

Wastewater standards cost efficiency case studies – Small Treatment Plants

Final

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Executive Summary

This document outlines a commissioned study undertaken by AFAS for the Department of Internal Affairs (DIA), exploring how national wastewater environmental performance standards can enhance cost and time efficiencies in small wastewater treatment plants (serving fewer than 1,000 people). Drawing on case studies from Southland, Horowhenua and Thames Coromandel District Councils, the report provides councils with insights for infrastructure investment planning, Water Service Delivery Plans and Long Term Plans (until they are replaced by Water Service Strategies for the water infrastructure investment components).

The existing system faces several critical issues. The plant-by-plant consenting approach is not only costly but also inefficient, with councils dedicating substantial resources to technical assessments, stakeholder consultations, and legal processes. Additionally, the lack of uniformity in treatment requirements and consent conditions across regions complicates compliance and prevents economies of scale in infrastructure design and procurement. Much of the wastewater infrastructure, now 30–40 years old, urgently requires upgrades, yet delays in consent renewals, some plants operate on expired consents for many years, worsen environmental and public health risks. Furthermore, inconsistent monitoring and reporting practices hinder performance benchmarking and accountability.

The analysis reveals that national standards could result in substantial cost reduction across the entire lifecycle of wastewater treatment plants in the order of 40 percent to 60 percent for consenting and design, with the main (but not only determinant) being if the discharge is to land or water. This would potentially reduce costs by approximately \$300,000 per project, with the projected cost savings for consenting and design for the 48 plants having expired consents amounting to \$16.8m. The total projected cost reduction for consenting and design for the further 62 plants that have consents expiring by 2030 amounts to \$21.7m.

Equally, the potential time reduction would be significant particularly for the consenting and design processes. The case studies strongly suggest that the current time periods could again be reduced by between 40 percent to 60 percent which in many cases would remove years from the overall process. Again, the extent of the time reduction is dependent upon whether the discharge is to land or water.

The case studies also identify common challenges potentially faced by councils, including the increased complexity of operations and potential operational cost increases. Southland District Council (SDC), in particular, anticipates higher ongoing operational costs due to additional reporting requirements and more complex monitoring procedures, while Horowhenua District Council (HDC) expressed concerns over community consultation during the consenting process. However, both councils report benefits from simplified design and consenting timelines, which contribute to overall project delivery time reductions.

A notable trend across all case studies is the adoption of modular treatment plants, which present long-term cost savings and scalability, particularly for smaller communities. Thames Coromandel District Council's (TCDC's) experience with the Matarangi Wastewater Treatment Plant exemplifies this shift. The Matarangi plant, challenged by seasonal population fluctuations, struggles with effluent quality and regulatory compliance, particularly for nutrient discharge and pathogen control. However, the proposed standards offer a framework for more predictable and cost-effective solutions. Thames Coromandel District Council, like the other case study councils, anticipates potential cost savings and improved project delivery through national standardisation, despite concerns regarding discharge limits and community impact.

In summary, implementing national environmental performance standards for wastewater treatment plants can significantly improve both cost-efficiency and project delivery timelines for small communities. By adopting standardised, modular designs and streamlining regulatory processes, better alignment of infrastructure investment with actual demand can be achieved, ensuring compliance while avoiding over-investment in oversized infrastructure. The insights from the case studies indicate that while challenges remain, the adoption of national standards will offer long-term financial and operational benefits, fostering more resilient and cost-effective wastewater management systems.

Introduction

AFAS has been commissioned by the DIA, through the National Infrastructure Funding and Financing initiative, to assess how proposed national wastewater environmental performance standards could improve cost and time efficiencies in the design, consenting, construction, and operation of small wastewater treatment plants (serving fewer than 1,000 people).

This work aligns with the Local Water Done Well policy.

Purpose

The purpose of this report is to develop case studies that highlight potential cost and time efficiencies in designing, consenting, constructing, and operating small wastewater treatment plants under new national wastewater environmental performance standards. The report aims to provide councils with actionable insights to guide their wastewater infrastructure investment planning, particularly for their Water Service Delivery Plans as mandated by new water services legislation.

The case studies examine how the proposed standards impact each stage of wastewater treatment plant development, including regulatory approvals, financial planning, and long-term sustainability. By analysing real-world examples, the report offers practical recommendations for councils to enhance service delivery efficiency.

Scope

The case studies examine how the proposed standards impact each stage of wastewater treatment plant development, including regulatory approvals, financial planning, and long-term sustainability. By analysing real-world examples, the report provides practical recommendations for councils to enhance service delivery efficiency.

The project focuses on small wastewater treatment plants serving communities of 1,000 or fewer people. It includes case studies from three specific geographic areas: Southland, Horowhenua and Thames Coromandel. Areas of investigation include:

- Evaluating how national standards influence cost savings across the wastewater treatment plant lifecycle, from design and consenting to construction and operations.
- Examining economies of scale, procurement efficiencies, and workforce development strategies.
- Assessing modular design solutions available in New Zealand.
- Conducting a stocktake of existing small wastewater treatment plants.
- Identifying regulatory benefits and mapping their realisation for the Department of Internal Affairs and the Water Services Authority – Taumata Arowai (WSA).

Figure 1: Report Scope

1. Plan

- Consider how investment planning decisions (e.g. LTP) for type of plant, location and timing of investment in wastewater infrastructure could lead to efficiencies with the standards in place.

2. Design

- Consider how wastewater standards (and infrastructure design solutions) could lead to cost efficiencies where less engineering bespoke design and options analysis are required.
- Consider use of standard and modular design for wastewater infrastructure plants and components.
- Consider level of treatment and where small plant standard could be used for existing plants.

3. Consent

- Look at how wastewater standards will streamline the consenting process and lead to cost efficiencies - reduced fees and staff time, less time for notification and hearings.
- Consider how infrastructure design solutions could further streamline the consenting process and reduce costs.
- Look at cost savings that might be achieved where consenting pathways are streamlined with less consultation and refinement needed on options.

4. Procure

- Consider procurement approaches such as global/catchment approaches to consenting.
- Consider how standardisation of wastewater infrastructure can lead to procurement efficiencies.

5. Build

- Look at where standard and modular design could be used to save costs.
- Look at cost savings where new plants or upgrades are designed to meet the national standards.

6. Operate

- Consider how standardisation might lead to less need for investment in inventory and wider ranges of spare parts.

7. Monitor

- Consider cost savings where a national set of standardised conditions are developed for the wastewater standards and monitoring arrangements can be streamlined and nationally reported.
- Consider how the use of standard and modular designed wastewater plants might allow remote/smart monitoring.

8. Support

- Consider how wastewater workforce training and development could support regional or national cost efficiencies.

The report does not explore in detail:

- The beneficial reuse of biosolids on land.

- Arrangements for risk-based monitoring and reporting for wastewater network overflows and bypasses.
- The potential opportunities arising from Supervisory Control and Data Acquisition (SCADA) and telemetry.
- Existing Treaty Settlement obligations but noting that the proposed consenting process will still involve mana whenua.
- Implications related to Te Mana o te Wai.
- The impact of Statutory Acknowledgements under the Ngai Tahu Claims Settlement Act 1998. The treatment of Statutory Acknowledgements under Local Water Done Well legislation has yet to be determined.
- Considerations of air, energy, or waste introduced by third parties into a wastewater network.

Approach

This report has been prepared within a constrained timeframe.

A variety of sources were used to compile the information presented, including a high-level desktop review and literature analysis. These provided contextual background and supporting evidence for the review.

Councils were invited to participate in case studies. Southland, Horowhenua and Thames Coromandel District Councils actively contributed to the study. Their input provided insights into the operational and regulatory challenges associated with small wastewater treatment plants.

Modular plant manufacturers were invited to contribute. The focus being how they saw the proposed changes from a commercial aspect with a particular focus on the wider implementation of modular plants.

McConnell Dowell were engaged to provide independent technical input and to support the development of the report.

The WSA provide advice and support through the provision of background information and data.

BECA provided details of previous work undertaken and review of the report.

Limitations

Whilst the approach adopted provides significant insights, there are a number of limitations noted below:

- The desktop and literature review were not in-depth and were based around readily available documents and those provided by the DIA.
- There has been limited time to finesse case studies and to undertake significant depth of research. As such the report has been framed around the information available at the end of March 2025.
- The Councils participating in the case studies were challenged around estimating the cost and time efficiencies arising from the proposed changes. Some areas, such as the changes arising from consenting, were easier to quantify, but those arising from proposed infrastructure design solutions that have not yet been developed in detail, provided a harder challenge.
- The findings contained in this report will not necessarily capture the unique circumstances faced by every council who operate one or more small wastewater treatment plants. Equally the cost and time savings identified through the case studies and other sources may not reflect what may be achieved in all cases. They do, however, provide guidance for councils on what it may be possible to achieve and enable them to reflect this onto into their own small wastewater plant portfolios.
- The report has been written alongside a broad consultation on the proposed changes and standards. It is anticipated that some of the currently proposed performance standards may change.

Background

Context

New Zealand faces a significant investment deficit in its three waters infrastructure (drinking water, wastewater, and stormwater). The assets are valued at approximately \$40 to \$50 billion, with estimates suggesting a need for \$120 to \$185 billion in investment over the next 30 years to address aging infrastructure, meet current environmental standards, and prepare for future growth.

The funding for investment in three-waters infrastructure has generally been through councils, who rate residents for the cost of capital investment, as well as operations and maintenance. Historically, this investment has been insufficient due to competing demands and public resistance to council rate increases. Additionally, expectations around the environmental performance of infrastructure have grown, particularly for wastewater systems. This has resulted in a demand for increased treatment standards, a shift toward land-based discharges, and a reduction in overflows.

Wastewater infrastructure is under significant strain due to aging systems, inconsistent consenting processes, and escalating costs. There are 334 publicly owned waste water treatment plants, and approximately 60 percent of these are scheduled to renew their wastewater consents over the next decade. Around 50 percent of council-owned wastewater treatment plants serve small communities with populations of 1,000 or fewer, where design and consenting costs constitute a significant portion of the overall expense.

Sapere published a review in July 2021 into the cost of consenting infrastructure projects in New Zealand, commissioned by the New Zealand Infrastructure Commission.

Depending on the type of project, Sapere estimated that 5.5 percent of the project budget is spent on obtaining a resource consent, with this figure rising to 15.9 percent for smaller projects. This increase is partly due to consenting authorities becoming more risk adverse and requiring more information on potential impacts. Additionally, there is often inconsistency between consent conditions for similar activities. New Zealand has a costly, high risk and time-consuming planning environment.

The frustrations experienced by councils in navigating the current resource consent processes were strongly reflected in the case studies included in this report, and this sentiment was echoed in general conversations with council staff.

The government has acknowledged the changing paradigm and recognised the need to balance community affordability with environmental protection. Through the Local Water Done Well legislation, the government aims to streamline the resource consenting process and the delivery of three-water infrastructure. By developing a suite of environmental performance standards for wastewater treatment plants, encouraging the adoption of infrastructure design solutions, and simplifying the consenting process, the government seeks to support councils in delivering affordable and practical solutions for wastewater treatment.

Figure 2: Example of Consenting Costs

Case study: a wastewater treatment plant

The applicant firm applied for resource consents to build a new wastewater treatment plant. They sought consents to extract water from a river to use for sterilising wastewater and cleaning, as well as consents to discharge water back into the river.

This consent had a public hearing, with submissions received from three parties. The applicant noted they did a lot of preparation work designing a proposal that they thought would get consented.

There was some disagreement about the investment schedule, with the council wanting upgrades within five years, rather than by Year 15. In the end the parties reached an agreed outcome – which still involved bringing forward some planned infrastructure upgrades.

The firm said the 10% of the project budget spent on consenting was similar to other similar projects and was reasonable in the circumstances. The firm observed that the environmental impact of a poorly designed wastewater treatment plant could have been serious and they considered it a 'cost of doing business' to ensure the local authority and community has any concerns addressed in a transparent manner.

Costs incurred for resource consent: \$1,537,000 (10% of project)

- \$258,000 in Council fees
- \$971,000 spent on external experts to assist with the application
- \$108,000 spent on external experts and legal fees for the hearing
- \$200,000 spent on internal staff time
- Application duration: 23 months
- Total budget for project: \$15,000,000

Overview of Small Wastewater Treatment Plants

There are currently 168 wastewater treatment plants serving populations of less than 1000 people; 82 of these plants serve a population of less than 300.

Treatment Categories

- 14 plants provide only a primary level of treatment.
- 95 plants provide a secondary level of treatment.
- 39 plants provide a tertiary level of treatment.
- 20 plants provide a tertiary level of polishing.

Discharge Categories

- 71 plants discharge to land.
- 70 plants discharge to water/coastal.
- 25 plants discharge to both land and water.
- 2 information unavailable.

Resource Consents

- 215 Resource Consents for discharge to land, or water/coastal.
- 48 Expired Consents.
- 62 Consents expire by the end of 2030.
- A further 27 Consents expire between 2030 and the end of 2035.

Local Water Done Well

The Local Water Done Well legislation is a comprehensive initiative aimed at reforming New Zealand's water services system. Its primary purpose is to ensure sustainable, efficient, and community-focused water service delivery by council ownership and establishing a robust framework for long-term management. This legislation addresses the shortcomings of previous reforms and prioritises local governance, accountability, and infrastructure resilience.

The legislation is being implemented in three stages, each supported by specific legislative measures:

- Water Services Acts Repeal Act (February 2024).
This Act repealed the previous government's water services legislation, restoring council ownership and control of water services. It marked the first step in transitioning away from centralised models, ensuring councils retained responsibility for water infrastructure and service delivery.
- Local Government (Water Services Preliminary Arrangements) Act (September 2024).
The Act establishes the foundational framework for the Local Water Done Well initiative. It introduces preliminary arrangements for the new water services system, including governance structures, funding mechanisms, and transitional support for councils.
- Proposed Local Government Water Services Bill (Introduced December 2024).
The third and final Bill, introduced to Parliament in December 2024, sets the enduring settings for the new water services system. It focuses on long-term sustainability, regulatory oversight, and performance standards to ensure consistent, affordable and high-quality water services across New Zealand.

As of March 2025, the legislative process is advancing as planned. The first two Bills have been enacted, and the proposed Local Government Water Services Bill is under parliamentary consideration.

Regulatory Consenting of Wastewater Treatment Plants

The existing provisions for the consenting of wastewater treatment plants under the Resource Management Act 1991 (RMA) is a frustrating, costly and time-consuming process. A previously study undertaken by Sapere has highlighted the issues;

- The consenting experience varies and is rarely consistent.
- Consenting authorities often reply heavily on expert advice, and this is making consenting more complex and costly.
- Consenting authorities often focus on negative local impacts without giving due weight to the wider societal benefits.
- Renewal and minor upgrades of assets and re-consenting usually also incur high costs and extended timelines.
- Project design is a consenting issue, with optimal designs often being compromised to ensure a smooth consenting path.
- Consenting costs are ten times higher for projects that require a public hearing.
- National Policy Statement (NPS) or National Environmental Standards (NES) are not reducing uncertainty but often adding to complexity.

Alongside this, a report prepared for the Ministry of Environment by BECA, GHS and Boffa Miskell in October 2020, highlighted inconsistency in terms of monitoring parameters, reporting, and the use of compliance limits.

The main legislative changes to the consenting of wastewater treatment plants proposed in the Local Government (Water Services) Bill are:

- Resource consents must give effect to the standards; the consent authority must not impose conditions on a resource consent that are more or less restrictive than the standard, unless the activity falls within an exception. Where an exception applies, the consent application would be processed in accordance with the relevant RMA requirements.
- The standards will take precedence over any RMA instruments including any national environmental standard, national policy statement, the New Zealand Coastal Policy Statement, regional plans, regional policy statements, and district plans. Existing rules in these plans or policy statements that conflict with or duplicate the standard will need to be amended or removed.
- The standards can set the duration that a consent holder can continue to operate under an expired consent
- The standards may specify the consent activity status of the activity that is controlled by a wastewater standard.
- A resource consent for an activity subject to a standard will not be subject to public or limited notification.
- A consent authority may review consent conditions under section 128 of the RMA in the case of any resource consent for an activity that is regulated by a wastewater standard.
- Where a wastewater network infrastructure proposal meets the requirements of a national wastewater environmental performance standard, the resource consent must specify a consent term of 35 years.
- Any consents for wastewater treatment plants that would have lapsed within the first two years, will have consent duration extended so that they expire two years after the commencement of the Bill.

In March 2025, a Report from the Expert Advisory Group on Resource Management Reform was published. This was entitled "Blueprint for resource management reform – A better planning and resource management system 2025". The document signalled recommended changes to existing planning and consenting legislation, which if enacted, will simplify and streamline the planning and consenting environment.

The main recommendation for replacing the existing Resource Management Act is to develop new legislation in two separate Acts:

- A Planning Act focused on regulating the use, development and enjoyment of land.
- A Natural Environment Act (NEA) focused on the use, protection and enhancement of the natural environment.

In respect of small wastewater treatment plants, the key signal is the recommendation to establish a national regulator (with regional presence) to undertake compliance and enforcement. This will enable single governance entity responsibility, guided by nationally consistent policies, procedures and decision-making.

A national entity will provide significant opportunities in terms of economy of scale to retain the specialist skills required and is likely to be financially more efficient. The national regulator's functions would include the full range of compliance and enforcement activities currently undertaken by councils, including compliance monitoring, complaint and environmental-incident response, and enforcement. The legislation would enable the transfer of compliance functions to the relevant regional or local authority if that was the most efficient and effective implementation approach.

