the Shotover River beyond the mixing zone, resulting in increases in nutrient concentrations in water quality in select parts of river braids. - Persistent change in river braids with maintenance of diversion, potentially impacting other braids due to reduced flow. - Public health risk being mitigated by exclusion riverbank area (reducing exposure).	2	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. **Assumptions:** - Overland flow structure sufficiently sized to preclude public contact with treated wastewater. - Shotover River inflow to Kawarau promotes rapid mixing **Rationale for scoring:** - Removes delta groundwater effects. - Reduces water quality effects in shallow riverbank areas. - Reduces potential for algal growth and nuisance growth. - Reduces potential for exposure with recreational land use. Score could be increased where an in-river diffuser allows for immediate mixing centrally within the river.	2	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. **Assumptions:** - Overland flow structure sufficiently sized to preclude public contact with treated wastewater. - Shotover River inflow to Kawarau promotes more rapid mixing **Rationale for scoring:** - Removes delta groundwater effects. - Reduces water quality effects in shallow riverbank areas. - Reduces potential for algal growth and nuisance growth. - Reduces potential for exposure with recreational land use. Score could be increased where an in-river diffuser allows for immediate mixing centrally within the river.	3	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. - Discharge to groundwater at Frankton Flats. - Subsequent discharge to Kawarau River via Frankton Flats groundwater flow paths. **Assumptions:** - Overland flow structure sufficiently sized to preclude public contact with treated wastewater. - Shotover River inflow to Kawarau promotes more rapid mixing - Discharge of 12,500 m3/day to Frankton bores and 1,500 m3/day to sorts field irrigation **Rationale for scoring:** - Removes delta groundwater effects. - Reduces water quality effects in shallow riverbank areas. - Reduces potential for algal growth and nuisance growth. - Reduces potential for exposure with recreational land use. Score could be increased where an in-river diffuser allows for immediate mixing centrally within the river. - More diffuse discharge to Kawarau River, with smaller direct discharge mixing zone.	3	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. - Discharge to groundwater at Frankton Flats. - Subsequent discharge to Kawarau River via Frankton Flats groundwater flow paths. **Assumptions:** - Overland flow structure sufficiently sized to preclude public contact with treated wastewater. - Shotover River inflow to Kawarau promotes more rapid mixing - Discharge of 12,500 m3/day to Frankton soak holes and 1,500 m3/day to sorts field irrigation **Rationale for scoring:** - Removes delta groundwater effects. - Reduces water quality effects in shallow riverbank areas. - Reduces potential for algal growth and nuisance growth. - Reduces potential for exposure with recreational land use. - More diffuse discharge to Kawarau River, with smaller direct discharge mixing zone.
The disposal of treated wastewater aligns with tikanga as guided by mana whenua.	• Mana whenua values and knowledge. • Alignment with mana whenua cultural practices, protocols and values.	By Aukaha	No score	**Key considerations:** The system is discharging to surface water. Discharge of human waste to water does not align with mana whenua values and tikanga. **Assumptions:** This option is for emergency purposes only. **Rationale for scoring:** The system is discharging to the Kimiākau and Kawarau rivers. Discharge of human waste to water does not align with mana whenua values and tikanga.	No score	**Key considerations:** From a mana whenua perspective this is no different from the BAU case. Although it utilises natural flow channels, the overall treatment in the ground is minimal (~200m flow channel). Discharge of human waste to water does not align with mana whenua values and tikanga. **Assumptions:** The receiving soil characteristic at the proposed disposal field is the same as the soil characteristic at the current disposal field **Rationale for scoring:** - Disposal beds are in the floodplain, and adjacent to the Kawarau, meaning that there is inadequate land based treatment prior to reaching the receiving waterbody to water. Discharge of human waste to water does not align with mana whenua values and tikanga. - does not give effect to mana whenua aspirations for TMoTW as per the Draft Otago RPS -LF-WAI-01 - through a matauraka Māori lens, this is effectively BAU, or more damaging than BAU. - The characteristics of the soils and the extra distance from the current disposal fields are not substantially different enough to classify this solution as distinct from the current disposal field. - minimal in-ground treatment	No score	**Key considerations:** -From a mana whenua perspective this is not significantly different from the BAU case. The subsurface wetland will provide only minimal treatment. - The characteristics of the soils and the extra distance from the current disposal fields are not substantially different enough to classify this solution as distinct from the current disposal field. **Assumptions:** -The receiving soil characteristic at the proposed disposal field is the same as the soil characteristic at the current disposal field.One week timeframe with rapid mixing in river under storm conditions. Longer under normal conditions. - the Beca report from June 2020 is representative of the flood modelling **Rationale for scoring:** - does not give effect to mana whenua aspirations for TMoTW as per the Draft Otago RPS -LF-WAI-01 - disposal area is still in the Kawarau. There is inadequate land based treatment prior to reaching the receiving waterbody to water. Discharge of human waste to water does not align with mana whenua values and tikanga. - through a matauraka Māori lens, this is effectively BAU. - The characteristics of the soils and the extra distance from the current disposal fields are not substantially different enough to classify this solution as distinct from the current disposal field.	No score	**Key considerations:** This method of disposing of wastewater is not common practice in Aotearoa (one plant in Russell). Mana whenua concerns are primarily around seismic activity shearing or rupturing the bores and contaminating the groundwater - Discharge directly to groundwater does not align with mana whenua values. **Assumptions:** - under a failure scenario, the groundwater aquifer then subsequent connected surface wter bodies would become contaminated - this option will only provide for a minor portion of the demand and therefore requires Option A or B as well **Rationale for scoring:** the risk of system failure and contamination of the groundwater - lack of knowledge about the groundwater aquifer and how it would interact with surface water if contaminated - preference not to trial technology in this area - high perceived contamination risk if system is comprised - there is a risk of groundwater mounding and generation of riverbank streams - Discharge directly to groundwater does not align with mana whenua values - also it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options.	No score	**Key considerations:** -The solution is in very close proximity to the treatment plant; meaning that the waste is treated and disposed of in-catchment, and is not off-loaded to another takiwā. **Assumptions:** - this option will only provide for a minor portion of the demand and therefore requires Option A or B as well **Rationale for scoring:** -The depth of separation from groundwater is substantially greater than any other considered, minimising the risk of aquifer or surface water contamination. - There is an anticipated 28 - 30 m depth between the injection point and the groundwater table - Out of all options considered, this one is expected to have the least impact on the GW aquifer and on the adjacent surface water bodies, and has the best alignment with mana whenua cultural practices, protocols and values around waste and water. However it does not have sufficient capacity to absorb the full discharge from the WTTP. It is only a partial solution and would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options.
The disposal of treated wastewater aligns with tikanga as guided by mana whenua.	• Mana whenua values and knowledge. • Alignment with mana whenua cultural practices, protocols and values.	By TAMI - Riria Hakiwai	No score	**Key considerations:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Assumptions:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Rationale for scoring:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information	No score	**Key considerations:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Assumptions:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Rationale for scoring:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information	No score	**Key considerations:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Assumptions:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Rationale for scoring:** Slightly better than current and option A, Fatally flawed.	No score	**Key considerations:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Assumptions:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Rationale for scoring:** Better than discharging entirely to water, however still fatally flawed.	No score	**Key considerations:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Assumptions:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Rationale for scoring:** Better than discharging entirely to water, however still fatally flawed.
Ability to service the community's and visitor wastewater needs now and into the future up to the equivalent flows projected for 2060.	• Can accommodate forecast population or economic growth over time. • Can accommodate peak day inflows. • Can be resilient to extreme climate events, climate change and natural disasters.	Ian Ho & Anthony Kirk (GHD)	0	**Key considerations:** - Short term consent sought to discharge treated effluent into the Shotover River via historical channel - Existing dishcarge channel has certain sections to be modified to accommodate 400L/s, more modifications for 600L/s (also require more river diversion works) **Assumptions:** - Short term consent granted and expires in 2030 - Channel capacity increase to peak flow capacity of 400 L/s - Further augmentation of the channel to increase 600L/s is possible (though difficult) **Rationale for scoring:** 0, Base Case	2	**Key considerations:** - New conveyance pipe will be installed from UV outlet to the land flow path (rock outfall) structure at the bottom of the delta **Assumptions:** - New pipe is sized for 2060 peak day flows **Rationale for scoring:** This option changes the disposal location from Shotover River to Kawarau River, and is more resilient to flood damage such as river bank erosion, channel erosion and sedimentation. Can accommodate future flows.	2	**Key considerations:** - New conveyance pipe will be installed from UV outlet to the land flow path (rock outfall) structure at the bottom of the delta - Constructed subsurface wetlands provide additional land contact prior to river discharge. **Assumptions:** - New pipe is sized for 2060 peak day flows - Constructed subsurface wetlands provided additional land contact, and wet weather flow management will be refined as part of wetland design **Rationale for scoring:** This option changes the disposal location from Shotover River to Kawarau River, and is more resilient to flood damage such as river bank erosion, channel erosion and sedimentation. Can accommodate future flows.	2	**Key considerations:** - On top of new infrastructure outlined in Option B, additional infrastructure of membrane filtration, pumping, pipelines, irrigation water to golf course and sportfields, and 10 injection bores **Assumptions:** - Additional infrastructure is sized for 12,500 m3/day bore disposal capacity (estimated to be 25th percentile) with median probably capacity of 8000 m3/day, approximately 1/3 of 2060 forecasted average flow **Rationale for scoring:** This option changes the disposal location from Shotover River to the Kawarau River for a portion of the flow, and is more resilient to flood damage such as river bank erosion, channel erosion and sedimentation. Can accommodate future flows.	2	**Key considerations:** - On top of new infrastructure outlined in Option B, additional infrastructure of membrane filtration, pumping, pipelines, irrigation water to golf course and sportfields, and 50 soakholes **Assumptions:** - Additional infrastructure is sized for 12,500 m3/day bore disposal capacity (estimated to be 25th percentile) with median probably capacity of 8000 m3/day, approximately 1/3 of 2060 forecasted average flow **Rationale for scoring:** This option changes the disposal location from Shotover River to the Kawarau River for a portion of the flow, and is more resilient to flood damage such as river bank erosion, channel erosion and sedimentation. Can accommodate future flows.
ironmental and Social Imp	**KPIS**	**Scoring Lead**										
Mō tātou, ā, mō kā uri ā muri ake nei For us and our children after us	• Integration of whakapapa Intergenerational equity, innovation, and knowledge. • Te mana o te wai Mauri of the water is upheld or enhanced. • Ki uta ki tai Whole of catchment impact and holistic consideration.	By Aukaha	No score	**Key considerations:** - the previous iteration of the disposal field project did not take into account the mana whenua views on appropriate location. Mana whenua concerns about discharge of wastewater to the Kimiākau have been expressed for more than 25 years. **Assumptions:** This option is for emergency purposes only. **Rationale for scoring:** - The current system does not recognise the intergenerational concerns of mana whenua about discharge of human waste to the awa, does not uphold the mauri of the awa and does not consider the whole-of-catchment effects from the discharge on water.	No score	**Key considerations:** -The disposal field lies within the floodplain, and is at most ~500m further away from the current disposal field, (although it has reached the Kawarau at this 500m distance). **Assumptions:** -The receiving soil characteristic at the proposed disposal field is the same as the soil characteristic at the current disposal field. **Rationale for scoring:** - Disposal beds are in the floodplain. - Susceptible to sedimentation and clogging from floods, therefore not expected to be resilient to natural hazard events. - Inappropriate receiving environment. The system does not recognise the intergenerational concerns of mana whenua about discharge of human waste to the awa, does not uphold the mauri of the awa and does not consider the whole-of-catchment effects from the discharge on water.	No score	**Key considerations:** This is mis-aligned with all of the KPIs. Mana whenua want the disposal area out of the delta to be able to restore the cultural practises in the area. **Assumptions:** -The receiving soil characteristic at the proposed disposal field is the same as the soil characteristic at the current disposal field. - the Beca report from June 2020 is representative of the flood modelling **Rationale for scoring:** - Disposal beds are partially in the floodplain, and are adjacent to the Kawarau. - Misaligned with mō tātou, ā, mō kā uri (pepeha) due to lack of flood resilience being situated in the floodplain, expected to need remedial works after flood. - Does not give effect to mana whenua aspirations for TMoTW as per the Draft Otago RPS -LF-WAI-01. - Through a matauraka Māori lens, this is effectively BAU, the characteristics of the soils and the extra distance from the current disposal fields are not substantially different enough to classify this solution as distinct from the current disposal field. - The primary issue as per the KTKO NRMP 2005 is that this option is not providing adequate land based treatment prior to reaching the receiving waterbody.It does not recognise the intergenerational concerns of mana whenua about discharge of human waste to the awa, does not uphold the mauri of the awa and does not consider the whole-of-catchment effects from the discharge on water.	No score	**Key considerations:** -This technology is not a widely established means of wastewater disposal in Aotearoa, so there is less regionally specific data to support how it performs in the long term here. **Assumptions:** - Under a failure scenario, the groundwater aquifer then subsequent connected surface water bodies would become contaminated. - this option will only provide for a minor portion of the demand and therefore requires Option A or B **Rationale for scoring:** - The option may cause land instability. - Southern edge is close to Kawarau. - Highly sensitive to quality of injected water, so not as robust. There is a risk of groundwater contamination, which would not uphold the mauri of that groundwater. - also it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options	No score	**Key considerations:** To the extent that it has the capacity to handle the loading from the WTTP, this is well-aligned with all of the KPIs **Assumptions:** - this option will only provide for a minor portion of the demand and therefore requires Option A or B as well **Rationale for scoring:** - The site is not in a flood prone location or expected to be destabilised with the disposal loading rates. - The contaminants are treated and disposed of in catchment. - The necessity for a pump-driven solution means that in the event of an emergency where power is out, the system will not be able to operate and will likely result in discharge to the current floodplain area. - however it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options
Mō tātou, ā, mō kā uri ā muri ake nei For us and our children after us	• Integration of whakapapa Intergenerational equity, innovation, and knowledge. • Te mana o te wai Mauri of the water is upheld or enhanced. • Ki uta ki tai Whole of catchment impact and holistic consideration.	By TAMI - Riria Hakiwai	No score	**Key considerations:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Assumptions:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Rationale for scoring:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information	No score	**Key considerations:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Assumptions:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Rationale for scoring:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information	No score	**Key considerations:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Assumptions:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Rationale for scoring:** Slightly better than current and option A, Fatally flawed.	No score	**Key considerations:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Assumptions:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Rationale for scoring:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation.	No score	**Key considerations:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Assumptions:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Rationale for scoring:** Culturally acceptable as Mana Whenua will always advocate for disposal to land
Cultural impacts to sites of significance and access to sites for cultural activities.	• Sites of cultural significance impacts • Physical access to site for cultural and recreational activities.	By Aukaha	No score	**Key considerations:** - Kimiākau (Shotover River) was part of the extensive network of **kāinga mahinga kai (food-gathering places)** and **traditional travel routes** throughout Central Otago. - The Kawarau River was a traditional travel route that provided direct access between Whakatipu Waimāori and Mata-au. Ngāi Tahu kaumātua recorded Kawarau as a **kāinga mahinga kai (food-gathering place)** where weka, kākāpō, kea, and tuna (eel) were gathered. **Assumptions:** This option is for emergency purposes only. **Rationale for scoring:** - The current system does not consider effects from the discharge on mahika kai values. - The current system is incompatible with allowing mana whenua to exercise cultural practices around food gathering and inhibits traditional mana whenua associations with the area.	No score	**Key considerations:** - Kimiākau (Shotover River) was part of the extensive network of **kāinga mahinga kai (food-gathering places)** and **traditional travel routes** throughout Central Otago. - The Kawarau River was a traditional travel route that provided direct access between Whakatipu Waimāori and Mata-au. Ngāi Tahu kaumātua recorded Kawarau as a **kāinga mahinga kai (food-gathering place)** where weka, kākāpō, kea, and tuna (eel) were gathered. **Assumptions:** mana whenua wish to restore and enhance mahika kai availability and access within the greater project area. **Rationale for scoring:** - From a mana whenua perspective it is culturally unacceptable to dispose of wastewater to water bodies, especially so if those waterbodies are associated with mahika kai.	No score	**Key considerations:** - Kimiākau (Shotover River) was part of the extensive network of **kāinga mahinga kai (food-gathering places)** and **traditional travel routes** throughout Central Otago. - The Kawarau River was a traditional travel route that provided direct access between Whakatipu Waimāori and Mata-au. Ngāi Tahu kaumātua recorded Kawarau as a **kāinga mahinga kai (food-gathering place)** where weka, kākāpō, kea, and tuna (eel) were gathered. **Assumptions:** mana whenua wish to restore and enhance mahika kai availability and access within the greater project area, mana whenua wish to have continued involvement in the area. **Rationale for scoring:** - From a mana whenua perspective it is culturally unacceptable to dispose of wastewater to water bodies, especially so if those waterbodies are associated with mahika kai. The extra distance through the wetland does not sufficently alter the disposal route from a mana whenua perspective, and mana whenua preference is to take the disposal area out of the delta	No score	**Key considerations:** -This technology is not a widely established means of wastewater disposal in Aotearoa, so there is less regionally specific data to support how it performs in the long term here. **Assumptions:** - Under a failure scenario, the groundwater aquifer then subsequent connected surface water bodies would become contaminated. - this option will only provide for a minor portion of the demand and therefore requires Option A or B **Rationale for scoring:** - No river crossings. - High risk potential for groundwater and surface water contamination if bore ruptures in seismic event. - Highly sensitive to quality of injected water, so not as robust. - also it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options	No score	**Key considerations:** -This option has significant benefits from a mana whenua perspective as the anticipated in-ground treatment is maximised in an appropriate receiving environment, in such a way that won't interfere with surface water flows or groundwater **Assumptions:** mana whenua wish to restore and enhance mahika kai availability and access within the greater project area, mana whenua wish to have continued involvement in the area. - careful management of the disposal would ensure no riverbank streams emerging and coursing toward the Kawarau. - this option will only provide for a minor portion of the demand and therefore requires Option A or B **Rationale for scoring:** -There are no river crossings, - This is seen as culturally appropriate disposal to land - This option would help restore the mauri of Kawarau and Kimiākau to allow safe re-establishment of mahika kai practices in the area - there is 28 - 30m depth before reaching the GW aquifer, which is through suitably permeable gravels - however it is only a partial solution that will not have capacity for the full discharge from the WTTP, so would be combined with either Fatally Flawed Option A or B. It cannot therefore be scored in isolation from those options
Cultural impacts to sites of significance and access to sites for cultural activities.	• Sites of cultural significance impacts • Physical access to site for cultural and recreational activities.	By TAMI - Riria Hakiwai	No score	**Key considerations:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Assumptions:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Rationale for scoring:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information	No score	**Key considerations:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Assumptions:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Rationale for scoring:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information	No score	**Key considerations:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Assumptions:** Considered direct discharge to water, Culturally unacceptable, please refer to CIA provided for further information **Rationale for scoring:** Slightly better than current and option A, Fatally flawed.	No score	**Key considerations:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Assumptions:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Rationale for scoring:** Better than discharging entirely to water, however still fatally flawed.	No score	**Key considerations:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Assumptions:** As a stand alone option this would be culturally acceptable however consideration is given to the supplementary discharge to water. Fatally flawed. Please refer to CIA provided for further explanation. **Rationale for scoring:** Better than discharging entirely to water, however still fatally flawed.
Impacts to the surrounding environment	• Natural waterway impacts • Biodiversity	Anthony Kirk (GHD)	0	**Key considerations:** - Discharge solely to Shotover River, with mixing in near riverbank braids. Pontential for localised areas of increased toxicity - Diversion of river required to manage water quality. **Assumptions:** - Consistent with short term consent and predicted effects - Maintenance of diversion channel achieved, providing continuous flow for dilution - Findings of ecosystem monitoring during historical discharge represent the outcomes of future discharges, albeit for a wastewater with historically higher ammonia concentrations and organic sediment load. **Rationale for scoring:** Base Case	2	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. **Assumptions:** - Shotover River inflow to Kawarau promotes rapid mixing. **Rationale for scoring:** -Area of influence predominantly limited to immediate mixing zone within the Kawarau river. Disposal mechanism (rock structure, diffuser, etc.) will influence mixing. -No river diversion required	2	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. **Assumptions:** - Shotover River inflow to Kawarau promotes rapid mixing. **Rationale for scoring:** -Area of influence predominantly limited to immediate mixing zone within the Kawarau river. Disposal mechanism (rock structure, diffuser, etc.) will influence mixing. -No river diversion required	2	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. - Discharge to groundwater at Frankton Flats. - Subsequent discharge to Kawarau River via Frankton Flats groundwater flow paths. **Assumptions:** - Shotover River inflow to Kawarau promotes rapid mixing. - Frankton Flats groundwater discharges are diffuse into Kawarau River bed. **Rationale for scoring:** -Area of influence predominantly limited to immediate mixing zone within the Kawarau river. Disposal mechanism (rock structure, diffuser, etc.) will influence mixing.	2	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. - Discharge to groundwater at Frankton Flats. - Subsequent discharge to Kawarau River via Frankton Flats groundwater flow paths. **Assumptions:** - Shotover River inflow to Kawarau promotes rapid mixing. - Frankton Flats groundwater discharges are diffuse into Kawarau River bed. **Rationale for scoring:** -Area of influence predominantly limited to immediate mixing zone within the Kawarau river. Disposal mechanism (rock structure, diffuser, etc.) will influence mixing.
Environmental impacts to surrounding catchment land, soil and groundwater	• Surface water effects • Soil health effects • Groundwater effects	Anthony Kirk (GHD)	0	**Key considerations:** - Discharge solely to Shotover River, with mixing in near riverbank braids. - Diversion of river required to manage water quality. - removal of localised DAD effects on groundwater **Assumptions:** - Consistent with short term consent and predicted effects - Maintenance of diversion channel achieved, providing continuous flow for dilution - Findings of ecosystem monitoring during historical discharge represent the outcomes of future discharges, albeit for a wastewater with historically higher ammonia concentrations and organic sediment load. **Rationale for scoring:** - Improvement on delta groundwater conditions. - Localised effects to surface water quality.	2	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. **Assumptions:** - Shotover River inflow to Kawarau promotes rapid mixing **Rationale for scoring:** - Improvement in delta groundwater conditions. - Effects to water quality within relatively small in-river mixing zone	2	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. **Assumptions:** - Shotover River inflow to Kawarau promotes rapid mixing **Rationale for scoring:** - Improvement in delta groundwater conditions. - Effects to water quality within relatively small in-river mixing zone	1	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. - Discharge to groundwater at Frankton Flats. - Subsequent discharge to Kawarau River via Frankton Flats groundwater flow paths. **Assumptions:** - Shotover River inflow to Kawarau promotes rapid mixing **Rationale for scoring:** - Improvement in delta groundwater conditions. - Impact to Frankton Flats groundwater quality - Effects to water quality within relatively small in-river mixing zone	1	**Key considerations:** - Discharge to river at the confluence of the Shotover and Kawarau Rivers. - Discharge to groundwater at Frankton Flats. - Subsequent discharge to Kawarau River via Frankton Flats groundwater flow paths. **Assumptions:** - Shotover River inflow to Kawarau promotes rapid mixing **Rationale for scoring:** - Improvement in delta groundwater conditions. - Impact to Frankton Flats groundwater quality - Effects to water quality within relatively small in-river mixing zone