This proposal aligns with the current shift towards centralisation and standardisation of consenting and compliance activity, removing uncertainty for councils and providing greater transparency

Proposed Wastewater Environmental Performance Standards

The proposed Local Government Water Services Bill, amends the Water Services Act and the RMA to provide for defined standards for wastewater environmental performance. The standards encompass discharge to water and land, the beneficial use of biosolids, and overflows and bypasses. The proposed standards do not include discharge to air, energy use or waste introduced by a third party into the wastewater network. Standards to cover these parameters may be developed in the future.

The WSA commenced a consultation on the proposed wastewater environmental performance standards on 25 February 2025, which closed on 24 April 2025. The standards seek to streamline the process for future consents by streamlining the process and ensuring greater transparency, particularly around the standards to be achieved.

The proposed standards will:

- Make wastewater consenting more cost effective while protecting public health and the environment.
- Create national consistency to enable greater certainty for the planning and funding of wastewater upgrades.
- Improve the availability of wastewater performance data through standardisation and commonality, delivering greater transparency.
- Support councils and communities in decision making through improved cost information and defined treatment requirements.

Small Plant Standard

Small wastewater plants have been defined as those serving 1000 people or less, or more specifically where the mean annual influent carbonaceous Biochemical Oxygen Demand over five days (cBOD5) \leq 85kg day.

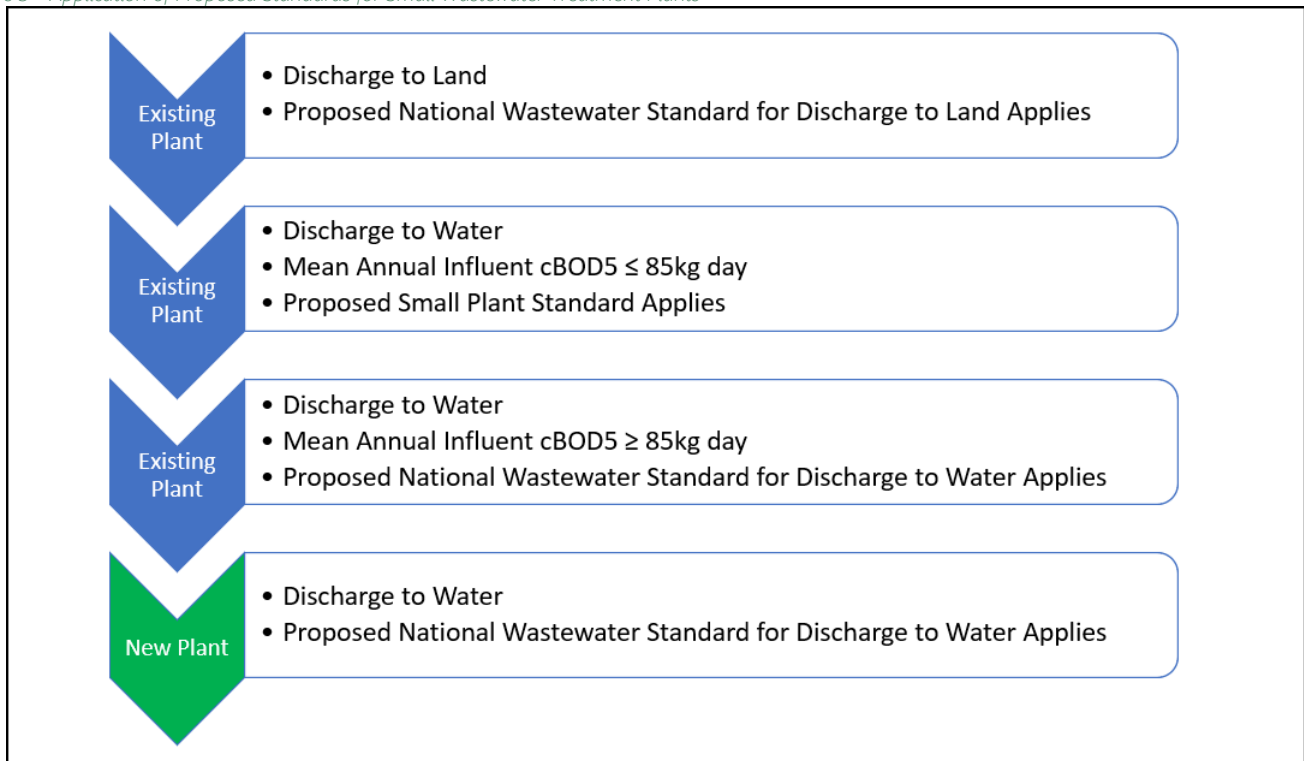
The proposed small plant standard reflects a tailored approach to wastewater management for small communities, recognising their unique challenges and lower environmental impact. By focusing on practicality, the standard removes or reduces treatment requirements for parameters that are less critical in small, isolated settings. However, it maintains an emphasis on environmental protection, particularly through the retention of the ammoniacal nitrogen standard due to its toxic nature.

The exclusion of new plants from the small plant standard ensures that future resource consent renewals reflect the realities and risks of small plant operation, with infrastructure designed to meet appropriate environmental standards, aligning with broader sustainability goals. This approach balances the needs of small communities with the need to protect water quality and ecosystems.

Application of the Proposed Performance Standards for Small Wastewater Treatment Plants

For small wastewater treatment plants there are different performance standard pathways depending on whether the proposal is for a new plant, or upgrades to an existing plant, and whether the receiving environment is to water or land. This is illustrated in Figure 3.

Figure 3 - Application of Proposed Standards for Small Wastewater Treatment Plants



There are a number of exceptions to the proposed national standard that would potentially impact upon the small plant standard:

- Discharges to rivers or streams with very low dilution - this will be the case for any discharge into minor watercourses and/or farm drains, particular in times of drought.
- Discharges into natural wetlands (i.e. those which are not part of the treatment process for the wastewater discharge).
- Discharges within 1000m upstream or 100m downstream of human drinking water abstraction points in rivers.

Mitigating these exceptions will require additional investment that would increase time and cost (i.e. piping farm drains).

Further consideration will need to be given to how the published performance measures for treated effluent discharge from small WWTP and the future stormwater performance measures will inter-relate.

Infrastructure Design Solutions

Infrastructure design solutions will standardise the design and operational requirements for modular wastewater treatment plants or their components, ensuring compliance with national wastewater environmental performance standards. The solutions are akin to Acceptable Solutions under the Water Services Act and the Building Act, providing a clear framework for compliance.

The WSA is tasked with developing the infrastructure design solutions. These solutions will be based on the proposed wastewater environmental performance standards. The initial focus will be on treatment plants for small communities (e.g., those serving populations of less than 1,000), which represent approximately 50 percent of council-owned wastewater plants. The solutions will include provisions for exceptions, activity status, consent duration, and compliance requirements, ensuring that they are adaptable to local conditions.

The infrastructure design solutions will establish technical performance standards, treatment processes, design requirements, and operating requirements for wastewater infrastructure. Compliance with these solutions will serve as evidence of meeting the relevant wastewater or stormwater environmental performance standards. The solutions may also specify the RMA activity status for certain activities, such as designating the discharge from a treatment plant as a controlled activity. Some activity statuses may be subject to change as part of the current resource management reforms.

Resource consent applicants will have the option to rely on an infrastructure design solution. When a solution is used, regional councils will be required to process and determine resource consents in accordance with the provisions of the solution. However, the solutions may identify specific circumstances where their use is not appropriate, such as when certain site characteristics are present. In such cases, matters not regulated by the solution will continue to be processed by regional councils under existing RMA requirements, relevant planning documents, and environmental performance standards.

The implementation of infrastructure design solutions will generate benefits for councils, through reduced costs associated with the provision of water infrastructure, streamlined design and consenting processes, and minimised regulatory compliance requirements. These cost savings can be passed on to ratepayers.

Cost savings are anticipated through several mechanisms. The use of solutions during the consenting process for modular treatment plants and upgrades may specify the activity status, such as designating certain activities as controlled, thereby reducing the need for extensive options analysis and public notification. Capital expenditure for new plants or modular upgrades to existing plants will be lower compared to bespoke design approaches. Modular, off-the-shelf components will further reduce design, construction, and procurement costs, enabling faster delivery of treatment plants. Standardised designs agreed upon at the outset of the process will provide greater certainty for councils in estimating construction costs. Finally, monitoring, compliance, and enforcement processes will be simplified, further reducing administrative requirements.

Additional benefits can be expected through cheaper spare parts readily available for standard solutions (reducing downtime), communality of training and operations requirements. This can streamline efficiencies in training centres for operators and maintenance staff, encourage staff exchange and knowledge transfer.

Summary of Findings

The case studies in the appendices have been prepared on a best-effort basis and are framed around local experience and conditions. Most of the predictive cost and time estimates have been estimated, so they should be considered indicative only. Where extrapolation has been used the results can only be taken as providing a general direction of travel.

There was reluctance to provide cost and timing data for Infrastructure Design Solutions due to the underdeveloped details behind these elements.

In addition to the case studies, several other councils were consulted. Wastewater staff were unanimously supportive of the proposed regulatory changes and the introduction of national environmental performance standards for wastewater. They see a significant opportunity to provide a predictable, consistent, and affordable wastewater service to their communities.

What has become apparent is that each wastewater plant is unique. Each one has its own particularly set of circumstances and local factors that impact upon performance. Standardisation will remove uncertainty around what level of performance needs to be achieved, but the challenge will continue to be the optimal processes to be used to meet compliance criteria

Though outside the direct scope of this report, it will be interesting to gauge how councils will implement the proposed changes within their existing consultation and engagement policies, particularly in respect of increased community expectations around the disposal of effluent to land. The proposals set minimum standards and councils can elect to exceed those standards.

Southland District Council

SDC provided comprehensive data for this report. Whilst the three plants chosen for the case study discharge to water, SDC undertook the theoretical assessment of potential cost and time savings based on land disposal. The full case study is included in Appendix A.

The case study provides a detailed assessment of the current state and future needs of three representative small wastewater treatment plants, Edendale-Wyndham, Balfour, and Nightcaps, within a district context marked by low population density, aging infrastructure, and tightening compliance expectations.

The Edendale-Wyndham plant stands out for serving a combined population exceeding 1,200 and facing complex regulatory considerations due to its discharge to the Mataura River, a waterbody of considerable statutory and ecological significance. The plant's current treatment configuration, a hybrid BioFiltro system incorporating primary sedimentation and Ultraviolet (UV), has struggled to consistently meet both discharge volume constraints and prospective performance standards. Actual discharge volumes have repeatedly exceeded design limits, revealing the inadequacy of original flow assumptions and the need for recalibrated planning assumptions. While existing performance is largely acceptable under current consents, future compliance will depend on a shift to more robust technologies such as Membrane Aerated Biofilm Reactors (MABR). The modularity and scalability of MABR, alongside its cost-effective footprint, formed the basis for its selection over textile filter-based options, although the projected capital expenditure remains significant.

At Balfour, the core issue is not only technical underperformance but vulnerability to inflow and infiltration, particularly under high groundwater conditions. This recurring challenge distorts the relationship between population served and actual hydraulic load. The current plant configuration, comprising an Imhoff tank and trickling filter, is unable to reliably manage surges in flow, thereby undermining treatment efficiency and inflating future upgrade costs. SDC's investment in targeted network renewal works is a necessary first step, designed to improve the cost-benefit ratio of subsequent modular plant options. A multi-technology upgrade pathway was shortlisted, with the preferred solution comprising modular bed reactors, anoxic treatment stages, carbon dosing, and UV disinfection, augmented by a pressurised sewer network to exclude infiltration volumes. This integrated approach enables compliance with more stringent nutrient and pathogen limits while managing spatial and environmental constraints.

Nightcaps presents a more constrained picture, both in terms of available information and treatment capacity. Serving under 300 residents, the plant operates with a basic pond and rock filter configuration. While performance against current consents is adequate, the absence of recent monitoring data limits the ability to rigorously forecast compliance risks under the proposed Small Plant Standards. Given the moderate dilution setting of the Wairiro Stream, future compliance, particularly for ammoniacal nitrogen and Escherichia coli (E.coli), is likely to become more challenging as growth occurs. Although design upgrades are being contemplated, they remain speculative without firm data on inflows, effluent quality, or site constraints. The conclusion is that future investment will be needed to preserve compliance and performance, particularly if discharge limits are tightened or if upstream catchment development accelerates.

A shared theme across all three plants is the disproportionate impact that even moderate regulatory shifts have on small communities with legacy infrastructure. The proposed national environmental performance standards expose weaknesses in hydraulic capacity, treatment capability, and consent compliance. The ability to respond effectively is often hampered by low ratepayer bases, elevated per-capita costs, and limitations in local workforce capacity. The study highlights the practical value of modular systems that can be scaled, staged, and adapted to site-specific needs, but also makes clear that such systems are not a panacea unless underlying network vulnerabilities, particularly infiltration, are resolved. Cost assessments for each plant consistently show that status quo investments are unlikely to deliver future compliance, and that higher upfront costs may be offset by operational resilience and regulatory certainty.

Figure 4 - Summary Assessment of potential time and cost reductions for consenting and design.

	Activity	Status Quo	Small Plant Standard - Water Discharge		National Performance Standard - Land	
			Cost Reduction (\$)	Cost Reduction (%)	Cost Reduction (\$)	Cost Reduction (%)
Wyndham WWTP	Resource Consent	\$ 614,200	\$ 393,700	64%	\$ 323,700	53%
	Design	\$ 244,500	\$ 129,500	53%	\$ 94,500	39%
WTP	Resource Consent	\$ 549,500	\$ 329,000	60%	\$ 259,000	47%
	Design	\$ 244,500	\$ 149,500	61%	\$ 114,500	47%
WWTP	Resource Consent	\$ 430,500	\$ 210,000	49%	\$ 210,000	49%
	Design	\$ 155,500	\$ 80,500	52%	\$ 80,500	52%

Substantive Insights (cost):

- Potential cost reductions arising from the changes to consenting legislation and process will be around 40 percent to 60 percent. This is estimated to be in the order of \$200k to \$300k for each consent application.
- Potential cost reductions arising from the implementation of national environmental standards for the design process will be around 40 percent to 60 percent. This is estimated to be in the order of \$100k for each plant upgrade.
- Total projected cost reductions for consenting and design for the 48 plants having expired consents amounts to \$16.8m.
- Total projected cost reduction for consenting and design for the further 62 plants that have consents expiring by 2030 amounts to \$21.7m.
- SDC did not expect any cost reduction to arise from conventional procurement and construction for plant upgrades (but see section on modular plants).
- SDC expected that overall, there would be an increase in operational costs, largely as a result of increased complexity of operation, and expectation of increased reporting requirements, and labour costs.
- It was noted that a number of the older small wastewater plants across the country are only kept compliant as a result of local operator knowledge. The value of a good plant operator should not be underestimated.

The tables below project the anticipated whole of project time savings for the three case study plants. **The clear direction is that there will be significant project delivery time savings compared to the current process.** The majority of this time saving will be generated as a result of simplified consenting processes and early definition of design parameters.