Multi Criteria Assessment - Scoring with base case as the current case

			BASE CASE Current situation *Discharge to Shotover River*	Commentary Discharge into the Shotover River via the historical channel	A *Land flow path to Kawarau River*	Commentary	B *Subsurface wetlands on Delta + Land Flow Path to Kawarau River*	Commentary In 2060, 100% of total treated effluent discharge to Kawarau River via a new rock outfall (land flow path) and subsurface wetland, expected average flow ~ 26,000 m3/d	Options C *Deep well (Bore) injections at Frankton + Excess flow to Kawarau River*	Commentary In 2060, total average flow is 26,000 m3/d, bore discharge at Frankton 8000 m3/d (median probability, pending field investigation confirmation), with remaining flow (~16,000 m3/d on average) discharged to Kawarau River via wetland	D *Shallow well (soakhole) injections at Frankton + excess flow to Kawarau River*	Commentary In 2060, total average flow is 26,000 m3/d, soakhole discharge at Frankton 1,500 m3/d (median probability, pending field investigation confirmation), with remaining flow (~23,000 m3/d on average) discharged to Kawarau River via wetland
Visual effects - The extent to which there is a visual impact from options that differ from existing land use or impact the surrounding natural environment.	• Visual impacts	**Claire Perkins (LandPro)**	0	**Key considerations:** Use of existing channel and new outfall to Shotover River Riverbed at discharge point is relatively out of the way of delta/riverbed users with vegetation nearby Limited visibility to delta/riverbed users - however dicharge is visible in the channel prior to full mixing and the walking/cycling track cross over the channel **Assumptions:** - Channel capacity increase to peak flow capacity of 400 L/s for short term consent - Further augmentation of the channel to increase 600L/s is possible (though difficult) **Rationale for scoring:** 0, Base Case	-1	**Key considerations:** Pipe on south of training line to outfall at land surface at end of delta No visibility of disposal until outfall. Outfall will be visible to users on the Delta and river. **Assumptions:** No DAD structure remains **Rationale for scoring:** -1, land flow path outfall structure being highly visible to users on the Delta, Kawarau River and further afield. Score could be improved with subsurface diffuser outfall. Benefit to base case in that discharge will be piped until the outfall point so not visible to majority of users on formed walking/cycling trails	0	**Key considerations:** Will have subsurface wetland as above ground structure. Lower than, but not dissimilar in size to DAD. Outfall at Kawarau River visible as well **Assumptions:** No DAD structure remains Assume wetland can be made visibly attractive with plants, walkways around/over **Rationale for scoring:** Outfall will be visible to users on the Delta and river, offset by positive visual impact of wetland that can be made accessible for recreational use with boardwalks etc	-1	**Key considerations:** Same as Option B, but with additional large tank structures up on Frankton Flats. **Assumptions:** No DAD structure remains Tank locations not yet confirmed but will be within or adjacent to industrial/business areas and/or recreation land of Queenstown Events Centre **Rationale for scoring:** -1, slight more visual impact from the tanks in Frankton Flat, although will be located in area with existing large industrial buildings so not entirely out of keeping with neighbourhood. Cumulative visual effect of highly visible river outfall along with above-ground well structures, despite wells being not overly incongruous with surrounding land use	-2	**Key considerations:** Same as Option C, but with significantly more large tank structures up on Frankton Flats. **Assumptions:** No DAD structure remains Tank locations not yet confirmed but will be within or adjacent to industrial/business areas and/or recreation land of Queenstown Events Centre **Rationale for scoring:** -2, significantly more tanks required on Frankton Flats compared to Option C, with increased ongoing maintenance/relocated wells adding to visual impact.
Amenity effects - The extent to which there is a receptor or social impact from options.	• Noise impacts • Risk to potential receptors • Recreational access • Air quality / odour risk	**Claire Perkins (LandPro)**	0	**Key considerations:** Use of existing channel and new outfall to Shotover River More effect on recreational use of Shotover River if they were functioning due to presence of treated wastewater within mixing zone area in an area of river used for passive recreation and possibly fishing. Minor effect on odour for users crossing over the channel on cycling/walking trails **Assumptions:** No DAD structure remains Minimal odour generated from treated effluent **Rationale for scoring:** 0, Base Case	0	**Key considerations:** Pipe on south of training line to outfall at land surface at end of delta Below ground pipe and location of outfall could be designed to reduce impacts on recreational use of Delta area **Assumptions:** No DAD structure remains Minimal odour generated from treated effluent **Rationale for scoring:** 0, less exposure to recreational users (e.g. trail users) with buried pipe compared to open channel. This is counteracted by the potential for more effect on recreational activity (particularly fishing and jet boats) near the Kawarau outfall compared to Base Case outfall location. Possible navigation hazard dependong pipe depth and location. Score could be improved with subsurface diffuser outfall, which may alleviate any safety concerns.	1	**Key considerations:** Will have subsurface wetland as above ground structure. Lower than, but not dissimilar in size to DAD. Outfall at Kawarau River **Assumptions:** No DAD structure remains Minimal odour generated from treated effluent Assume wetland can be made visibly attractive with plants, walkways around/over Assume no public health hazard potential if public have access to walkways over wetland **Rationale for scoring:** 1, provided the wetland can be made publicly accessible via boardwalks etc, this will likely provide a net cumulative amenity benefit, despite the issues with the Kawarau outfall	1	**Key considerations:** Same as Option B, but with additional large tank structures up on Frankton Flats. **Assumptions:** No DAD structure remains Minimal odour generated from treated effluent No additional positive or negative effects from the addition of the deep well injection **Rationale for scoring:** 1, reduction in discharge volume at the Kawarau outfall will mean better receiving river water quality. Risk to recreational users around the Kawarau outfall remains as per Option B. Insignificant adverse effects expected from well installation/maintenance on Frankton Flats	1	**Key considerations:** Same as Option B, but with additional large tank structures up on Frankton Flats. **Assumptions:** No DAD structure remains Minimal odour generated from treated effluent No additional positive or negative effects from the addition of the soakholes **Rationale for scoring:** 1, similar to Option C, reduction in discharge volume at the Kawarau outfall will mean better receiving river water quality. Risk to recreational users around the Kawarau outfall remains as per Option B. Insignificant adverse effects expected from well installation/maintenance on Frankton Flats
sign, Delivery and Operati	KPIS	Scoring Lead										
Constructability and technical feasibility	• Technical feasibility • Technical / constructability risks • Compatibility • Technical robustness and operational resilience.	**Ian Ho (GHD)**	0	**Key considerations:** Existing discharge channel requires modification to achieve 400L/s (for 2030, short term consent) For achieving 600L/s (long term peak discharge rate), this would require further modification (e.g. raising channel embankment at low spots) **Assumptions:** See considerations, channel modification for 600L/s is assumed viable (as a comparsion option) **Rationale for scoring:** 0, Base Case	0	**Key considerations:** A pipeline to convey UV treated effluent to the delta for land flow path discharge Tertiary filter upgrade included in this option to further polish the treated effluent Land flow path construction to consider variable river depth in Kawarau **Assumptions:** Flood wall protection being addressed by ORC Land flow path repair required only **Rationale for scoring:** 0, good dilution by the Kawarau River, land flow path is an acceptable and established way to discharge treated effluent	0	**Key considerations:** Same as Option A, plus subsurface wetland 3ha split in a few cells **Assumptions:** Same assumptions as Option A Constructed wetlands for land contact only **Rationale for scoring:** 0, good dilution by the Kawarau River and using constructed wetland for highly treated effluent is well established	-2	**Key considerations:** Desktop assessment estimate range is large median probability of 8000 m3/day and 25% probability of 12,500 m3/day Field investigation necessary to confirm capacity Location specific factors to be considered **Assumptions:** Based on median probability of 8000m3/day, subject to field investigation confirmation Two stage approach, with Stage 1 to operate 2-3 years trial with 2 bores, before committing to long term full production **Rationale for scoring:** -2, uncertainties of the bore disposal capacity, to confirm by future investigations	-3	**Key considerations:** Desktop assessment estimate range is large median probability of 1400 m3/day and 13% probability of 12,500 m3/day Field investigation necessary to confirm capacity Location specific factors to be considered **Assumptions:** Based on median probability of 1400m3/day, subject to field investigation confirmation Two stage approach, with Stage 1 to operate 2-3 years trial with 2 soakholes, before committing to long term full production Rationale for scoring: -3, uncertainties of the soakhole disposal capacity, to confirm by future investigations. Also require ongoing replacing soakholes as part of long term programme
Sustainability - Carbon emissions and sustainable use of resources supporting organisational goals.	• Carbon emissions (operation carbon included) • Beneficial reuse	**Ian Ho (GHD)**	0	**Key considerations:** Gravity flow to Shotover river via historical channel Raising the channel embankment for accommodating higher flow **Assumptions:** Channel modification to achieve 600L/s peak discharge is viable periodic maintenance river channel diversion requires moving of river gravels to maintain flow **Rationale for scoring:** 0, Base Case	-1	**Key considerations:** Gravity flow to Kawarau River via a new 1.5km pipeline to the bottom of the Delta before disperse into the land flow path **Assumptions:** Gravity flow to discharge point, 1.5km pipeline **Rationale for scoring:** -1, more construction works than Base Case	-2	**Key considerations:** Same as Option A, plus a 3ha subsurface wetland **Assumptions:** Gravity flow to discharge point, 1.5km pipeline 3 ha subsurface area, media depth ~ 1.2m **Rationale for scoring:** -2, more construction materials than Base Case	-4	**Key considerations:** Same as Option B, with a portion of flow undergoes additional treatment (membrane filtration) before pump to Frankton bore holes for disposal via 3.2km pipeline three 400 m3 storage tanks **Assumptions:** Gravity flow to discharge point, 1.5km pipeline 3 ha subsurface area, media depth ~ 1.2m Pumping to Frankton with 3.2km pipeline, ~180,000kWh/year Bore diameters (10 bores, 100m deep, 0.3m diam) **Rationale for scoring:** -4, Much higher construction volume than Base Case, and significant pumping and chemicals related to membrane filtration treatment, on top of pipeline construction	-4	**Key considerations:** Same as Option B, with a portion of flow undergoes additional treatment (membrane filtration) before pump to Frankton soakholes for disposal via 3.2km pipeline three 400 m3 storage tanks **Assumptions:** Gravity flow to discharge point, 1.5km pipeline 3 ha subsurface area, media depth ~ 1.2m Pumping to Frankton with 3.2km pipeline, ~180,000kWh/year Soakholes (50, 20m deep) **Rationale for scoring:** -4, Much higher construction volume than Base Case, and significant pumping and chemicals related to membrane filtration treatment, on top of pipeline construction
Operational reliability and maintainability	• Ease of operations / maintenance • Operational complexity and risks • Functionality	**Ian Ho (GHD)**	0	**Key considerations:** Historical channel would require routine inspection and clearance of deposited vegetations especially after major wet weather events Diversion channel requires periodic maintenance to ensure sufficient dilution water **Assumptions:** Weekly inspection of discharge channel Inspection and clearance of vegetation after major storm events Fortnightly check of diversion flow , and quarterly diversion maintenance **Rationale for scoring:** 0, Base Case	1	**Key considerations:** After major flood events, the land flow path/ rock outfall may require moderate to significant rehab to replace rock media lost **Assumptions:** Weekly inspection of the land flow path structure Inspection and rehabilitation of the land flow path after major weather events **Rationale for scoring:** 1, reflects on marginally lower O&M input required	0	**Key considerations:** Similar to Option A, and vegetation/inspection of wetland cells With coarse media and high quality of treated effluent (tertiary filtered), blockage issue of filter media is expected to be low risk **Assumptions:** Weekly inspection of the land flow path structure Inspection and rehabilitation of the land flow path after major weather events Quarterly maintenance of vegetation **Rationale for scoring:** 0, expect similar O&M input to the Base Case	-2	**Key considerations:** **Assumptions:** Same as Option B, plus 0.5 FTE to operate membrane filtration and inspect bore fields Backflushing provided in bores to reduce clogging Higher level skills required to operate new plant assets **Rationale for scoring:** -2, higher O&M input than the Base Case	-3	**Key considerations:** **Assumptions:** Same as Option B, plus 0.5 FTE to operate membrane filtration and inspect soakholes Require infrequent reconstruction of soakholes (frequency difficult to quantify) Higher level skills required to operate new plant assets **Rationale for scoring:** -3, higher O&M input than the Base Case and Option C
Property difficulties and impacts	• Property requirements, impacts and difficulties.	**Claire Perkins (LandPro) & Ian Ho (GHD)**	0	**Key considerations:** Historical channel continues to be used to discharge highly treated effluent Mostly QLDC-owned land Some disposal infrastructure located on public conservation land **Assumptions:** **Rationale for scoring:** 0, Base Case	0	**Key considerations:** Construction of disposal pipeline to the Kawarau River end of delta, with a rock outfall structure for effluent discharge into the River QLDC owned land for most of pipeline; Crown land for end of pipeline and outfall **Assumptions:** **Rationale for scoring:** 0, similar to Base Case - instead of DOC approvals, LINZ approvals needed	0	**Key considerations:** Similar to Option A, constructed subsurface wetland is built inside the training line **Assumptions:** **Rationale for scoring:** 0, same as Option A, wetland and most of subsurface pipe on QLDC property; end of pipeline and outfall on Crown land	-2	**Key considerations:** In addition to property requirements for Option A, additional property will be needed for conveyance infrastructure to bores, and 10 injection bores and associated infrastructure on the Frankton Flats. **Assumptions:** assumed that land other than QLDC property will be required for siting some of the injection bores, and that this will be limited to QAC and QEC-owned property. **Rationale for scoring:** -2, multiple landowner approvals will be required. If SH6 is utilised for conveyance, NZTA Waka Kotahi approval will also be required. Scoring would be further reduced if additional land beyond QLDC, QAC and QEC was required for the system.	-3	**Key considerations:** In addition to Option C property requirements, additional property occupations will likely be required to facilitate adequate distribution of 50 soakholes **Assumptions:** assumed that land other than QLDC property will be required for siting some of the injection bores, and that this will be limited to QAC and QEC-owned property. **Rationale for scoring:** -3, additional difficulties may be presented above Option C due to the large number of soak holes required - obtaining landowner approvals for this many bores could present significant challenges.
Achievability of Indicated Outcomes	•Level of confidence in the ability of the option (solution) in achieving the indicated outcomes (i.e. disposal flows).	**Ian Ho & Anthony Kirk (GHD)**	0	**Key considerations:** Discharge channel will be modified for future discharge volume Getting 600L/s discharge volume could require fairly substantial change to the discharge channel Maintaining diversion channel in Shotover River to mitigate water quality effects expected to become more difficult at higher dry weather flow **Assumptions:** This option is only for options comparison only **Rationale for scoring:** 0, Base Case (for comparison only)	2	**Key considerations:** Discharge volume and the desired outcome will be achieved **Assumptions:** Pipeline and discharge structure can be designed for future discharge volume and rate **Rationale for scoring:** 2, better than Baseline for higher certainty achieving the required disposal capacity (volume and rate)	2	**Key considerations:** Discharge volume and the desired outcome will be achieved **Assumptions:** Pipeline and discharge structure can be designed for future discharge volume and rate Hydraulic design might include separate flow arrangement for high flows in the wetlands **Rationale for scoring:** 2, better than Baseline for higher certainty achieving the required disposal capacity (volume and rate)	-3	**Key considerations:** Desktop assessment estimate range is large median probability of 8,000 m3/day and 25% probability of 12,500 m3/day Field investigation necessary to confirm capacity Location specific factors to be considered **Assumptions:** -Aquifer conditions, constraints and potential for clogging of bore and aquifer are appropriately represented by preliminary analysis carried out. -The indicated 12,500 m3/day represents the succesful outcome for disposal via boreholes **Rationale for scoring:** -3, relatively low probability/certainty to achieve the target disposal volume	-4	**Key considerations:** Desktop assessment estimate range is large median probability of 1,400 m3/day and 13% probability of 12,500 m3/day Field investigation necessary to confirm capacity Location specific factors to be considered **Assumptions:** -Soil and aquifer conditions, aquifer constraints and potential for clogging, are appropriately represented by preliminary analysis carried out. -The indicated 12,500 m3/day represents the succesful outcome for disposal via boreholes **Rationale for scoring:** -4, low probability/certainty to achieve the target disposal volume
Consent , Design, Construction Implementation Timeframe	•The ability of the option to have a new consent for disposal option lodged by 31 May 2026. And the engineering design for the preferred solution to be completed by 31 December 2027 with construction and implementation by 31 December 2030.	**Ian Ho (GHD) & Anthony Kirk (GHD)**	0	**Key considerations:** Obtain a long term 35 years consent to continue discharge to Shotover River (for options comparison only) **Assumptions:** Consent lodgement in May 2026 24 months consent duration includig 1 hearing process, consent granted around May 2028. Then 1.5 years of design and construction, approximately end of 2029 Longer consent processing than Option A due to more difficulties and complexities, potentially harder to consent and delay **Rationale for scoring:** 0, completion around end of 2029, potential risk of extended consenting delaying the project	1	**Key considerations:** Obtain a long term 35 years consent to continue discharge to Kawarau River **Assumptions:** Consent lodgement in May 2026 18 months consent duration includig 1 hearing process, consent granted around Nov 2027. Then 1.5 years of design and construction, approximately mid to late 2029 Easier to consent **Rationale for scoring:** 1, within Dec 2030 deadline, likely easier programme due to shorter consenting	-1	**Key considerations:** Obtain a long term 35 years consent to continue discharge to Kawarau River, with land contact via constructed wetlands Mana whenua and stakeholder input to the constructed wetland design **Assumptions:** Consent lodgement in May 2026 Consent granted in Nov2027 (18 months after lodgement and 1 hearing process), then 2-2.5 years for detailed design and construction, operational by early 2030, just within December 2030 timeline **Rationale for scoring:** -1, while still within Dec 2030 completion. Later than Baseline Option	-3	**Key considerations:** Extensive investigations and a multi-year trial expected to be required to prove the net capacity of bore disposal Mana whenua and stakeholder input to the constructed wetland design **Assumptions:** Consent lodgement in Nov 2026 (6 months extension), granted in May 2028 (18 months after lodgement and 1 hearing process), then 2-2.5 years for detailed design and construction for Stage 1. Stage 1 completion around Dec 2030. Then another 2 years trial to determine capacity before Stage 2 is implemented (1 to 1.5 years). Stage 2 completion around mid 2034 **Rationale for scoring:** -3, while Stage 1 is operation by Dec 2030, but this option will take much longer as an overall programme to complete	-3	**Key considerations:** Extensive investigations and a multi-year trial expected to be required to prove the net capacity of soak hole disposal Mana whenua and stakeholder input to the constructed wetland design **Assumptions:** Consent lodgement in Nov 2026 (6 months extension), granted in May 2028 (18 months after lodgement and 1 hearing process), then 2-2.5 years for detailed design and construction for Stage 1. Stage 1 completion around Dec 2030. Then another 2 years trial to determine capacity before Stage 2 is implemented (1 to 1.5 years). Stage 2 completion around mid 2034 **Rationale for scoring:** -3, while Stage 1 is operation by Dec 2030, but this option will take much longer as an overall programme to complete
Costs and affordability	• Capital costs • Operation costs (annual) • Whole of life costs (NPV) • Stage ability	**Ian Ho (GHD)**	0	**Key considerations:** **Assumptions:** - Pro-rata from Option A, with assumptions - Tertiary filters, Calamity Pond PS, included - Discharge pipe and land flow path discharge excluded -CAPEX estimate ~$27M, well within LTP budget of $77M **Rationale for scoring:** 0, Base Case	-1	**Key considerations:** **Assumptions:** - CAPEX estimate ~$44M, within LTP budget of $77M, OPEX is lowest out of all 4 shortlisted options (i.e. best NPV) **Rationale for scoring:** -1, higher CAPEX and OPEX than Base Case	-2	**Key considerations:** **Assumptions:** CAPEX estimate ~$80M, exceeded LTP budget of $77M, OPEX is slightly higher than Option A **Rationale for scoring:** -2, this option has higher CAPEX, OPEX and NPV	-4	**Key considerations:** **Assumptions:** CAPEX estimate ~$180M, significant exceeded LTP budget of $77M, also very higher OPEX Two stage approach , Stage 1 CAPEX ~ $120M Bore disposal capacity at 12500 m3/day **Rationale for scoring:** -4, significantly higher CAPEX, OPEX and NPV than Base Case	-5	**Key considerations:** **Assumptions:** CAPEX estimate >$200M, significant exceeded LTP budget of $77M, also very higher OPEX Two stage approach, Stage 1 CAPEX ~ $110M Soak hole disposal capacity at 12500 m3/dayl if the capacity is found to be less than 4000 m3/day, no Stage2 upgrade **Rationale for scoring:** -4, significantly higher CAPEX, OPEX and NPV than Base Case
Comments/notes from discussion												

Scoring Scale

For this scoring scale , base case = current case

Criteria Name	KPI Description	-5	-4	-3	-2	-1	0	1	2	3	4	5
Investment objectives												
Health and well-being of the surrounding waterways are maintained, protected and improved where practicable to support water quality.	• Ecosystem / Aquatic health effects. • Human health effects. • Nuisance growth. • Recreation impacts.	Water quality or impact is significantly worse compared to current discharge	Water quality is worse than current discharge.	Moderate negative impact compared to current discharge.	Slightly worse than current discharge.	Marginally worse than current discharge.	Water quality as per current discharge to Shotover	Requirements of proposed WW standards are met	Noticeable improvement over current discharge and proposed WW standards are met.	Moderate improvement (more then score 2) over the current discharge and proposed WW standards are met.	Major benefits over current discharge over current discharge and proposed WW standards are met.	Water quality or impact is significantly improved compared to current discharge to Shotover
The disposal of treated wastewater aligns with tikanga as guided by mana whenua.	• Mana whenua values and knowledge. • Alignment with mana whenua cultural practices, protocols and values.	Current Discharge - does not align with tikanga.										
Ability to service the community's and visitor wastewater needs now and into the future	• Can accommodate forecast population or economic growth over time. • Can accommodate peak day inflows. • Can be resilient to extreme climate events, climate change and natural disasters.	Unable to meet future flow rates even with upgrades	Significant upgrades required to meet future requirements	Major upgrades required to meet future requirements	Medium upgrades required to meet future requirements	Some upgrades required to meet future requirements	Current case requires some upgrade to channel to meet future flow rates	Minor upgrades required to meet future requirements.	Limited upgrades required to meet future requirements.	Minimal upgrades required to meet future requirements.	Can meet future flows with very minor or no upgrades.	Can meet future flows and more without significant upgrades. Resilient to events
Critical success factors												
Mō tātou, ā, mō kā uri ā muri ake nei. For us and our children after us	• Integration of whakapapa Intergenerational equity, innovation, and knowledge. • Te mana o te wai Mauri of the water is upheld or enhanced. • Ki uta ki tai Whole of catchment impact and holistic consideration.	Impact of current discharge te mana o te wai										
Cultural impacts to sites of significance and access to sites for cultural activities.	• Sites of cultural significance impacts • Physical access to site for cultural and recreational activities.	Impact of current discharge on site and access										
Impacts to the surrounding environment	• Natural waterway impacts • Biodiversity, birds	Impact is significantly worse than current case	Noticeable degradation of environmental quality and biodiversity when compared to current case.	Some harm to ecosystems and biodiversity, though less severe than -4.	Minor additional environmental stress or biodiversity loss to the current case.	Almost neutral but still slightly more detrimental to environemnt then the current case.	Impact of the current case on the environment	Marginal improvement over current case.	Noticeable improvement over current case with benefits to ecosystems and biodiversity.	Strong positive impact on environmental quality and biodiversity over current case.	Major benefits over current case.	Substantial benefits over current case to biodiversity and environment
Environmental impacts to surrounding catchment land, soil and groundwater	• Surface water effects • Soil health effects • Groundwater effects	Impact is significantly worse than current case	Impact is worse than current case.	Moderate negative impact compared to current case.	Slightly worse than current case.	Marginally worse than current case.	Impact of the current case on land, soil, GW	Marginal improvement over current case.	Noticeable improvement over current case.	Significant improvement over current case.	Major benefits over current case.	Impact is significantly better than current case
Visual effects - The extent to which there is a visual impact from options that differ from existing land use or impact the surrounding natural environment.	• Visual impacts, e.g., tanks, above ground structures,	Visual impact is significantly worse than current case	Visual impact is worse than current case.	Moderate negative visual impact compared to current case.	Slightly worse than current case.	Marginally worse than current case.	Visual impact of the current case on land, soil, GW	Marginal improvement over current case.	Noticeable improvement over current case.	Significant improvement over current case.	Major benefits over current case.	Visual impact is significantly better than current case
Amenity effects - The extent to which there is a receptor or social impact from options.	• Noise impacts • Risk to potential receptors • Recreational access • Air quality / odour risk	Impact is significantly worse than current case	Impact is worse than current case.	Moderate negative impact compared to current case.	Slightly worse than current case.	Marginally worse than current case.	Impact of current case on amenity values	Marginal improvement over current case.	Noticeable improvement over current case.	Significant improvement over current case.	Major benefits over current case.	Impact is significantly better than current case
Constructability and technical feasibility	• Technical feasibility • Technical / constructability risks • Compatibility • Technical robustness and operational resilience.	Constructibility is significantly worse than current case	Constructibility is worse than current case.	Moderate constructibility issues.	Slightly worse than current case.	Marginally worse than current case.	Technical feasibility of current case	Marginal improvement over current case.	Noticeable improvement over current case. Clear benefits in constructibility; simpler design or fewer constraints.	Significant improvement over current case. Strong technical feasibility; construction is straightforward and efficient.	Major benefits over current case. Highly practical and easy to implement; minimal risk or complexity.	Impact is significantly better than current case. Exceptional constructibility and technical feasibility; best-case scenario for implementation.
Sustainability - Carbon emissions and sustainable use of resources supporting organisational goals.	• Carbon emissions (operation carbon included) • Beneficial reuse	Sustainability impact is significantly worse than current case	Substantially worse	moderately worse	noticeable worse	slightly worse	Sustainability aspects of current case	negligible improvement	minor improvement	moderate improvement	major improvement	Sustainability impact is significantly better than current case
Operational reliability and maintainability	• Ease of operations / maintenance • Operational complexity and risks • Functionality	Significant and complex operational requirements. Very high complexity; requires extensive resources, specialized staff, and continuous monitoring.	High operational complexity. Noticeable increase in operational effort; multiple systems and frequent interventions needed.	Moderate operational complexity. Clear additional requirements beyond baseline; manageable but resource-intensive.	Slightly more complex than current case. Minor increase in operational tasks; some added checks or processes.	Marginally more complex than current case. Slightly higher operational effort then current case.	Operational requirements of current case	Marginal improvement over current case. Slightly reduced operational complexity; minor efficiency gains.	Noticeable improvement over current case. Clear reduction in operational tasks; simpler processes.	Significant improvement over current case. Strong operational efficiency; minimal intervention required.	Major benefits over current case. Very low operational complexity; streamlined and highly efficient.	Operational requirements are significantly less than current case. Exceptional simplicity; minimal ongoing effort and resource needs.
Property difficulties and impacts	• Property requirements, impacts and difficulties.	Significant property purchase or impacts	High property purchase or impact.	Moderate property purchase or impact.	Slight property purchase or impact.	Marginal property purchase or impact.	Impact of current case on property	Marginal improvement over current case for impact on property.	Noticeable improvement over current case for impact on property.	Significant improvement over current case for impact on property.	Major benefits over current case.	Impact on property is significantly better than current case
Achievability of indicated outcomes	• Level of confidence in meeting outcomes	Significantly unlikely to meeting design expectations	Very unlikely to meet design expectations	Unlikely to meet design expectations	Somewhat unlikely to meet design expectations	Slightly unlikely to meet design expectations	Likelihood in meeting the design expectations	Slightly likely to exceed design expectations	Somewhat likely to exceed design expectations	Likely to exceed design expectations	Very likely to exceed design expectations	Highly likely to meet the design expectations
Consent, design, construction implementation timefr	• Consent lodged by May 2026 • Designed by Dec 2027 • Constructed by 2030	Upgrade complete after 2035.	Upgrade complete after 2034.	Upgrade complete after 2033.	Upgrade complete by 2032.	Upgrade complete by 2030, late than Base Case	Current case required no additional implementation time, would required long term consent expected to be acheived by 2030.	Faster than Base Case - Upgrade complete by 2029.	Upgrade complete by 2028.	Upgrade complete by 2027.	Upgrade complete by 2026.	Upgrade complete by 2025.
Cost and Affordability	• Capital costs • Operation costs (annual) • Whole of life costs (NPV) • Stage ability	CAPEX>180M	CAPEX<180M	CAPEX<120M	CAPEX<80M	CAPEX<50M	CAPEX and Op costs of current case (CAPEX ~$30M)	CAPEX and OPEX are less than current case.	Noticeable cost benefits over current case.	Significant cost benefits over current case.	Major cost benefits over current case.	Exceptional cost efficiency.

Appendix C

Multi-criteria analysis framework

October 2025

Memorandum

30 October 2025

To	QLDC - Andrew Hill	**Contact No.**	+64 3 378 0916
Copy to	LandPro - Claire Perkins, GHD	**Email**	tim.eldridge@ghd.com
From	Tim Eldridge	**Project No.**	12645246
Project Name	Shotover WWTP Disposal Field Alternative Discharge		
Subject	Multi-Criteria Analysis Framework Short List Assessment Memorandum		

1. Introduction

Queenstown Lakes District Council (QLDC) has engaged GHD to identify and develop an alternative discharge solution for the treated effluent from the Shotover Wastewater Treatment Plant (WWTP). The existing disposal field is no longer operating as designed, is struggling to meet current flows, and is not compliant with the conditions of the resource consent.

GHD has developed a project multi-criteria analysis (MCA) framework. This MCA framework is to be used to assess the performance of the long list and short list options with the aim of identifying a preferred option to take forward. There were minor changes to the MCA framework between the long list and short list assessment processes which are outlined in this memorandum.

A previous memorandum ‘MCA set up workshop summary notes’ was prepared in February 2025 which records the development of the MCA Framework and in appended to the Long List report. The project is currently at the short list options assessment phase (October 2025).

Figure 1 below outlines an indicative methodology for the project.

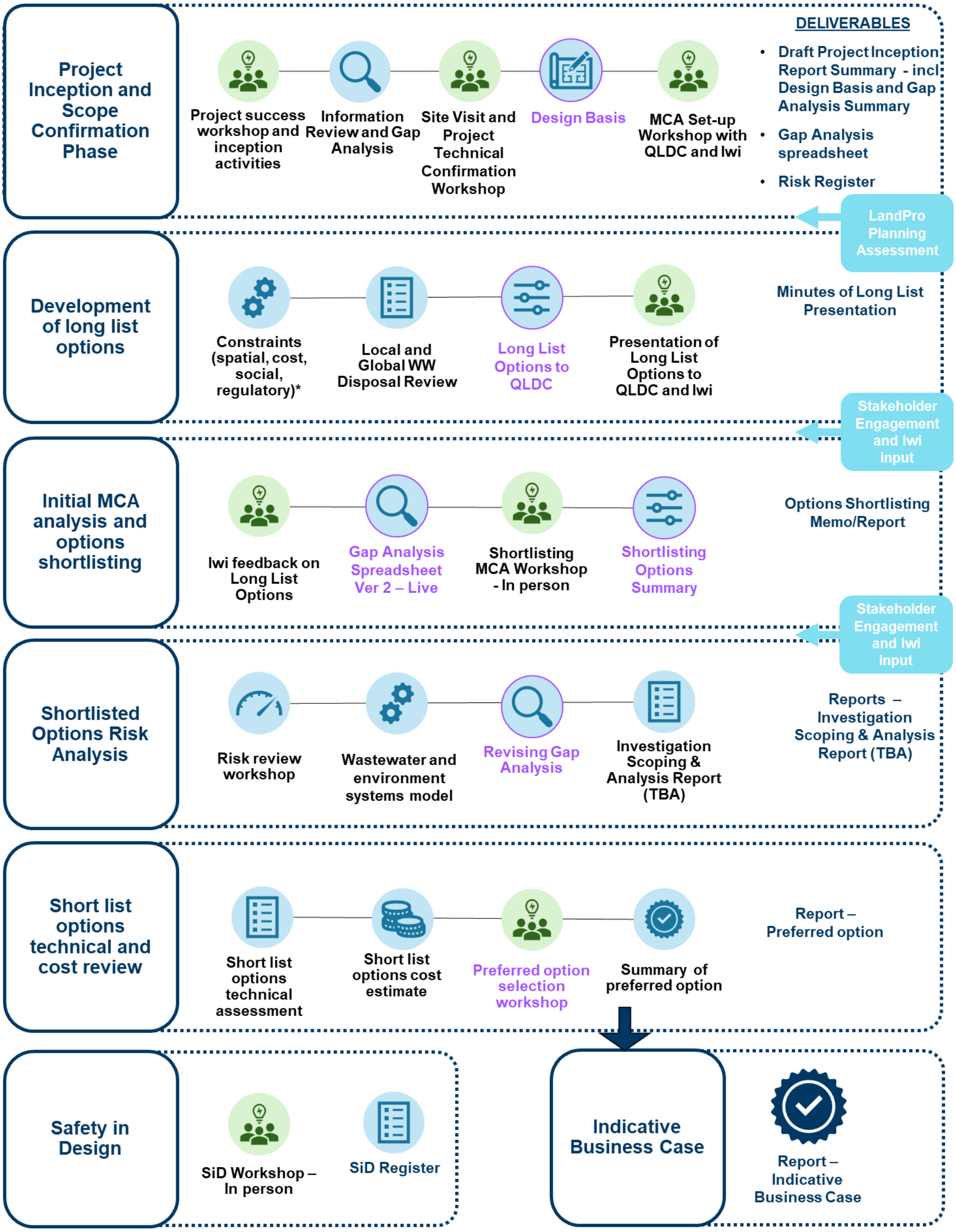

Figure 1 *QLDC Shotover WWTP Disposal Field indicative program.*

1.1 Purpose of this Memorandum

The purpose of the memorandum is to provide an update to the outline of the MCA framework and assessment criteria to be used for the short list stage of the project. Updates from the long list scoring framework have been presented in italics to indicate where changes have been made.

The MCA and assessment criteria were developed during the MCA set up workshop on December 12th, 2024, prior to its application for the long list assessment in March 2025. The short list assessment was performed against the MCA framework and assessment criteria on the 8th October 2025.

This memorandum provides a summary of the discussions from the initial MCA set up workshop (December 12, 2024) and updates made in September and October that contributed to the framework's development.

Overall, the assessment approach undertaken for the short list assessment was the same as the long list except for the following changes.

- Following feedback from the Shortlist MCA workshop, there were two changes to the criteria used in the final short list assessment. For the long list assessment, a criteria called 'Implementation Timeframe' was used, this has been updated to 'Consent, Design, Construction, and Implementation Timeframe' criteria.
- During the short list option development, the ability to achieve the required flows became an increasingly important factor as a result a new criteria named 'Achievability of Indicated Outcomes' was developed and used in the short list assessments.
- The fatally flawed score has been removed for the short list assessment scoring system as all short listed options and categories require a score. Short list options (excluding the current case) were only included if they could feasibly be implemented.
- At the long-list stage, the MCA assessment was compared against a base case in which the DAD was fully operational. During the project period, wastewater discharge was redirected to flow through an existing channel into the Kimi-ākau/Shotover River. After discussions at the MCA Workshop, the base case used for scoring during the Short List MCA assessment was updated to reflect the current situation (for scoring purposes only). However, Iwi partners completed their scoring before this update, so their evaluations are based on the original base case of the DAD being fully operational.

1.2 Scope and limitations

This memorandum: has been prepared by GHD for Queenstown Lakes District Council and may only be used and relied on by Queenstown Lakes District Council for the purpose agreed between GHD and Queenstown Lakes District Council as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Queenstown Lakes District Council arising in connection with this memorandum. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this memorandum were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the memorandum. GHD has no responsibility or obligation to update this memorandum to account for events or changes occurring subsequent to the date that the memorandum was prepared.

The opinions, conclusions and any recommendations in this memorandum are based on assumptions made by GHD described in this memorandum. GHD disclaims liability arising from any of the assumptions being incorrect.

2. MCA Summary

A summary of the multi-criteria analysis (MCA) framework and specific criteria used in the short list assessment stage is outlined in the following Table 1.

Table 1 Summary

Criteria	Description	Key performance indicators
Investment objectives 	The health and well-being of the surrounding waterways are maintained, protected and improved where practicable to support water quality.	• Ecosystem / Aquatic health effects • Human health effects • Nuisance growth • Recreation impacts
	The disposal of treated wastewater aligns with tikanga as guided by mana whenua.	• Mana whenua values and knowledge. • Alignment with mana whenua cultural practices, protocols and values.
	Ability to service the community's and visitor wastewater needs now and into the future up to the equivalent flows projected for 2060.	• Can accommodate forecast population or economic growth over time • Can accommodate peak day inflows • Can be resilient to extreme climate events, climate change and natural disasters
Social and environmental effects 	Mō tātou, ā, mō kā uri ā muri ake nei For us and our children after us	• Integration of whakapapa Intergenerational equity, innovation, and knowledge. • Te mana o te wai Mauri of the water is upheld or enhanced. • Ki uta ki tai Whole of catchment impact and holistic consideration.
	Cultural impacts to sites of significance and access to sites for cultural activities.	• Sites of cultural significance impacts • Physical access to site for cultural and recreational activities.
	Impacts to the surrounding environment	• Natural waterway impacts • Biodiversity
	Environmental impacts to surrounding catchment land, soil and groundwater	• Surface water effects • Soil health effects • Groundwater effects
	Visual effects – the extent to which there is a visual impact from options that differ from existing land use or impact the surrounding natural environment.	• Visual impacts
	Amenity effects – the extent to which there is a receptor or social impact from options	• Noise impacts • Risk to potential receptors • Recreational access • Air quality / odour risk
Critical Success Factors 	Constructability and technical feasibility	• Technical feasibility • Technical / constructability risks • Compatibility • Technical robustness and operational resilience.
	Sustainability - Carbon emissions and sustainable use of resources supporting organisational goals	• Carbon emissions (operation carbon included) • Beneficial reuse

	Operational reliability and maintainability	• Ease of operations / maintenance • Operational complexity and risks • Functionality
	Property difficulties and impacts	• Property requirements, impacts and difficulties.
	Achievability of indicated outcomes	• *What is the level of confidence in the ability of the option (solution) in achieving the indicated outcomes.*
	Ability to meet consent approval, design, construction, and implementation timeframe	• *The ability of the option to have a new consent for disposal option lodged by 31 May 2026. And the engineering design for the preferred solution to be completed by 31 December 2027 with construction and implementation by 31 December 2030.*
Costs	Costs and affordability	• Capital costs • Operation costs (annual) • Whole of life costs (NPV) • Stage ability

3. Framework

The MCA framework consists of four categories of assessment criteria, these are outlined in the following Figure 2.