Figure 5 - Anticipated time savings (Edendale and Wyndham WWTP)

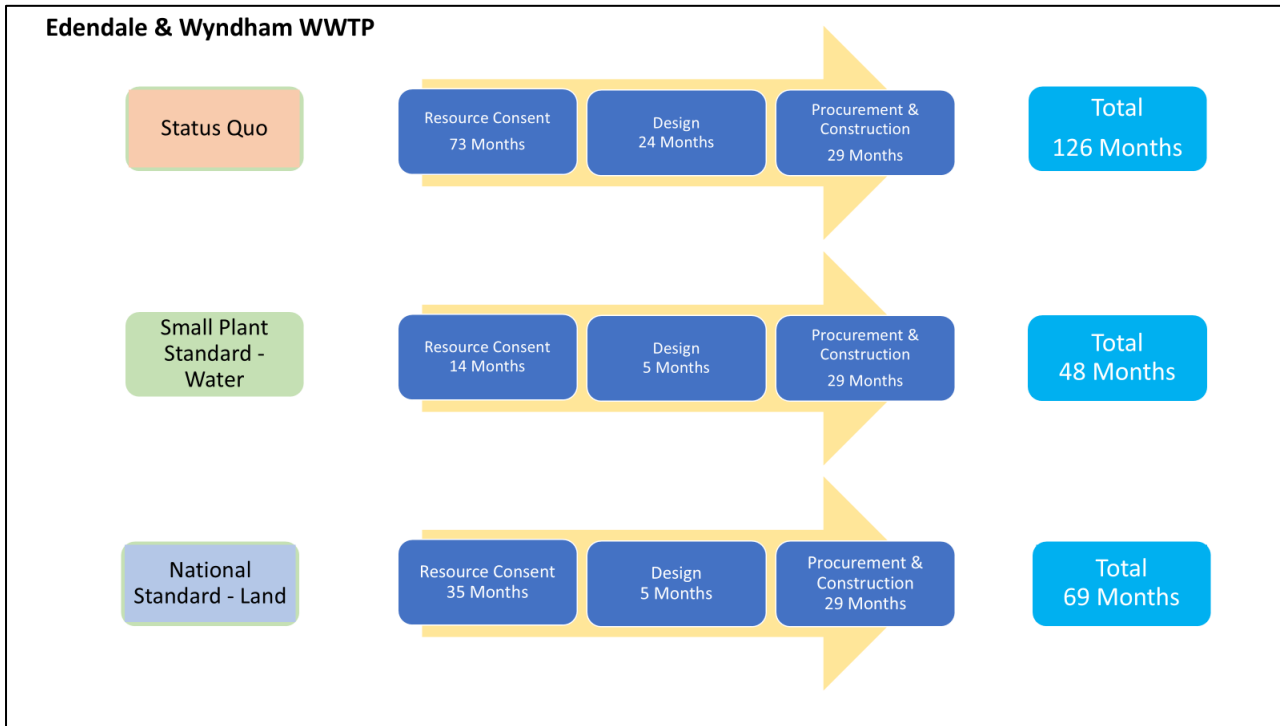


Figure 6 - Anticipated time savings (Balfour WWTP)

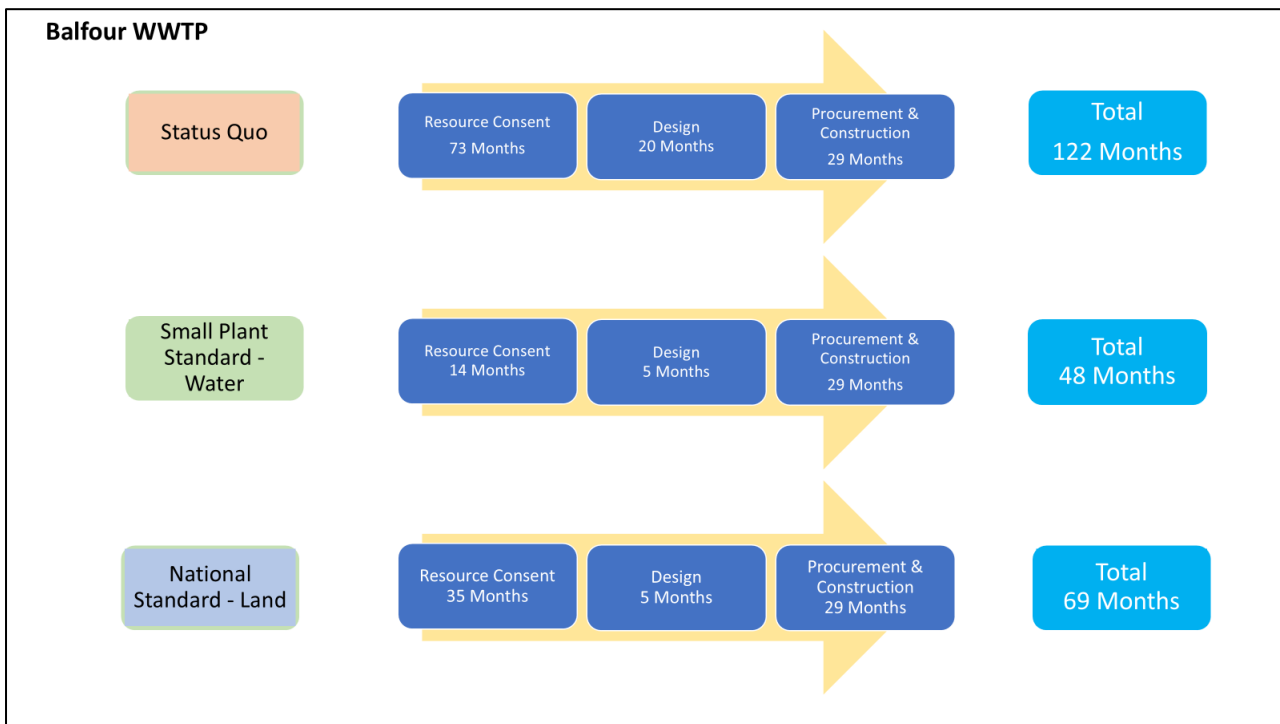
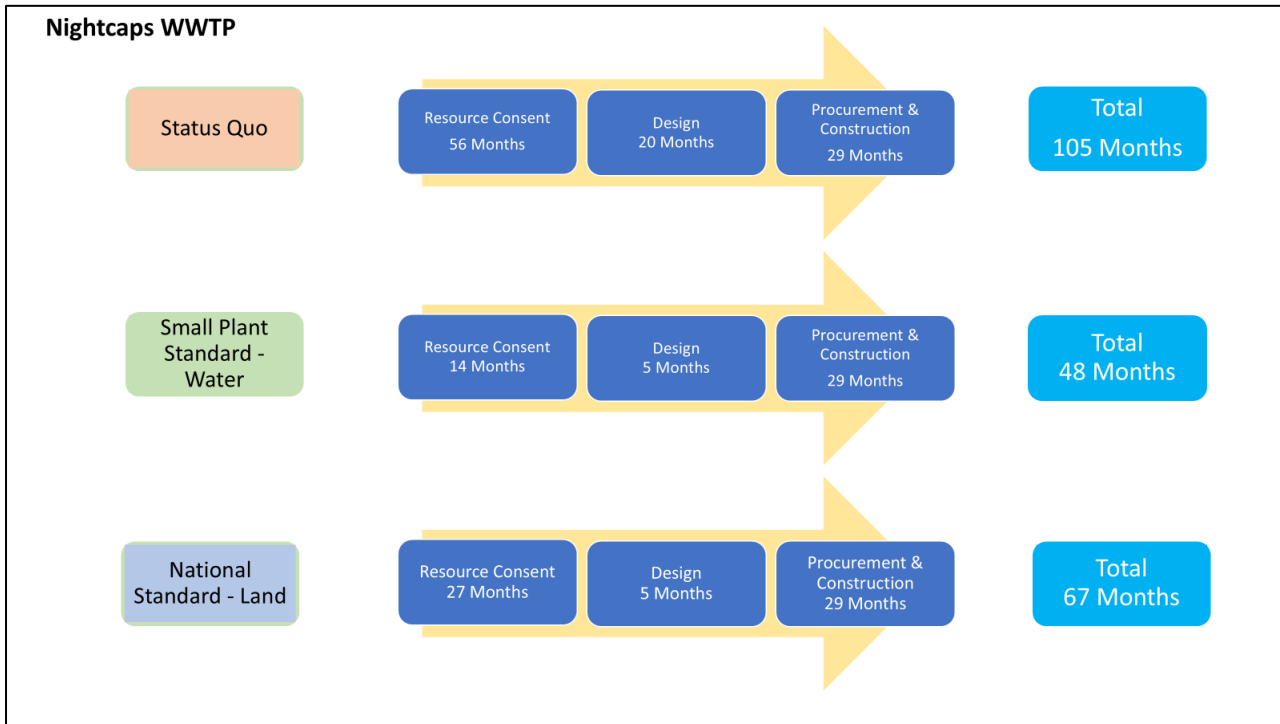


Figure 7 - Anticipated time savings (Nightcaps WWTP)



Horowhenua District Council

HDC provided information on the Tokomaru wastewater treatment plant. The full case study is included in Appendix B.

The Tokomaru wastewater treatment plant serves a small, rural community with a relatively stable population, but faces compliance and operational challenges due to its sensitive receiving environment. The current system, comprising screening, an oxidation pond, and a constructed wetland, has generally performed well against existing consent conditions. However, challenges remain around wet weather overflows, ammonia levels, and the consented discharge point into Centre Drain, which typically lacks upstream flow and thus fails to meet the dilution criteria required for national wastewater environmental performance standards to apply.

The expiration of the discharge consent in mid-2023, and the subsequent abatement notice and formal warning received from Horizons Regional Council, underscore the growing pressure on the council to upgrade or reconfigure the existing treatment and disposal processes. A notable feature of the current arrangement is its reliance on a rapid infiltration process through the wetland base during drier months, effectively bypassing discharge to surface water, although this pathway is not covered under the proposed wastewater standards and remains subject to RMA consenting.

While treatment performance is generally sound, future compliance will depend on further investment. The currently proposed upgrade options span a range of technologies, from traditional facultative ponds to membrane bioreactors, with costs varying significantly in both capital and operational terms. The facultative pond and trickling filter configurations have emerged as preferred pathways, offering a balance between treatment quality, cost-effectiveness, and carbon footprint.

A move to full land disposal has been proposed to align with the council's long-term aspirations and cultural considerations. However, site constraints, including shallow groundwater, marginal soil permeability, and uncertainty around land classification, introduce compliance risks. Even if the site achieves a Class 3 designation, additional phosphorus removal would be required. Should the site instead be classified as Class 5, the proposed standards would not apply, rendering the entire regulatory approach more complex and open to challenge.

In parallel, a discharge to the Tokomaru River remains technically viable and offers better dilution ratios, which could trigger the application of the more permissive high-dilution standards. This option risks undermining community trust and relationships with mana whenua, which have been cultivated over time in support of land-based solutions.

Whilst not all information could be provided, there was a high degree of commonality between the case studies regarding the anticipated potential reduction in consenting costs and timeframes. However, HDC still considered that there were residual risks regarding environmental and community consultation in relation to consenting activities. It was not possible to discern whether this was due to the council itself requiring a higher level of engagement than is currently being proposed.

Other costs such as design, capital, and operational costs were estimated to increase depending on the solution selected. The increase in operational costs reflected the potential increased complexity of operation compared to an oxidation pond.

Thames Coromandel District Council

TCDC provided information on the Matarangi wastewater treatment plant. This plant exemplifies the growing tension between seasonal population pressures and static infrastructure capacity in coastal communities. With the population swelling from approximately 650 to over 7,000 during peak holiday periods, the plant experiences increases in influent loads that challenge its operational envelope. This dynamic has had material consequences, not only for effluent quality but also for regulatory compliance and environmental protection, particularly in relation to nutrient discharge and pathogen control. The full case study is included in Appendix C.

Despite these challenges, the plant has demonstrated reasonable performance against legacy consent conditions, with cBOD₅ and total suspended solids (TSS) levels remaining within limits. However, the treatment process struggles to meet more stringent thresholds for ammonia nitrogen. This is a concern given the receiving environment's sensitivity, and the growing focus on nutrient reduction as part of national environmental policy direction. While effluent pathogen levels have generally declined over time, there is variability during peak loads.

The broader infrastructure network across the district reflects the same seasonal stressors and legacy constraints. Many of the treatment plants were designed for stable, low-density populations and are now faced with accelerating demands that exceed their original design capacities. This is exacerbated by aging assets and the fragmented nature of upgrades across the network. The result is a risk of non-compliance and increasing operational expenditure to maintain minimal service levels, particularly during summer peaks.

Matarangi's treatment process, comprising oxidation ponds, membrane filtration, UV disinfection and diffusion beds, has provided a functional but ultimately insufficient long-term barrier to contaminants to meet new consent standards. The combination of pond systems and limitations in nutrient removal technologies has prompted a detailed options assessment, initiated as early as 2016 and carried through to a publicly notified consent application. The potential Sequencing Batch Reactor (SBR) upgrade, represents a shift towards a more resilient treatment infrastructure, albeit at a significant capital and operational cost.

The discharge environment remains a key complicating factor. The Mapauriki Stream, with a dilution ratio calculated at just 2.66, cannot provide sufficient assimilative capacity to support high-load effluent discharges without significant downstream effects. This puts pressure on TCDC to either upgrade treatment to a much higher standard or pursue alternative discharge strategies. Options such as ocean outfalls, land application, and constructed wetlands have all been considered, with the latter originally selected before stakeholder engagement led to its withdrawal. The fallback of the continued use of the diffusion beds represents a pragmatic but temporary solution, pending regulatory clarity and resource consent certainty.

The consenting process itself stands out as a major systemic challenge. With over seven years elapsed since initial assessments began, and more than \$795,000 in incurred costs, the lack of a resolution illustrates the complexity and inertia embedded within current regulatory frameworks. The absence of a clear outcome from the Environment Court process adds further uncertainty to forward planning and investment.

The size and current discharge arrangements for the plant mean that it will not be covered by the proposed national environmental performance standards. This may change if the scope of the standards are broadened to include rapid infiltration beds and/or very small dilution ratios (<10). However, TCDC still see advantages in terms of cost and time arising from the proposed regulatory and performance changes.

Industry Perspectives

Industry have provided perspectives and technical data supporting the use of modular wastewater treatment plants under a standardised regulatory framework. Several key insights emerge, primarily relating to how standardisation, modularity, and performance-based consenting can improve efficiency, cost predictability, and delivery timeframes.

Clear national standards for effluent quality will simplify the consenting process significantly. They create an opportunity to reduce the current reliance on bespoke design solutions and case-by-case regulatory negotiations. This in turn provides an incentive for councils to directly engage with plant and equipment manufacturers, potentially reducing consultant involvement in the design phases, and improving the accuracy and speed of early-stage project scoping and budgeting.

Efficiencies are also likely to be realised through the wider adoption of standardised modular treatment units. These can be pre-designed, pre-approved, and configured according to site-specific receiving environment categories, allowing repeatable deployment across multiple communities. Where sufficient demand exists, manufacturers can justify investment in inventory, logistics, and component uniformity, thereby reducing capital and operational costs over time. This includes the potential for standardisation of SCADA, instrumentation, and spare parts, enabling lower stockholding requirements and better technical support.

Plant case studies highlight the scalable nature of the technology, identifying cost-effective installation for small communities, with increasing numbers of pods and tanks proportional to daily flow rates. These examples illustrate the potential for modular plants to offer reliable compliance with effluent quality requirements while allowing incremental expansion.

From a design perspective, efficiencies would be maximised if the standards include performance-linked approvals for defined treatment process configurations. Similar to the approach used for drinking water, this would allow developers to pre-select compliant solutions without prolonged negotiations. This model could also guide the selection of technologies based on the required nutrient or pathogen reduction.

Regarding peak wet weather flows and inflow and infiltration, the industry advises a shift in council expectations. With tighter discharge standards, it is suggested that investment must pivot from treatment overcapacity towards network improvement and buffering strategies. Existing ponds, if repurposed as balancing tanks, could complement modular plants without undermining compliance.

Planning

Investment decisions in wastewater infrastructure through Long Term Plans and Spatial Plans can drive efficiencies by aligning growth planning with plant type, location, and timing alongside the proposed national wastewater standards.

Optimising Infrastructure

With national standards in place, councils can make more informed decisions regarding the type of wastewater treatment plants best suited to their needs. Standardised modular treatment technologies will allow for scalable solutions that can be deployed in stages, aligning capital expenditure with actual demand instead of over-investing in oversized infrastructure. This approach offers flexibility, ensuring wastewater systems remain adaptable to population growth and environmental needs while maintaining compliance with regulatory frameworks.

Strategic Planning for Network Efficiency

Standardised infrastructure promotes a coordinated approach to location selection for future wastewater treatment plants. By incorporating national guidelines into investment planning, councils can identify optimal plant locations that minimise environmental impact, reduce duplication, and potentially encourage and enhance inter-regional collaboration.

By planning wastewater infrastructure in accordance with standardised parameters, councils can better integrate treatment plants with broader land-use and urban development plans. This ensures that wastewater services are positioned efficiently to

support anticipated population growth and mitigate risks associated with climate change and natural hazards. The result will be a more resilient and cost-effective wastewater management system benefiting both urban and rural communities.

Timing Investments to Maximise Cost Savings

Aligning infrastructure investment timing with national standards will allow councils to reduce financial risks and capitalise on procurement efficiencies. Standardised plant designs will streamline approval processes, reducing delays and associated uncertainties. Predictable consent pathways ensure that infrastructure projects are delivered within planned timeframes, minimising cost escalations due to regulatory uncertainties or prolonged consultation.

Timing investments based on standardised lifecycle cost assessments also allows for proactive maintenance planning, reducing the likelihood of costly emergency repairs or premature asset replacements. Councils can schedule upgrades and installations alongside procurement cycles, potentially leveraging bulk purchasing agreements and minimising price volatility. This ensures investment aligns with best-practice asset management principles, avoiding investment spikes and maintaining long-term cost-effectiveness.

In the short term, councils should prioritise investment in plants with expired consents or those nearing expiration.

Enhancing Financial and Operational Efficiencies

Integrating national standards into investment planning strengthens financial management by improving budget predictability and reducing expenditure variability. Standardisation enables councils to apply consistent cost models when forecasting infrastructure needs, ensuring financial planning remains accurate, sustainable, and aligned with the Long Term Plan. The ability to compare costs across standardised systems also enhances benchmarking, fostering evidence-based decision-making.

Operational efficiencies arise from the reduced complexity in managing wastewater infrastructure. Standardised systems allow councils to optimise staffing, enhance knowledge-sharing, and implement centralised monitoring and training frameworks, improving service reliability, lowering operational costs, and boosting regulatory compliance.

Design

The integration of national wastewater standards for discharge to land and water with standardised infrastructure design solutions generates efficiencies beyond cost reduction. These measures work together to streamline regulatory processes, enhance environmental protection, and improve long-term infrastructure planning.

Accelerated Consent Approvals Through Pre-Defined Compliance Pathways

The proposed discharge standards will allow councils to determine required treatment levels without extensive case-by-case evaluations. Pre-approved modular designs within the proposed infrastructure design solutions will enable consent applications referencing these designs to bypass prolonged technical reviews, as they are anticipated to be pre-certified for compliance.

For example, a small-town council upgrading a Class 2 land discharge plant could select an off-the-shelf modular system already validated for that classification, reducing consent processing time from months to weeks.

Lower Compliance Costs Through Harmonised Monitoring and Reporting

Consistent contaminant limits, such as E.coli thresholds for land discharge or nitrogen caps for rivers, will simplify compliance verification. Unified reporting frameworks will enable councils to adopt standardised monitoring protocols, reducing redundant laboratory testing and administrative overheads.