Figure 2 MCA framework

The key and notable features of this bespoke MCA framework include:

- Cultural considerations are often within the social and environmental effects, however for this project some of the cultural considerations are captured as investment objectives as well as the effects. – As discussed in workshop this will not dilute or take away from the cultural considerations.

- Consentability is not a separate criterion, it is captured in each specific criteria (e.g. visual impact) and its impact on the ability of an option to be consented.

The MCA assessment criteria proposed to assess options for this project (under each category) are described in Section 4 to 6. The proposed key performance indicators, measures and considerations that will be used to inform the option scoring against the criteria are also outlined in Section 4 to 6.

4. Proposed Investment objectives

Following the Long List MCA assessment, these are the proposed investment objectives to be used in the Short List MCA assessment.

Health and well-being of surrounding waterways

The health and well-being of the surrounding waterways are maintained, protected and improved where practicable to support water quality.

The proposed key performance indicators are:

Ecosystem and aquatic health effects

- Macroinvertebrate Community Index (MCI) indices.
- Potential of hydrogen (pH).
- Dissolved oxygen (DO).
- Biochemical oxygen demand (BOD).
- Temperature.
- Suspended solids.
- Ammoniacal nitrogen.
- Nitrate nitrogen.

Human health effects

- Pathogens.
- Cyanobacteria.
- Clarity.

Nuisance growth

- Total nitrogen.
- Dissolved inorganic nitrogen.
- Total phosphorous.

Alignment with tikanga

The disposal of treated wastewater aligns with tikanga as guided by mana whenua.

The proposed key performance indicators are:

Mana whenua values and knowledge.

Alignment with mana whenua cultural practices, protocols and values.

Ability to service now and future flows

Ability to service the community's and visitor wastewater needs now and up to the equivalent flows projected for 2060.

The proposed key performance indicators are:

Can accommodate forecast population or economic growth over time

- Supports and informs southern corridor planning over time.

Can accommodate peak day inflows

- Hydraulic load.

Can be resilient to extreme climate events, climate change and natural disasters

- Flooding and earthquakes.

5. Social & environmental effects

Following the workshop and incorporating QLDC and Iwi feedback, below are the agreed social and environmental effects to be used during the MCA assessment.

Mō tātou, ā, mō kā uri ā muri ake nei - Cultural impacts

Mō tātou, ā, mō kā uri ā muri ake nei (For us and our children after us).

The proposed criteria scoring considerations are:

Integration of whakapapa Intergenerational equity, innovation and knowledge.

Te mana o te wai (Mauri of the water is upheld or enhanced).

Ki uta ki tai (Whole of catchment impact and holistic consideration).

Cultural impacts

Cultural impacts to sites of significance and access to sites for cultural activities.

The proposed criteria scoring considerations are:

Sites of cultural significance impacts

- Impacts to known sites of cultural significance.

Physical access to site for cultural and recreational activities

- Access to river for cultural practices such as mahinga kai.

Surrounding environment

Impacts to the surrounding environment.

The proposed criteria scoring considerations are:

Natural waterway impacts

- Avoiding WWTP discharges (direct and indirect) to natural waterways and water pipe crossings over waterways.

Biodiversity

- Birds and other biodiversity in delta.
- Bird strike.

Surrounding catchment land, soil and groundwater

Environmental impacts to surrounding catchment land, soil and groundwater.

The proposed criteria scoring considerations are:

Surface water effects

- Ecotoxicity from contaminants.
- Nutrient influence on eutrophication status and nuisance algae/plant growth.
- Impact on potential for resource and recreational use.

Soil health effects

- Contaminant accumulation.
- Impact on use.

Groundwater effects

- Impact on groundwater levels and quality.
- Impact on potential for groundwater resource use.

Visual effects

Visual effects – the extent to which there is a visual impact from options that differ from existing land use or impact the surrounding natural environment.

The proposed criteria scoring considerations are:

Visual impacts

- The likely visual impact of options on the surrounding environment.
- Existing land uses sites of natural significance.

Amenity effects

Amenity effects – the extent to which there is a receptor or social impact from options.

The proposed criteria scoring considerations are:

Noise impact

- The likely intensity of noise impacts.
- Frequency and duration of noise (construction and operation).

Risk potential receptors

- Distance to receptors.

Recreational access

- Ability to maintain access to the Delta and surrounding area for recreational purposes.

Air quality / odour risk

- Odour.
- Spray drifts.
- Aerosols.

6. Critical success factors

Following the Long List MCA assessment, these are the agreed proposed critical success and cost factors to be used during the Short List MCA assessment.

Constructability and feasibility

Constructability and technical feasibility.

The proposed criteria scoring considerations are:

Technical feasibility

- To what extent is the proposed solution a known engineering or technical approach.

Technical / constructability risks

- Risks with this approach including capability and competency within New Zealand
- Risks with respect to sourcing skills and materials internationally to implement the proposed solution.

Compatibility

- Ability to tie in with existing infrastructure.

Technical robustness and operational resilience

- The extent that the proposed solution can handle treated effluent from the Shotover WWTP, particularly in terms of variability in quality and quantity.

Sustainability

Sustainability - Carbon emissions and sustainable use of resources supporting organisational goals.

The proposed criteria scoring considerations are:

Carbon emissions (embodied and operational).

Beneficial reuse.

Operational reliability and maintainability

Operational reliability and maintainability.

The proposed criteria scoring considerations are:

Ease of operations / maintenance

- Access to plant equipment and repair.
- Ability to train and maintain appropriate workforce skill requirements.

Operational complexity and risks

- Increase of wastewater treatment and disposal system complexity.
- Risk of operational issues.

Functionality

- Confidence that the option considered will perform as expected.

Property

Property difficulties and impacts.

The proposed criteria scoring considerations are:

Property requirements, impacts and difficulties.

- Scale of land required
- Availability of suitable land for technical solution
- Property acquisition (time and legal requirements)

Achievability of Indicated Outcomes

Achievability of indicated outcomes

The proposed criteria scoring considerations are:

Likelihood of achieving the indicated outcomes

- *Level of confidence in the ability of the option (solution) in achieving the indicated outcomes (i.e. disposal flows).*

Consent, Design, Construction, and Implementation Timeframe

Consent, design, construction, and implementation timeframe.

The proposed criteria scoring considerations are:

Timeline

- *The ability of the option to have a new consent for disposal option lodged by 31 May 2026. And the engineering design for the preferred solution to be completed by 31 December 2027 with construction and implementation by 31 December 2030.*

Costs

Costs and affordability.

The proposed criteria scoring considerations are:

Capital costs.

Operation costs (annual).

Whole of life costs (NPV).

Affordability (relative to expected budget allocations).

Stageability.

7. MCA scoring system

MCA enables a wide range of different aspects to be taken into consideration in evaluating options and provides a systematic framework for working through the merits and disadvantages of each option.

It is a tool that can help decision making, but it does not make the decision. Done well, it provides an open, traceable, and repeatable process. It enables consideration of a range of criteria which are both qualitative and quantitative.

The future year of 2060 has been proposed for these MCA assessments in line with potential 35-year consent. It is assumed that all elements of each option are in place by 2060 for scoring purposes.

The scoring of all shortlist options will be completed relative to the DAD disposal field as if it were working as intended and meeting the consent requirements (RM13.215.03.V2) which is expected to receive a score of zero for each criteria.

The scoring system for the long list phase and updated for the short list phase are outlined in Table 2 below.

Table 2 MCA scoring system

Score	Scoring Description – Short list phase
+ 5	Substantial benefits and a high degree of confidence of benefits being realised and/or long term / permanent benefits
+ 4	High extent of benefits and confidence of benefit being realised and/or medium – long term benefits
+ 3	Good benefits and/or medium term

+ 2	Low or localised benefits and/or short term
+ 1	Very low benefits and/or very short term
0	The 'current case' which comprises discharge of treated effluent to the Kimi-ākau/Shotover River via a discharge channel
- 1	Few difficulties, very low cost or low impact on some resources/values and/or very short term
- 2	Minor difficulties, low cost or minor impacts on resources/values and/or short term
- 3	Some difficulties, moderate cost or some impact on resources/values and/or medium term
- 4	Clear difficulties, high cost or high impact on resources/values and/or medium – long term
- 5	Substantial difficulties, very high and extremely high cost or substantial impact on resources/values and/or long term / permanent including effects which cannot be mitigated by reasonable measures and may not be able to be mitigated by extraordinary mitigation

Similar to the long list stage, all short list options will be scored against each criteria of the MCA Framework. This will allow the options to be ranked based on the MCA assessment results and decision makers to understand the relative trade-offs between options. The short list MCA assessment results are intended to be considered alongside the option costs, risks and other key organisational considerations to inform the selection of the recommended option for further design refinement.

The differences between the scoring framework for the two phases are:

- The fatally flawed score has been removed for the short list assessment scoring system as all short listed options and categories require a score. The outcomes and descriptions have been incorporated into the -5 score. This is due to:
    - Short list options (excluding the current case) were only included if they could feasibly be implemented.
    - The need to accommodate a flexible scoring approach, that can adapt to changes in decision making directives if needed, without significant restructuring of the framework.

Project name	Shotover WWTP Disposal Field Alternative Discharge					
Document title	Shotover WWTP Alternative Disposal | Multiple Criteria Analysis Framework Short List Assessment Memorandum					
Project number	12645246					
File name	Multiple Criteria Analysis Framework Short List Assessment Memorandum					

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	Multiple Criteria Analysis Framework Short List Assessment Memorandum	Sarah Browne	Tim Eldridge		Ryan Orr		29/10/2025

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Appendix D

Risk assessment

	STAGE 1: RISK IDENTIFICATION & DETAILS						STAGE 3 - ANALYSIS OF UNCONTROLLED RISK	Consequence											STAGE 4: RISK CONTROLS				STAGE 5 - ANALYSIS OF CONTROLLED RISK										
Options Applicable	Risk ID (Sentient Generated)	Category	Risk Title There is a chance that...	Date Raised	Risk is caused by Because...	Raised By	Consequence (Description)	Delivery	Stakeholders/Community	Cost	Strategic/Political	Environmental	Legal/Compliance	Health and Safety	Likelihood (WOC)	Likelihood (without control) Required duplicate of	Consequence without control =MAX(P:V)	Priority Score without control (=Q*R)	Risk Control	Planned Control Implementation Date	Risk Control /Action Status Update	Actionee	Delivery (WC)	Stakeholders/Community (WC)	Cost (WC)	Strategic/Political (WC)	Environmental (WC)	Legal/Compliance (WC)	Health and Safety (WC)	Likelihood (WC)	Likelihood Required duplicate of column AM	Consequence =MAX(Y:AE)	Priority Score (=AG*AH)
RISKS FOR ALL LONG TERM OPTIONS (A, B, C, D)																																	
A,B,C, D		Stakeholders/Partners/Public	Public perception of options is negative		Public do not support proposed option	Risk Workshop Team	Public dissatisfaction		5		4				4	4	5	20	Community education, comms, and engagement strategy					4		4				4	4	4	16
A,B,C, D		Regulatory and Consent	The proposed legislation changes impact the project		New legislation proposes "To choose the option it considers to be the most cost-effective option for providing wastewater services over the life of the infrastructure assets"	Risk Workshop Team	Opportunity and risk: Makes decision pathway clearer. But may make stakeholder engagement more difficult and potentially poorer environmental and cultural impacts. Media coverage of project as it might be one of the first project through the new process. Could impact preferred option Councillor decision	4	4		4		4		4	4	4	16	Included as a 'additional consideration' in the MCA scoring criteria.				3	4		4		4		3	3	4	12
A,B,C, D		Regulatory and Consent	The process to select the preferred option is challenged by iwi , stakeholders or public		MCA scoring could be open for challenges in terms of the option selection process, or there are challenges regarding the "most cost effective" solution		Delays to process, potential for judicial review.	4							3	3	4	12	Sensitivity analysis of MCA scoring results				4							2	2	4	8
A,B,C, D		Regulatory and Consent	Legislative changes occur during the project timeline	9-Sep-25	Risk: Proposed new wastewater standards may mean the current shotover river discharge complies with regulatory requirements resulting in with pressure to select this as the lowest cost conforming option	GHD	Public dissatisfied and not supportive of the solution, put pressure on Council for new solution.	3	3	1	1	1	1	1	5	5	3	15	Limited control - wait and see				3	3	1	1	1	1	1	3	3	3	9
A,B,C, D		Regulatory and Consent	Legislative changes occur during the project timeline		Opportunity : Proposed new wastewater standards may mean the current shotover river discharge complies with regulatory requirements resulting in with pressure to select as the lowest cost conforming option	GHD	Opportunity - reduced regulatory requirements	1							1	1	1	1	Limited control - wait and see				1							1	1	1	1
A,B,C, D		Regulatory and Consent	Consent conditions are extremely stringent	1-Sep-25	Risk of consent conditions which are extremely stringent.	GHD	Consent conditions cannot be met with the proposed treatment or added costs to the proposed options.		4				4		2	2	4	8	Plan for discussions on consent conditions with stakeholders and legal to highlight any concerns, if required. Early engagement with ORC			QLDC		3				4		2	2	4	8
A,B,C, D		Regulatory and Consent	May 26 Consent timeframe is not achieved	17-Sep-25	Caused by: Extended time required to develop the preferred option, Councillor delays in decision-making, short-term consent hearing impacting long-term application and resourcing, additional work or delays from Consultants, Council, Iwi, and Stakeholders, dependency on the selected solution, legislative changes causing time delays and impacts on quality of assessment due to compressed timelines	Risk Workshop Team	Requirement of the Enforcement Order not complied with (unless variation to extend timeframes sought).				3		4		5	5	4	20	Request extension from ORC on the May 2026 date							3		4		5	5	4	20
A,B,C, D		Regulatory and Consent	QLDC doesn't approve the business case for a new disposal solution.	17-Sep-25	Business case documentation not in line with expectations. Recommendation not in line with QLDC objectives. The recommended solution is unaffordable	Risk Workshop Team	Re-work and delays in progressing works. Ongoing compliance with existing site. Need to go back to the long list.			5					3	3	5	15	Discussions with Strategic investment advisor from QLDC						5					2	2	5	10
A,B,C, D		Regulatory and Consent	The assessment of alternatives is not sufficient	17-Sep-25	The assessment of alternatives is not sufficient resulting in consenting delays	Risk Workshop Team	Consent processing is delayed or is not granted.			3			3		3	3	3	9	Buddle Findlay to review prior to consent submission						3			3		1	1	3	3
A,B,C, D		Stakeholders/Partners/Public	Key partners (e.g. Iwi) have reduced capability and capacity to effectively engage	1-Sep-25	Engagement of iwi representatives isn't effective due to time and resource constraints	GHD	Strained relationship between iwi and Council. Opposition of the proposed solution.		5	5	4		3		5	5	5	25	Early communication with all iwi representatives, invitation to regular project meetings during option development stage.			QLDC		4	2	3		3		4	4	4	16
A,B,C, D		Stakeholders/Partners/Public	Iwi input and perception of options does not support the proposed options	17-Sep-25	Iwi input and perception of options does not support the proposed options	Risk Workshop Team	Iwi don't support the proposed options and project team are required to go back to the long list or delays are added to the timeline of delivery	4	4	4					5	5	4	20	Early communication with all iwi representatives, invitation to regular project meetings during option development stage.				4	4	4					4	4	4	16
A,B,C, D		Stakeholders/Partners/Public	Stakeholders are dissatisfied	1-Sep-25	Not enough stakeholder or public consultation and engagement during option development.	GHD	Potential stakeholder and public dissatisfaction with the design and budget for upgrades.		4	3	4		3		5	5	4	20	Stakeholder engagement plan developed. Engagement and communication with community required.			QLDC		3	2	3				5	5	3	15
A,B,C, D		Stakeholders/Partners/Public	Local govt elections change the direction of the project	1-Sep-25	Local elections lead to change in Councillor staff during project.	GHD	Change in directive from Council due to change in Councillors, impact on programme due to timing of workshops with Council change (re-educate). Councillors don't like any of the options and need to go back to the long list	4	4	4					5	5	4	20	Discussion planned with Infrastructure Committee and Executive prior to elections to plan for new Councillors to have early induction related to project.				4	4	4					5	5	4	20
A,B,C, D		Budget	The cost estimation is insufficient	1-Sep-25	Cost estimates not accurate as details are not included/considered at options stage.	GHD	Cost escalation.	4		5					3	3	5	15	ALTA engaged as part of the short list options development to perform cost estimation on the options. Preferred option cost to also be updated with preliminary design details.			GHD	4		5					2	2	5	10
A,B,C, D		Environment	Contamination of ground or surface water occurs due to emerging contaminants	17-Sep-25	Contamination of groundwater or surface water with emerging contaminants	Risk Workshop Team	Environmental impact					5			2	2	5	10	The risk to be considered as part of the assessment. Potential for consent conditions or additional monitoring.								5			2	2	5	10
A,B,C, D		Design	Flooding occurs on the delta (floodplain)	17-Sep-25	The delta is located within a floodplain area	Risk Workshop Team	Flooding occurring at the proposed assets and mixing of surface water with the wastewater effluent prior to it passing through the land flow path structure	3		4		4		3	2	2	4	8	All assets currently proposed are on the west/south side of the floodwall				3		4		4		3	1	1	4	4
A,B,C, D		Design	Geotechnical and underground services are required	1-Sep-25	Geotechnical condition and unknown underground services	GHD	May delay or result in additional construction cost	4		4					3	3	4	12	Conduct geotechnical fieldwork and underground services location during preliminary engineering						4					2	2	4	8
A,B,C, D		Design	Ability to achieve outcomes with selected solution are inadequate	1-Sep-25	Treatment and disposal requirements not met.	GHD	The treatment or disposal of the wastewater is inadequate, resulting in safety risks and dissatisfaction among stakeholders, partners, and the public.		3	5		3		4	1	1	5	5	Ensure sufficient technical design Allow for technical peer review of design and optioneering.					3	5		3		4	1	1	5	5
OPTION A - Kawarau River Discharge																																	
A		Regulatory and Consent	Legislative changes (TA)	1-Sep-25	Taumata Arowai are understood to be developing national wastewater standards, with these due to be implemented during the timeline of this project (October 2025).	GHD	Option A will likely meet WW standard as currently proposed. May impact programme impacts as standards due to be in place Late Oct 25 and preferred option workshop early Oct. Preferred option may require more treatment than the minimum required by the standard			1	1	1	1	1	5	5	1	5	No control - monitoring the legislation changes.			GHD	1	1	1	1	1	1	1	5	5	1	5
A		Regulatory and Consent	Legislative changes (TA)	1-Sep-25	Water services bill states that	GHD	Option A will likely meet WW standard as currently proposed. May impact programme impacts as standards due to be in place Late Oct 25 and preferred option workshop early Oct. Preferred option may require more treatment than the minimum required by the standard			1	1	1	1	1	5	5	1	5	No control - monitoring the legislation changes.			GHD	1	1	1	1	1	1	1	5	5	1	5

Sensitivity: General

	STAGE 1: RISK IDENTIFICATION & DETAILS						STAGE 3 - ANALYSIS OF UNCONTROLLED RISK	Consequence											STAGE 4: RISK CONTROLS				STAGE 5 - ANALYSIS OF CONTROLLED RISK										
Options Applicable	Risk ID (Sentient Generated)	Category	Risk Title There is a chance that...	Date Raised	Risk is caused by Because...	Raised By	Consequence (Description)	Delivery	Stakeholders/Community	Cost	Strategic/Political	Environmental	Legal/Compliance	Health and Safety	Likelihood (WOC)	Likelihood (without control) Required duplicate of ...	Consequence without control =MAX(P:V)	Priority Score without control (=Q*R)	Risk Control	Planned Control Implementation Date	Risk Control /Action Status Update	Actionee	Delivery (WC)	Stakeholders/Community (WC)	Cost (WC)	Strategic/Political (WC)	Environmental (WC)	Legal/Compliance (WC)	Health and Safety (WC)	Likelihood (WC)	Likelihood Required duplicate of column AM	Consequence =MAX(Y:AE)	Priority Score (=AG*AH)
A,B		Stakeholders/Partners/Public	Cultural alignment	1-Sep-25	The proposed option is perceived as fatally flawed from a cultural perspective by both Aukaha and TAMI.	GHD	The option is not aligned with iwi, this may impact the relationship between QLDC and Aukaha or Tami negatively. Resulting in strained relationships and iwi not accepting the design.		5						4	4	5	20	Engagement with iwi throughout the process helps them to understand the constraints and issues. Engagement at higher level than project team					5						4	4	5	20
Option B - Kawarau River discharge + wetland (includes all Option A,B applicable risks above)																																	
B		Stakeholders/Partners/Public	The option does not appease the cultural requirements for land contact prior to discharge to the river	17-Sep-25	The option does not appease the cultural requirements for land contact prior to discharge to the river	Risk Workshop Team	Iwi don't support the proposed options and project team are required to go back to the long list leading to delays/increased costs	4	4	5					4	4	5	20	Engagement with iwi throughout the process helps them to understand the constraints and issues. Engagement at higher level than project team				4	4	5					2	2	5	10
B		Stakeholders/Partners/Public	There is opportunity for recreation features	8-Sep-25	Opportunity to include recreational features into wetland design such as boardwalks, education boards	GHD	Improved public perception of the wastewater discharge and environmental benefit, but with a cost increase			4					3	3	4	12	Need to maintain access for Queenstown Twin Rivers Trail						4					2	2	4	8
B		Stakeholders/Partners/Public	Recreation activities may be restricted	8-Sep-25	Access to the wetland area may be restricted and current recreation activities occurring in this location may be impacted.	GHD	Impact on the community and public dissatisfaction with the solution.		4						2	2	4	8	To consider adding access into and around the wetland.					4						1	1	4	4
A,B		Regulatory and Consent	Legislative changes (TA) impact direction on the preferred option	1-Sep-25	Taumata Arowai are understood to be developing national wastewater standards, with these due to be implemented during the timeline of this project (October 2025). May provide directive on preferred option.	GHD	Option B will likely meet requirement for national standard as currently proposed.	1		1			1	1	4	4	1	4	No control - monitoring the legislation changes.			GHD	1	1	1	1	1	1	1	3	3	1	3
B		Environment	Wetland degradation impacts wetland performance	8-Sep-25	Weather conditions and not enough maintenance causing wetland degradation.	GHD	Wetland will need redevelopment and replanting.			5		3	3	3	3	3	5	15	Include maintenance as part of O&M practice						5		3	3	3	3	3	5	15
B		Environment	Birds are attracted to the wetland site	8-Sep-25	Birds attracted to wetland site.	GHD	Increased risk of bird strike, resulting in aircraft damage.		4					5	3	3	5	15	Wetland design to minimise ponded water and planted with species that don't attract large and aerial birds			GHD		4					5	2	2	5	10
B		Environment	Mosquito breeding occurs at the wetland site	8-Sep-25	Mosquitos and other insects become a nuisance to users on the delta .	GHD	Impact on the community and public dissatisfaction with the solution.		3			4		3	2	2	4	8						3			4		3	2	2	4	8
B		Environment	Odour issues occur at the wetland site	8-Sep-25	Inadequate flow through or vegetation management in wetland.	GHD	Odour concerns.		4			4			2	2	4	8	A prelim hydraulic evaluation of the option has been done. Highly treated prior to entering the wetland.			GHD		4			4			2	2	4	8
A,B		Environment	Flooding and erosion occur for assets on the delta	1-Sep-25	Heavy rain events or hydraulic overloading resulting in flooding and causes damage to assets on the delta.	GHD	This could cause erosion at the rock outfall and of the pipe along the delta, requiring additional maintenance		4	4		4	4	3	4	4	4	16	Designer to propose a maintenance plan for the rock outfall and other assets in the O&M tender documentation.			GHD			3		2			3	3	3	9
B		Design	Hydraulic performance constraints occur	1-Sep-25	Hydraulic constraints - at current design is using gravity to convey water from UV via wetland to outfall.	GHD	Effluent not flowing to outfall as designed.			3		3	3		3	3	3	9	A prelim hydraulic evaluation of the option has been done, and further hydraulic design will be undertaken as part of prelim design			GHD			3		3	3		2	2	3	6
Option C - Boreholes																																	
C,D		Design	The solution is close to the Airport	8-Sep-25	The boreholes may be located close to the airport, risk of the airport and associated traffic interfering with the construction, operation and maintenance of the boreholes.	GHD	Disruption to the construction, operation and maintenance of the boreholes.	3	3						4	4	3	12	Focus infrastructure on QLDC and public land.				3	3						4	4	3	12
C,D		Stakeholders/Partners/Public	Land use conflicts occur	8-Sep-25	There are land parcels on the Frankton for which there may be conflicts on what the land should be used for and if the bore holes should be located in or near these parcels of land.	GHD	Land availability reduces and not enough land for the bore option to be implemented.		4		4				4	4	4	16	Stakeholder engagement with QAC, QEC and other land owners in the area.					4		4				4	4	4	16
C,D		Design	High visibility of assets on Frankton results in vandalism and negative community perception	8-Sep-25	Large tanks are required for recycled water storage, and number of boreholes required.	GHD	Target for vandalism and negative community perception.		4	3	4				4	4	4	16	Consider fencing, security cameras.					4	3	4				4	4	4	16
C,D		Regulatory and Consent	Proposed sites are not suitable for boreholes	8-Sep-25	Unknown discharge capacity of the groundwater and the GW contours, and ground condition at specific sites may not be suitable for boreholes	GHD	Risk of reduced / lower disposal capacity than expected, community dissatisfaction. Bank instability.		5			5		5	5	5	5	25	Staged approach with a trial stage prior to further development.			GHD		5		5	5		5	4	4	5	20
C,D		Stakeholders/Partners/Public	Public and community perception of the option is negative	8-Sep-25	The community perception of the option may be easily influenced by outside sources especially since this is a new ww disposal solution to NZ.	GHD	Public dissatisfied and not supporting the solution.		4		4				4	4	4	16	Ensure sufficient public and community communications and opportunities to understand technology.					4		4				4	4	4	16
C,D		Budget	The cost estimation is insufficient	1-Sep-25	Cost estimation not being sufficiently done due to the option being new to NZ and not many past projects to base on.	GHD	Cost escalation.			5					4	4	5	20	ALTA engaged and we have initial quotations for trial investigations.			GHD			5					3	3	5	15
C,D		Regulatory and Consent	Consenting timeline does not meet the May 2026 consent application date	1-Sep-25	Design takes longer to develop and agree on than expected, not meeting the May 2026 consent application deadline application date.	GHD	Consenting timeline being delayed. EO requires long term consent application, and would no longer meet the EO requirements(unless a variation is sought). Added cost and legal implications.	4		3	3		4		4	4	4	16	Careful tracking of the program via monthly reporting. QLDC to request an extension from ORC if this is required. Staging of option to be able to consent within timeframe.			GHD/QLDC	4			3		4		3	3	4	12
C,D		Regulatory and Consent	Legislative changes (TA) impact direction on the preferred option	1-Sep-25	Taumata Arowai are understood to be developing national wastewater standards, with these due to be implemented during the timeline of this project (October 2025). May provide directive on preferred option.	GHD	Option C will likely meet requirement for national standard as currently proposed, discharge to land via boreholes not a standard option, but Option may not be required as a partial solution.	5		5			5	1	4	4	5	20	Monitoring the legislation changes.			GHD	1	1	1	1	1	1	1	3	3	1	3
C		Construction and Operation	Boreholes require additional investigation and maintenance then originally anticipated	8-Sep-25	Borehole technology is new to New Zealand and requires further investigation and trials to confirm suitability. There is limited local experience in operating and maintaining this technology	GHD	Increased investigation and operational costs Exclusion of the option due to uncertainty or lack of confidence Performance issues resulting in compliance risks and reputational damage Higher operational costs due to limited local capability	4	4	5	4	4	4		3	3	5	15	GHD to engage technical experts who have required knowledge Staged approach.			GHD	3	3	4	4	4	4		3	3	4	12
C		Construction and Operation	Boreholes fail	8-Sep-25	Boreholes clog due to inadequate filtration or algal even	Risk Workshop Team	Additional significant cost of drilling new boreholes and infrastructures, reduced confidence in disposal method, wastewater leak or discharge		4	4	4	4	3	3	3	3	4	12	Membrane filtration and UV provided as add-on treatment, on top of back flushing provision. Allowance for cleaning each borehole annually.						3		2			1	1	3	3
C,D,E		Construction and Operation	Pumping cost increases due to electricity cost	8-Sep-25	Future discharge are directed to the river due to the high cost associated with operating the discharge to the Frankton area	Risk Workshop Team	Increased river discharge, perception of waste of money on infrastructure that isn't used.		5	5		3			3	3	5	15	May be mitigated through consent condition requirements					5	5		3			3	3	5	15
C, D, E		Construction and Operation	Bore trial is not successful	8-Sep-25	Option not progressed beyond trial stage due to the cost of a new consent and unwillingness to spend more money when the river discharge solution is viable	Risk Workshop Team	Increased river discharge, negative Iwi point of view, negative public perception			5					4	4	5	20	Initial investigations prior the Stage 1 of the trial.						5					4	4	5	20
Option D - Soak holes																																	
C,D		Stakeholders/Partners/Public	Public are dissatisfied and not supporting the solution.	8-Sep-25	The community perception of the option may be easily influenced by outside sources especially since this is a new ww disposal solution to NZ.	GHD	Public dissatisfied and not supporting the solution. *Or otherwise some community may support the decision as the discharge is not going to the River.*		4		4				4	4	4	16	Ensure sufficient public and community communications and opportunities to understand technology.					4		4				4	4	4	16
C,D		Stakeholders/Partners/Public	Land use conflicts occur	8-Sep-25	There are land parcels on the Frankton for which there may be conflicts on what the land should be used for and if the soak holes should be located in or near these parcels of land.	GHD	Land availability reduces and not enough land for the bore option to be implemented.		4		4				4	4	4	16	Stakeholder engagement with QAC, QEC and other land owners in the area.					4		4				4	4	4	16