Scalability and Future-Proofing of Infrastructure Investments

Modular components will allow councils to incrementally expand capacity, such as adding filtration units as populations grow, without requiring full system redesigns. The proposed 35-year consent duration will provide long-term certainty, enabling multi-stage upgrades aligned with projected population growth demand.

A coastal community with a low-energy coastal discharge consent, for instance, could begin with a basic modular plant and later integrate nutrient-removal units if required.

Reduced Technical Barriers for Small and Remote Communities

Simplified requirements for small plants, such as exemptions from phosphorus limits, lower the engineering expertise needed for compliance. Off-the-shelf solutions eliminate the necessity for costly custom designs in isolated areas.

A rural settlement relying on an oxidation pond, could adopt a pre-approved desludging and monitoring plan rather than hiring consultants to develop a site-specific solution.

Enhanced Environmental Outcomes Through Targeted Risk Mitigation

Tailored treatment levels ensure high-risk sites, such as those near drinking water sources, receive stricter controls, while low-risk areas avoid unnecessary over-treatment. Predictable contaminant reductions, achieved through standardised discharge limits, improve ecosystem protection without reliance on detailed and costly assessments.

A high-sensitivity river, would enforce stringent nitrogen limits, whereas an open ocean outfall would avoid costly tertiary treatment where environmental impacts are minimal.

Resource Consent

Work undertaken by the WSA, Martin Jenkins, and BECA has outlined the potential opportunities and efficiencies arising from the proposed wastewater standards. This work was framed around three case studies, all of which identified cost savings in the Resource Consent process.

For a new small to medium wastewater treatment plant, these savings were informed by work conducted by Sapere for the Infrastructure Commission, and amounted to 25 percent to 40 percent (\$375,000 to \$600,000) based on an overall project cost of \$15m.

Reducing Complexity in the Consenting Process

Currently, the resource consent process for wastewater treatment infrastructure is often hindered by lengthy approval times, regionally inconsistent requirements, and the need for bespoke engineering assessments. This variability results in high legal and consultancy fees, as applicants must navigate complex regulatory frameworks. By introducing a set of nationally recognised infrastructure design solutions, a more predictable and efficient pathway for obtaining consents can be established. Standardised designs would enable applicants to reference pre-approved engineering specifications, reducing the need for time-intensive assessments and case-by-case negotiations with regulatory bodies.

Infrastructure design solutions would also facilitate a risk-based consenting approach, where projects that adhere to predefined performance standards benefit from simplified approval pathways. This would allow councils to focus their regulatory efforts on non-standard or high-risk applications while expediting the approval of treatment plants that align with best-practice designs. A reduction in processing times will enable faster project initiation, ensuring that the necessary wastewater treatment upgrades are delivered without unnecessary delays.

Supporting a More Predictable Regulatory Environment

The introduction of proposed infrastructure design solutions will contribute to a more predictable and transparent regulatory environment. By reducing the need for extensive site-by-site assessments, regulatory bodies can allocate their resources more effectively, focusing on monitoring and compliance rather than prolonged and detailed consent evaluations. Nationally

consistent performance benchmarks will enhance confidence in wastewater treatment outcomes, provide transparency and support environmental objectives.

A standardised approach will also improve stakeholder engagement by providing clear expectations for both applicants and regulators. Projects will benefit from greater certainty regarding compliance requirements, while regulatory bodies can apply a consistent framework for evaluating wastewater treatment solutions. This will foster a more collaborative and efficient approach to infrastructure development.

Procurement

Standardising wastewater infrastructure presents an opportunity to enhance procurement efficiencies, reduce costs, and improve service delivery. By adopting consistent design specifications, materials, and procurement processes, councils can streamline supply chains, lower lifecycle costs, and improve project delivery timelines.

Standardisation drives cost reduction through economies of scale by enabling bulk procurement of common components such as pipes, pumps, and treatment systems, thereby lowering unit costs. It also reduces the need for custom engineering and bespoke solutions, decreasing both design and manufacturing expenses.

Procurement efficiency improves as standardised designs and materials simplify tender processes, reducing bid evaluation time. Framework agreements with suppliers could be established for repeat purchases.

Supply chain resilience is enhanced as standardised parts encourage greater supplier competition, reducing dependency on single-source providers. Simplified inventory management also decreases lead times for critical components.

Procurement frameworks could be optimised through national or regional panel contracts for common wastewater components. Digital procurement platforms with standardised product libraries could support efficient purchasing.

Adopting a catchment-level approach will streamline consenting processes. Collaborative consent bundling, where councils within a catchment can jointly apply for consents, will provide opportunity to deliver cost efficiencies.

Modular Wastewater Treatment Plants

Modular wastewater treatment plants offer a viable solution for small communities, especially those in rural or remote areas where conventional, larger-scale systems may not be feasible. These systems are scalable, flexible, and can be tailored to meet specific needs.

The proposed infrastructure design solutions provide an effective pathway to reduce costs and expedite the consenting process. Off-the-shelf, pre-approved modular designs could cut design and consenting costs by 40 percent to 60 percent. By aligning with national wastewater environmental performance standards, modular solutions simplify compliance and standardise compliance reporting. Standardised designs also facilitate bulk procurement, lowering construction and operational expenses. Councils could aggregate demand for modular plants to negotiate more favourable pricing with suppliers.

Various types of modular systems exist, including biological, membrane bioreactors (MBR), and chemical treatment systems, each offering distinct advantages in terms of efficiency, space requirements, and treatment capacity.

Types of Modular Wastewater Treatment Systems

Biological Systems: These systems rely on biological processes to treat wastewater, using microorganisms to break down organic pollutants. They are typically cost-effective and are suitable for areas with limited space or resources. They can handle a wide range of influent water qualities and are commonly used in smaller, decentralised applications.

Membrane Bioreactors (MBR): MBR systems combine biological treatment with membrane filtration to provide high-quality effluent. These systems are highly efficient and capable of producing effluent with low levels of pollutants, making them ideal for locations with stringent discharge regulations. They are more expensive to install and potentially may have higher

operational power and chemical costs. Newer technologies including Moving Bed Biofilm Reactors (MBBR) and Membrane Aerated Biofilm Reactors (MABR) can also be considered.

Chemical Treatment Systems: These systems use chemicals (e.g., chlorine, ozone) to treat wastewater. They are often used in conjunction with other treatment technologies to achieve disinfection or remove specific contaminants. While they tend to be more expensive in terms of operational costs due to the need for chemicals, they can be highly effective in certain applications

Installation and Operational Costs

The cost of modular wastewater treatment systems can vary significantly depending on the type of system, location, and scale of the installation.

- **System Costs:** Typical system costs depend on the type and size of the unit installed Typical system costs are:
 - Servicing 200 people - \$350,000.
 - Servicing 500 people - \$700,000.
 - Servicing 1000people - \$1,200,000.
- **Installation Costs:** Installation costs typically range from \$200,000 to \$500,000. Membrane bioreactor systems tend to be on the higher end of this range due to the complexity of the technology. Biological treatment systems can be more affordable, starting at around \$150,000 for small-scale installations.
- **Operational Costs:** Operational costs are usually lower for biological systems, which rely on natural processes, compared to MBR or chemical systems, which require more energy and consumables. Operational costs for a small modular plant can range from \$10,000 to \$30,000 per year, depending on the type of system and the complexity of treatment required.

For example, the Hihi project in the Far North had a total MBR project cost of \$5,971,000 (2020). While this was the most expensive option considered, it was a bespoke one-off design. Efficiencies would be realised through standardisation.

Similarly, Innoflow Wastewater Specialists installed a modular system in Piopio Township, serving up to 250 residential and business properties at a cost of \$3.45 million (2012).

Figure 8: Example Hihi Wastewater Treatment Plant

Hihi - Far North District Council. Hihi is a small coastal town with a population of 170 people (2013). The plant discharges treated wastewater via a constructed wetland to Hihi Stream. As a popular tourist destination, the area experiences a significant increase in population during holiday periods with a peak population over 500 people. The overall capacity of the treatment plant was insufficient for both peak flow and peak load. This caused intermittently very poor effluent passing to the tertiary wetland and into the stream.

Three options were considered (2020 prices):

Option 1 - Do minimum: Replacement of an aeration tank with a new tank, constructing safe working platforms, refurbishment and installation of an inlet screen. Cost Estimate \$2,424,659.

Option 2 - Conventional Activated Sludge (ASP) Construct a like for like replacement of the existing activated sludge treatment and upgrade of the tertiary filter capacity. Cost Estimate \$5,376,245

Option 3 – Membrane Bioreactor (MBR) This solution considered the construction of a biological process based on using membranes for the solid's separation stage. Cost Estimate \$5,970,973

Hihi WWTP - MBR Estimate Cost

Description	Unit	Qty.	Rate	Estimated Price
Connection to Pre-treatment	LS	1	\$21,460.00	\$ 21,460
Pre-treatment	LS	1	\$91,700.00	\$ 91,700
Biological reactor - Civil Works	LS	1	\$150,400.00	\$ 150,400
Biological reactor - Equipment	LS	1	\$483,660.00	\$ 483,660
Aeration	LS	1	\$97,940.00	\$ 97,940
Services Building	LS	1	\$138,000.00	\$ 138,000
Sludge RAS + WAS - Civil works	LS	1	\$2,000.00	\$ 2,000
Sludge RAS + WAS - Equipment	LS	1	\$49,165.00	\$ 49,165
Tertiary Treatment	LS	1	\$19,000.00	\$ 19,000
Electrical Installation Work	LS	1	\$170,600.00	\$ 170,600
Control	LS	1	\$70,000.00	\$ 70,000
Commissioning and Testing	LS	1	\$94,800.00	\$ 94,800
Temporary Connections	LS	1	\$1,000.00	\$ 1,000
Demolitions and Site Reinstatements	LS	1	\$130,000.00	\$ 130,000
Temporary Site Works	LS	1	\$140,000.00	\$ 140,000
Emergency generator	LS	1	\$200,000.00	\$ 200,000
Sub-total				\$ 1,859,725
P&G	%	15		\$ 278,959
Contractor Risk	%	8		\$ 148,778
Installation and Commissioning	%	30		\$ 557,918
Contractor Overheads	%	20		\$ 371,945
Contract Design	%	5		\$ 92,986
Sub-total project cost				\$ 3,310,311
Contractor Profit and off-site overhead	%	11		\$ 364,134
Sub-Total Contract Cost (Excluding GST)				\$ 3,674,445
FNDC Cost 10%				\$ 367,444
Consultant 10%				\$ 367,444
Engineer to Contract 5%				\$ 183,722
Sub-Total Contract Cost (Excluding GST)				\$ 4,593,056
Project Uncertainty (30% On Grand total)				\$ 1,377,917
TOTAL Estimated Cost				\$ 5,970,973

Considerations

While modular plants provide opportunities for efficiencies in terms of cost and installation time, there has been a general reluctance across New Zealand to widely adopt them for small wastewater plants. This is partly due to the legacy of oxidation ponds, which are low-technology processes, as well as the increased skill set and perceived cost required to operate and maintain modular plants.

For the widespread adoption of modular systems, the following considerations should be addressed:

- Stormwater inflow and infiltration into the wastewater network through damaged pipes, defective joints, high water tables, and incorrect connections. This can be managed by:
 - Buffering peak flows through storage or bypass systems (often most efficiently through repurposing existing oxidation ponds).
 - Greater use of pressurised systems retrofitted to wastewater networks.
 - Inflow and infiltration management programmes in the pipe network.
- Increased education and enforcement.
- Workforce training and competency assessment.
- Standardisation of designs to deliver a clearly identified level of treatment.

While modular treatment plants for small wastewater treatment facilities offer a significant opportunity to reduce costs, the extent of this opportunity depends on whether each installation needs to be designed specifically for each site, or if standard designs and possibly pre-approved suppliers, as envisioned by infrastructure design solutions, can be used. Standardisation would substantially reduce consenting, design, and procurement costs. The case study of the Hihi WWTP demonstrated that modular plants do not deliver cost savings when considered as bespoke solutions.

From the published material, it has not been possible to clearly identify where accountability for the performance of modular plants will sit. If the aim is to move away from bespoke designs toward standardised plants through one or more suppliers, then one organisation will need to take accountability for the specification of the modular plant and its ultimate performance. Certification for modular plants will need to be implemented.

International Experience

The Netherlands and Denmark have pioneered the use of standardised, modular wastewater treatment systems that reduce costs and accelerate installation. Dutch water boards use "treatment train" approaches, where pre-engineered modules (e.g., biological reactors, clarifiers) are combined based on site-specific needs. This modularity allows for scalability; small communities can start with basic systems and expand as populations grow. Denmark's "package plant" approach provides off-the-shelf solutions for small towns, with pre-approved designs that streamline consenting.

Operate

Reduction in Inventory Investment

The transition to standardised wastewater treatment plant components will lower the need for councils to maintain large inventories of spare parts. Bespoke treatment plants can require unique components, leading to higher costs in procurement and storage. With standardisation, a limited range of interchangeable parts can be stocked and used across multiple treatment facilities, allowing a reduction of capital tied up in inventory.

A standardised approach will also enable bulk purchasing agreements for components, driving down costs through economies of scale. Suppliers will benefit from predictable demand, enabling them to streamline production and distribution, while operators will have faster access to replacement parts without incurring high storage costs. The consistency of design across treatment plants will ensure that inventory management can be optimised, with fewer instances of obsolete or underutilised spare parts sitting in storage.

Enhanced Availability of Spare Treatment Plants

Standardisation will allow for the development of modular treatment plants that can be deployed as temporary or permanent solutions in times of maintenance, expansion, or emergency response. With many smaller wastewater treatment plants facing consenting and upgrade requirements, the ability to deploy spare modular systems will provide a critical advantage. These systems can be pre-approved under national infrastructure design solutions, ensuring compliance with environmental performance standards while enabling councils to act quickly when additional capacity is required.

With a pool of standardised spare treatment plants available, councils can avoid expensive, case-by-case investments in bespoke upgrades. Instead, a shared approach to spare plant allocation can be implemented, where temporary modules can be leased or relocated to address demand fluctuations. This model will not only improve financial sustainability but also enhance resilience in wastewater management, particularly for smaller communities that may lack the resources to invest in permanent large-scale upgrades.

Operational and Maintenance Efficiencies

By reducing the variability of components and treatment processes, standardisation will improve the efficiency of maintenance practices. Operators will be able to apply uniform servicing protocols across multiple plants, reducing training requirements and minimising the risk of operational errors. A more predictable maintenance schedule will further ensure that spare parts are available when needed.

The ability to streamline workforce training due to standardised designs will complement inventory management improvements. Operators will be familiar with common systems and procedures, leading to more efficient troubleshooting and faster resolution of technical issues.

Monitor

Streamlining Monitoring Arrangements and National Reporting

National standardised resource consent conditions will enable a more coordinated approach to monitoring and compliance reporting. Currently, each wastewater treatment plant is subject to regionally determined monitoring requirements, leading to inefficiencies and inconsistencies in data collection. A centralised system will allow for a unified monitoring framework, making it easier to track performance, identify trends, and implement improvements at a national level.

Standardised monitoring arrangements would enhance data comparability, allowing councils and regulators to assess treatment plant performance against national benchmarks providing greater transparency around relative performance. A consistent reporting structure would enable informed infrastructure investment decisions, prioritising upgrades where they are most needed. This will improve cost-effectiveness by ensuring that funding is allocated to areas with the greatest environmental and operational benefits.

A centralised data management system would further streamline reporting by automating compliance submissions, reducing manual reporting burdens for councils and operators. Cloud-based platforms could facilitate real-time data sharing, enabling regulators to identify and respond to emerging issues proactively. This would not only improve compliance outcomes but also reduce enforcement costs associated with non-compliance investigations and remediation efforts.

Integration of Remote and Smart Monitoring Technologies

Standardised and modular wastewater treatment plants are inherently designed for compatibility with advanced monitoring technologies. The uniformity of system components allows for the seamless integration of sensors, automation controls, and real-time data analytics platforms. Smart monitoring solutions can track key performance indicators, such as flow rates, biochemical oxygen demand, nutrient levels, and energy consumption, ensuring that plants operate within regulatory and efficiency parameters.

The deployment of remote monitoring solutions is particularly beneficial for smaller communities that lack on-site technical expertise. By equipping modular plants with cloud-connected sensors, operators can access real-time performance data from centralised control centres. This enables predictive maintenance, where potential issues are identified before they escalate, reducing the risk of system failures and unplanned downtime. Standardisation ensures that these technologies can be deployed consistently across multiple treatment facilities, streamlining data integration and simplifying the management of diverse sites. There is an opportunity for the incorporation of remote monitoring solutions to be incorporated into standard modular designs.

Cost Savings and Future Scalability

The adoption of smart monitoring technologies in modular wastewater treatment plants would lead to significant cost savings by reducing the need for frequent on-site inspections and minimising reactive maintenance expenses. Remote monitoring allows for targeted dispatching of maintenance teams only when necessary, optimising labour costs and ensuring that resources are allocated efficiently. Standardisation also enables the use of a shared national monitoring platform, reducing software development and integration costs while providing a unified interface for stakeholders.

Future scalability is another benefit of standard and modular designs. As wastewater treatment needs evolve, additional modular units can be integrated into existing plants without requiring extensive modifications to monitoring systems. This ensures that monitoring infrastructure remains compatible as treatment capacity expands, reducing the risk of obsolescence and supporting long-term investment planning.