Sensitivity: General

	STAGE 1: RISK IDENTIFICATION & DETAILS						STAGE 3 - ANALYSIS OF UNCONTROLLED RISK	Consequence											STAGE 4: RISK CONTROLS				STAGE 5 - ANALYSIS OF CONTROLLED RISK										
Options Applicable	Risk ID (Sentient Generated)	Category	Risk Title There is a chance that…	Date Raised	Risk is caused by Because…	Raised By	Consequence (Description)	Delivery	Stakeholders/Community	Cost	Strategic/Political	Environmental	Legal/Compliance	Health and Safety	Likelihood (WOC)	Likelihood (without control) Required duplicate of	Consequence without control =MAX(P:V)	Priority Score without control (=Q*R)	Risk Control	Planned Control Implementation Date	Risk Control /Action Status Update	Actionee	Delivery (WC)	Stakeholders/Community (WC)	Cost (WC)	Strategic/Political (WC)	Environmental (WC)	Legal/Compliance (WC)	Health and Safety (WC)	Likelihood (WC)	Likelihood Required duplicate of column AM	Consequence =MAX(Y:AE)	Priority Score (=AG*AH)
C,D		Regulatory and Consent	The soak holes result in bank instability and algal blooms	8-Sep-25	Unknown discharge capacity of the groundwater and the GW contours.	GHD	Algal blooms in lake if groundwater flows towards lake. Bank instability		5			5		5	3	3	5	15	Staged approach with investigations					5			5		5	2	2	5	10
C,D		Regulatory and Consent	Consenting timeline does not meet the May 2026 application date	1-Sep-25	Design takes longer to develop and agree on than expected, not meeting the May 2026 consent application deadline application date.	GHD	Delays to the consenting timeline may result in the long-term consent application not meeting EO requirements (unless a variation is sought). This could lead to added costs, legal implications, and potential penalties.	4			3		4		4	4	4	16	Carefully track the programme through monthly reporting. QLDC to request an extension from ORC if required. Stage the preferred option to enable consenting within the required timeframe. Future consenting may be mitigated by including it as part of a staged process under a single consent, as outlined in the consenting strategy.			GHD/QLDC	4			3		4		3	3	4	12
C,D		Regulatory and Consent	Legislative changes (TA) impact direction on the preferred option	1-Sep-25	Taumata Arowai are developing national wastewater standards, with these due to be implemented during the timeline of this project (October 2025). May provide directive on preferred option.	GHD	Option D will likely meet requirement for national standard as currently proposed, but option may not be required as a partial solution.			1	1	1	1	1	4	4	1	4	Monitoring the legislation changes. Boreholes and soak holes may ne included in October released standards			GHD	1	1	1	1	1	1	1	3	3	1	3
		Regulatory and Consent	Soak hole trial is not successful	8-Sep-25	Option not progressed beyond trial stage due to the cost of a new consent and unwillingness to spend more money when the river discharge solution is viable	GHD	Increased river discharge, negative Iwi point of view, negative public perception	4	5						2	2	5	10	Staging of investigation/trial stage prior to development of pumping/conveyance infrastructure to mitigate risk of spending money on future works that might not happen				4	5						2	2	5	10
		Environment	Ground conditions are not suitable for soak holes	9-Sep-25	Ground conditions are not suitable for the soak holes	GHD	Option is not progressed beyond trial stage, money spent on option is lost, community unhappy and untrusting of QLDC in future.		4	5					4	4	5	20	Staged approach with a trial stage prior to further development. Initial investigations before commencing trial?					4	5					3	3	5	15
C,D		Budget	The cost estimation is insufficient	1-Sep-25	Cost estimation not being sufficiently done due to the option being new to NZ and not many past projects to base on.	GHD	Cost escalation.			5					4	4	5	20	ALTA engaged and we have initial quotations for trial investigations.			GHD			5					3	3	5	15
C,D		Design	The solution is close to the Airport	8-Sep-25	The soak holes may be located close to the airport, risk of the airport and associated traffic interfering with the construction, operation and maintenance of the boreholes.	GHD	Disruption to the construction, operation and maintenance of the soak holes.	3	3						4	4	3	12	Comms, location of soak holes, site investigations, and staged approach				3	3						4	4	3	12
C,D		Design	High visibility of assets on Frankton results in vandalism and negative community perception	8-Sep-25	Large tanks are required for wastewater storage, and number of soak holes required (50).	GHD	Target for vandalism and negative community perception.		4	3	4				4	4	4	16	Consider fencing, security cameras.					4	3	4				4	4	4	16
D		Design	Soak holes clog	1-Sep-25	Soak holes will degrade with time. Filtration is important to reduce the risk of this happening faster than expected.	GHD	Soak holes not being able to be used or requiring high amount of O&M to fix, added cost and community unhappy.		4	5	4	4	4		3	3	5	15	Filtration and chlorination prior to discharge. Ops budget to include allowance for new boreholes in the future					4	5	4	4	4		3	3	5	15
C,D,E		Construction and Operation	Pumping cost increases due to electricity cost	9/8/2025	Discharge is directed to the river due to the high cost associated with operating the discharge to the Frankton area	Risk Workshop Team	Increased river discharge		5	5		3			3	3	5	15	Ensure adequate assessments of operating and maintenance costs.					5	5		3			3	3	5	15
C,D,E		Construction and Operation	Discharge method not suitable in power cut	8-Sep-25	Discharge method not suitable in power cut, so would need back up if earthquake or power cut affects WWTP operations	Risk Workshop Team	Increased river discharge					3			2	2	3	6	Allow for back up power source on critical elements.								3			2	2	3	6
Supplementary Option - Sports fields irrigation																																	
		Design	The wastewater is not compatible with the existing infrastructure	8-Sep-25	Existing irrigation infrastructure at the locations of interest	Risk Workshop Team	No compatibility and new irrigation infrastructure. Could result in fields having to be re-dug up and new infrastructure added. Higher cost. Could required a greater level of treatment due to type of irrigation. C	3	4	4					3	3	4	12	Not relied upon as a critical discharge. Confirmation of compatibility in Prelim design.				3	4	4					3	3	4	12
		Stakeholders/Partners/Public	QEC concerns on irrigation impact	8-Sep-25	QEC concerns on the impact of the irrigation	Risk Workshop Team	Spray from irrigation impacting airport and other areas close by.		4						3	3	4	12	Use sub-surface where possible. Establish time of use to mitigate spray effects. Consider replacing spray with sub-surface irrigation.					4						3	3	4	12
E		Stakeholders/Partners/Public	Land use conflicts occur	1-Sep-25	Future land use of the sports field and golf course not compatible with wastewater disposal.	GHD	Affects ability for development of sport field and golf course in the future.		4		4				4	4	4	16	Ensure that future plans are communicated by QEC and that design link in with these. Need awareness of future plans for the golf course area.			QLDC/GHD		4		4				3	3	4	12
E		Stakeholders/Partners/Public	Public are dissatisfied and not supporting the solution.	1-Sep-25	Public perception on application of wastewater to grounds that people are in direct contact with.	GHD	Public has negative association with playing fields and could link occurrences such as skin infections and sickness to the area.		4						4	4	4	16	Public education required as part of project implementation.			QLDC		3						3	3	3	9
E		Environment	Odour issues occur at the irrigation site	1-Sep-25	Odour issues from wastewater treated effluent.	GHD	Odour being able to be smelt in the surrounding area		4	5	4			3	1	1	5	5	Highly treated effluent - very low likelihood					4	5	4			3	2	2	5	10
E		Budget	The cost estimation is insufficient	1-Sep-25	Cost estimation not being sufficiently done.	GHD	Cost escalation.	3		3					3	3	3	9	External QS for cost estimation			GHD	2		5					2	2	5	10
E		Regulatory and Consent	Effluent may not be treated to the required standard.	1-Sep-25	Effluent may not be treated to the required standard.	GHD	Result is illness and infection from contact with contaminants.		4		4		4	4	4	4	4	16	Adequate controls required to ensure effluent treatment meets the required quality. This includes regular testing and procedures for if effluent does not meet specification.			Operators		4		4		4	3	3	3	4	12
E		Design	Irrigation does not meet the assumed capacity	1-Sep-25	The amount of irrigation that can be applied may be less than assumed, especially in winter without affecting the playing surface.	GHD	Less wastewater is discharged to sports field and more to the river.	5							4	4	5	20	Ensure discharge is not relied on as a critical element.				5							4	4	5	20
C,D,E		Construction and Operation	Pumping cost increases due to electricity cost	8-Sep-25	Discharge is directed to the river due to the high cost associated with operating the discharge to the Frankton area	Risk Workshop Team	Increased river discharge		5	5		3			3	3	5	15	May be controlled by consent conditions					5	5		3			3	3	5	15
C, D		Stakeholders/Partners/Public	High visibility of assets on Frankton results in vandalism and negative community perception	1-Sep-25	Large tanks are required for wastewater storage.	GHD	Target for vandalism and negative community perception.		4	3	4				4	4	4	16	Consider fencing, security cameras.					4	3	4				4	4	4	16
C,D,E		Construction and Operation	Discharge method not suitable in power cut	8-Sep-25	Discharge method not suitable in power cut, so would need back up if earthquake or power cut affects WWTP operations	Risk Workshop Team	Increased river discharge					3			2	2	3	6	Allow for back up power source on critical elements.								3			2	2	3	6
Supplementary Option - Wastewater Reuse																																	
F		Stakeholders/Partners/Public	Less wastewater used for reuse activities		Public perception or inconvenience	GHD	Less water is reused than predicted and system is oversized leading to perception of waste of money			5	3				3	3	5	15	Need to assess on a cost/benefit aspect. Could be added at a later date if deemed appropriate.						5	3				3	3	5	15
			Someone gets sick from using reuse water inappropriately		Caused by using reuse water inappropriately		Illness							4	1	1	4	4	Procedures in place										4	1	1	4	4

Appendix E

Borehole and soak hole preliminary analysis

E 1.1 Borehole and soak hole preliminary analysis

The limited timeframe for identifying and assessing the short listed option precluded comprehensive ground investigations and monitoring at Frankton Flats. Investigations are needed to obtain information for refining the understanding of the potential for boreholes and soak holes to be meet disposal needs. Recognising the potential uncertainty this introduced to the consideration of these options, further analysis of the range of likely outcomes was carried out with the assistance of a water balance model and Monte Carlo analysis of select aquifer and well parameters. This section presents a summary of this assessment for options C and D

E1.2 Option C - borehole disposal rate refinement

The potential borehole disposal was constrained by the following assumptions:

- The working range for each bore was 30 m head of applied wastewater within a bore and 20 m within a soak hole.
- Discharge to ground should not result in groundwater mounding of no more than 1m at a distance of approximately 150 m from the point of disposal. This constraint was adopted to provide protection against springs forming on the Kawarau riverbank, potentially destabilising the riverbank or eroding the surface due to overland flow of discharged water.
- Aquifer transmissivity within the range of 1,000 to 3,000 m^2/day, as suggested by ORC[17], with this uniformly distributed across this range.
- The potential clogging of aquifer material immediately surrounding the bore would result in long-term reduction of permeability to between 10 to 50% of the broader aquifer. This may result from the discharge of fine particulate entrained in the treated wastewater or biofouling within the aquifer due to elevated nutrient levels.
- Preference for discharge to the southern and eastern areas of Frankton Flats, with this assumed to reduce the potential for creating flow of nutrient rich water to Lake Wakatipu.

- The cumulative probability for aquifer transmissivity immediately surrounding the bores, considering the adopted range of transmissivity and clogging is illustrated in Figure E-1.

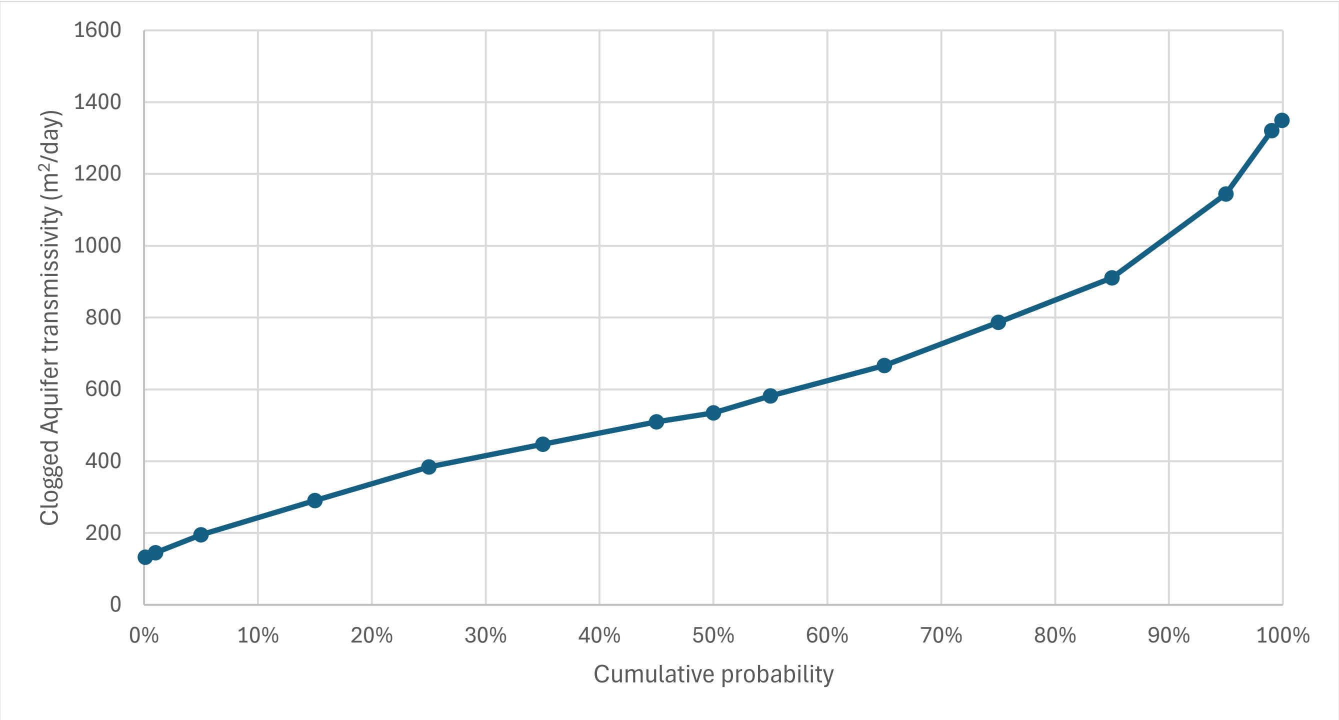


Figure E-1 Range of transmissivity and clogging for the boreholes on Frankton.

[17] Otago Regional Council, July 2014. Investigation into Wakatipu Basin Aquifers.

Discharge rates for disposal boreholes were predicted using the following approach:

- Eden Hazel analytical analysis, assuming 10 and 20% well efficiency, with 30 m working head within the bore, giving a discharge rate resulting in approximately 3 - 6m water level increase in the clogged aquifer immediately adjacent to the borehole.
- Consideration of the 5%, 50% and 95% clogged aquifer transmissivity values (approximately 190 m^2/day, 530 m^2/day and 1,150 m^2/day respectively). from which a distribution of acceptable discharge rates was developed. This distribution of individual borehole discharge rates is illustrated in Figure X.
- Analysis using Theis time-drawdown/distance-drawdown solution, assuming a midpoint aquifer transmissivity (not clogged) of 2,000 m^2/day and water level response after 365 days, to screen out those discharge rates that result in groundwater level increases at 150 m greater than 1m.

This analysis indicated that at the 95th percentile transmissivity range and where water level mounding in the aquifer was in the order of 6 m (20% well efficiency), the discharge had the potential to cause water levels at 150 m distance to increase by more than 1 m. The predicted discharge rates resulting in approximately 3 m of mounding (10% well efficiency), were predicted to cause water level increases at 150 m of no more than 1m. The conditions that resulted in no more than approximately 3m increase in groundwater levels adjacent to the discharge boreholes was therefore adopted as the likely range of acceptable discharge rates. These discharge rates, considering the range of potential aquifer clogging outcomes is illustrated in Figure E-2.

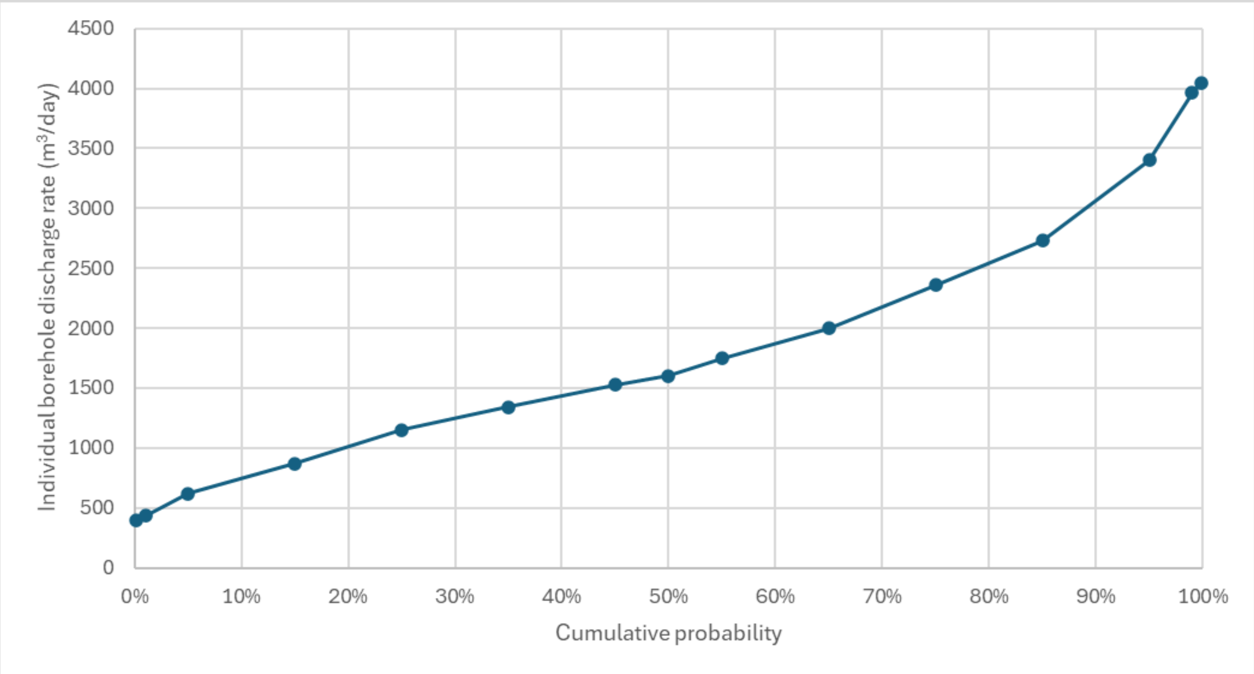


Figure E-2 Individual borehole discharge rate

To determine the number of bores that could operate at Frankton Flats, indicative siting and spacing was assumed to have the following constraints:

- Spacing between bores in the order of 200 m, and a minimum distance to the terrace edge of 150m, with these spacings assumed to reduce cumulative mounding effects and adverse effects to riverbank stability.
- Siting to reduce cumulative mounding effects along a groundwater flow path from the discharge bore to the Kawarau River, with the intention of reducing cumulative mounding at the riverbank areas.
- Siting of the bores on land owned and accessible to QLDC, and located towards eastern and southern areas, to reduce the potential for creating flow of nutrient rich waters to Lake Wakatipu.

Approximately ten boreholes have been identified as suitably fitting within the Frankton Flats area while meeting all relevant constraints. It is recognised that, due to uncertainties in the various inputs affecting individual discharge rates and impacts on groundwater levels and flow, there remains a significant level of uncertainty—and likely conservatism—in this estimated number of boreholes.

Additional conservatism has been incorporated to address ongoing bore maintenance and the management of aquifer impacts by considering the bore operational regime. It is anticipated that maintaining long-term operability will necessitate periodic backwashing of the bores. For the proposed total of 10 bores, the operational plan assumes that nine bores will be active at any given time.

The probability of the combined discharge rate, considering the range of potential aquifer clogging outcomes and operational regime is illustrated in Figure E-2.

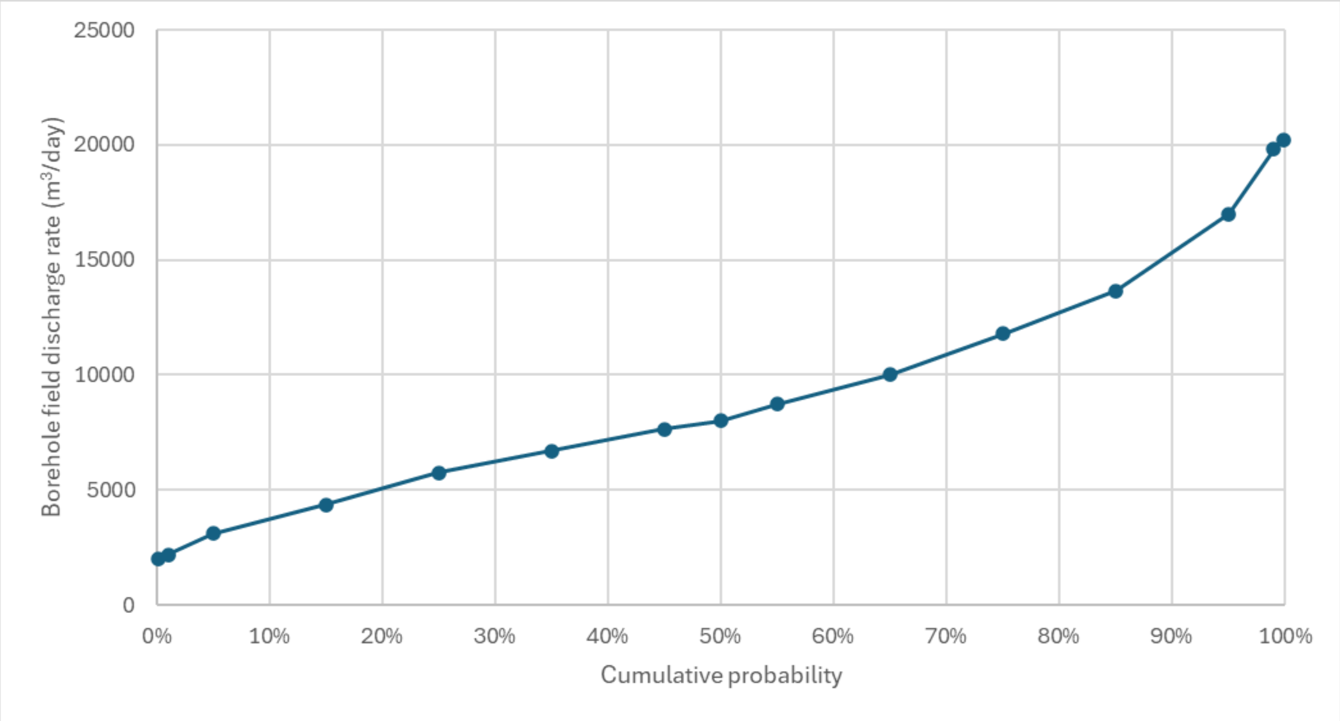


Figure E-3 Combined borehole discharge rate (total of 10 bores)

The net disposal rate on Frankton Flats is interpreted to be constrained primarily by available siting locations and the potential for impacts to groundwater levels and groundwater flow regime, rather than discharge rates. A potential upper bound for wastewater disposal to ground and groundwater of approximately 20,000 m^3/day is adopted as the upper bound for the aquifer capacity to accommodate wastewater disposal, for both Option C (boreholes) and Option D (soak holes).

E1.3 Option D – soak hole disposal refinement

In this option, soak holes have been assumed to be boreholes of 0.2m – 0.4m diameter approximately 20 m in depth, with a slotted casing and gravel backfill. The soak holes allow the discharge of treated wastewater to the vadose zone, approximately 20 m above the Frankton Flats groundwater water level. Treated wastewater then percolates downwards to groundwater.

Similar to the borehole option, discharge of wastewater via soak holes can be expected to result in an increase in the groundwater level (mounding) in the vicinity of the discharge and potential changes to the groundwater flow regime. The upper bound aquifer capacity before such effects become significantly adverse is assumed to be 20,000 m^3/day.

Review of soil investigation data for Frankton Flats indicates shallow soils to approximately 4 m depth consisting of a range of fine sand to sandy gravels, which align with the alluvial deposits on the Shotover delta. These materials demonstrate a wide range of hydraulic properties, depending on the presence and nature of the finer soil matrix fraction. Evidence from stormwater disposal activities on Frankton Flats and from the clogging issues with the Dose and Drain wastewater disposal system on the Shotover delta, suggests that while the soils are relatively permeable, inflow rates can be constrained by clogging, or where soils are particularly fine.

The following assumptions were made with regards to soil permeability and clogging potential for the soak holes:

- Hydraulic conductivity in the range of 1 x 10^{-5} m/s to 1 x 10^{-7} m/s, consistent with a medium to very-fine sand to silty sand. A uniform distribution across this range is assumed. It is noted that the hydraulic conductivity considered is likely to be lower than that suggested by aquifer transmissivity in the consideration of bores. The aquifer transmissivity is understood to
- Clogging potential consistent with that assumed for boreholes, being long-term reduction of soil permeability to between 10 to 50% of the broader aquifer. A uniform distribution across this range is also assumed for assessment.

Figure E-4 illustrates the range of clogged soil permeability, based upon the uniform distributed probability of clogging and hydraulic conductivity.

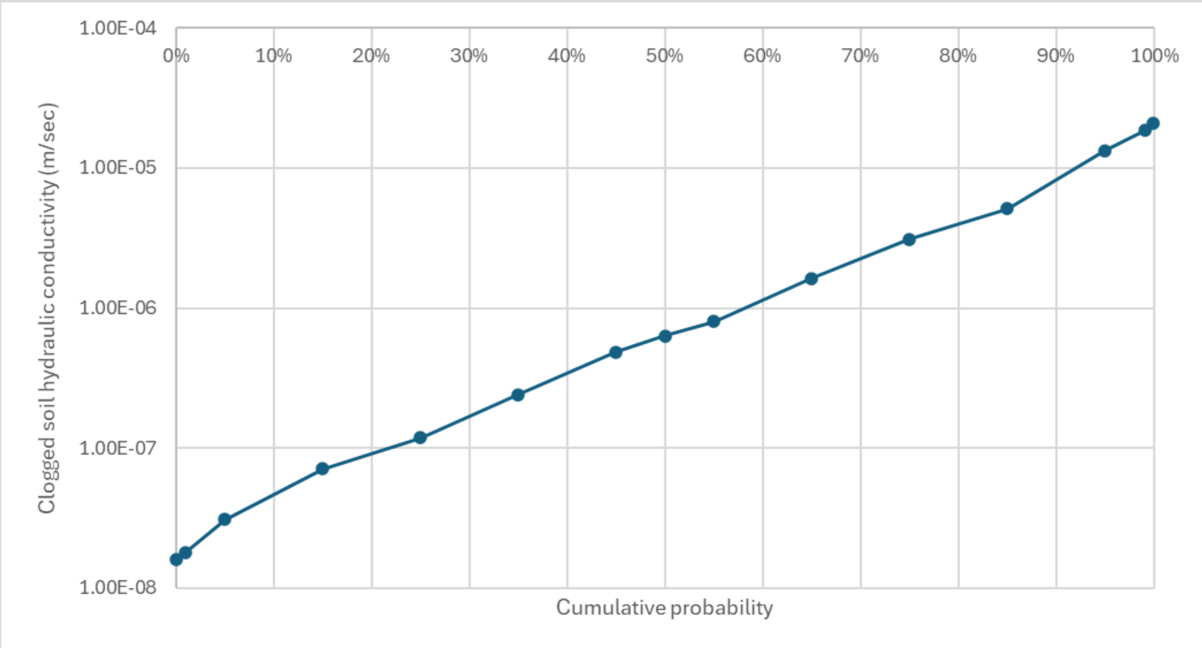


Figure E-4 ***Range of transmissivity and clogging for the soakholes on Frankton***

- Using SEEP/W finite element modelling software, with saturated/unsaturated prediction capability, an axis-symmetric model was developed to simulate soakage rates from a soak hole with 20 m of working head of treated wastewater. Maximum seepage rates were determined for three clogged aquifer hydraulic conductivities (5 x 10^{-6} m/s, 2 x 10^{-7} m/s and 1 x 10^{-8} m/s), with the predicted discharge rates extrapolated using the probability distribution for clogged soil hydraulic conductivity, to provide a predicted probability distribution for soak hole discharge, with this illustrated in Figure E-5.

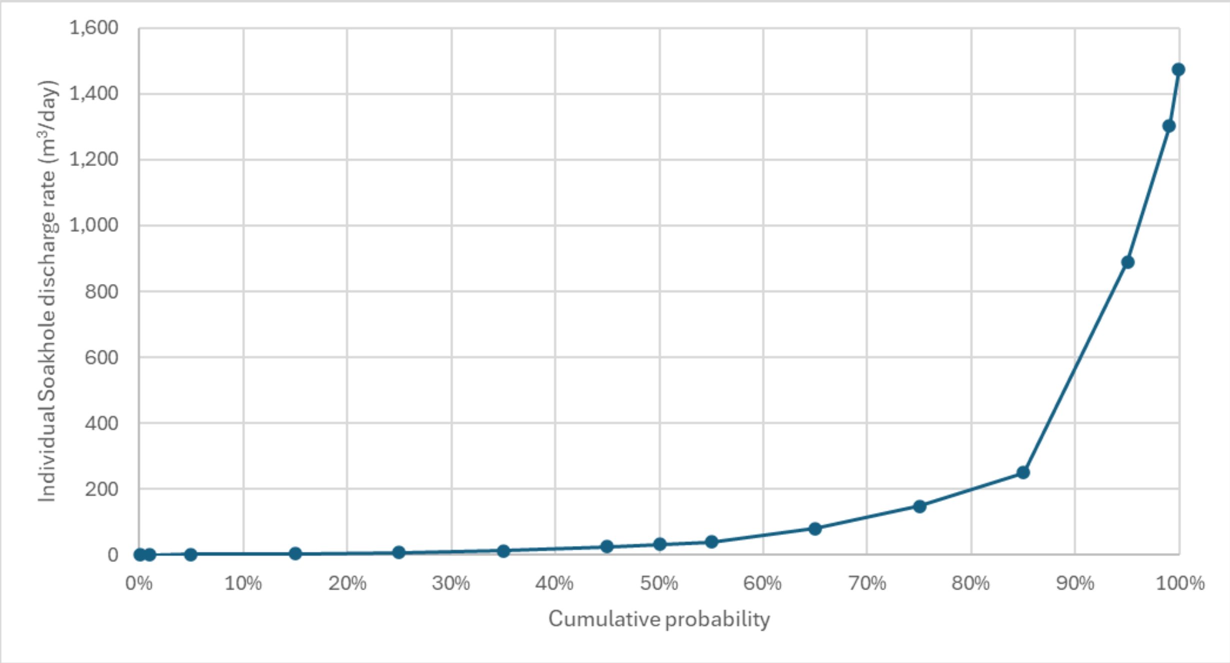


Figure E-5 Individual soakhole discharge rate

- Soak holes are assumed to be spaced approximately 10 m apart, with level control ensuring individual soakage rates are maximised. A total of 50 soak holes, following the same general siting constraints as per boreholes, were assumed to represent the upper bound for effective operations. Significant increases in soak hole numbers could be considered, however the individual level control and disposal network infrastructure needed to support this would be significant.
- Since backwashing and regular maintenance cannot be performed on soak holes except for resting, it may be necessary to periodically replace them. To efficiently install infrastructure over time, expansion areas should be pre-sited. To estimate the operational discharge volume for a soak hole field it is assumed to be in operation 90% of the time, reflecting the lower potential for resting to maintain hydraulic performance. Alternately, a larger number of soak holes, with longer rest periods can be accommodated within the same estimate of total discharge, with this total discharge and estimated cumulative probability of achievement illustrated in Figure E-6.

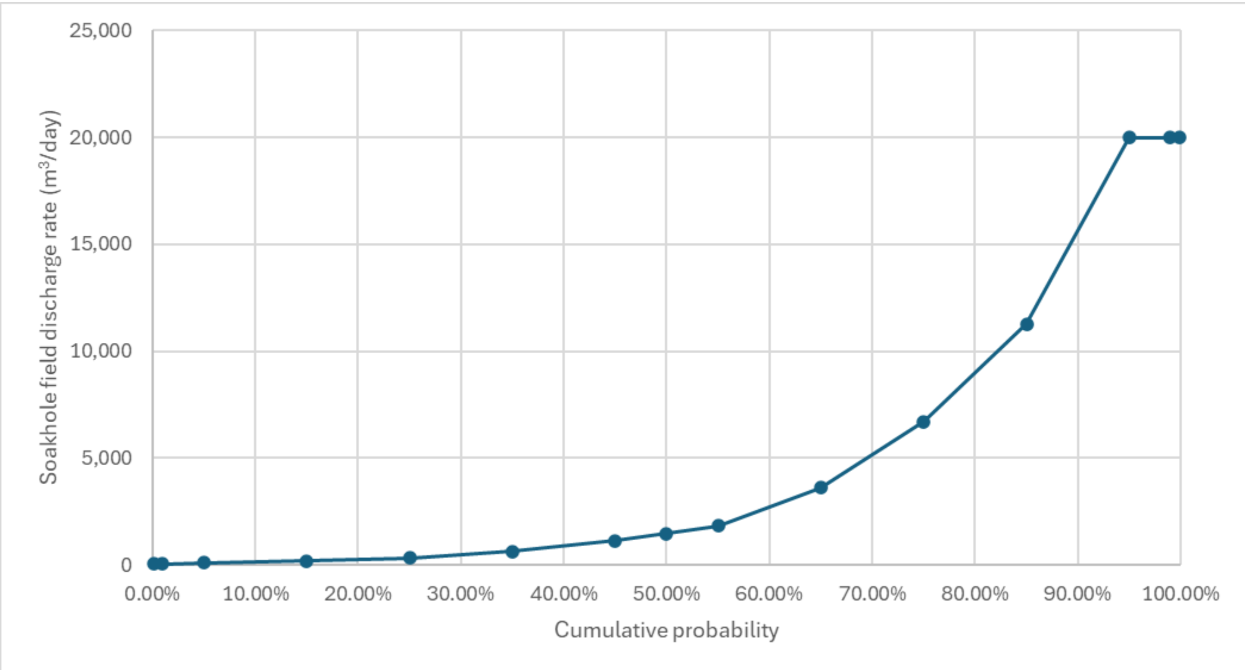


Figure E-6 Combined soakhole discharge rate (50 soakholes)

- The comparison of estimated discharge rates for Option C and Option D, and probability of achieving them is illustrated in the box and whisker diagram provided in Figure E-7.

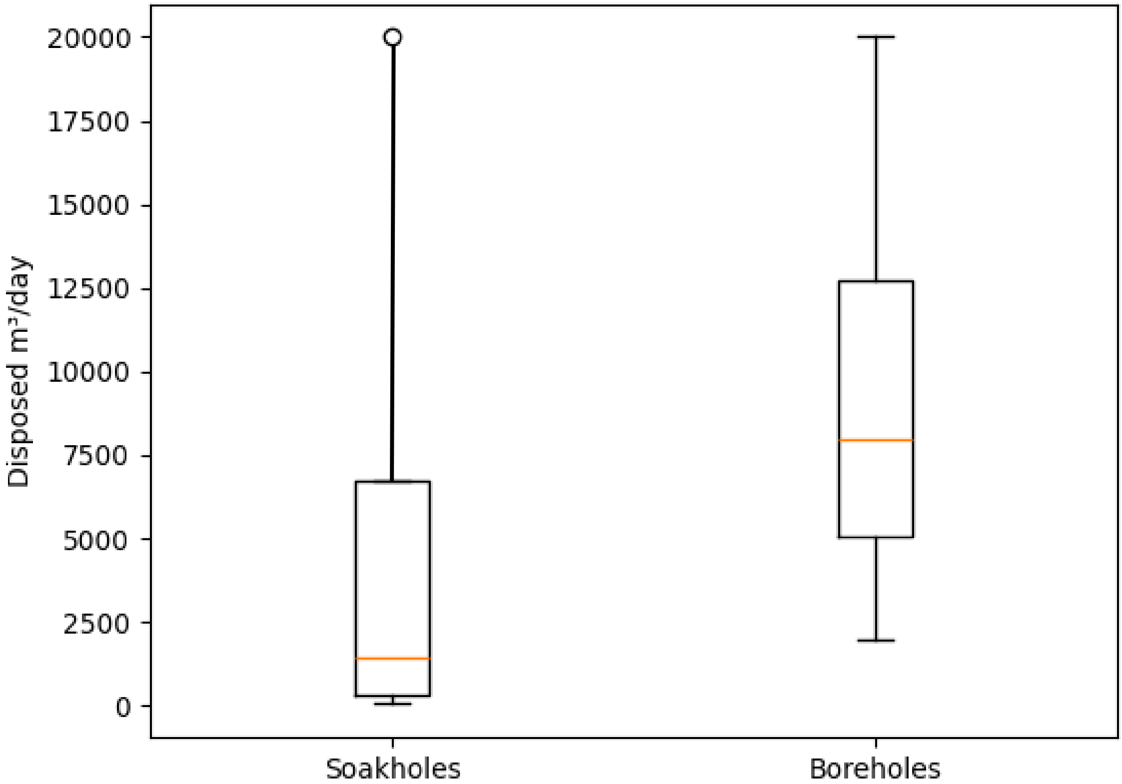


Figure E-7 Estimated discharge rates for Soakholes and Boreholes and the probability of achieving this.

- *Note: Yellow line represents median probability, the upper and lower extents of the box represent the lower quartile and upper quartiles, with the extents of the whisker representing the outer quartiles of the range. The long upper range of soak holes option reflects significant deviation from a normal distribution of potential discharge.*
- Significant refinement of these estimates, including the range and probability of outcomes, would be achieved through site investigations and trialling of the disposal approach. Where adopted, demonstration that the option can provide disposal sustainably and for a meaningful component of the total WWTP wastewater volume is expected to be required before proceeding to large scale implementation.

Appendix F

MCA criteria weighting scenario

	Scenario 1 Investment Objectives focused	Scenario 2 Effects focused	Scenario 3 Water quality and environment focused	Scenario 4 Iwi outcomes focused	Scenario 5 Implementability focused	Scenario 6 Even weighted	Scenario 7 National water standards and cost focused
Investment Objectives							
The health and well-being of the surrounding waterways are maintained, protected and improved where practicable to support water quality.	15%	7%	20%	5%	5%	6.25%	29%
The disposal of treated wastewater aligns with tikanga as guided by mana whenua.	10%	5%	5%	15%	5%	6.25%	3%
Ability to service the community's and visitor wastewater needs now and into the future up to the equivalent flows projected for 2060.	10%	5%	5%	5%	5%	6.25%	3%
Environmental and Social Impacts							
Mō tātou, ā, mō kā uri ā muri ake nei For us and our children after us	5%	8%	5%	10%	5%	6.25%	3%
Cultural impacts to sites of significance and access to sites for cultural activities.	5%	8%	5%	10%	5%	6.25%	3%
Impacts to the surrounding environment	5%	8%	10%	5%	5%	6.25%	3%
Environmental impacts to surrounding catchment land, soil and groundwater	5%	8%	10%	5%	5%	6.25%	3%
Visual effects - The extent to which there is a visual impact from options that differ from existing land use or impact the surrounding natural environment.	5%	8%	3%	5%	5%	6.25%	3%
Amenity effects - The extent to which there is a receptor or social impact from options.	5%	8%	3%	5%	5%	6.25%	3%
Design, Delivery and Operation							
Constructability and technical feasibility	5%	5%	5%	5%	10%	6.25%	3%
Sustainability - Carbon emissions and sustainable use of resources supporting organisational goals.	5%	5%	5%	5%	5%	6.25%	3%
Operational reliability and maintainability	5%	5%	5%	5%	8%	6.25%	3%
Property difficulties and impacts	5%	5%	5%	5%	8%	6.25%	3%
Achievability of Indicated Outcomes	5%	5%	5%	5%	8%	6.25%	3%
Consent , Design, Construction Implementation Timeframe	5%	5%	5%	5%	8%	6.25%	3%
Costs and affordability	5%	5%	4%	5%	8%	6.25%	29%

Appendix G

Land disposal assessment

Report

24 November 2025

To	Andrew Hill	**Contact No.**	0275645297
Copy to	-	**Email**	Helen.Barclay@ghd.com
From	GHD	**Project No.**	12645246
Project Name	Shotover WWTP Disposal Field Alternative Discharge		
Subject	Land Disposal Assessment		

1. Summary of land disposal assessment

Queenstown Lakes District Council (QLDC) engaged GHD to identify a long-term solution for the disposal of treated effluent from the Shotover Wastewater Treatment Plant. This included consideration of potential options for disposal of treated wastewater to land. Due to the limited capacity for disposal to land at Frankton, a re-evaluation of possible land disposal options was conducted to determine whether any alternative land disposal areas were appropriate. This report documents the high-level spatial assessment that was carried out to refine the evaluation of potential areas suitable for land disposal.

Land based disposal options are the preferred wastewater disposal method of mana whenua, where the mauri of the wastewater is restored.

Land disposal methods can be conducted at either surface or subsurface levels. Approaches include:

- low-rate applications such as surface or subsurface drip irrigation and aerial spray irrigation
- moderate-rate techniques like disposal trenches or soakage swales
- and high-rate methods that utilise soakholes, trenches or infiltration basins.

To accommodate the projected average daily wastewater flow for 2060, any option using a land disposal method must be capable of accommodating at least 26,000 m³ per day all year round. Where land disposal cannot accommodate peak flows (up to 60,000 m^3/day), wastewater storage may be used to buffer flows and this would likely be at the treatment plant. The total land area required is influenced by factors such as disposal method, soil characteristics, and topography. High-rate disposal methods would require approximately 10 to 25 hectares, while low-rate methods would likely require land in excess of 500 hectares.

A spatial multi criteria analysis was conducted to further support the identification of appropriate land parcels for consideration as a treated wastewater disposal option. This provides another line of evidence for the range of land disposal options considered. The criteria evaluated included:

- environmental/physical criteria such as slope, geology, and proximity to water bodies;
- property criteria including planning zones, property size, and ownership; and
- built environment aspects including distance and elevation from the Shotover WWTP.

The assessment was undertaken at screening level only. Site specific assessments would be required if potential land disposal options are deemed suitable and feasible. This would be to confirm suitability of sites for wastewater application, likely acceptable long term loading rates, and the total area of land required. Mixed disposal solutions, such as discharge to water and land as a dual discharge were not considered in the identification of land potentially suitable for land application of wastewater. There are two mixed solutions evaluated as part of the short list assessment.

The high-level spatial assessment identified only a limited number of potential land areas likely to be suitable for consideration of options for land disposal. Much of the Wakatipu basin area is highly constrained with geology, other environmental constraints, land use and topographical constraints presenting significant challenges to the land application of wastewater at a large scale.

The potentially feasible locations are further constrained when the built constraints of distance and elevation rise from the Shotover WWTP are considered, with these directly impacting upon the capital and operational cost of the disposal option.

The areas identified as potential opportunities for waste disposal options, and the relationship to the options considered, are summarised in Table 1.

Table 1 Application method summary

Application method		Comment / Key Considerations	Potential areas identified in screening assessment	Long list option
Surface		• Not suitable due to climate constraints (can't discharge during winter months)	None	
Subsurface	**High rate**	• Potential for high-rate disposal • Some areas would need engineered solutions such as infiltration basin or trenches • Smaller land area required (10 – 25 ha)	• Shotover delta – engineered ground solutions, such as infiltration basin or trenches. • Frankton Flat – soak holes	Option 1a Option 1b Option 5 Option 8
	Medium rate	• subsurface medium rate application has potential using closed trenches or low-pressure effluent distribution (LPED) • Relatively large land area required (>70 ha) • Limited large land parcels available	• Frankton Flat • Bridesdale Flat • Southern Corridor • Ladies Mile • True right of Kawarau River	Option 2a Option 2c Option 2b Option 2c Option 2c
	Low rate	• Not suitable due to large land area required in excess of 500 ha	None	

2. Background

2.1 Purpose of this report

The purpose of this report is to document the spatial assessment of options for the discharge of wastewater from the QLDC Shotover Wastewater Treatment Plant (WWTP) to land. This is intended to provide further information related to the option identification to that outlined in the long list assessment process. This includes quantifying constraints to land application of wastewater as a means of supporting the screening level assessment carried out to identify appropriate land areas for options consideration.

2.2 Scope of work

The assessment scope includes the following:

- Identify typical wastewater disposal to land approaches that may be suitable for use in the broader Queenstown area.
- Carry out a screening-level spatial assessment to identify locations potentially suitable for land disposal of wastewater.
- Develop wastewater disposal to land options to be included in the long-list assessment of options for Queenstown wastewater disposal.

2.3 Limitations

This report: has been prepared by GHD for Queenstown Lakes District Council and may only be used and relied on by Queenstown Lakes District Council for the purpose agreed between GHD and Queenstown Lakes District Council as set out in section 2.1 of this report.

GHD otherwise disclaims responsibility to any person other than Queenstown Lakes District Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared the rough order cost estimates set out in section 7 of this report (Cost Estimate) using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.

The Cost Estimate has been prepared for the purpose of option comparison only and must not be used for any other purpose.

The Cost Estimate is a preliminary rough order estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the works can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

3. Assumptions

This assessment serves as a preliminary screening of constraints and opportunities related to the disposal of wastewater to land. The reported constraint scores quantitatively represent qualitative measures, and do not include weighting to indicate the relative importance of individual constraints. Further detailed analysis would be required to determine the availability, extent, and suitability of any land areas for disposal. This assessment does not incorporate social factors related to the location of land disposal areas, such as community or cultural concerns.

The identification of wastewater disposal approaches and options to be included in the wastewater disposal long list is not intended to be exhaustive. Instead, it is intended to provide a number of options that broadly reflect the different disposal approaches and potential opportunities for implementing these, that are less constrained (and therefore more likely to be feasible) when considering the selected siting and operational constraints.

This means that the assessment is not intended to provide for extensive iteration on the possible land disposal opportunity, where for various reasons an identified option is determined to be overly constrained in long list or short list assessment.

Information considered in this assessment are from publicly available datasets provided by QLDC and Otago Regional Council (ORC). It is assumed that these datasets are accurate and reflect current conditions.

4. Basis of design

The design basis is described in Section 3 of the GHD Short List Report (November 2025) and uses updated wastewater flow estimates for 2060. Table 2 summarises this information.

Table 2 Future wastewater flow estimates

Parameter	Recent wastewater discharge flows		Future wastewater flow estimations			
	2023	2024	2030	2040	2048	2060
Average day population	46,002	49,359	57,265	69,892	82,325	94,887
Peak day population	65,685	72,565	84,830	103,759	122,399	141,233
Average day flow (ADF) (m^3/day)	9,995	12,060	15,061	19,080	22,475	25,904
Peak dry weather flow (PDWF) (m^3/day)	13,388	15,934	18,675	22,897	26,970	31,085
Peak wet weather flow (PWWF) (m^3/day)	18,861	32,724	34,640	43,885	51,692	59,579

5. Land disposal methods

Wastewater can be disposed to land using either **surface** or **subsurface** methods, with various designs and materials chosen based on site and soil conditions. Surface options include aerial spraying, inundation or infiltration ponds, soakage swales, and surface drippers, while subsurface alternatives comprise trenches (conventional or evapotranspiration (ETA/ETS) beds), soakholes, low-pressure effluent distribution, and shallow drip irrigation. Methods are also classified by application rate: high, medium, low. In addition to the cost of development and operation, method selection should consider soil properties, environmental setting, available land, and proximity to sensitive areas.

Table 3 provides a matrix of example disposal methods within surface/subsurface and disposal rate categories. This is not an exhaustive list of land disposal methods.

Table 3 Land disposal methods - overview

	High Rate	Moderate Rate	Low Rate
Sub-surface	• Trenches • Soakholes	• Trenches • Low pressure effluent distribution (LEPD)	• Shallow subsurface drip irrigation
Surface	• Inundation or infiltration basins	• Soakage swales	• Aerial spray • Surface drip irrigation

For the purpose of identifying land disposal options, the disposal category (low, medium, or high) has been used as the primary performance metric in determining land requirements and feasibility. This assumes that for a given disposal rate category a number of disposal options may be viable, and the most appropriate disposal method would be confirmed with more detailed assessment.

The general requirements and methods of each of the disposal rate categories considered are detailed in the following sections.

5.1 High-rate disposal methods

High rate disposal methods considered include:

- Infiltration basins (Long List Option 1a)
- Closed trenches (Long List Option 1b)
- Soak holes (Long List Option 8)

Infiltration basins are shallow, excavated basins where treated wastewater is discharged to allow it to seep into the ground. A key requirement is that the underlying ground is sufficiently permeable to allow for rapid infiltration through the ground to maintain a suitable discharge rate. In addition, the infiltration basins must be elevated above the groundwater table (allowing for seasonal variation in water levels) to reduce the risk of groundwater mounding limiting the disposal and/or result in groundwater flooding. The number and size of basins is dependent on the site characteristics and design flow rate, however it is typical to include redundancy (extra basins) in the design to allow for resting and cycling between discharge basins. This option will result in areas of ponded water which may not be suitable in some locations.

Closed disposal trenches discharge treated wastewater to ground via buried perforated pipes within a gravel filled trench. Unlike infiltration basins, this option does not result in areas of ponded water at surface. The site requirements for closed trench systems share a lot of the same characteristics as infiltration basins, with permeable ground conditions and sufficient depth to the groundwater table. Allowance for resting and cycling is also recommended. As the trenches are buried, maintenance is not as easy as in infiltration basins, therefore additional filtration and treatment of the wastewater is required to reduce the risk of clogging in the trench media and the underlying soils/geology.

Soak holes are large diameter bore holes drilled into the ground above the groundwater table (vadose zone). Depending on the site geology, the bore hole may be filled with permeable gravel or large rocks or left open/unfilled to maximise infiltration. Wastewater is discharge to the soak holes which then infiltrates to the surrounding ground. The infiltration rate is dependent on the hydraulic characteristics of the surrounding geology. Soak holes have a limited area footprint and can be dispersed between other site uses or in constrained areas (i.e. road verge or park areas). A key limitation is that the soak holes cannot be easily remediated therefore additional filtration of wastewater is essential to reduce the risk of clogging. However, it is considered likely that the soak holes will fail over time with use due to clogging within the surrounding ground and a regular replacement programme must be considered for this option.

These considerations and requirements for high-rate disposal methods are summarised in Table 4.

Table 4 High rate disposal options

<table>
<tr><th>Common high rate disposal methods</th><th>Typical site requirements</th><th>Typical operational requirements</th></tr>
<tr><td>Infiltration basins</td><td rowspan="3">• Highly permeable ground conditions
• Absence of low permeability zones or constrained aquifer conditions.
• Elevated with respect to groundwater and surface water levels.
• Greater separation from sensitive receptors than lower rates of disposal</td><td rowspan="3">• Treatment/filtration to prevent clogging of media
• Relatively low maintenance, but periodic rejuvenation or replacement where maintenance is not possible (e.g. soakholes)</td></tr>
<tr><td>High rate trenches</td></tr>
<tr><td>Soak holes</td></tr>
</table>

5.2 Moderate-rate disposal methods

Moderate rate disposal methods (Long List Option 2) include:

- Infiltration beds
- Trenches
- Low-Pressure Effluent Distribution (LPED)
- Spray irrigation

Moderate-rate disposal methods are often used in areas with moderate to high permeability ground conditions. When compared to high-rate disposal, moderate-rate systems typically have lower discharge rates and/or allowance for longer resting time between discharge events.

Infiltration beds or swales, and closed trenches are similar to the infiltration basins described in Section 5.1, however with a lower discharge rate. LPED systems typically comprise a series of small diameter (~50 mm) perforated pipes buried in shallow gravel filled trenches. Wastewater is distributed to the pipes under low pressure conditions, infiltrating the ground over a wide area.

Spray irrigation involves discharge of wastewater to land surface via irrigation at moderate disposal rates. The land area required must consider soil properties, climate conditions, slope and aspect, land use and wind direction, with allowance for resting between land discharge events.

These considerations and requirements for moderate rate disposal methods are summarised in Table 5.

Table 5 Moderate rate disposal methods

Common moderate rate disposal methods	Typical site requirements	Typical operational requirements
Infiltration beds / swales Closed trenches LPED	• At least moderate permeable soils and underlying geology • Absence of low permeability zones or constrained aquifer conditions. • Sufficient depth to groundwater table	• Treatment/filtration to prevent clogging of media • Routine maintenance and inspections required
Spray Irrigation	• Consideration of prevailing winds, risk of wind drift • Consideration of rainfall and run-off • Typically, larger buffer distances as result of above.	As above with addition of: • Sufficient storage should conditions not be suitable for irrigation (temperature/precipitation)

5.3 Low-rate disposal methods

Low-rate disposal methods (Long List Option 3) include:

- Drip irrigation (surface and subsurface)
- Spray irrigation

Drip irrigation involves discharge of wastewater via small drippers attached to a small diameter polyethylene pipe or similar. For subsurface discharge, the pipes are generally buried directly into the soils (no gravel bedding material). This method is suitable for lower permeability soils.

The low-rate disposal (via spray or drip) means there is potential for significant nutrient uptake by vegetation reducing drainage to groundwater. Therefore, this option may be suitable in areas of more sensitive environmental receptors. However, a large land area is required for this option.

These considerations and requirements for low rate disposal methods are summarised in Table 6.

Table 6 Low rate disposal methods

Common moderate rate disposal methods	Typical site requirements	Typical operational requirements
Drip irrigation	• Large areas of connected land • At least low to moderate permeability soils	• Treatment/filtration to prevent clogging of emitters and soils. • Regular monitoring and inspections • Significant land area maintenance
Spray Irrigation	As above with addition of: • Consideration of prevailing winds, risk of wind drift. • Consideration of rainfall and potential for run-off. • Typically, larger buffer distances as result.	As above with addition of: • Sufficient storage should conditions not be suitable for irrigation (wind, rainfall)

5.4 Disposal method summary

A summary of land disposal methods is included in Table 7.

Table 7 Summary of advantages and disadvantages of land disposal methods

Land disposal type	Advantages	Disadvantages
High rate	• Smaller land area required compared to low and moderate rate land disposal	• Potential to impact groundwater levels and quality, must consider sensitive receptors • Limited to areas with permeable ground conditions • May require engineering solution (i.e. raise ground surface to raise disposal area above groundwater level)
Moderate rate	• Suitable in less permeable soils compared to high-rate disposal options	• Relatively large land area required • Storage capacity required for surface discharge options to allow for periods when irrigation not possible.
Low rate	• Suitable in low permeability soils • Potential for nutrient uptake by plants • Lower risk of groundwater impacts (groundwater level and quality) • Larger range of land uses can be considered (i.e. sports fields / parks)	• Large land area required • Significant infrastructure may be required to distribute over large land area • Storage capacity required for surface discharge options to allow for periods when irrigation not possible.

5.5 Surface application of wastewater

Climate conditions can influence the suitability of land disposal systems, particularly for shallow or surface disposal methods. During wet conditions land application via irrigation may not be feasible due to water logging of soils. Frosty conditions can also limit soil capacity and can result in damage to infrastructure (e.g. freezing of pipes), therefore subsurface disposal methods may be more suitable in these areas.

Queenstown has a continental style climate with distinct seasons. Summers are typically warm and dry, with temperatures averaging in the low 20's°C, with hot days exceeding 30°C. Winters are cold, with frosts common and the occasional low-level snowfall. During winter, many areas with southerly aspects do not experience sunshine for several weeks due to the shading by the surrounding mountains. In these areas, frost conditions can persist for extended periods if the temperature remains low.

Table 8 presents the seasonal rainfall summary for Queenstown. While the average rainfall is similar between seasons, greater variability in rainfall occurs in spring and summer often associated with the prevalence of westerly weather patterns during this period.

Table 8 Seasonal rainfall summary from 1990 – 2020. Data sourced from NIWA Climate Database (StatsNZ 2023)

Season	Min (mm)	Max (mm)	Average (mm)
Autumn	103.4	271.6	179.3
Spring	70.3	333.2	181.0
Summer	83.6	454.8	190.5
Winter	100.4	273.1	175.0

The cold and/or wet conditions in winter and spring is likely to severely limit surface land disposal. It is expected that there would be extended periods where land application to surface is not possible due to soil moisture conditions. Significant storage would be required which is expected to be cost prohibitive, on this basis surface land disposal options are not considered to be suitable for this location.

5.6 Land requirements – subsurface application

Estimated land area requirements for low, medium and high-rate land disposal are summarised in Table 9. The land area estimates are based on assumed average loading rates and the projected 2060 wastewater average day flow. A nominal allowance for buffer distances (20%) and capacity for field resting (25%) is assumed. It is also assumed that peak flows could be buffered with storage. These land area estimates and loading rates are for screening purposes only and would need to be confirmed through site specific investigations

Table 9 High level land requirements for high, medium, and low-rate land disposal

Land disposal type	Loading rate	Approx land required for 2060 average day flow	Assumptions
High rate	500 - 1000 mm/day	10 - 25 ha	*Engineered solution – built up from aggregate as natural ground unlikely to achieve high-rate soakage (for example previous DAD field)* *May require additional engineering works to raise beds/trenches above groundwater table. Discharge rate dependent on thickness of disposal bed and gradient.*
Moderate rate	75 mm/day	70 ha	*Assumes moderate permeability soils/geology (e.g. sand), 80% land use efficiency, loading rate higher than domestic guidance (AS/NZS1547) taking into account:* *- Higher levels of treatment.* *- Detailed design supported by robust analysis.* *- Routine maintenance.*
Low rate	7.75 mm/day	520 ha	*5 mm/day application rate, with additional allowance (2.75 mm/day) for evapotranspiration, 80% land use efficiency, assuming low-moderate soil permeability and vegetation.*

6. Land availability analysis

The environment setting of Queenstown and its surrounds dictate the opportunity for land application of wastewater as a long-term means of disposing of wastewater, with much of this opportunity determined by the geology and soil conditions, and the proximity to sensitive water environments. For instance, areas with soils of relatively high permeability are likely to be more favourable for land disposal of wastewater, as less land is required. Similarly, areas distant from sensitive water bodies are more likely to be favourable for land application.

These conditions influence the selection of wastewater disposal method (low-rate, moderate-rate or high-rate) and determine amount of land required. Additional natural factors affect the feasibility of land application, including those that support in-ground treatment processes, which can decrease downgradient contaminant levels and limit negative effects on water quality.

Natural and built environment conditions, social and cultural considerations, and the cost of implementation and operation also influence the land application opportunity. The nature of that opportunity and the potential to realise it can be predicted through a characterisation and analysis of constraints. To provide this analysis and assist in identifying land areas that may be suitable for long term land application of wastewater, a spatial multi-criteria analysis has been carried out. This analysis has followed the below steps:

Identification of key criteria that influence the potential to undertake land application of wastewater, with these represented by individual spatial data layers, and grouped into one of the following broad criteria groupings:

– Environment/physical criteria
– Property and zoning criteria
– Built environment criteria

For example, land topography is an environment/physical criteria and represented by an elevation data layer.

Discretisation of each criterion into distinct spatial features or categories and characterisation of the degree of constraint they impose on the potential for land application of wastewater. For example, land sloping 0-5 degrees may be considered as relatively un-constrained, whereas land sloping >20 degrees may be considered to be highly constrained.

Representation of the level of constraint for that feature as a constraint score, from 0 to 100, where 0 is unconstrained and 100 is highly constrained. This reflects the influence that the feature has on the feasibility of land application. No criteria weighting is imposed, and features that are highly constrained still remain within the assessment as representing possible, but difficult conditions.

Identification of features that are unsuitable for land application for various reasons or require minimum distance offsets for any land application of wastewater. These features and buffer areas are marked as unsuitable and excluded from the spatial assessment. For example, lakes, rivers and buildings are removed as unsuitable features and also have minimum buffer distances around them.

Overlaying of spatial layers and criteria scores to provide a cumulative, multicriteria constraints score.