Support

Workforce Training and Development

National wastewater environmental standards will establish a consistent foundation for training wastewater professionals. By aligning workforce development with these standards, training programs can focus on best practices, regulatory compliance, and operational efficiencies. This will enhance the competency of operators, engineers, and maintenance personnel across the sector. Standardised training will facilitate workforce mobility, ensuring that personnel trained in one region can seamlessly transition to roles in other regions without extensive retraining.

The integration of modular wastewater treatment plant designs, supported by infrastructure design solutions, will provide a structured learning pathway for operators. Training programs can be tailored to standardised plant components, allowing personnel to develop specialised expertise that can be applied across multiple facilities. This consistency in training will also enhance safety standards, as workers will be familiar with common protocols and procedures across different treatment plants.

Regional and National Impact

A unified framework for wastewater treatment training will provide opportunity for regional and national efficiencies in service delivery. Smaller councils, which may lack the resources for extensive in-house expertise, could benefit from a shared knowledge base and training programs that ensure consistency in wastewater management practices.

Improved workforce competency will support compliance with environmental performance standards, reducing the risk of regulatory penalties and associated costs. As infrastructure design solutions become embedded in regulatory frameworks, councils will be able to allocate resources more effectively, prioritising investment in high-need areas without the financial burden of developing unique treatment solutions for each locality.

Other

Energy from Wastewater

While outside the direct scope of this report, a review of best practices for extracting energy from wastewater was conducted.

Methods for extracting energy from wastewater treatment processes focus on harnessing organic matter and thermal energy to generate power and reduce overall energy consumption.

- Anaerobic digestion, where microorganisms break down organic material in wastewater sludge to produce biogas, primarily composed of methane and carbon dioxide. This biogas can then be used for on-site electricity and heat generation through combined heat and power (CHP) systems, reducing the plant's reliance on external energy sources.
- Microbial fuel cells (MFCs), which use bacteria to convert organic matter in wastewater directly into electricity. While still in development, MFCs show promise for decentralised power generation and reducing the carbon footprint of wastewater treatment plants.
- Thermal energy recovery using wastewater heat energy that can be captured using heat exchangers and heat pumps. This recovered heat can be used to warm treatment facilities or be integrated into district heating systems, improving overall energy efficiency.
- Hydraulic energy recovery, where micro-hydropower turbines harness the kinetic energy of flowing wastewater to generate renewable electricity.

In New Zealand, energy recovery from wastewater initiatives is in the early stages, especially for small treatment plants, where the primary focus has been on treatment quality and compliance.

SDC has confirmed that they reclaim heat from some plants to warm water, although this is on a small scale. No biogas extraction is currently undertaken. HDC extracts biogas from the digesters at the Levin plant to power boilers

Re-use of Biosolids

Biosolids from desludging wastewater treatment plants can be beneficially reused in a number of ways:

- Agricultural and Horticultural Land Application.
- Land Rehabilitation and Forestry.
- Composting and Blending with Green Waste.
- Energy Recovery (Biogas Production).
- Landfill Cover and Alternative Daily Cover.
- Vermiculture.

SDC currently leaves the majority of biosolids within the oxidation pond site for dewatering, after which they are disposed of in landfill (a common practice). Two of the plants are activated sludge systems with sludge drying beds, and the sludge is disposed of in landfills. The third plant is a vermiculture plant, with beds replaced every three to five months before disposal in landfill. No biosolids are used for financial or environmental benefit. However, the council does have one plant that applies treated effluent to land and generates income through a cut-and-carry process for grass.

HDC currently takes biosolids to the landfill but is interested in exploring reuse options if cost-effective, whether independently or through collaboration with neighbouring councils.

Discussion

General Observations

This report provides a valuable insight into the current issues faced by many councils managing small wastewater treatments, particularly in rural areas with small populations. Whilst the introduction of streamlined resource consent processes and national environmental performance standards is to be applauded, and is generally welcomed by the majority of councils, there remains an air of uncertainty around the potential implications.

The study has identified that each plant is to some extent unique, whether that be through variations to influent loading (volume and quality) , to discharge to different receiving environments. The final detail of the new standards and how they will be implemented remains the main cause of uncertainty for councils.

Experience has indicated that many small wastewater treatment plants with older consents have conditions that focus mainly on volume rather than quality. This is providing some concern that councils may need significant investment to meet the proposed performance standards (but noting that this would also be the case under current arrangements).

The proposed changes to consenting and environmental performance standards will reduce consenting and design costs and provide greater earlier certainty about the technical standards to be achieved. Construction costs will largely remain constant except where infrastructure design solutions are implemented. There remains concerns that operational costs will increase through increased regulation and reporting, alongside plant complexity. In the short term, consenting processes should be simplified by leveraging the new national environmental performance standards, which will provide significant reductions in cost and time. With projected savings of up to 60 percent in consenting and design costs, focus should be on ensuring compliance with the new standards as soon as they are finalised.

Consideration should be given to the adoption of modular wastewater treatment plants. Modular systems have demonstrated scalability and cost-effectiveness. Partnerships should be explored with suppliers who offer pre-approved modular systems to take advantage of bulk procurement and rapid deployment, reducing both capital and operational expenditures.

In the longer term, investment should be directed toward scalable and flexible infrastructure solutions, such as modular wastewater treatment plants. The key advantage of modular systems lies in the ability to expand in stages, thus aligning capital expenditure with actual demand. This ensures that over-investment in oversized infrastructure is avoided while maintaining the ability to scale up as populations grow. By aligning infrastructure design with population forecasts and national standards, the long-term sustainability and cost-effectiveness of wastewater management systems can be enhanced.

As the industry shifts toward standardised modular solutions, investment will be needed in workforce training programs that focus on operating and maintaining these systems. Standardised designs will reduce the need for specialised knowledge in each location, enabling staff to move between plants and share best practices. Additionally, by adopting national standards for monitoring and reporting, performance data will be consistent and actionable, providing a solid foundation for future infrastructure upgrades and planning.

Governance

The proposed national standards are defined as being the minimum standards for the discharge of effluent that must be achieved. This report has been framed around the requirement to meet those standards and the potential cost and time savings that would consequently accrue. However, councils may elect to implement a higher level of treatment than the proposed standards require, or alternatively adopt or continue with policies that favour discharge to land. This would potentially extend the time required for engagement and consultation, and increase costs. Councils will need to be transparent with communities in respect of the cost of delivering higher environmental performance standards than required.

Data Quality

Data quality is and is likely to continue to be an issue. Research for this report and past experience has shown that the collection and use of data to support robust performance monitoring is not always accurate and consistent, particular for small wastewater treatment plants. There is no single source of the truth across organisations, and often within councils, with wastewater data and information held in disparate locations, often with inconsistencies and anomalies.

For example, whilst researching this report, it was identified that data held by the WSA, which was supplied by councils, did not always align with councils' own records or actual site circumstances.

Data needs to be reliable to be of use to professionals and to instil trust by customers.

SCADA and Telemetry

Wastewater treatment plants employ a range of SCADA and telemetry systems to monitor and control operations.

The purpose of the systems are threefold:

1. Process an operational control.
2. Alarm monitoring and response.
3. Compliance monitoring.

Historic investment in SCADA and telemetry systems has been insufficient, with a significant proportion of equipment deployed reaching the end of its life. There is also little standardisation on the system platforms, notification tools, equipment suppliers and communication protocols. Whilst the upgrading of legacy systems is happening, there is not a coordinated nationwide approach.

The adoption of modular plants would provide a catalyst for standardisation and acceleration towards cloud-based system platforms. However, consideration needs to be given whether single or multiple suppliers are engaged, development of a standardised schedule of performance measures, and probably the most significant, cyber security. Previous work undertaken to support Three Waters Reform, particularly for Auckland/Northland, had identified a potential roadmap for implementation.

The key risks identified were:

- Scada system Integrator Industry within New Zealand would need support to deliver a nationwide approach.
- Internal resources are very limited.
- Existing council networks would need separation from council domains.

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Appendix A: Case Study - Southland District Council

Background

Southland, is a predominantly rural area. The 2023 Census recorded 31,833 residents within the Southland District out of a total wider Southland population of 100,143. The number of residents in the district rose by 2,676 or 2.7 percent from 2018, driven largely by internal migration as individuals and families relocate from larger urban centres. There are 20,993 rating units in the district, up from 20,621 in 2018.

Geographically, Southland is one of New Zealand's least densely populated regions, with 2.3 people per square kilometre. The majority of residents are concentrated in urban centres such as Invercargill (47,000 residents) and Gore (8,000 residents), while rural areas continue to experience gradual depopulation.

Southland was selected for this case study based on the number of small plants in the network and the number of consents coming up for renewal, with five plants operating on expired consents. It is noted that the Edendale -Wyndham plant serves a combined population of over 1000 residents. This selection allows for robust data for costs and timings. Southland faces the common challenges around affordability, particularly for compliance and consent-based activities and works, the recruitment and retention of suitably qualified staff, and ageing infrastructure.

Overview of Wastewater Network

Southland includes numerous small communities, many with populations under 1,000. Nineteen towns are reticulated with Council owned and maintained wastewater infrastructure. These are Balfour, Browns, Curio Bay, Edendale/Wyndham, Gorge Road, Lumsden, Manapouri, Monowai, Nightcaps, Oban, Ohai, Otautau, Riversdale, Riverton Rocks, Riverton Town Side, Te Anau, Tokanui, Tuatapere, and Winton.

From data provided by SDC many of the wastewater treatment plants consist of only primary treatment consisting of 65 percent oxidation ponds with combination of discharge consents between water and land relatively evenly split.

The wastewater network comprises:

- 271.7km of wastewater mains.
- 74 wastewater pumping stations and chambers.
- 19 wastewater treatment plants (two plants in Riverton).
- 8,849 wastewater connections.
- 4 land-based discharge systems.

Operations and maintenance are undertaken by a specialised contractor. All capital works are planned and programmed by the council's Water and Waste Services department.

The three plants selected for this case study are

1. Edendale-Wyndham.
2. Balfour.
3. Nightcaps.

Table 1: Overview of Wastewater Plants

Plant Name	Population	Calculated ADWF (m3/day)	Treatment	Discharge Consent		
				Resource Consent (Date Granted)	Resource Consent (Date Expires)	Receiving Environment (Water/Land)
Edendale - Wyndham	629 Edendale, 613 Wyndham	2	BioFiltro Worm Farm	10/09/2008	10/09/2023	Water
Balfour	145	29	Imhoff Tank/Trickling Filter	02/02/2002	02/02/2024	Water
Nightcaps	299	59	Oxidation Pond/Rock Filter Beds	01/03/2017	01/07/2027	Water
Browns	145	29	Activated Sludge/Trickling Filter	21/02/2013	21/02/2033	Water & Land
Curio Bay	30	-	MBR	18/11/2014	18/11/2039	Water
Gorge Road	218	43	Oxidation Pond	06/12/2004	06/12/2029	Water
Lumsden	465	93	Oxidation Pond	20/11/2006	20/11/2031	Land
Manapouri	636	127	Oxidation Pond	06/09/2004	06/09/2024	Land
Monowai Village	102	20	Septic Tank	20/04/2009	31/03/2029	Land
Oban	434	86	Oxidation Pond	02/11/2004	02/11/2024	Water
Ohai	307	61	Imhoff Tank/Trickling Filter/UV	31/07/2020	31/07/2030	Water
Otautau	892	178	Oxidation Pond	16/01/2007	16/01/2032	Land
Riversdale	505	101	Oxidation Pond	05/10/2016, 03/09/2021	01/04/2037, 05/10/2026	Water
Riverton Rocks	770	154	Oxidation Pond	01/12/2015	01/12/2040	Land
Riverton Townside	770	154	Oxidation Pond	09/08/2004	09/08/2039	Land
Te Anau	418	588	Oxidation Pond	2/12/2019	2/12/2044	Land
Tokenui	147	29	Oxidation Pond/Maturation Pond	05/07/2019	05/07/2034	Water & Land
Tautapere	570	114	Oxidation Pond/Maturation Pond/Wetland	20/11/2006	20/11/2031	Water
Winton	2554	486	Oxidation Pond	1/09/2023	8/12/2028	Water

Note: The Discharge Consent for Wallacetown is held by the Alliance Group not SDG.

Summary of Findings

Table 2: Summary of Findings - Cost

Activity	Status Quo	Small Plant Standard - Water Discharge		National Performance Standard - Land	
		Cost Reduction (\$)	Cost Reduction (%)	Cost Reduction (\$)	Cost Reduction (%)
Edendale- Wyndham WWTP	Resource Consent	\$ 614,200	\$ 393,700	\$ 323,700	53%
	Design	\$ 244,500	\$ 129,500	\$ 94,500	39%
Balfour WWTP	Resource Consent	\$ 549,500	\$ 329,000	\$ 259,000	47%
	Design	\$ 244,500	\$ 149,500	\$ 114,500	47%
Nightcaps WWTP	Resource Consent	\$ 430,500	\$ 210,000	\$ 210,000	49%
	Design	\$ 155,500	\$ 80,500	\$ 80,500	52%