Land areas with lower overall constraints scores are considered more likely to be suitable for long-term land application of wastewater.

The specific constraints considered in the spatial analysis are outlined below. Data references and individual constrain maps are provided in Appendix A.

6.1 Extent of assessment

A distance of 25 km from the Shotover WWTP has been considered in spatial analysis (Figure 1), with this encompassing the Wakatipu Basin which extends approximately 8 km from WWTP, and all notable areas, such as southern corridor to Jacks Point, in the vicinity of Queenstown.

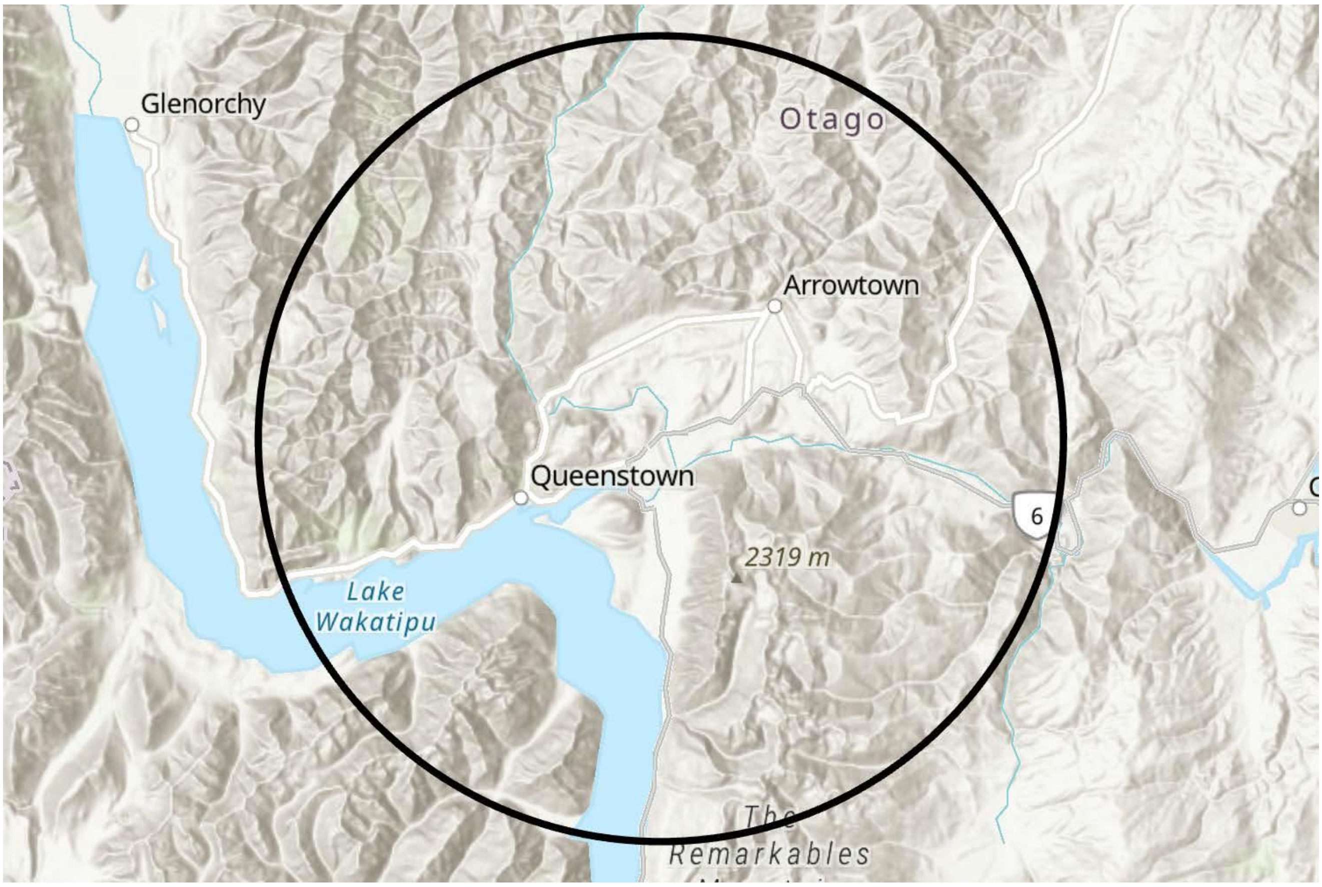


Figure 1 ***Spatial analysis extent (25 km radius around Shotover WWTP)***

6.2 Environment and physical criteria

6.2.1 Geological and soils conditions

The 250k scale geological spatial data layer sourced from Geological Nuclear Sciences (GNS) was used to represent surface geology in the spatial assessment.

The Queenstown area is underlain by schist and semi-schist of the Torlesse and Caples supergroup. The schist forms the mountain ranges and high points (e.g. Morven Hill) in and around the Wakatipu Basin. These areas are typically steep, with a thin layer of soils or bare rock. The schist bedrock is effectively impermeable to water flow except where fractured. Limited infiltration of rainfall (or irrigation) into fractured rock often reappears as springs or seeps further down the hill. For these reasons, areas dominated by schist are not considered suitable for wastewater disposal.

Within the Wakatipu basin, the geology is influenced by multiple glacial advances, carving out the basin and leaving behind glacial sediments (till and outwash gravels) as the glaciers retreated. The glacial sediments are highly variable in terms of permeability. In general, the permeability of the materials decreases with age, i.e. sediments deposited in older glacial periods (older than Quaternary 2) are generally more weathered with a higher proportion of fine-grained materials and generally lower permeability.

Table 10 provides a summary of the typical sedimentary deposits found in the Wakatipu basin.

Table 10 Geological unit description and interpreted permeability

Type	Depositional environment	Description	Permeability
Till	Deposited by the ice during the advance or retreat of glaciers	Unsorted mix of silt, sand, gravel and boulder.	Low The high silt content and lack of sorting limits water flow through the material
Outwash / alluvial gravels	Deposited by glacial meltwater (river at end of glacier). As the meltwater flows, the sediment is sorted removing fined grained materials leaving behind larger gravel and sand.	Gravel with silt and sand	Moderate to high Deposits are well sorted with lower proportion of silt
Lake sediments	Formed at base of lake, represents fined grained material (silt and clay) setting out of water column in low energy environment	Silt	Low

The permeability and drainage properties of soils are important for shallow and surface disposal options. Moderate to high-rate disposal options such as trenches and basins discharge below the shallow soil layers. Soils are generally reflective of the underlying geology, with more permeable soils overlying permeable geological units.

For the purpose of this screening level assessment, it is assumed that the properties of the geological units with respect to land disposal potential, also broadly reflect those of the soils and no separate soil spatial layers have been considered. The influence geological conditions have on the potential for land disposal is reflected in the following constraint scoring Table 11.

Table 11 Geological constraint scoring

Geological unit	Level of constraint	Constraint score
Q1 - river deposits	None	0
Q2 - river deposits	Low	20
Q2-Q6 (Younger) - Till	Medium-high	80
Q6+(Older) - Till	High	100
Lake Deposits	Medium-high	80
Schist	Unsuitable	-

6.2.2 Topography

The Land Information New Zealand (LINZ) elevation layer at 8 m grid is used to represent topography in the spatial assessment. Land slope influences land disposal in a number of ways, including:

- Construction costs, with increasing slope of land generally increasing the complexity and so the cost of constructing disposal fields.
- Cost of operation, with increasing limitations on access and land maintenance with greater topography. Also, greater elevation differences increase the potential for breakages in the disposal network and spatially variable performance, due to pressure differentials. More controls are needed to manage these, increasing maintenance requirements.
- The potential for generating run-off from surface applied wastewater, and the potential for overflows with subsurface application. With increasing slope, it is typical to require lower application rates to manage the potential for such effects. Some disposal methodologies, such as most high-rate disposal methods, require land of relatively low slope.

The influence of topography on the potential for land disposal is reflected in the following constraint scoring in Table 12.

Table 12 Topographical constraints scoring

Land slope	Level of constraint	Constraint score
0 – 5 degrees	None	0
5 – 10 degrees	Low -medium	33
10 – 15 degrees	Medium-high	66
15 – 20 degrees	High	100
>20	Unsuitable	Unsuitable

6.2.3 Faults

The 250k scale geological spatial data layer, sourced from Geological Nuclear Sciences (GNS), is used to represent known active and inactive faults in the spatial assessment.

Ground displacement along faults can damage wastewater disposal infrastructure, and in particular the network of lines for sub-surface land application of wastewater. It is common to avoid constructing a wastewater disposal field on known faults, with this imposing a potential constraint on siting. This constraint is represented in the assessment as follows:

– Mapped active faults are considered to impose a medium level of constraint (constraint score of 50).
– Mapped inactive faults are considered to impose a low level of constraint (constraint score of 20).

However, we note that Queenstown’s proximity to the Alpine Fault and other major fault systems results in an inherent risk of infrastructure damage not reflected by this spatial analysis.

6.2.4 Surface water bodies

The LINZ Rivers/Lake/Ponds dataset is used to represent surface water bodies within the spatial assessment. Setback distances from these features have been adopted from the Otago regional plan (ref), with those areas within the setback area considered unsuitable for land application of wastewater. The adopted set back distances are outlined in Table 13.

Table 13 Surface water constraints scoring

Surface water feature	Adopted setback distance (m)
River centreline / stream	50 m
Major watercourse	50 m
Lake and pond	100 m
Wetland	100 m

6.2.5 Flood plain

While flood plains may often have soils conditions and topography suitable for land application of wastewater, the potential for significant damage to infrastructure is such that flood plains are not preferred locations for siting of a long-term land application scheme. To reflect this, areas with greater flood risk, as indicated by the 100 ARI flood zone, are considered to have a high level of constraint (constraint score of 100).

6.2.6 Lake Hayes

Lake Hayes has a long history of poor water quality, resulting from catchment drainage and land use. Numerous initiatives have been carried out in the catchment to improve water quality. Estimated total phosphorous load to the lake was estimated to be in the order of 2 tonnes/year for 2023[1].

Prior to the 21 August 2025 repeal of the nutrient limits in the ORC Regional Plan: Water for Otago the Lake Hayes catchment had a nitrogen limit of 20 kg/ha/y to protect water quality in Lake Hayes, reflecting a significant constraint on the application of nutrients in the catchment. The lake Hakes catchment area as presented in ORC Maps is shown in Figure 2.

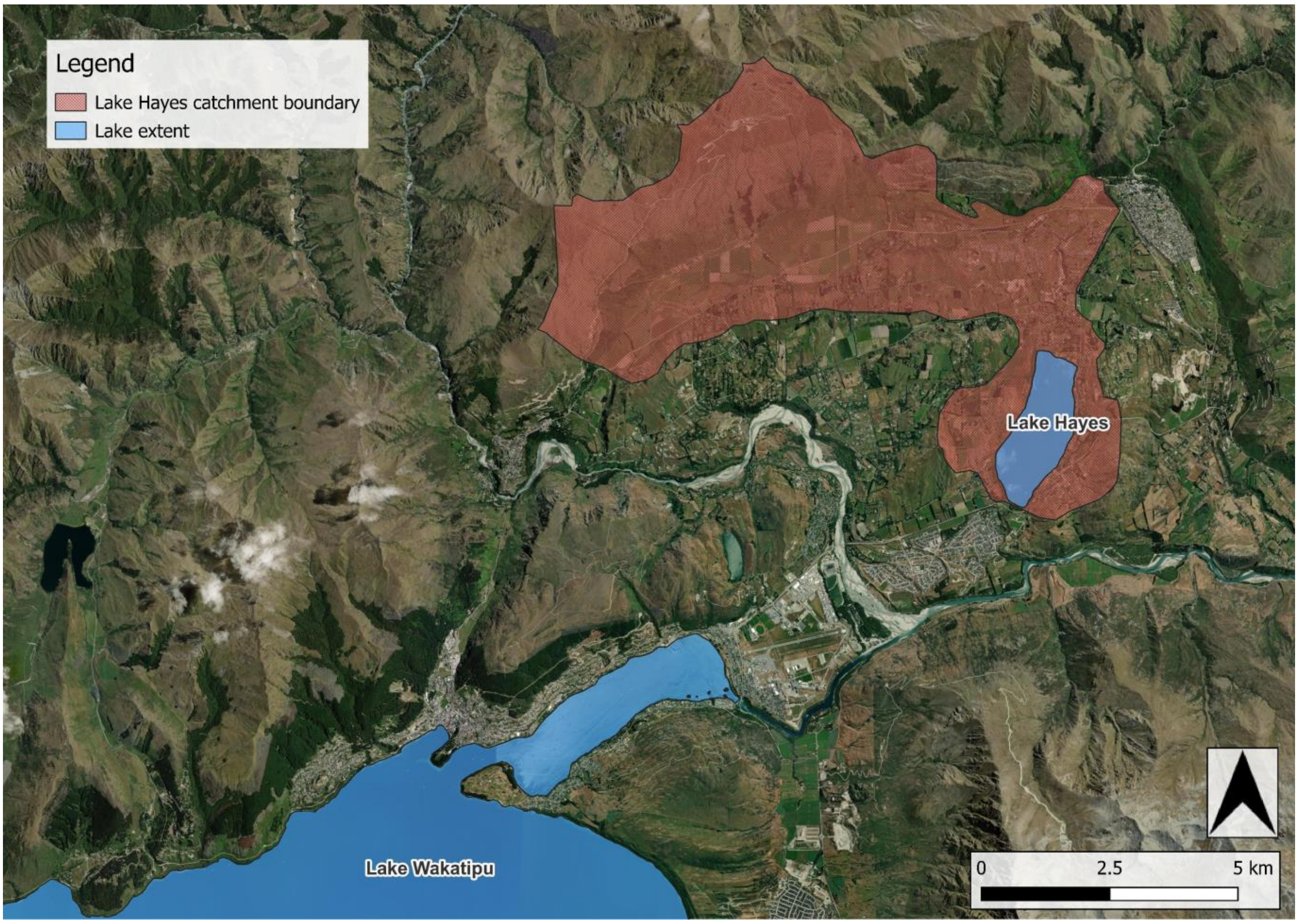


Figure 2 Lake Hayes catchment area

Wastewater disposal in the catchment, at volumes that would form a meaningful component of future average daily flows for the Shotover WWTP, has the potential to multiply this nutrient mass load to Lake Hayes. In this context, Lake Hayes represents an extremely sensitive receptor, with this reflected in the spatial assessment by applying a high level of constraint to the catchment (constraint score of 100).

6.3 Planning and Property

6.3.1 District plan zones

The district plan zones are used to reflect the land use across the district and provides an approximate measure of available undeveloped land that may be suitable to land disposal. Commercial/industrial and residential land use are considered not to be suitable for land disposal. Rural land use is considered unconstrained as these areas are likely to represent larger portions of undeveloped land. Rural lifestyle blocks are often smaller with mixed use, limiting the available land for disposal options. Recreational and reserve land

[1] HydroSphere Research Ltd, October 2023. Lake Hayes State of Environment 2023

areas are considered to have medium level constraints due to the potential for public use and interaction which would need to be considered in the design of any land disposal system. District plan zone constraints scoring used is included in Table 14.

Table 14 District plan zones constraints scoring

Land slope	Level of constraint	Constraint score
Rural	None	0
Rural Lifestyle	Medium	50
Recreation	Medium-high	75
Designated Reserve	Medium	50
Commercial	Unsuitable	-
Industrial	Unsuitable	-
Industrial Amenity	Unsuitable	-
Urban/Residential	Unsuitable	-

6.3.2 Property ownership and property size

Use of land for wastewater disposal requires changes to land-use and often the acquisition of land. The influence of these changes, and the difficulty in reaching agreements for change is reflected in the spatial assessment through consideration of property size and ownership.

To avoid negotiating use or acquisition with numerous parties, the spatial assessment only considered properties of greater than 5 ha. Properties of at least this size and owned by QLDC was considered to be un-constrained in its potential use (constraint score of 0), whereas properties with multiple owners was assumed to impose a medium level of constraint (constraint score of 50) to reflect the potential difficulty in reaching agreement.

6.4 Built Environment

6.4.1 Distance and elevation from Shotover WWTP

The distance of the land disposal areas from the WWTP and network connections required between potentially disparate disposal areas directly impacts upon the capital cost of developing the option. Conveyance is considered to represent a high constraint when the conveyance distance alone results in costs exceeding approximately half of the current available funding for the disposal scheme.

The Shotover WWTP is located at a relatively low elevation within the Wakatipu Basin. With the exception of a delta disposal option, any land disposal option is likely to require pumping up from the WWTP with additional pumping/boosters required for increasing elevation. There is also the potential for breakages with greater pressure differentials as discussed above in section 6.2.2

Rough order estimates were made of the cost of conveyance for a range of distances from the treatment plant, and elevation changes. The capital cost of the pipeline, including pumps and fittings is shown graphically in Figure 3. These are high level cost estimates for the purpose of option comparison only and must not be used for any other purpose. Land disposal options within 10 km of the treatment plant were considered favourable, with the estimated cost of conveyance exceeding $50M for distances further than this.

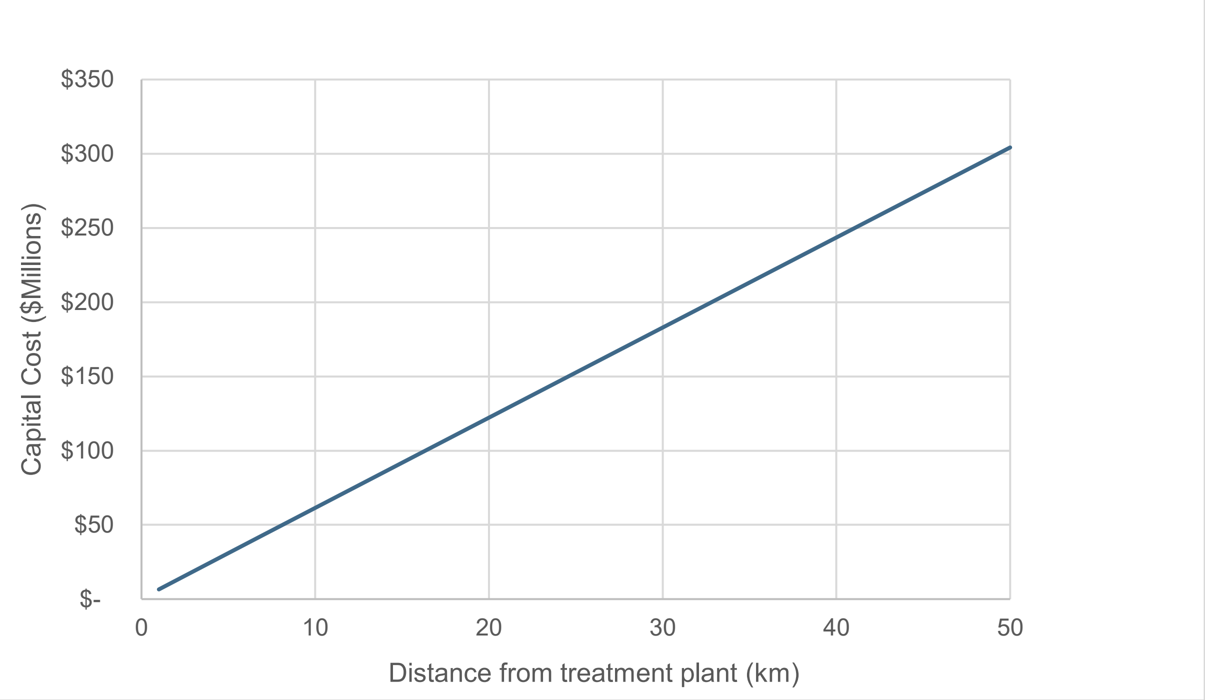


Figure 3 ***Rough order capital cost of conveyance compared to distance from treatment plant***

Both the distance and the elevation change between the wastewater treatment plant and the disposal location impact the annual operating costs of the disposal location as this significantly increases the pumping power requirements. This relationship is shown in Figure 4. The annual operating costs are also influenced by the pipeline cost as an allowance for operation, maintenance, and renewal as a proportion of the capital cost is included in these estimates.

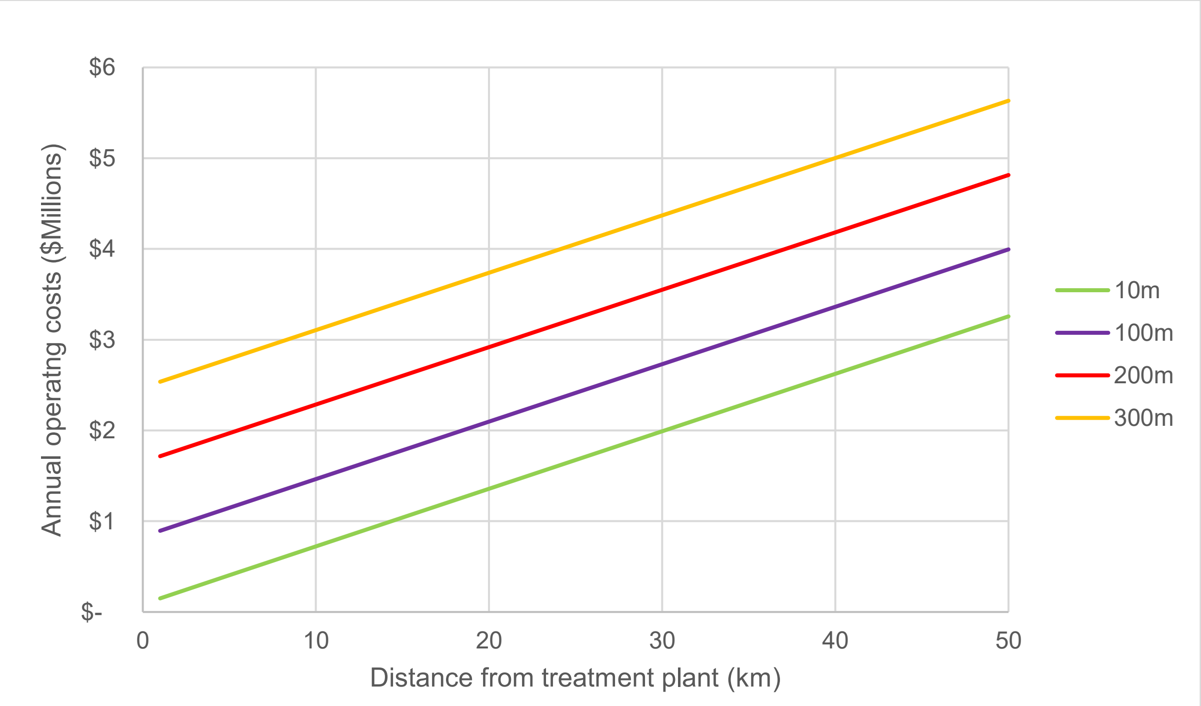


Figure 4 ***Annual operating costs for a range of distances and elevations***

The annual operating costs and capital costs for the conveyance of wastewater to a disposal site were combined into a net present value over a 30-year period for comparison and is shown in Figure 5 below. This reinforced the assumption that disposal options beyond about 10 km are not economically viable options.

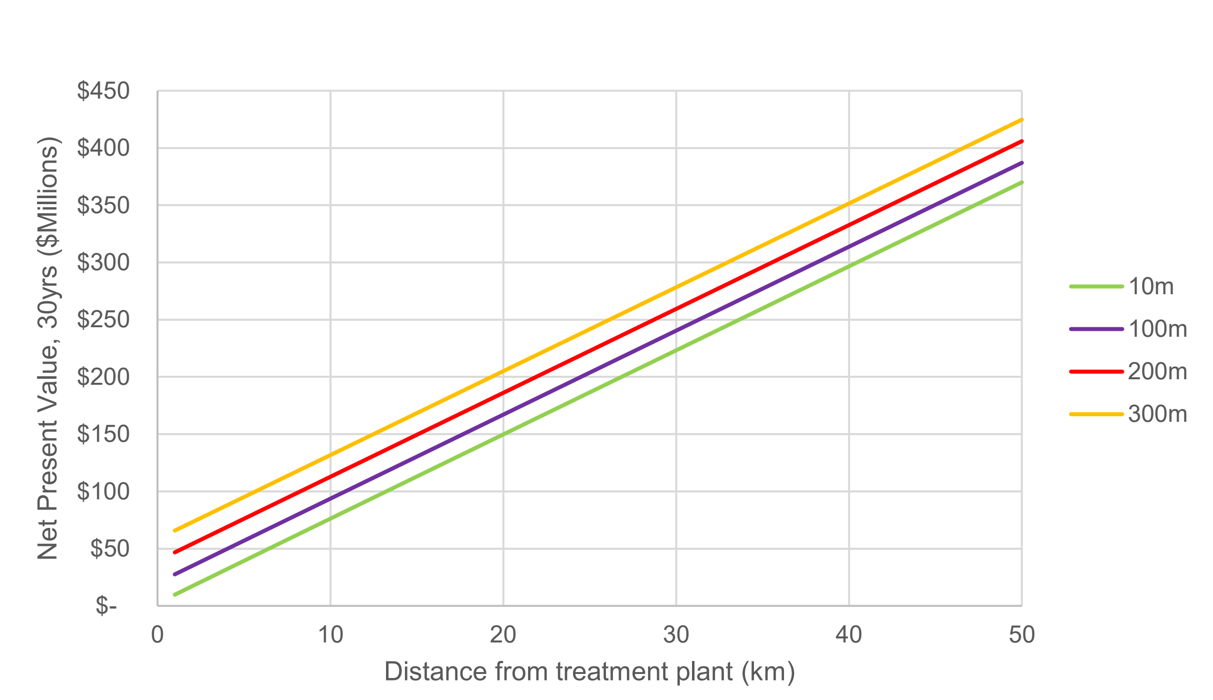


Figure 5 ***Net present value of capital and operating costs for a range of elevations over a 30 year period***

Considering the impact of construction and conveyance costs, constraints scoring were applied to distance and elevation increase relative to the WWTP as shown in Table 15 and Table 16. The level of constraint adopted is a reflection of the potential impact on total cost and operating cost. A distance of 8 km from the WWTP would cost more than half the current LTP budget, and an elevation increase of more than 300 m increases the operating costs by more than $2.5M a year.

Table 15 ***Distance from WWTP constraints scoring***

Linear distance from Shotover WWTP	Level of constraint	Constraints score
0 – 2 km	None	0
2 – 4 km	Low - moderate	25
4 – 6 km	Moderate	50
6 – 8 km	Moderate - high	75
>8 km	High	100

Table 16 ***Elevation increase from WWTP constraints scoring***

Elevation increase from Shotover WWTP	Level of constraint	Constraints score
< 0 m	None	0
0 – 10 m	Low - moderate	25
10 – 50 m	Moderate	50
50 – 100 m	Moderate - high	75
100 – 300 m	High	100

6.4.2 Water supply wells

A number of groundwater wells are used for water supply within the area of assessment. These include QLDC water supply wells near Lake Hayes and on the Shotover (true left) riverbank across from the WWTP. ORC wells database also shows a number of domestic or other water supply wells within the Wakatipu Basin. An exclusion zone of 50 m around these wells was adopted, to provide separation and protection in where well headwork integrity is impaired. Water security zones, representing the potential catchment from which wells yield water and pathogens could be transported, were not considered as part of this screening level assessment. It is assumed that such refinements for hydrogeological conditions would be provided in more detailed assessment.

The assessment excluded wells or bores drilled for geotechnical investigation purposes or other non-consumptive purposes.

6.4.3 Roads and buildings

Setback distances of 5 m and 50 m were applied for existing roads and buildings respectively, with land within this radius considered unsuitable for land application of wastewater.

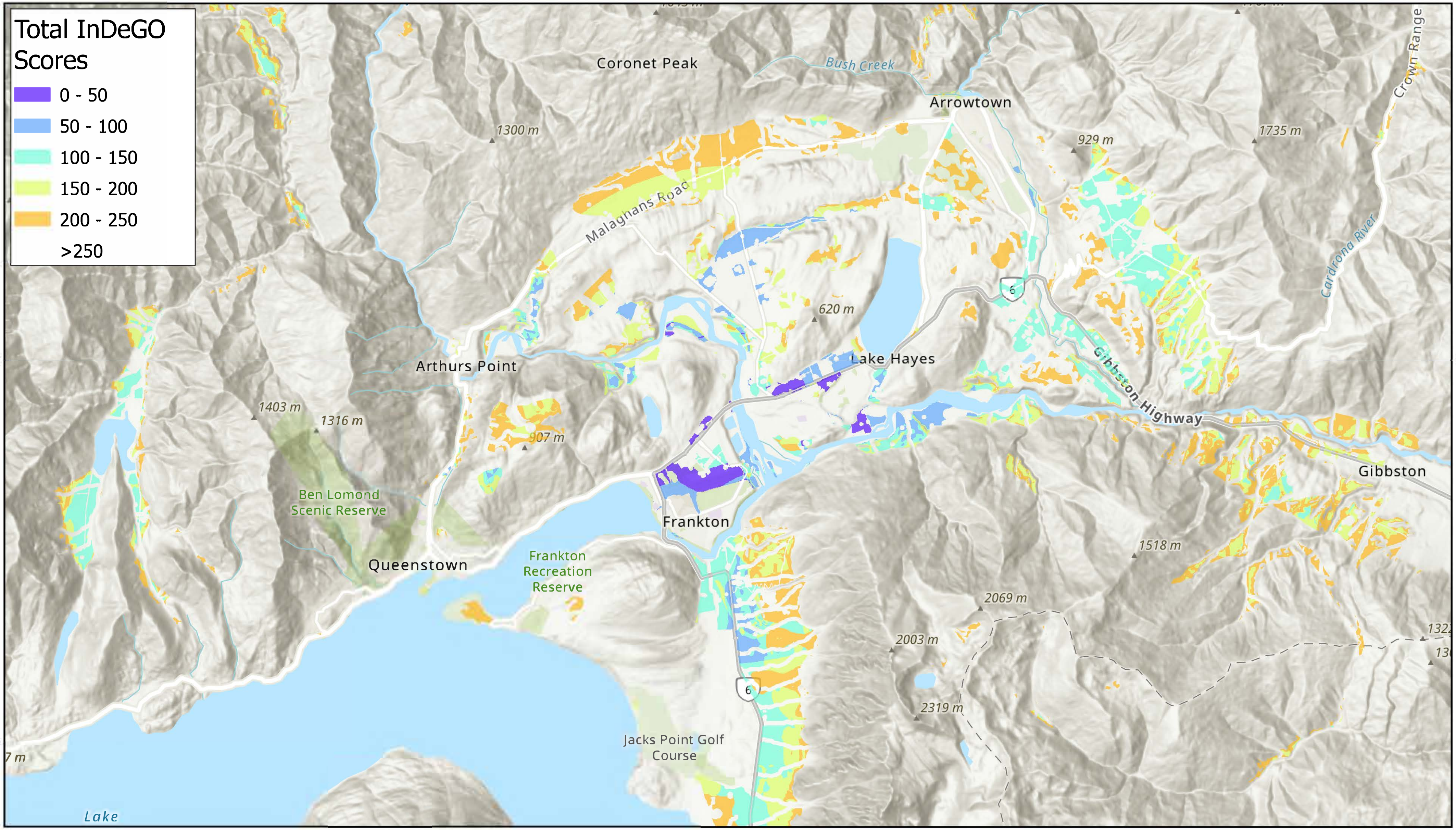
6.5 Spatial multi-criteria analysis

The cumulative constraints scores for land within the areas assessed (25 km radius of WWTP), ranged from a constraint score of 0 to 560, reflecting a level of constraint ranging from no constraints to numerous very significant constraints. For the purpose of identifying areas for land application of wastewater, only those areas with a total constraint score of 250 or less were considered. This relatively high constraints threshold includes areas assessed as having multiple high constraints, and considered at the upper end of what may be considered viable for optioneering

Figure 6 shows the constraints scoring without consideration for the distance and elevation constraints that consider distance from the WWTP.