Figure 9: Edendale & Wyndham Time Comparison

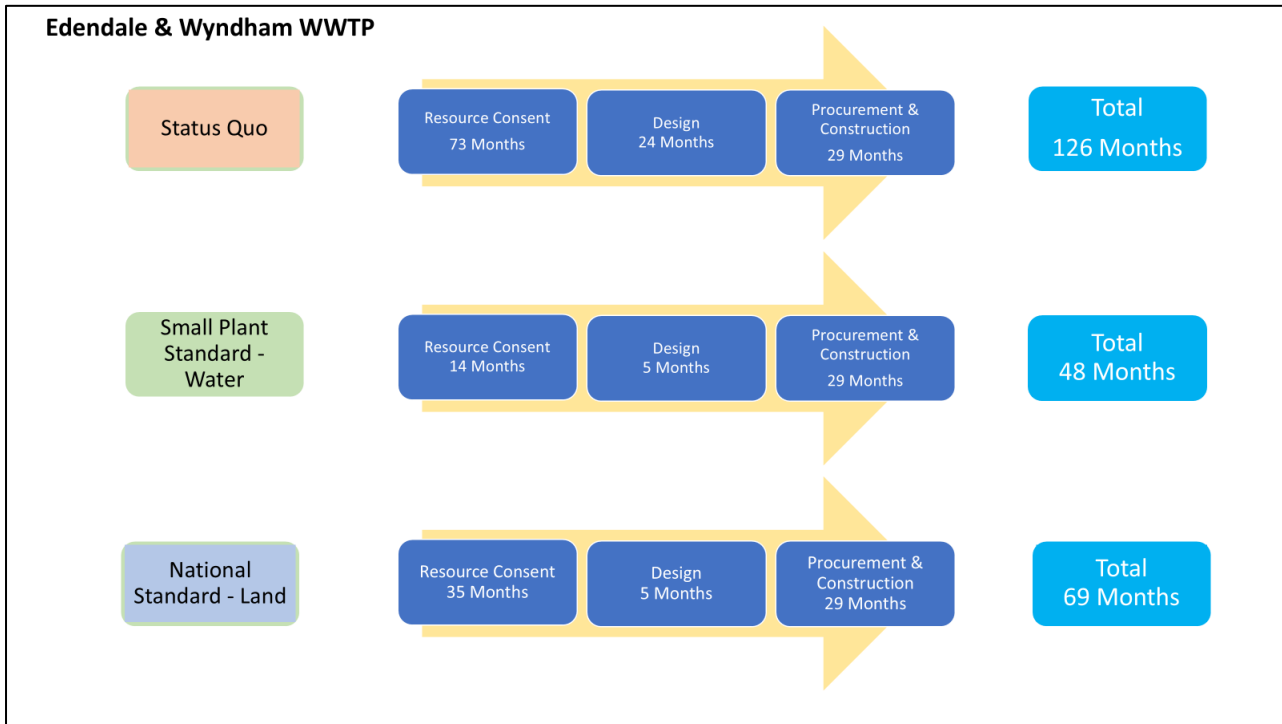


Figure 10 - Balfour Time Comparison

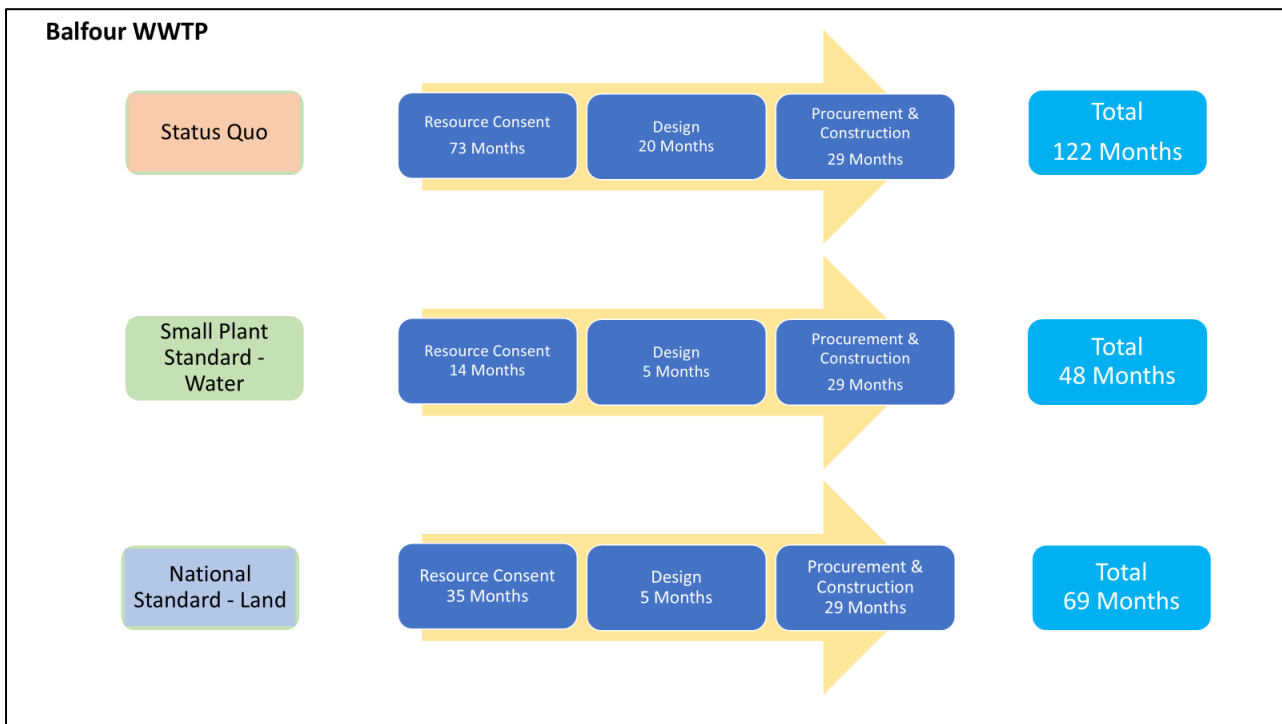
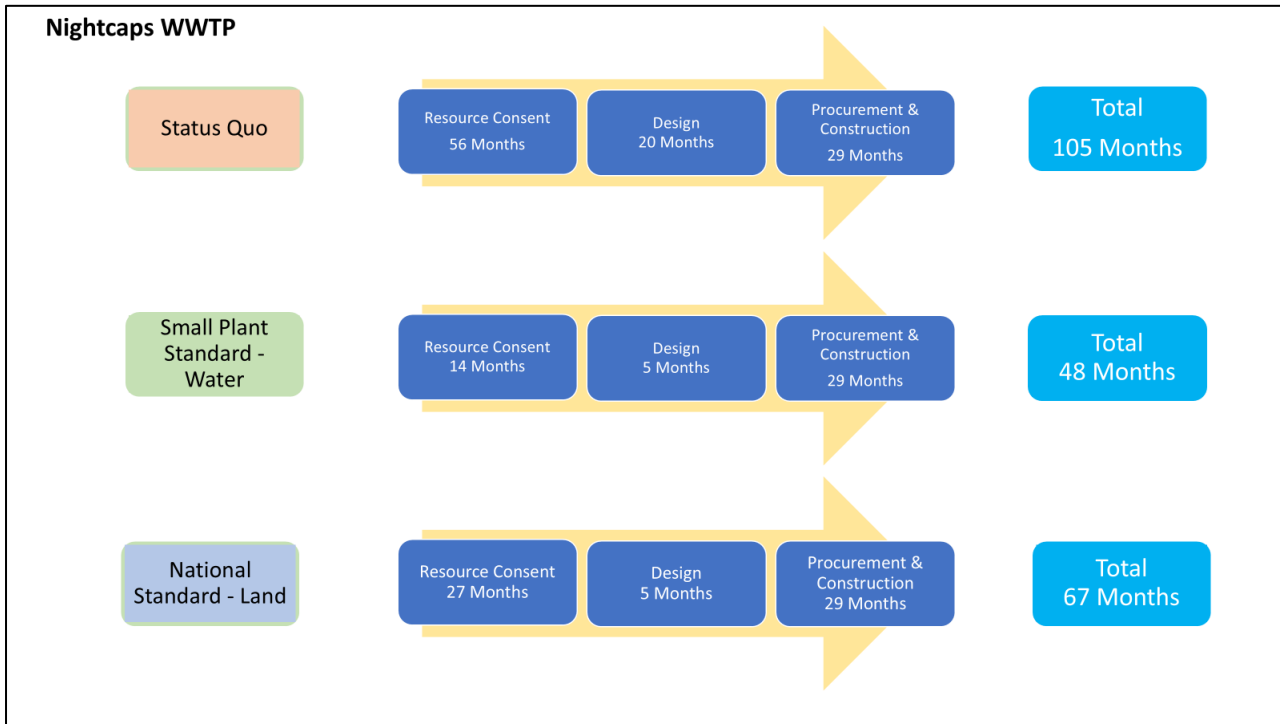


Figure 11 - Nightcaps Time Comparison



Edendale-Wyndham Wastewater Treatment Plant

Context

- Population Served: 629 Edendale, 613 Wyndham.
- Treatment Technologies and Processes: The plant employs a combination of primary sedimentation, BioFiltro worm farm and UV. (BioFiltro is a treatment system that utilises a combination of worms and micro-organisms to break down organic matter in wastewater).
- Receiving Environment: Mataura River. Dilution Ratio 2097 (High). The Mataura River has a Statutory Acknowledgement under the Ngai Tahu Claims Settlement Act 1998. This impacts existing consenting applications and requires iwi to be consulted on applications relating to that river.
- The Mataura River is subject to the Mataura River Conservation Order 1997. This identifies technical requirements for discharges, which would sit alongside and take precedence to the proposed National Standards. (See Below).
- Resource Consents: The existing discharge consent expired on 10/9/2023. An application (APP-20232970) for a new discharge consent has been submitted, with processing suspended under section 91A of the RMA as of August 2023.
- Calculated Average Dry Weather Flow (ADWF): 232 m³/day.
- Average discharge volume limit 264m³/day. Maximum discharge volume limit 528m³/day.
- Average discharge volume 422 m³/day. Maximum daily volume 653 m³/day (2019 and 2022).
- Replacement Cost (2023/24): \$25,023,106.
- Annual Depreciation (2023/24): \$324,246.
- Key Challenges and Unique Features: Balancing the treatment needs of two communities and addressing potential future growth.

Figure 12: Mataura River Water Conservation Order (Extract)

Water Conservation (Mataura River) Order 1997

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7 Provisions relating to discharges

(1) A discharge permit must not be granted and a regional plan must not be made for any discharge into the protected waters if the effect of the discharge would be to breach the following provisions and standards:

- (a) any discharge is to be substantially free from suspended solids, grease, and oil;
- (b) after allowing for reasonable mixing of the discharge with the receiving water in that part of the protected waters between map references NZMS 260 F45:967503 to F45:963508 (Mataura River),—
 - (i) the natural water temperature must not be changed by more than 3 degrees Celsius;
 - (ii) the acidity or alkalinity of the waters as measured by the pH must be within the range of 6.0 to 8.5, except when due to natural causes;
 - (iii) the waters must not be tainted so as to make them unpalatable, nor must they contain toxic substances to the extent that they are unsafe for consumption by humans or farm animals, nor must they emit objectionable odours;
 - (iv) there must not be any destruction of natural aquatic life by reason of a concentration of toxic substances;
 - (v) the natural colour and clarity of the waters must not be changed to a conspicuous extent;
 - (vi) the oxygen content in solution in the waters must not be reduced below 6 milligrams per litre;
 - (vii) based on not fewer than 5 samples taken over not more than a 30-day period, the median value of the faecal coliform bacteria content of the water must not exceed 2000 per 100 millilitres and the median value of the total coliform bacteria content of the water must not exceed 10 000 per 100 millilitres;
- (c) after allowing for reasonable mixing of the discharge with the receiving water in that part of the protected waters between map references—
 - (i) NZMS 260 F45:894581 to F45:885584 (Mataura River); and
 - (ii) NZMS 260 F46:917391 to F46:924396 (Mataura River),—
 - (A) the natural water temperature must not be changed by more than 3 degrees Celsius;
 - (B) the acidity or alkalinity of the waters as measured by the pH must be within the range of 6.5 to 8.3, except when due to natural causes;
 - (C) the waters must not be tainted so as to make them unpalatable, nor must they contain toxic substances to the extent that they are unsafe for consumption by humans or farm animals, nor must they emit objectionable odours;
 - (D) there must not be any destruction of natural aquatic life by reason of a concentration of toxic substances;
 - (E) the natural colour and clarity of the waters must not be changed to a conspicuous extent;
 - (F) the oxygen content in solution in the waters must not be reduced below 6 milligrams per litre;
 - (G) based on not fewer than 5 samples taken over not more than a 30-day period, the median value of the faecal coliform bacteria content of the waters must not exceed 200 per 100 millilitres;
- (d) after allowing for a reasonable mixing of the discharge with the receiving waters in those parts of the protected waters other than the parts specified in paragraphs (b) and (c),—
 - (i) the natural water temperature must not be changed by more than 3 degrees Celsius;
 - (ii) the acidity or alkalinity of the waters as measured by the pH must be within the range of 6.0 or 9.0, except when due to natural causes;
 - (iii) the waters must not be tainted so as to make them unpalatable, nor must they contain toxic substances to the extent that they are unsafe for consumption by humans or farm animals, nor must they emit objectionable odours;
 - (iv) there must not be any destruction of natural aquatic life by reason of a concentration of toxic substances;
 - (v) the natural colour and clarity of the waters must not be changed to a conspicuous extent;
 - (vi) the oxygen content in solution in the waters must not be reduced below 5 milligrams per litre.

(2) Where it is impracticable, because of emergency overflows or the carrying out of maintenance work or any other temporary situation, to require compliance with the relevant provisions of subclause (1), water permits and discharge permits may be granted by the Southland Regional Council.

Figure 13: Plant Process Flow Diagram

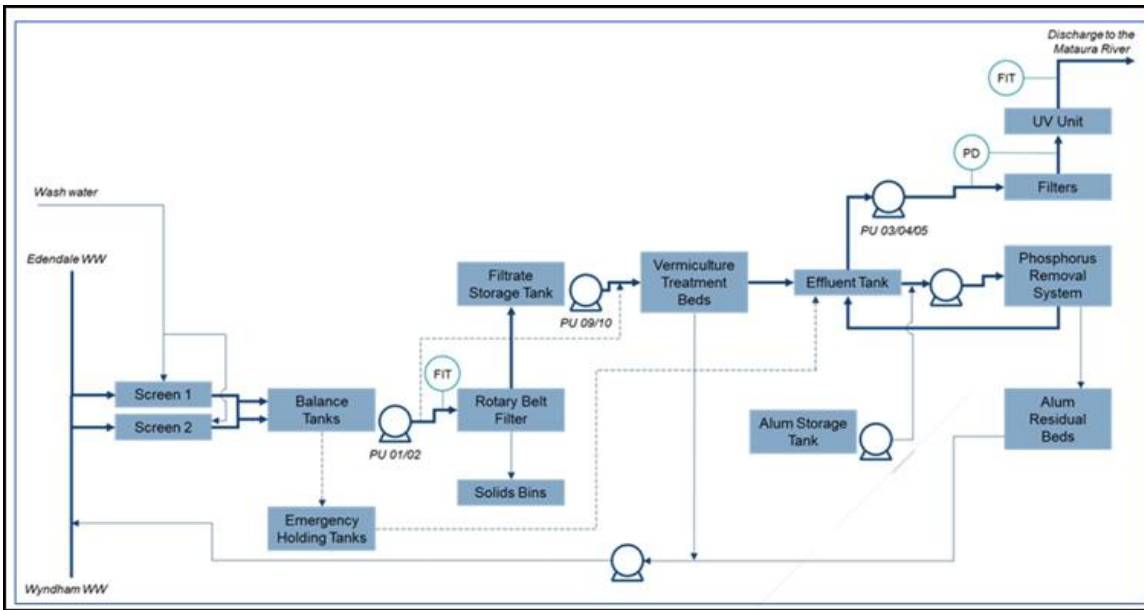
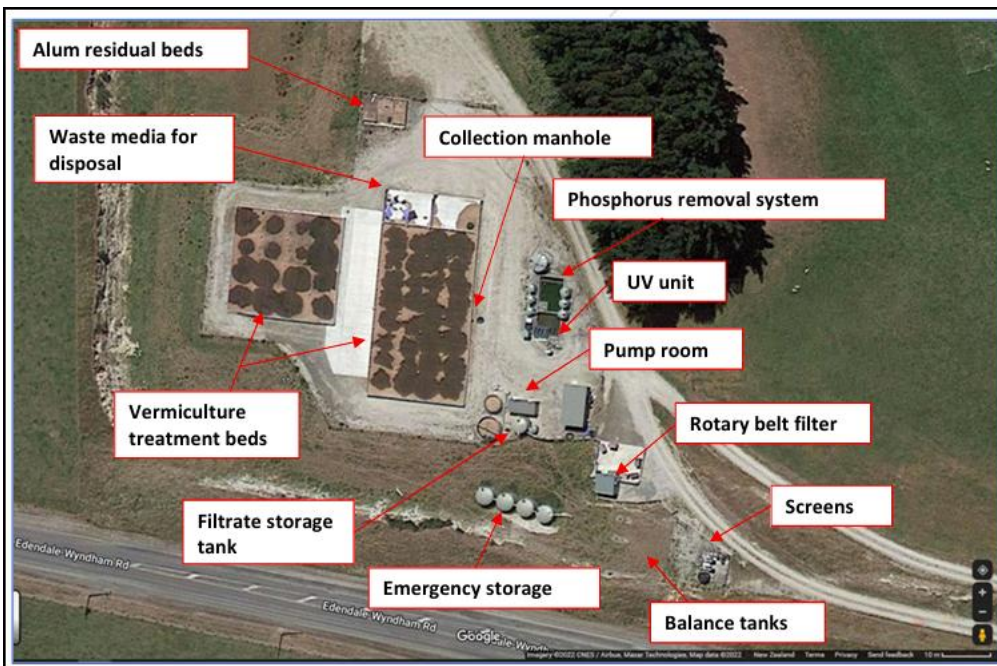


Figure 14: Plant Layout



Wastewater Characteristics

A wastewater treatment plant Resource Consent Application and Assessment of Environmental Effects report has been completed.

Edendale WWTP Wastewater Characteristics and Consent Limits are tabulated below.

Table 3: - Edendale - Wyndham Wastewater Characteristics (Sept 2017 - Sept 2022)

Parameter	Unit	Sept 17 - Sept 22 data		Current consented Limit (average)
		Mean	95%ile	
BOD5	g/m ³	10	21	30
TSS	g/m ³	17	46	70
Dissolved Reactive Phosphorous (DRP)	g/m ³	2.5	4.2	4
AmmN	g/m ³	8.7	15	15
TN	g/m ³	30	40	No Limit
E.Coli	MPN/100ml	1696	16,000	6,000cfu/100ml

Table 4... Summary of Scheduled Monitoring Results (1 July 2023 - 30 June 2024)

Parameters	Upstream Mean	Downstream Mean
Dissolved Oxygen (g/m ³)	8.6	8.9
Dissolved Reactive Phosphorus (g/m ³)	0.012	0.013
Electrical Conductivity (mS/cm@25C)	95	98
Escherichia coli (MPN/100mL)	159	175
Nitrate Nitrogen (g/m ³)	1	1.1
pH	7.2	7.2
Total Ammonia Nitrogen (g/m ³)	0.03	0.03
Total Suspended Solids (g/m ³)	3	3

There has been some re-validation of design flows as initial design parameters based on discharge consent limits (detailed in context), appear to have been underestimated. This may have a detrimental impact to the current wastewater treatment plant performance where there have been some spikes in volume, but generally otherwise the plant performs adequately against the current consent limits.

Options Assessment

In determining the optimal way forward for this plant, SDC have considered in detail two modular based options:

1. A Membrane Aerated Biofilm Reactor (MABR) – This was the chosen option.
2. A primary sedimentation tank (PST) paired with a recirculating textile filter (RTF).

The relative costs are summarised below:

Table 5... Options Cost Estimate Summary

	RTF +PST	MABR
Capex range (need to add allowance for 20% higher N load).	\$9.7 to \$15m	\$7.8 to \$12M
Opex	Approx \$295k per annum	Approx \$311k per annum

Receiving Environment

The receiving environment is Mataura River. This has a dilution ratio of 2097 (High).

Table 6... National Performance Standard Extract

Category	cBOD5 (mg/L)	Total Suspended Solids (mg/L)	Total Nitrogen (mgN/L)	Total Phosphorus (mgP/L)	Ammoniacal Nitrogen (toxicity) (mgN/L)	E.Coli (Public Health) (cfu/100mL)	Enterococci (Public Health) (cfu/100mL)
	Annual Median	Annual Median	Annual Median	Annual Median	Annual 90%ile	Annual 90%ile	Annual 90%ile
Rivers and Streams							
High Dilution Ratio	20	30	35	10	25	32,500	Not Required

A comparison between the required standard and the plant performance shows significant gaps. A hybrid combination of MABR, tertiary filtration, and UV disinfection, will improve the performance of the plant significantly. Further investigation and detailed design would need to be completed to confirm full compliance against the required standards.

Cost Assessment

Cost information has been supplied for the proposed plant upgrade under the current arrangements (status quo), alongside estimated costs for the proposed national environmental performance standards for both compliance with the small plant standard and the national environmental standard for land discharge. Not all requested information could be provided at this time.

Table 7...Cost Assessment

Activity	Status Quo -	Proposed Small Plant Standard - Water Discharge				National Environmental Performance Standard - Land			
	Cost \$	Estimated Cost \$	Cost Reduction \$	Cost Reduction %	Impact	Estimated Cost \$	Cost Reduction \$	Cost Reduction %	Impact
Resource Consent									
Regional Council Fees (assumed peer review)	\$ 222,000	\$ 30,000	\$ 192,000	86%	↓	\$ 75,000	\$ 147,000	66%	↓
Council Internal Staff Costs	\$ 19,200	\$ 8,000	\$ 11,200	58%	↓	\$ 13,000	\$ 6,200	32%	
Technical Consultants - Consenting	\$ 45,000	\$ 10,000	\$ 35,000	78%	↓	\$ 25,000	\$ 20,000	44%	
Assessment of Environmental Effects (AEE)	\$ 25,000	\$ 5,000	\$ 20,000	80%	↓	\$ 10,000	\$ 15,000	60%	↓
Wastewater Characterisation Report	\$ 11,000	\$ 11,000	\$ -	0%		\$ 11,000	\$ -	0%	
Hydrological and Hydrogeological Assessment	\$ 5,000	\$ 5,000	\$ -	0%		\$ 5,000	\$ -	0%	
Community engagement	\$ 15,000	\$ 12,000	\$ 3,000	20%		\$ 12,000	\$ 3,000	20%	
Iwi engagement	\$ 28,000	\$ 3,000	\$ 25,000	89%	↓	\$ 3,000	\$ 25,000	89%	↓
Cultural Impact Assessment	\$ 25,000	\$ 5,000	\$ 20,000	80%	↓	\$ 5,000	\$ 20,000	80%	↓
Ecological Impact Assessment	\$ 8,000	\$ 5,000	\$ 3,000	38%		\$ 5,000	\$ 3,000	38%	
Monitoring and Management Plan	\$ 5,000	\$ 5,000	\$ -	0%		\$ 5,000	\$ -	0%	
Noise Assessment (if applicable)	\$ 5,000	\$ 5,000	\$ -	0%		\$ 5,000	\$ -	0%	
Odour and Air Quality Assessment (if applicable)	\$ 9,000	\$ 5,000	\$ 4,000	44%		\$ 5,000	\$ 4,000	44%	
Traffic and Transport Assessment (if applicable)	\$ 3,000	\$ 3,000	\$ -	0%		\$ 3,000	\$ -	0%	
Climate Change and Resilience Assessment	\$ 2,500	\$ 2,500	\$ -	0%		\$ 2,500	\$ -	0%	
Stakeholder Engagement Report	\$ 13,000	\$ 3,000	\$ 10,000	77%	↓	\$ 3,000	\$ 10,000	77%	↓
Alternative Options Analysis	\$ 68,000	\$ 25,000	\$ 43,000	63%	↓	\$ 25,000	\$ 43,000	63%	↓
Compliance with National Environmental Standards	\$ 30,000	\$ 15,000	\$ 15,000	50%	↓	\$ 15,000	\$ 15,000	50%	↓
Visual Impact Assessment (if applicable)	\$ 8,000	\$ 8,000	\$ -	0%		\$ 8,000	\$ -	0%	
Cumulative Effects Assessment	\$ 5,000	\$ 5,000	\$ -	0%		\$ 5,000	\$ -	0%	
Peer Review	\$ 17,500	\$ 5,000	\$ 12,500	71%	↓	\$ 5,000	\$ 12,500	71%	↓
Sampling / lab results	\$ 45,000	\$ 45,000	\$ -	0%		\$ 45,000	\$ -	0%	
Total	\$ 614,200	\$ 220,500	\$ 393,700	64%		\$ 290,500	\$ 323,700	53%	
Design									
Council Internal Staff Costs	\$ 60,000	\$ 20,000	\$ 40,000	67%	↓	\$ 30,000	\$ 30,000	50%	↓
Technical Consultants - Design	\$ 145,000	\$ 85,000	\$ 60,000	41%		\$ 110,000	\$ 35,000	24%	
Design and Engineering Report	\$ 22,000	\$ 5,000	\$ 17,000	77%	↓	\$ 5,000	\$ 17,000	77%	↓
Peer Review	\$ 17,500	\$ 5,000	\$ 12,500	71%	↓	\$ 5,000	\$ 12,500	71%	↓
Total	\$ 244,500	\$ 115,000	\$ 129,500	53%		\$ 150,000	\$ 94,500	39%	
Construction									
Capital Works	\$ 12,547,500	\$ 12,547,500	\$ -	0%					
Upgraded power/load requirements (could include solar, battery and generator)	\$ 35,000	\$ 35,000	\$ -	0%					
Procurement	\$ 20,000	\$ 20,000	\$ -	0%					
Council Internal Staff Costs	\$ 16,250	\$ 16,250	\$ -	0%					
MSQA	\$ 81,250	\$ 81,250	\$ -	0%					
Total	\$ 12,700,000	\$ 12,700,000	\$ -	0%					
Operation (Annual Cost) - (Current)									
Annual Operating Costs - Labour (how often are plants visited)	\$ 700,000	\$ 100,000	\$ 600,000						
Annual Operating Costs - Materials/Chemicals	\$ 16,000	\$ 16,000	\$ -						
Annual Operating Cost = Power	\$ 23,928	\$ 23,928	\$ -						
Compliance Monitoring and Testing	\$ 8,000	\$ 8,000	\$ -						
Reporting to Regional Council	\$ 1,000	\$ 1,000	\$ -						
Enforcement of consent conditions	\$ 2,500	\$ 2,500	\$ -						
Total	\$ 751,428	\$ 151,428	\$ 600,000						

Time Assessment

An assessment of the potential time savings has also been undertaken:

Table 8...Time Assessment

Activity	Status Quo - Existing	Proposed Small Plant Standard - Water Discharge	National Environmental Performance Standard - Land Discharge
	Estimated Time (months)	Estimated Time (months)	Estimated Time (months)
Resource Consent			
Gather information & prepare reports	2	2	2
Consultation and Engagement with Community and Iwi	34	6	12
Develop preferred option and prepare consent application	12	3	12
Lodge Application	3	1	3
Consideration by Consent Authority	12	1	3
Determination of Application by Consent Authority	8 to 12	1	3
Design			
Detailed Engineering Design of Plant and Monitoring Requirements	24	5	5
Construction - (Design / Build & Operate contract)			
Procurement	5	5	5
Fabrication (Modular Plants)(including shipping)	9	9	9
Construction of works	12 to 18	12 to 18	12 to 18
Commissioning and trial period (defects period 24 months)	12	12	12
Total	Approx 138 months	Approx 60 months	Approx 69 months
Post Construction - (Council staff)			
Annual Operations	2 months	2 months	3 months
Compliance Monitoring and Testing	2 weeks	2 weeks	1 month
Reporting to Regional Council	2 weeks	2 weeks	1 month
Enforcement of consent conditions	2 weeks	2 weeks	2 weeks

Balfour Wastewater Treatment Plant

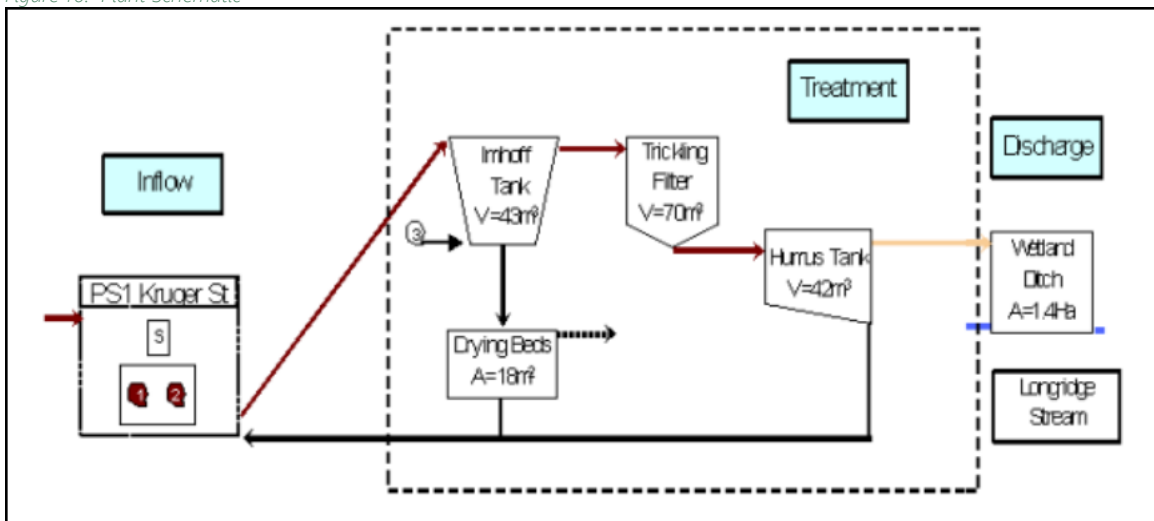
Context

- Population Served: The WWTP is located at 4 Kruger Street, Balfour, Southland, New Zealand. It serves the Balfour township, which has a population of approximately 145 residents.
- Treatment Technologies and Processes: The plant utilises primary treatment through Imhoff tank and trickling filter.
- Receiving Environment: Longridge Stream. Dilution Ratio 284 (High).
- Resource Consents: The existing discharge consent expired on 2/2/2024. An application (APP-20233398) for a new consent has been submitted, with processing suspended under section 91A of the RMA.as of September 2023.
- Capacity and Performance Metrics: The wastewater treatment plant is designed to discharge an average of 250 m³/day of treated wastewater. However, the plant has experienced issues with inflow and infiltration (I&I), particularly during winter months when groundwater levels rise and following heavy rainfall events. These issues have led to increased flow rates, impacting the plant's efficiency and performance.
- Calculated Average Dry Weather Flow (ADWF): 29 m³/day.
- Discharge Quantity: Maximum discharge volume limit 250m³/day.
- Replacement Cost (2023/24): \$3,348,210.
- Annual Depreciation (2023/24): \$52,089.
- The plant discharge pipe merges with a stormwater pipe before discharging into a wetland ditch and then subsequently Longridge Stream. There is an opportunity to pipe this ditch to ensure alignment with proposed performance standards.
- Key Challenges and Unique Features: A significant challenge for the Balfour WWTP is managing inflow and infiltration, which leads to increased flow rates during certain periods. To address this, SDC have awarded a contract for the repair of sections of the wastewater network in Balfour. The goal is to reduce infiltration and inflow, thereby enhancing the plant's efficiency and allowing for a more cost-effective upgrade in the next two to five years.

Figure 15: Existing WWTP



Figure 16: Plant Schematic



Wastewater Characteristics

A wastewater treatment plant options assessment report has been recently completed for Balfour wastewater treatment plant. In the absence of wastewater characteristics, typical per capita generation rates were used to estimate the approximate wastewater loads. The following per capita values were used in the calculation:

Balfour WWTP Wastewater Characteristics:

- Biochemical Oxygen Demand (BOD5): 70g/day.
- Total Suspended Solids (TSS): 75g/day.
- Total Nitrogen (TN): 18 g/day.
- Ammoniacal Nitrogen (AmmN) 10g/day.
- Total Phosphorous (TP) 5g/ day.

The reported (BOD5) of 70g/day has been assumed to be a mean annual influent of < 85kg day. Balfour WWTP will meet the proposed small plant standard category.

Options Assessment

A number of options have been shortlisted for Balfour wastewater treatment plant which can be defined as hybrid variants and a combination of modular technologies to meet the performance requirements. A few factors impacted the options assessment and preliminary capital costs were estimated at between \$7m to \$30m. (-15% to +40%).

The greater cost range was significantly impacted by high existing flows (infiltration issues) and land requirements for disposal of waste to land.

The preferred option which was determined by multi criteria analysis weighted scoring was a combination of modular bed reactors, pre & post anoxic tanks, carbon dosing, and UV disinfection. For this option a newly installed pressurised sewer network was proposed to mitigate infiltration and high flows as the proposed modular systems could not compensate for infiltration flows and loads.

The capital cost estimate for this option was lowest between \$7 to \$11m (-15% to +40%).

Receiving Environment

The receiving environment for treated effluent is Longridge Stream via a wetland ditch. Assuming the ditch is piped and the discharge is then directed to the stream, then Balfour would have a high dilution ratio.

From the proposed Small Plant Standard, the proposed treatment standards are:

Table 9... Proposed Effluent Quality Limits

Category	cBOD5 (mg/L)	Total Suspended Solids (mg/L)	Ammoniacal Nitrogen (toxicity) (mgN/L)	E.Coli (Public Health) (cfu/100mL)	Enterococci (Public Health) (cfu/100mL)
	Annual Median	Annual Median	Annual 90%ile	Annual 90%ile	Annual 90%ile
Rivers and Streams					
High Dilution Ratio	20	30	25	32500	Not Required

Table 10... Plant Performance (Jan 2018 to June 2022- nine samples)

Parameter	Unit	Recent Performance (9 Results)			Current Consent Limit	
		Mean	80%ile	Max	80%ile	Max
BOD5	mg/L	10	11	24	25	40
TSS	mg/L	12	10.4	40	25	40
DO	mg/L	5.4	6.8	7.9		
AmmN	mg/L	3.6	3.8	8.3	-	2.57
TN	mg/L	11	12	17	-	-
E.Coli	MPN/100ml	357,533	210,000	672,000	-	-

Comparison between table 9 (proposed limits receiving environments) and table 10 (plant performance (Jan 2018 – June 2022, nine samples)) suggests that the current plant would not meet all the proposed new wastewater treatment limits. It is noted that the plant currently performs well against current consent conditions.

Cost Assessment

Cost information has been supplied for the proposed plant upgrade under the current arrangements (status quo), alongside estimated costs for the proposed national environmental performance standards for both compliance with the small plant standard and the national environmental standard for land discharge. Not all requested information could be provided at this time.

Table 11... Cost Assessment

Activity	Existing		Proposed Small Plant Standard - Water Discharge				National Environmental Performance Standard - Land Discharge			
	Cost \$	Estimated Cost \$	Cost Reduction \$	Cost Reduction %	Impact	Estimated Cost \$	Cost Reduction \$	Cost Reduction %	Impact	
Resource Consent										
Regional Council Fees	\$ 180,000	\$ 30,000	\$ 150,000	83%	↓	\$ 75,000	\$ 105,000	58%	↓	
Council Internal Staff Costs	\$ 14,000	\$ 8,000	\$ 6,000	43%	↓	\$ 13,000	\$ 1,000	7%	↓	
Technical Consultants - Consenting	\$ 45,000	\$ 10,000	\$ 35,000	78%	↓	\$ 25,000	\$ 20,000	44%	↓	
Assessment of Environmental Effects (AEE)	\$ 25,000	\$ 5,000	\$ 20,000	80%	↓	\$ 10,000	\$ 15,000	60%	↓	
Wastewater Characterisation Report	\$ 11,000	\$ 11,000	\$ -	0%	↓	\$ 11,000	\$ -	0%	↓	
Hydrological and Hydrogeological Assessment	\$ 5,000	\$ 5,000	\$ -	0%	↓	\$ 5,000	\$ -	0%	↓	
Community engagement	\$ 15,000	\$ 12,000	\$ 3,000	20%	↓	\$ 12,000	\$ 3,000	20%	↓	
Iwi engagement	\$ 28,000	\$ 3,000	\$ 25,000	89%	↓	\$ 3,000	\$ 25,000	89%	↓	
Cultural Impact Assessment	\$ 25,000	\$ 5,000	\$ 20,000	80%	↓	\$ 5,000	\$ 20,000	80%	↓	
Ecological Impact Assessment	\$ 8,000	\$ 5,000	\$ 3,000	38%	↓	\$ 5,000	\$ 3,000	38%	↓	
Monitoring and Management Plan	\$ 5,000	\$ 5,000	\$ -	0%	↓	\$ 5,000	\$ -	0%	↓	
Noise Assessment (if applicable)	\$ 4,000	\$ 5,000	\$ -1,000	-25%	↑	\$ 5,000	\$ -1,000	-25%	↑	
Odour and Air Quality Assessment (if applicable)	\$ 9,000	\$ 5,000	\$ 4,000	44%	↓	\$ 5,000	\$ 4,000	44%	↓	
Traffic and Transport Assessment (if applicable)	\$ 3,000	\$ 3,000	\$ -	0%	↓	\$ 3,000	\$ -	0%	↓	
Climate Change and Resilience Assessment	\$ 2,500	\$ 2,500	\$ -	0%	↓	\$ 2,500	\$ -	0%	↓	
Public Consultation and Stakeholder Engagement Report	\$ 13,000	\$ 3,000	\$ 10,000	77%	↓	\$ 3,000	\$ 10,000	77%	↓	
Alternative Options Analysis	\$ 54,000	\$ 25,000	\$ 29,000	54%	↓	\$ 25,000	\$ 29,000	54%	↓	
Compliance with National Environmental Standards	\$ 30,000	\$ 15,000	\$ 15,000	50%	↓	\$ 15,000	\$ 15,000	50%	↓	
Visual Impact Assessment (if applicable)	\$ 8,000	\$ 8,000	\$ -	0%	↓	\$ 8,000	\$ -	0%	↓	
Cumulative Effects Assessment	\$ 5,000	\$ 5,000	\$ -	0%	↓	\$ 5,000	\$ -	0%	↓	
Peer Review	\$ 15,000	\$ 5,000	\$ 10,000	67%	↓	\$ 5,000	\$ 10,000	67%	↓	
Sampling / lab results	\$ 45,000	\$ 45,000	\$ -	0%	↓	\$ 45,000	\$ -	0%	↓	
Total	\$ 549,500	\$ 220,500	\$ 329,000	60%		\$ 290,500	\$ 259,000	47%		
Design										
Council Internal Staff Costs	\$ 60,000	\$ 20,000	\$ 40,000	67%	↓	\$ 30,000	\$ 30,000	50%	↓	
Technical Consultants - Design	\$ 145,000	\$ 65,000	\$ 80,000	55%	↓	\$ 90,000	\$ 55,000	38%	↓	
Design and Engineering Report	\$ 22,000	\$ 5,000	\$ 17,000	77%	↓	\$ 5,000	\$ 17,000	77%	↓	
Peer Review	\$ 17,500	\$ 5,000	\$ 12,500	71%	↓	\$ 5,000	\$ 12,500	71%	↓	
Total	\$ 244,500	\$ 95,000	\$ 149,500	61%		\$ 130,000	\$ 114,500	47%		
Construction										
Capital Works	\$ 11,054,500	\$ 11,054,500	\$ -	0%	↓					
Upgraded power/load requirements (could include solar, battery and generator)	\$ 28,000	\$ 28,000	\$ -	0%	↓					
Procurement	\$ 20,000	\$ 20,000	\$ -	0%	↓					
Council Internal Staff Costs	\$ 16,250	\$ 16,250	\$ -	0%	↓					
MSQA	\$ 81,250	\$ 81,250	\$ -	0%	↓					
Total	\$ 11,200,000	\$ 11,200,000	\$ 0	0%						
Operation (Annual Cost)										
Annual Operating Costs - Labour (how often are plants visited)	\$ 45,000	\$ 120,000	\$ -75,000							
Annual Operating Costs - Materials/Chemicals	\$ -	\$ 8,000	\$ -8,000							
Annual Operating Cost = Power	\$ 4,659	\$ 10,000	\$ -5,341							
Compliance Monitoring and Testing	\$ 6,000	\$ 6,000	\$ -							
Reporting to Regional Council	\$ 1,000	\$ 1,000	\$ -							
Enforcement of consent conditions	\$ 2,300	\$ 2,300	\$ -							
Total	\$ 58,959	\$ 147,300	\$ -88,341							