When distance and elevation are taken into account (with the scoring reflective of the additional costs), the available land areas with a constraint score of 250 or less are significantly narrowed to select locations, as shown in Figure 7.

The spatial analysis confirms that much of the Wakatipu basin is highly constrained, with the more suitable land generally in isolated pockets. Notably, the more favourable areas, with fewer constraints (total constraints score less than 100), are predominantly limited to Frankton Flats and adjacent to Shotover Country, consistent with options considered at Long List stage.



Paper Size ISO A4

0 1 2 3 4

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

Queenstown Lake District Council
Shotover WWTP Disposal Field Alternative Discharge

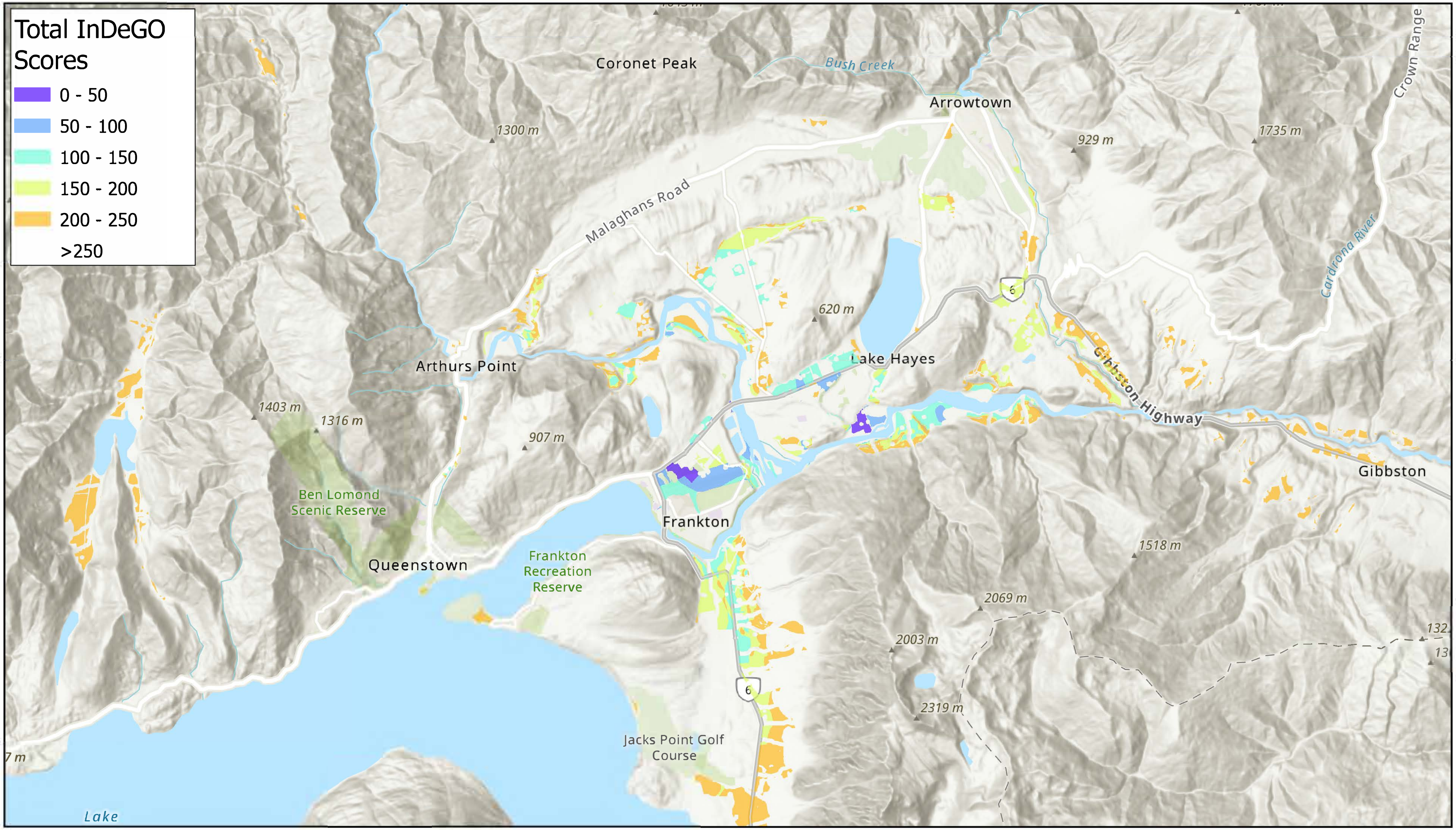
Project No. **12645246**
Revision No. **0**
Date **20251124**

Constraints Scoring without Shotover WWTP source consideration

FIGURE 6

\\ghdnet\ghd\NZ\Christchurch\Projects\51\12645246\GIS\Maps\Working\12645246_InDeGO Working\12645246_InDeGO_Working.aprx - 12645246_InDeGO_Scores_V2
Print date: 24 Nov 2025 - 13:38

Data source: GHD: InDeGO Scores - 20251110; LINZ Data Service: Property information - 20251016 World Hillshade: Esri, CGIAR
World Topographic Map: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community. Created by: nrama



Paper Size ISO A4

0 1 2 3 4

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

Queenstown Lake District Council
Shotover WWTP Disposal Field Alternative Discharge

Project No. **12645246**
Revision No. **0**
Date **20251124**

Constraints Scoring including Shotover WWTP source consideration

FIGURE 7

\\ghdnet\ghd\NZ\Christchurch\Projects\51\12645246\GIS\Maps\Working\12645246_InDeGO Working\12645246_InDeGO_Working.aprx - 12645246_InDeGO_Scores_V1
Print date: 24 Nov 2025 - 13:32

Data source: GHD: InDeGO Scores - 20251110; LINZ Data Service: Property information - 20251016 World Hillshade: Esri, CGIAR
World Topographic Map: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community. Created by: nrama

7. Land disposal assessment

A discussion on the potential areas for high, medium and low-rate land application of wastewater is provided in the following sections. Where areas were considered in the long list report, relevant long list option numbers have been included.

7.1 High-rate land application

High-rate land application systems require very permeable ground conditions. The most permeable geology within the basin is considered be the recent (Q1) river gravels adjacent to current river systems, for example the Shotover Delta. However, the previous high-rate Dose and Drain (DAD) disposal system on the Shotover Delta did not perform due to several reasons, particularly the high seasonal groundwater table (during high river conditions) and presence of fine sand and silt within the schist derived gravels.

No areas were identified as having conditions suitable for high-rate disposal under natural conditions. High-rate disposal may be possible with engineered solutions however, such as where the disposal build is constructed of high permeability aggregate above the natural ground surface. Such approaches have been included in the disposal option assessment and are described in Option1a and 1b in the long list report.

Soak holes may have a smaller footprint than other high-rate disposal options and can have greater vertical ground exposure. While this can require greater separation between the discharge point and the underlying groundwater table, it may improve the area-based infiltration rates i.e. with sufficient vertical surface area soakholes may be relatively more performant and increase soakage capacity over shallow soakholes or other high-rate methods. Frankton Flats, where groundwater is >30 m from the land surface represents such a situation, where the significant depth to groundwater may allow relatively deep soakholes and large vertical surface area. This may offset the otherwise only moderate rate drainage potential of the shallow soils and allow locally high-rate infiltration.

Site specific investigations and testing are required to confirm the potential for soakholes to sustainably achieve a relatively high rate of disposal.

7.2 Medium rate land application

Land areas considered for medium rate land application, included low to medium constraint score areas, in the range of constraint score of 0 and 150. The land area required for moderate disposal is estimated to be in the order of 70 ha. However, 70 ha is considered likely to represent a minimum area for this purpose, as the suitability of land may vary and the requirements for periodic resting of land between following use may be significant in some situations. Refined estimation of land area is expected to require site specific investigations and assessment.

Large land parcels, and/or closely space land parcels with sufficient land area are summarised in Table 17.

Table 17 Potential areas for medium rate land application

Area No.	Area (Long list option)	Scoring	Considerations
1	Frankton Flats (Option 2a)	0-150	Large land parcels owned by council Significant depth to groundwater Competing land use with airport activities
2	Bridesdale Flat (Option 2c)	0-100	Land purchase/agreement required Greater distance from WWTP, river crossing required
3	Southern corridor (Option 2b)	150	Discrete pockets due to constraints (surface water/wetlands) Land development activities reducing available land Land purchase/agreement required Greater distance from WWTP, river crossing required

Area No.	Area (Long list option)	Scoring	Considerations
4	Ladies Mile (Option 2c)	100-150	Land purchase/agreement required Greater distance from WWTP, river crossing required
5	True right of Kawarau River (near Morven Hill) (Option 2c)	100-150	Land purchase/agreement required Greater distance from WWTP Limited road access, may require multiple river crossings

7.3 Low-rate land application

Low-rate land application is suitable for a wide range of soil conditions (considered up to a constraint score of 250), however a key drawback is the large area of land required. The screening analysis identified that an area in excess of 500 ha would be required to meet the projected average day 2060 wastewater flows. The spatial analysis did not identify any large parcels and/or multiple land parcels in close proximity that could accommodate this. The use of numerous disconnected land parcels was not considered feasible in this analysis, due to likely costs associated with land access/purchase, relatively inefficient land buffer requirements associated with property boundaries, and the greater distribution and control infrastructure required to facilitate use. Therefore, low-rate land application is not regarded as a practical option for disposing of the wastewater generated by the Shotover WWTP.

8. Conclusions

The high-level spatial assessment identified a limited number of potential land areas suitable for consideration as opportunities for land disposal of wastewater from the Shotover WWTP. The outcomes of the assessment are summarised in Table 18.

Table 18 Assessment summary

Application method		Comment / Key Considerations	Potential areas identified in screening assessment	Long list option
Surface		• Not suitable due to climate constraints (can't discharge during winter months)	None	
Subsurface	**High rate**	• Potential for high-rate disposal • Some areas would need engineered solutions such as infiltration basin or trenches • Smaller land area required (10 – 25 ha)	• Shotover delta – engineered ground solutions, such as infiltration basin or trenches. • Frankton Flat – soak holes	Option 1a Option 1b Option 5 Option 8
	Medium rate	• subsurface medium rate application has potential using closed trenches or low-pressure effluent distribution (LPED) • Relatively large land area required (>70 ha) • Limited large land parcels available	• Frankton Flat • Bridesdale Flat • Southern Corridor • Ladies Mile • True right of Kawarau River	Option 2a Option 2c Option 2b Option 2c Option 2c
	Low rate	• Not suitable due to large land area required in excess of 500 ha	None	

Much of the Wakatipu is highly constrained, with geology and soils, environmental constraints, land use and topographical constraints presenting significant challenges to the land application of wastewater at a large scale, such as for projected volumes of wastewater to 2060. Surface application methods, at the volumes assessed are considered unsuitable for the environmental setting, given the potential for extensive run-off of applied wastewater and creation of aerosols and spray drift, with wind action.

Of the sub-surface methods considered, moderate land application methods are considered most likely to be suitable, with these methods expected to make best use of the moderately permeable alluvial soils in the area, and requiring land area (in the order of 70 ha or more) towards the upper bound of potentially suitable open land in the area.

The assessment carried out is at screening level only and reflects predominantly environmental and built environment constraints. Site specific assessment is required to confirm suitability of sites for wastewater application, likely acceptable long term loading rates and the total area of land required.

Mixed disposal approaches, such as dual discharge to both water and land, have not been included in the process of identifying areas suitable for the application of wastewater or treated wastewater to land. Dual discharge options were considered as part of the short list option refinement when a standalone discharge to land was considered highly unlikely to be achievable.

The spatial assessment showed a limited number of potential land areas suitable for long term disposal of treated wastewater at the projected 2060 volumes and reinforced the identification and selection of potential land disposal options provided as part of the long list options assessment. The relatively high constraint scores for land areas outside of those identified for the assessed long list options suggests that iterative testing of additional areas is unlikely to provide an overall more favourable option for treated wastewater disposal.

Appendices

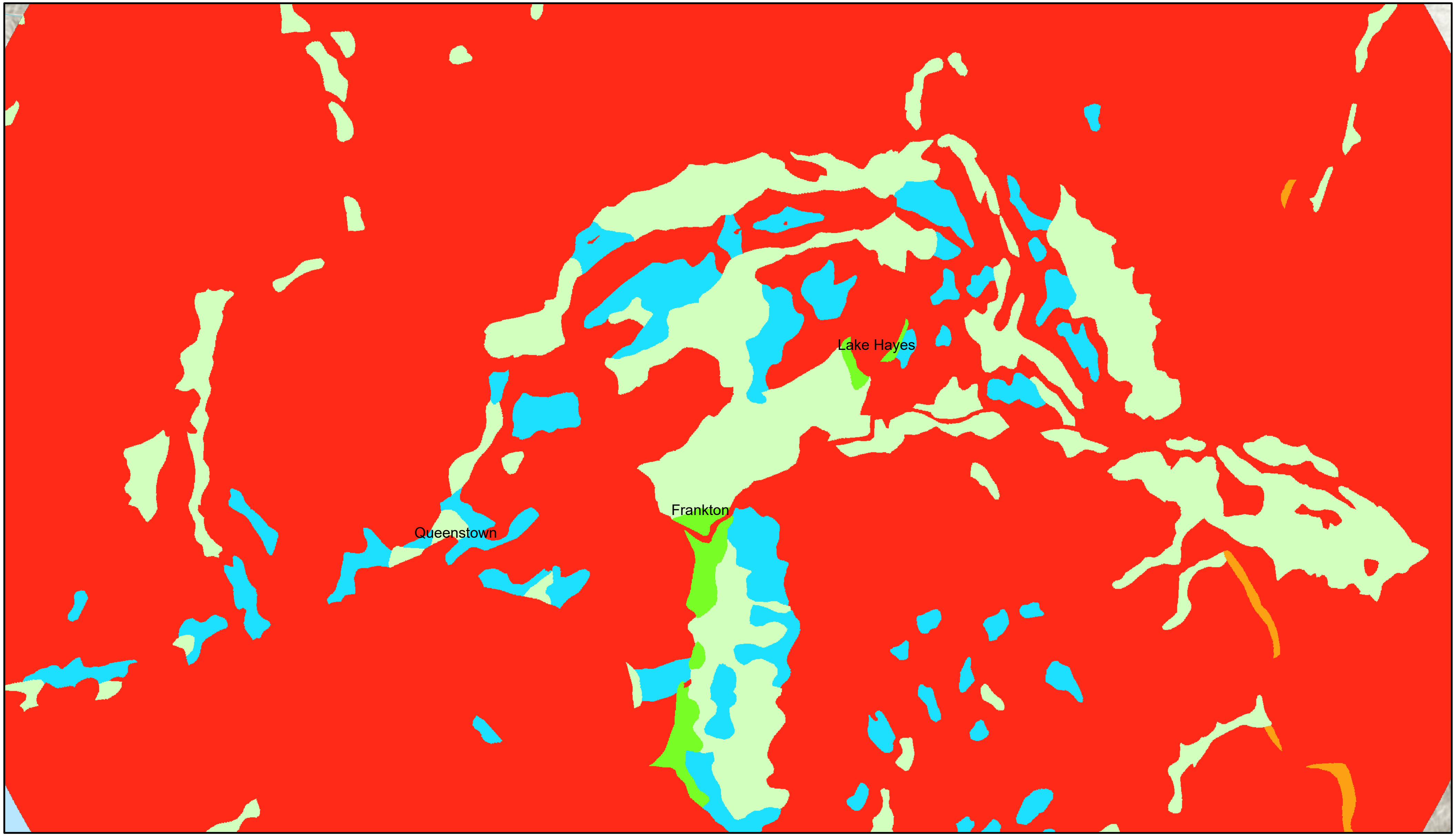
Appendix A

Spatial assessment images

Table A1 Summary of Spatial Assessment data sources

Spatial assessment image	Data layer name	Data source link
Figure A1 – Geology	NZL_GNS_250k_Geological_Units (GNS)	https://data.gns.cri.nz/geology/
Figure A2 – Slope	NZ 8m Digital Elevation Model (2012) (LINZ)	https://data.linz.govt.nz/layer/51768-nz-8m-digital-elevation-model-2012/
Figure A3 – Faultlines	NZL_GNS_250K_faults (GNS)	https://data.gns.cri.nz/geology/
Figure A4 – River centerlines	NZ River Centrelines (Topo, 1:50k) (LINZ)	https://data.linz.govt.nz/layer/50327-nz-river-centrelines-topo-150k/
Figure A5 – River polygons	NZ River Polygons (Topo, 1:50k) (LINZ)	https://data.linz.govt.nz/layer/50328-nz-river-polygons-topo-150k/
Figure A6 – Lakes, Ponds and Swamps	NZ Lake Polygons (Topo, 1:50k) (LINZ)	https://data.linz.govt.nz/layer/50293-nz-lake-polygons-topo-150k/
	NZ Pond Polygons (Topo, 1:50k) (LINZ)	https://data.linz.govt.nz/layer/50310-nz-pond-polygons-topo-150k/
	NZ Swamp Polygons (Topo, 1:50k) (LINZ)	https://data.linz.govt.nz/layer/50359-nz-swamp-polygons-topo-150k/
Figure A7 – Floodplains	2021 ORC – Flood Hazard Area (ORC)	https://experience.arcgis.com/experience/30bb9b65ada445b5af4ab4a0bc2d6d93/page/Flooding
Figure A8 – Lake Hayes Nitrogen Discharge	Catchment Boundary nitrogen discharge QLDC_20251110 (QLDC)	QLDC provided
Figure A9 – QLDC Land Zoning	Operative District Plan Zones (QLDC)	https://experience.arcgis.com/experience/80c97d34e5764669bb9aab99e40d5b8d/page/Map-Navigator?views=District-Plan
Figure A10 – Property Ownership	NZ Property Titles Including Owners (LINZ)	https://data.linz.govt.nz/layer/50805-nz-property-titles-including-owners/
Figure A11 - Elevation	NZ 8m Digital Elevation Model (2012) (LINZ)	https://data.linz.govt.nz/layer/51768-nz-8m-digital-elevation-model-2012/
Figure A12 - Wells	Wells_Otago (ORC)	https://maps.orc.govt.nz/OtagoViewer232/?map=9869c74871aa4db390b6ffe2a49ac2c5
Figure A13 – Building Footprint	NZ Building Outlines (LINZ)	https://data.linz.govt.nz/layer/101290-nz-building-outlines/
Figure A14 – Road Parcels	NZ Primary Road Parcels (LINZ)	https://data.linz.govt.nz/layer/50796-nz-primary-road-parcels/

Figure A1 - Geology



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Study_Area_E02_Geological_Features_Scores

Score
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20
50
80
999

1:200,000

0 1.25 2.5 5 mi

0 1.75 3.5 7 km

Stats NZ, Esri, TomTom, Garmin, METI/NASA, USGS, Esri, CGIAR

Figure A2 - Slope

21/11/2025, 9:59:37 am

Study_Area_E01_LINZ_8m_Slope_Scores

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33	100
	999

1:200,000

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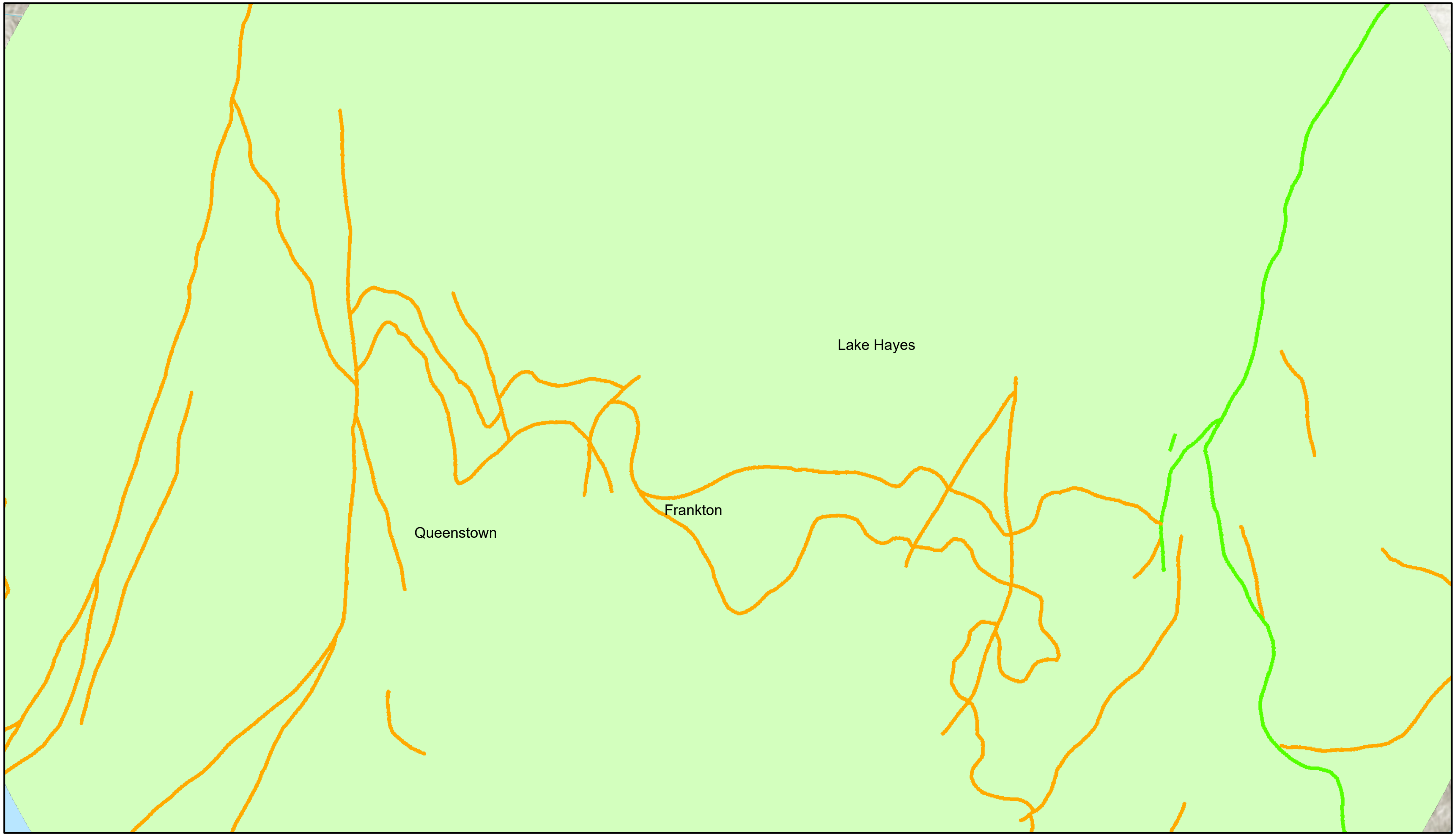
0 1.75 3.5 7 km

Stats NZ, Esri, TomTom, Garmin, METI/NASA, USGS, Esri, CGIAR

Figure A3 - Faultlines



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- 50

1:200,000

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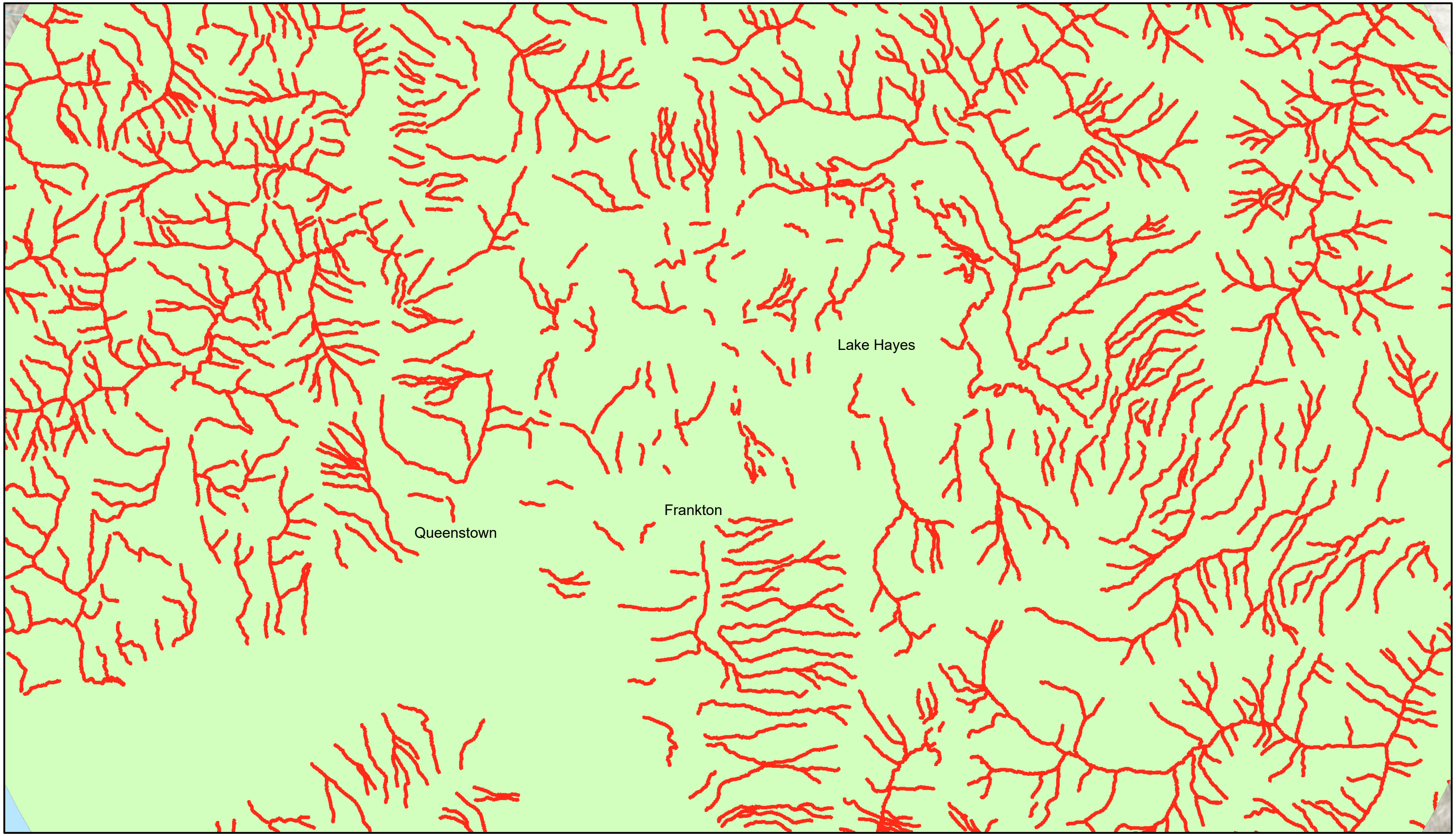
0 1.75 3.5 7 km

Stats NZ, Esri, TomTom, Garmin, METI/NASA, USGS, Esri, CGIAR

Figure A4 - River Centerlines



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Study_Area_E04_River_Centrelines_Buffer_50m_Scores

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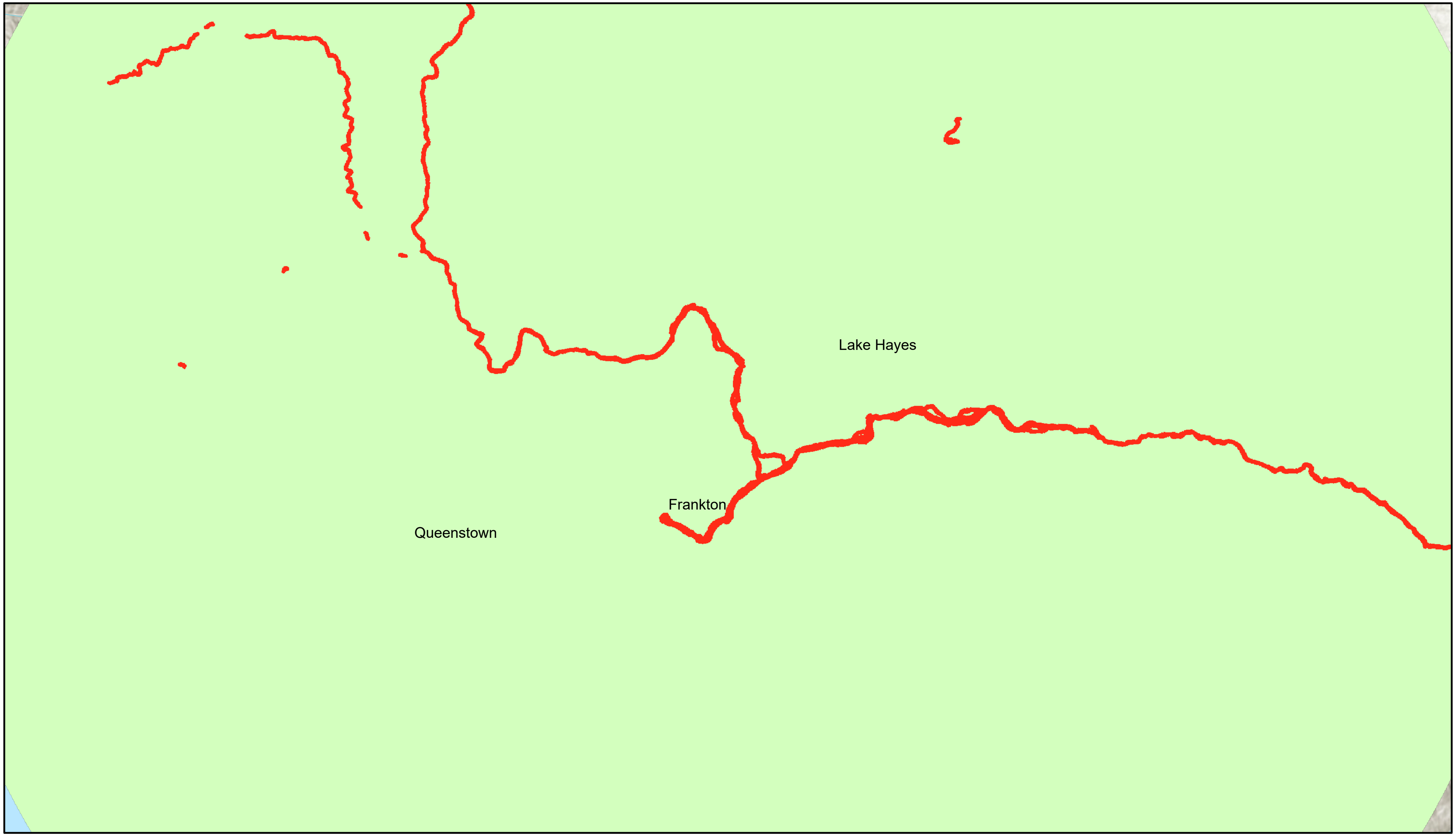
Figure A5 - River Polygons



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0

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Frankton

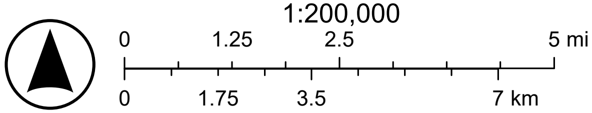

Figure A6 - Lakes and Ponds

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Study_Area_E06_Lake_Pond_Swamp_Scores

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999

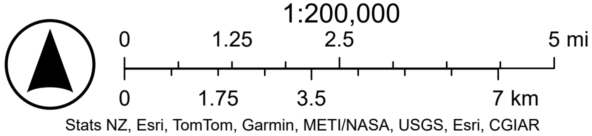

Figure A7 - Floodplains

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Study_Area_E07_Flood_Hazard_Area_Scores

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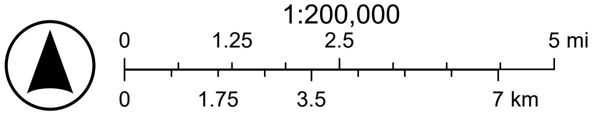

Stats NZ, Esri, TomTom, Garmin, METI/NASA, USGS, Esri, CGIAR

Figure A8 - Lake Hayes Nitrogen Discharge

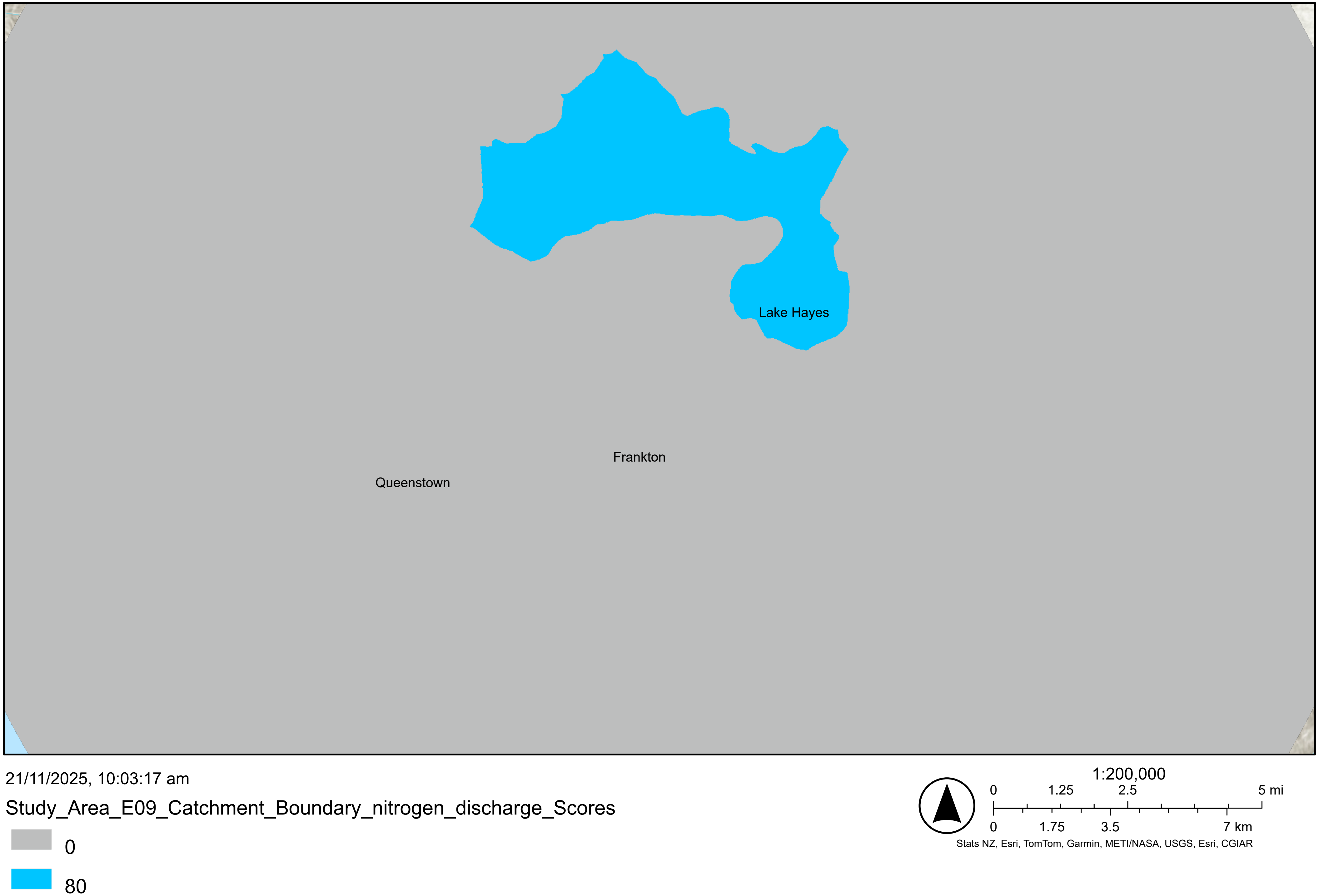

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Figure A9 - QLDC Land zoning

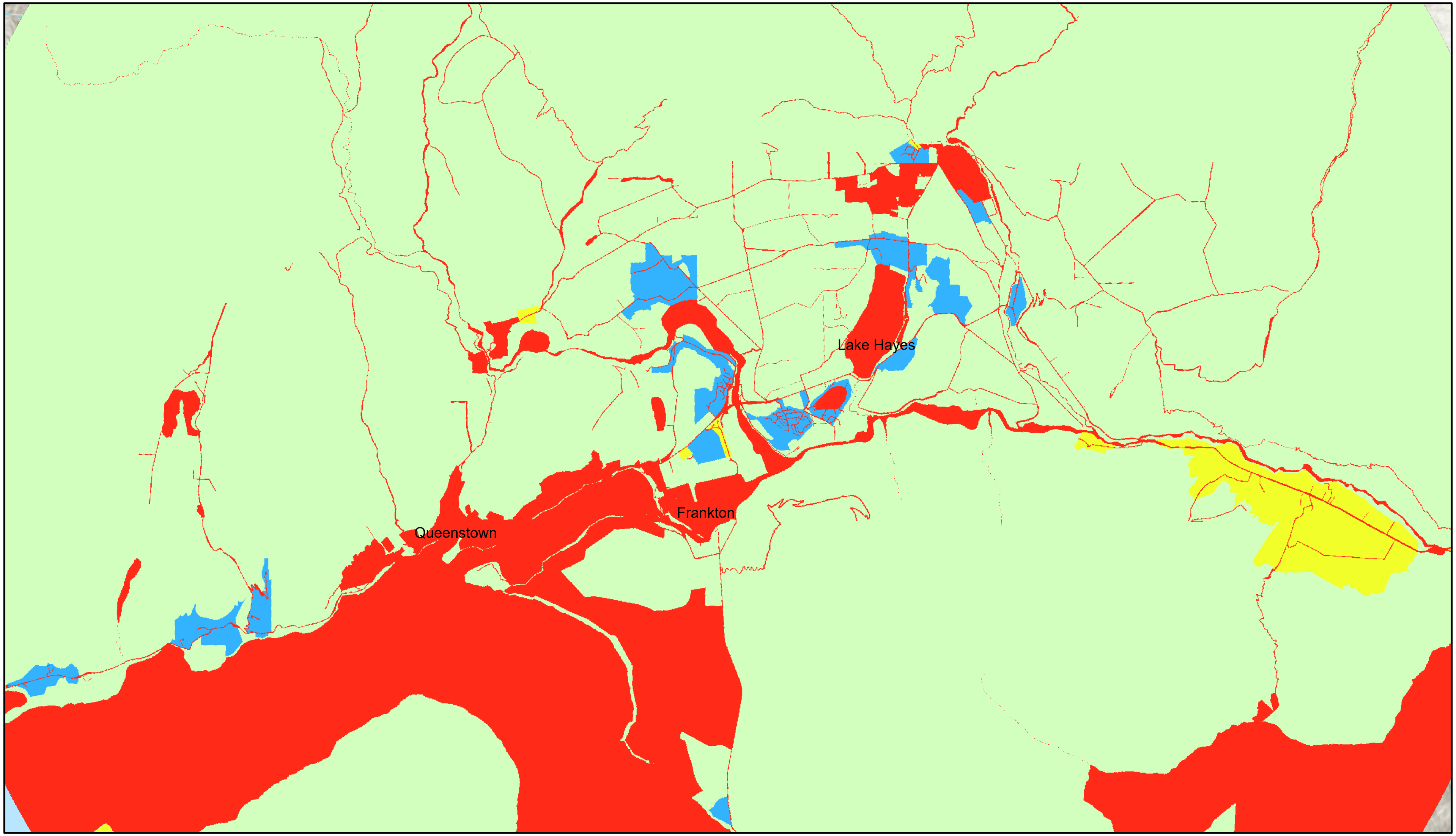

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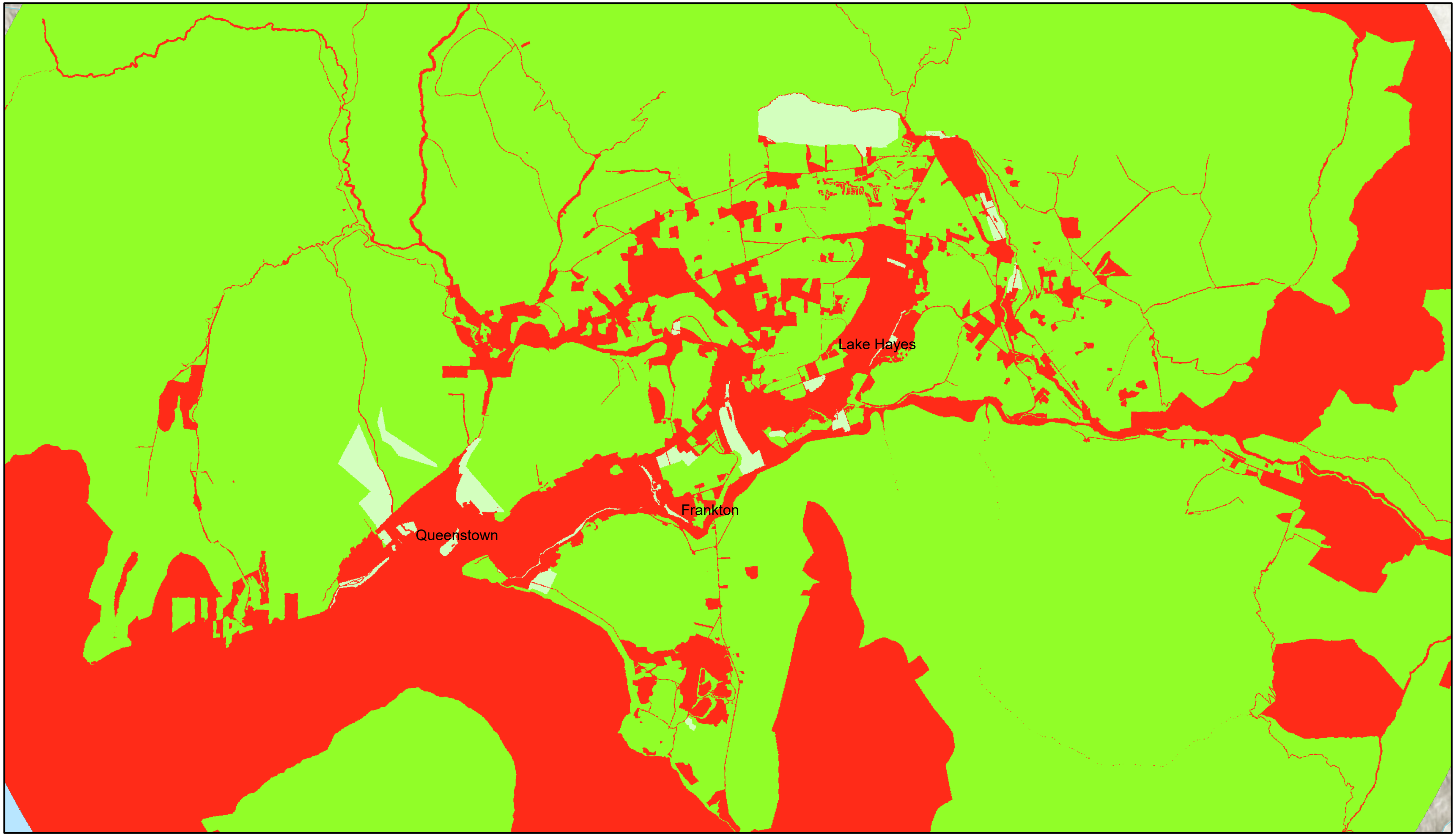
Figure A10 - Property ownership



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- 999

1:200,000

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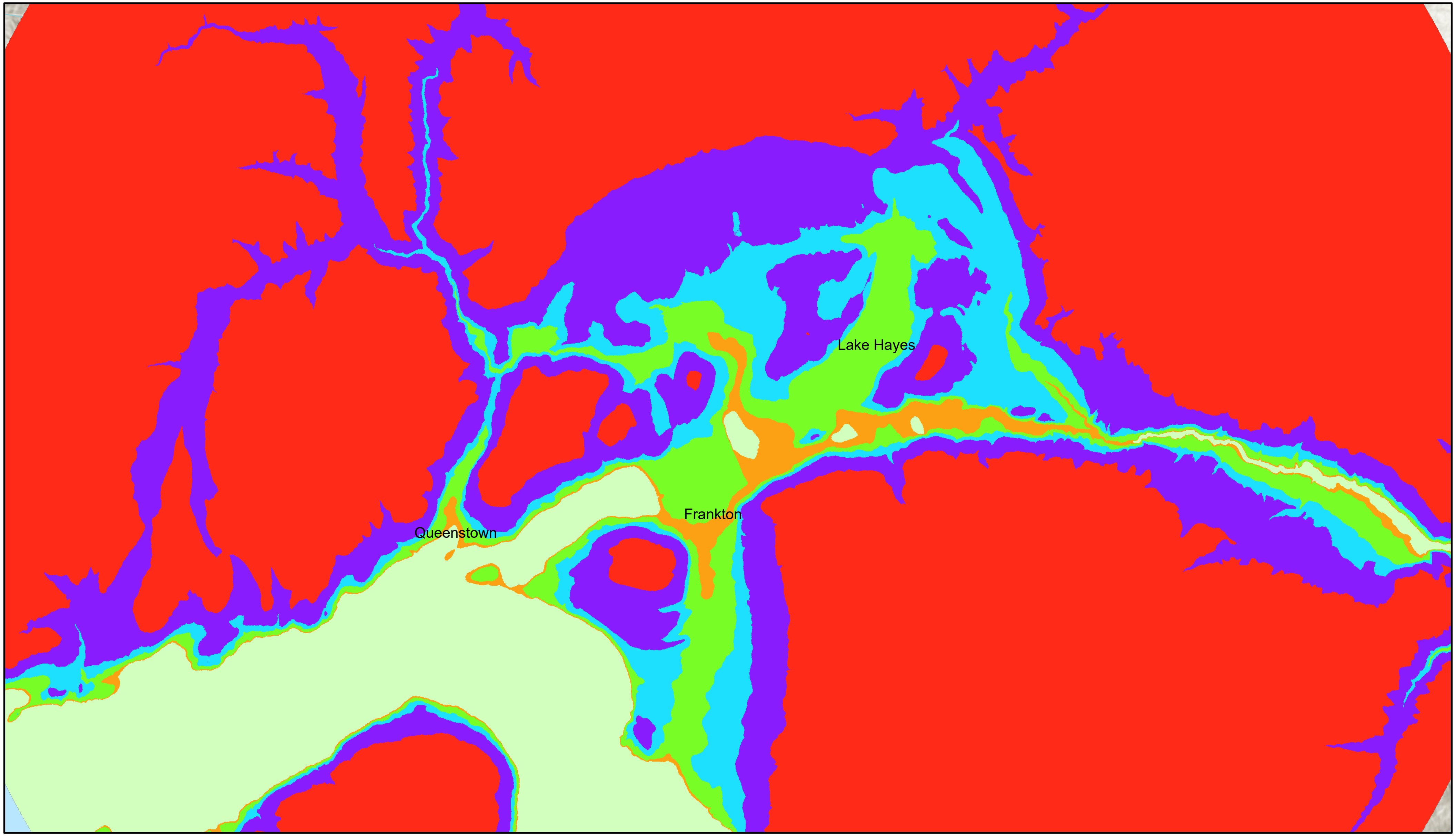
0 1.75 3.5 7 km

Stats NZ, Esri, TomTom, Garmin, METI/NASA, USGS, Esri, CGIAR

Figure A11 - Elevation



21/11/2025, 9:59:08 am

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- 50
- 75
- 100
- 999

1:200,000

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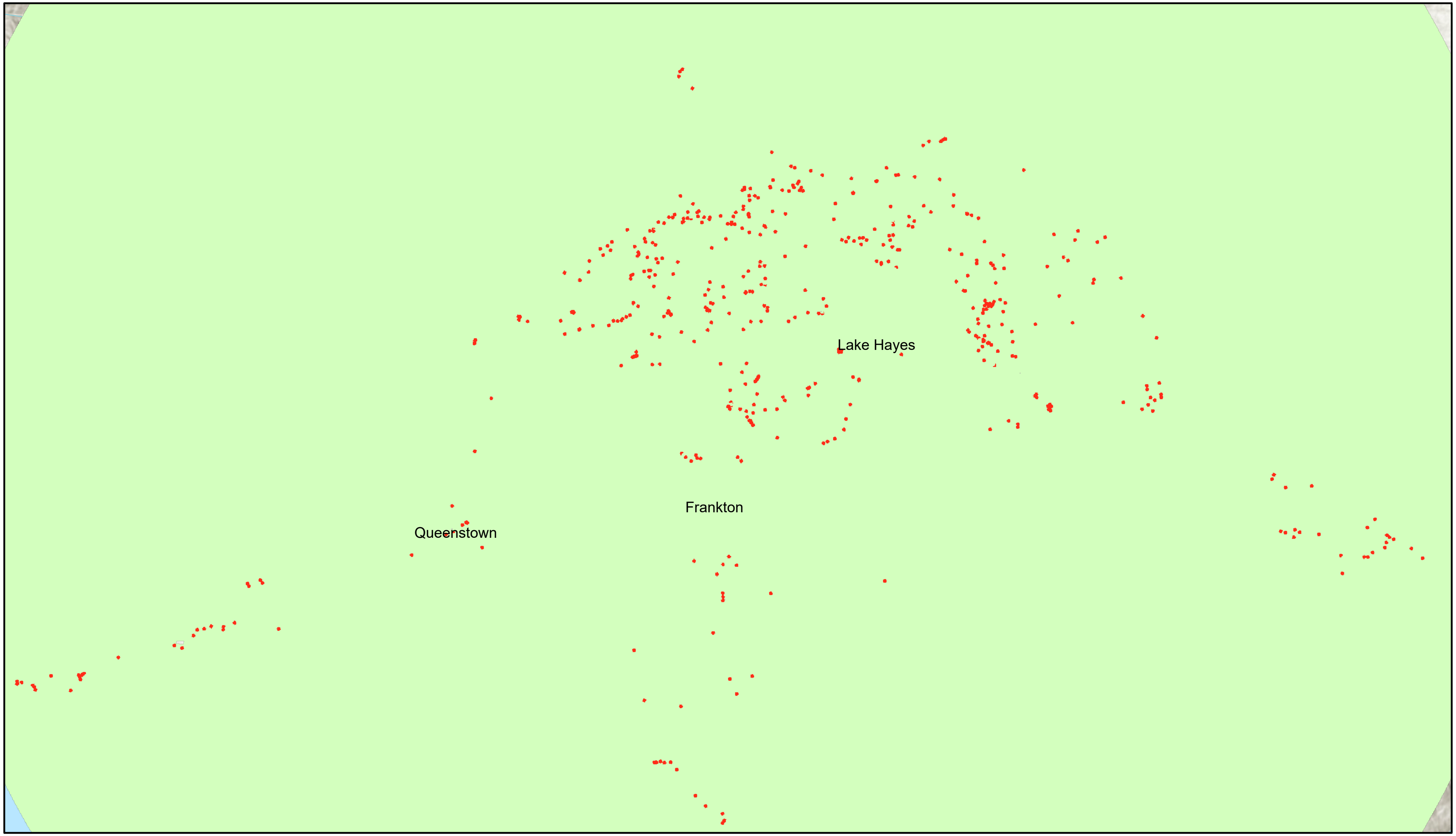
0 1.75 3.5 7 km

Stats NZ, Esri, TomTom, Garmin, METI/NASA, USGS, Esri, CGIAR

Figure A12 - Wells



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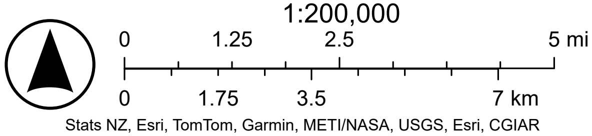
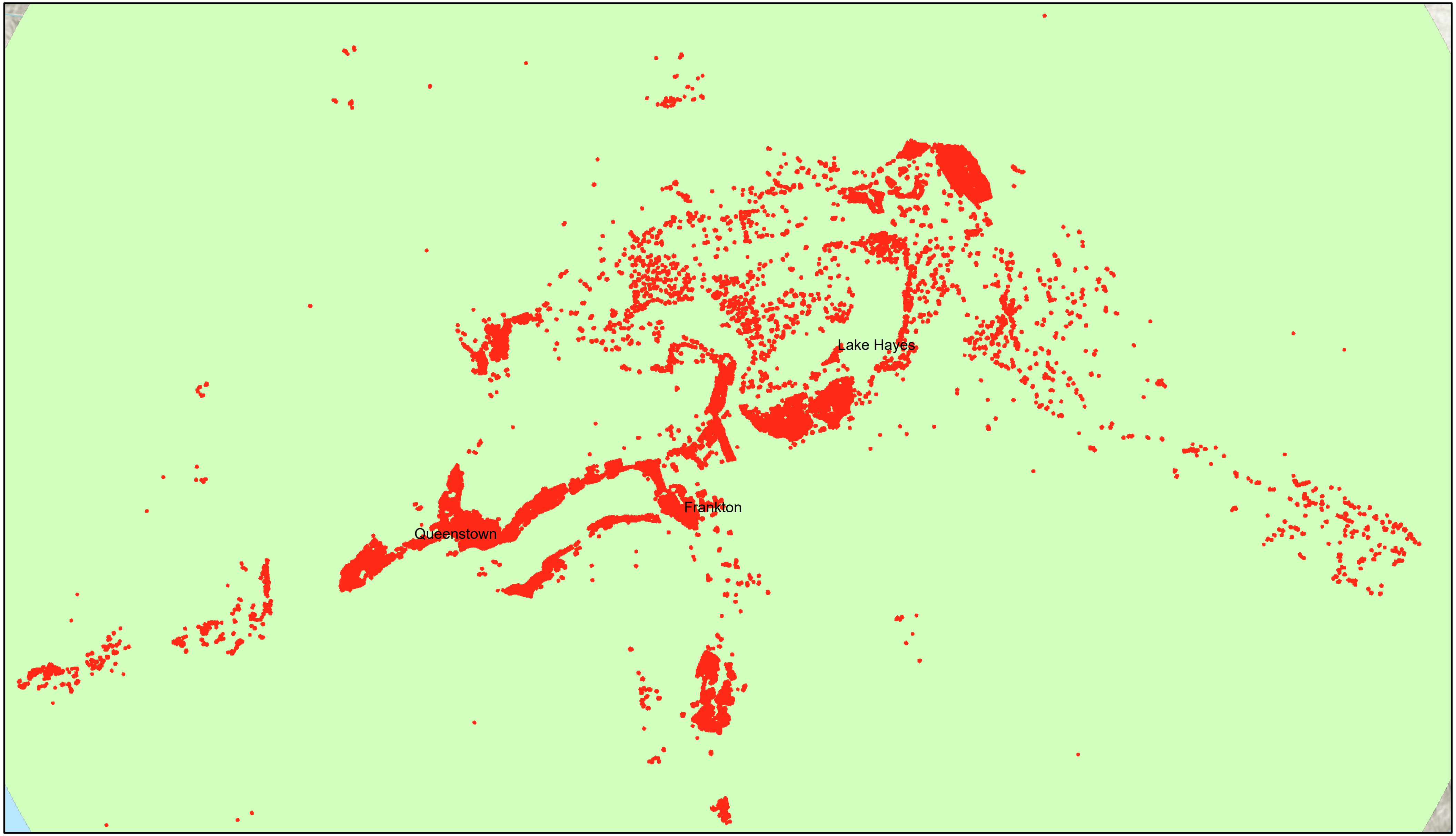


Figure A13 - Building footprint



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999

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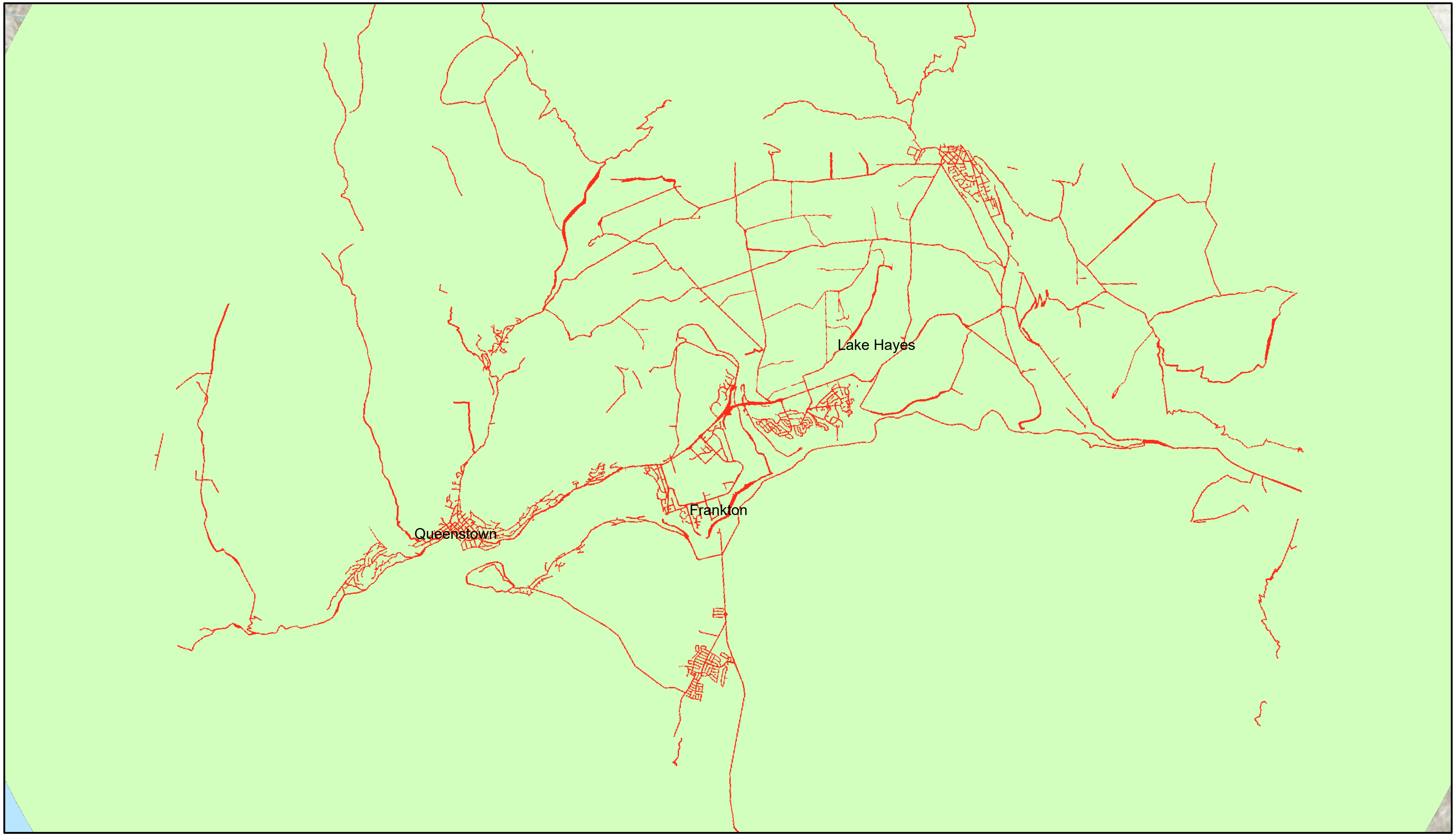
Stats NZ, Esri, TomTom, Garmin, METI/NASA, USGS, Esri, CGIAR

Figure A14 - Road parcels



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Study_Area_B02_Road_Parcel_Scores

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999

1:200,000

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0 1.75 3.5 7 km

Stats NZ, Esri, TomTom, Garmin, METI/NASA, USGS, Esri, CGIAR

Project name	Shotover WWTP Disposal Field Alternative Discharge
Document title	Report
Project number	12645246
File name	12645246 REP Land disposal assessment.docx

Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S4	Rev 0	Dusk Mains	Anthony Kirk		Ryan Orr		26/11/25

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