Time Assessment

An assessment of the potential time savings has also been undertaken:

Table 12... Time Assessment

Activity	Status Quo - Existing	Proposed Small Plant Standard - Water Discharge	National Environmental Performance Standard - Land Discharge
	Estimated Time (months)	Estimated Time (months)	Estimated Time (months)
Resource Consent			
Gather information & prepare reports	2	2	2
Consultation and Engagement with Community and Iwi	34	6	12
Develop preferred option and prepare consent application	12	3	12
Lodge Application	3	1	3
Consideration by Consent Authority	12	1	3
Determination of Application by Consent Authority	8 to 12	1	3
Design			
Detailed Engineering Design of Plant and Monitoring Requirements	20	5	5
Construction			
Procurement	5	5	5
Fabrication (Modular Plants)	9	9	9
Construction of works	12 to 18	12 to 18	12 to 18
Commissioning and trial period (defects period 24 months)	12	12	12
Total	Approx 134 months	Approx 60 months	Approx 81 months
Post Construction			
Annual Operations	2 weeks	2 weeks	3 months
Compliance Monitoring and Testing	2 weeks	2 weeks	1 month
Reporting to Regional Council	2 weeks	2 weeks	1 month
Enforcement of consent conditions	2 weeks	2 weeks	2 weeks

Nightcaps Wastewater Treatment Plant

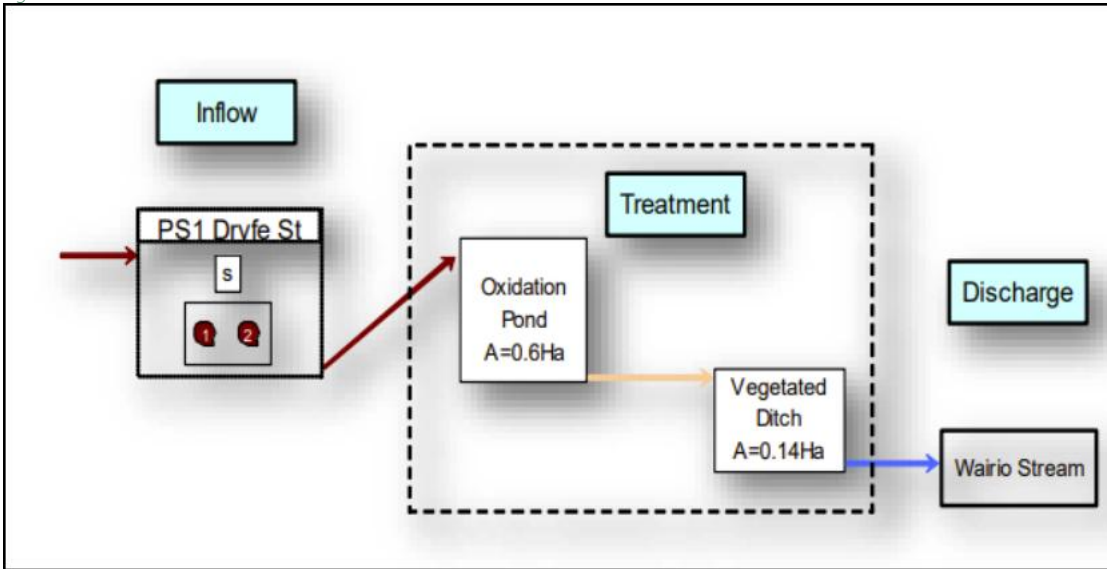
Context

- Population Served: 299 residents.
- Treatment Technologies and Processes: The plant utilises primary treatment through oxidation pond and rock filter beds.
- Receiving Environment: Wairiro Stream. Dilution Ratio 52 (Moderate).
- Resource Consents: The existing discharge consent expires on 1/7/2027. The plant would be subject to the proposed two-year resource consent extension.
- Calculated Average Dry Weather Flow (ADWF): 60 m³/day.
- Discharge Quantity: Average discharge volume limit 400 m³/day.
- Replacement Cost (2023/24): \$8,308,219.
- Annual Depreciation (2023/24): \$96,805.
- Key Challenges and Unique Features: Addressing potential future growth and maintaining treatment efficiency with a small user base.

Figure 17: :Oxidation Pond



Figure 18: Plant Schematic



Wastewater Characteristics

There is no recent plant assessment information available for this plant. Therefore, typical per capita generation rates have been used to estimate the approximate wastewater loads. The following per capita values were used in the calculation:

- Biochemical Oxygen Demand (BOD5): 70g/day.
- Total Suspended Solids (TSS): 75 g/day.
- Total Nitrogen (TN) 18 g/day.
- Ammoniacal Nitrogen (AmmN) 10 g/day.
- Total Phosphorus (TP) 5g/day.

Based on the limited information available, including limited Environment Southland compliance monitoring reporting, it has been assessed that the existing plant performs adequately against consent conditions.

Receiving Environment

If the vegetated ditch is piped, then the receiving environment is Wairio Stream. This has a dilution ratio of 53 (Moderate)

From the proposed Small Plant Standard, the proposed treatment standards are:

Table 13... Small Plant Standard Wairio Stream

Category	cBOD5 (mg/L)	Total Suspended Solids (mg/L)	Ammoniacal Nitrogen (toxicity) (mgN/L)	E.Coli (Public Health) (cfu/100mL)	Enterococci (Public Health) (cfu/100mL)
	Annual Median	Annual Median	Annual 90%ile	Annual 90%ile	Annual 90%ile
Rivers and Streams					
Medium Dilution Ratio	15	15	3	6500	Not Required

One observation is that the current carbonaceous Biochemical Oxygen Demand (cBOD5) is that the current consent is already 15 mg/l for rivers and streams (moderate dilution). Whilst not conclusive, Nightcaps wastewater treatment plant may face challenges of growth generating greater wastewater loads that has the potential to impact on compliance with the newly proposed standards.

Cost Assessment

Cost information has been supplied for the proposed plant upgrade under the current arrangements (status quo), alongside estimated costs for the proposed national environmental performance standards for both compliance with the small plant standard and the national environmental performance standard for land discharge. Not all requested information could be provided at this time.

Table 14... Cost Assessment

Activity	Status Quo -	Proposed Small Plant Standard - Water Discharge				National Environmental Performance Standard - Land			
	Cost \$	Estimated Cost \$	Cost Reduction \$	Cost Reduction %	Impact	Estimated Cost \$	Cost Reduction \$	Cost Reduction %	Impact
Resource Consent									
Regional Council Fees	\$ 80,000	\$ 30,000	\$ 50,000	63%	↓	\$ 30,000	\$ 50,000	63%	↓
Council Internal Staff Costs	\$ 9,000	\$ 8,000	\$ 1,000	11%		\$ 8,000	\$ 1,000	11%	
Technical Consultants - Consenting	\$ 45,000	\$ 10,000	\$ 35,000	78%	↓	\$ 10,000	\$ 35,000	78%	↓
Assessment of Environmental Effects (AEE)	\$ 25,000	\$ 5,000	\$ 20,000	80%	↓	\$ 5,000	\$ 20,000	80%	↓
Wastewater Characterisation Report	\$ 11,000	\$ 11,000	\$ -	0%		\$ 11,000	\$ -	0%	
Hydrological and Hydrogeological Assessment	\$ 5,000	\$ 5,000	\$ -	0%		\$ 5,000	\$ -	0%	
Community engagement	\$ 15,000	\$ 12,000	\$ 3,000	20%		\$ 12,000	\$ 3,000	20%	
Iwi engagement	\$ 8,000	\$ 3,000	\$ 5,000	63%	↓	\$ 3,000	\$ 5,000	63%	↓
Cultural Impact Assessment	\$ 4,000	\$ 5,000	-\$ 1,000	-25%	↑	\$ 5,000	-\$ 1,000	-25%	↑
Ecological Impact Assessment	\$ 8,000	\$ 5,000	\$ 3,000	38%		\$ 5,000	\$ 3,000	38%	
Monitoring and Management Plan	\$ 5,000	\$ 5,000	\$ -	0%		\$ 5,000	\$ -	0%	
Noise Assessment (if applicable)	\$ 4,000	\$ 5,000	-\$ 1,000	-25%	↑	\$ 5,000	-\$ 1,000	-25%	↑
Ecological and Cultural Assessment (if applicable)	\$ 9,000	\$ 5,000	\$ 4,000	44%		\$ 5,000	\$ 4,000	44%	
Traffic and Transport Assessment (if applicable)	\$ 3,000	\$ 3,000	\$ -	0%		\$ 3,000	\$ -	0%	
Climate Change and Resilience Assessment	\$ 2,500	\$ 2,500	\$ -	0%		\$ 2,500	\$ -	0%	
Public Consultation and Stakeholder Engagement Report	\$ 13,000	\$ 3,000	\$ 10,000	77%	↓	\$ 3,000	\$ 10,000	77%	↓
Alternative Options Analysis	\$ 84,000	\$ 25,000	\$ 59,000	70%	↓	\$ 25,000	\$ 59,000	70%	↓
Compliance with National Environmental Standards	\$ 30,000	\$ 15,000	\$ 15,000	50%	↓	\$ 15,000	\$ 15,000	50%	↓
Visual Impact Assessment (if applicable)	\$ 8,000	\$ 8,000	\$ -	0%		\$ 8,000	\$ -	0%	
Cumulative Effects Assessment	\$ 5,000	\$ 5,000	\$ -	0%		\$ 5,000	\$ -	0%	
Peer Review	\$ 12,000	\$ 5,000	\$ 7,000	58%	↓	\$ 5,000	\$ 7,000	58%	↓
sampling / lab results	\$ 45,000	\$ 45,000	\$ -	0%		\$ 45,000	\$ -	0%	
Total	\$ 430,500	\$ 220,500	\$ 210,000	49%		\$ 220,500	\$ 210,000	49%	
Design									
Council Internal Staff Costs	\$ 35,000	\$ 20,000	\$ 15,000	43%		\$ 20,000	\$ 15,000	43%	
Technical Consultants - Design	\$ 85,000	\$ 45,000	\$ 40,000	47%		\$ 45,000	\$ 40,000	47%	
Design and Engineering Report	\$ 18,000	\$ 5,000	\$ 13,000	72%	↓	\$ 5,000	\$ 13,000	72%	↓
Peer Review	\$ 17,500	\$ 5,000	\$ 12,500	71%	↓	\$ 5,000	\$ 12,500	71%	↓
Total	\$ 155,500	\$ 75,000	\$ 80,500	52%		\$ 75,000	\$ 80,500	52%	
Construction									
Capital Works	\$ 12,417,000	\$ 12,417,000	\$ -						
Upgraded power/load requirements (could include solar, battery and generator)	\$ 180,000	\$ 180,000	\$ -						
Procurement	\$ 20,000	\$ 20,000	\$ -						
Council Internal Staff Costs	\$ 15,000	\$ 15,000	\$ -						
MSQA	\$ 68,000	\$ 68,000	\$ -						
Total	\$ 12,700,000	\$ 12,700,000	\$ -						
Operation (Annual Cost)									
Annual Operating Costs - Labour (how often are plants visited)	\$ 40,000	\$ 100,000	-\$ 60,000						
Annual Operating Costs - Materials/Chemicals	\$ -	\$ 8,000	-\$ 8,000						
Annual Operating Cost = Power	\$ -	\$ 20,000	-\$ 20,000						
Compliance Monitoring and Testing	\$ 6,000	\$ 6,000	\$ -						
Reporting to Regional Council	\$ 1,000	\$ 1,000	\$ -						
Enforcement of consent conditions	\$ 2,300	\$ 2,300	\$ -						
Total	\$ 49,300	\$ 137,300	-\$ 88,000						

Time Assessment

An assessment of the potential time savings has also been undertaken:

Table 15... Time Assessment

Activity	Status Quo - Existing	Proposed Small Plant Standard - Water Discharge	National Environmental Performance Standard - Land Discharge
	Estimated Time (months)	Estimated Time (months)	Estimated Time (months)
Resource Consent			
Gather information & prepare reports	2	2	2
Consultation and Engagement with Community and Iwi	17	6	8
Develop preferred option and prepare consent application	12	3	8
Lodge Application	3	1	3
Consideration by Consent Authority	12	1	3
Determination of Application by Consent Authority	8 to 12	1	3
Design			
Detailed Engineering Design of Plant and Monitoring Requirements	20	5	5
Construction			
Procurement	5	5	5
Fabrication (Modular Plants)	9	9	9
Construction of works	12 to 18	12 to 18	12 to 18
Commissioning and trial period (defects period 24 months)	12	12	12
Total	Approx 117 months	Approx 60 months	Approx 73 months
Post Construction			
Annual Operations	2 weeks	2 weeks	3 month
Compliance Monitoring and Testing	2 weeks	2 weeks	1 month
Reporting to Regional Council	2 weeks	2 weeks	1 month
Enforcement of consent conditions	2 weeks	2 weeks	2 weeks

Appendix B: Case Study - Horowhenua District Council



Background

The Horowhenua District is located in the lower North Island of New Zealand and is characterised by its rural and semi-rural landscapes and strong Māori cultural heritage. It has a population of approximately 28,150 residents (2023 estimate). The district has a low population density of 34 people per square kilometre, with the urban centre of Levin serving as the primary hub for economic activity and population growth.

Horowhenua was chosen as a case study as it faces growth pressures. This case study will look at the Tokomaru Wastewater Treatment Plant (WTP). Originally Levin WTP was also considered alongside Tokomaru, but Levin's population size meant it fell significantly outside the scope of this report, and therefore the value of its inclusion was doubtful.

HDC is facing common challenges of affordability, particularly for compliance and consent-based activities and works, the recruitment and retention of suitably qualified staff, and ageing infrastructure.

Overview of Wastewater Network

Horowhenua comprises a number of small communities, many with populations under 1,000. Six towns within the district are reticulated with council owned and maintained wastewater infrastructure. These are Levin, Foxton, Foxton Beach, Shannon, Tokomaru and Waitarere Beach.

Table 16...Plant Overview

Plant Name	Population Equivalent	Annual Predicted Population Growth	Treatment Capacity (m ³ /day)	Primary Treatment	Secondary Treatment	Tertiary Treatment	Discharge Consent				Discharge to Land				
							Assessed Level of Stormwater Inflow and Infiltration (m ³ /day)	Resource Consent (Date Granted)	Resource Consent (Date Expires)	Receiving Environment (Water/Land)	Is a discharge to land assessment available	Average Total Nitrogen (kg/ha/year)	Average Total Phosphorous (Kg/ha/year)	Average Annual E.coli (cfu/100ml)	Note*
Tokomaru	594	3	121	Screening	Oxidation Pond	Wetland	100m ³ /day dryflow to 575m ³ /day max in last 5 years, June 2022.	31/07/2020	30/06/2023	Land/Water	No	-	-	-	Not applicable to this plant as the consent is for controlling seepage which has no specific size of area.
Levin	19533	196.9	9319	Screening; Sedimentation	Biological Filtration; Oxidation Ponds	↘	median flows upto 6505m ³ /day, peak flows 27482m ³ /day with a one off event of 50260	27/11/2014	1/07/2034	Land	No	-	-	-	Not applicable to this plant as the consent is for controlling seepage which has no specific size of area.
The Pot															
Waitare Beach	960	21.2	486	Screening	Oxidation Pond	Land Irrigation	150m ³ /day dry, upto 1425m ³ /day (July 2022)	6/06/2018	1/07/2044	Land		930.8	124.03	11410000	
Foxton Beach	2130	23.3	441	Screening	Oxidation Pond	Land Irrigation	Median flow 318-364 dry vs wet year, peak flow 1970m ³ /day feb 2021	11/03/2003	1/04/2028	Land		349	60.59	60320	
Foxton	3384	33.3	1997	Screening	Oxidation Pond	Land Irrigation	1534-1819m ³ /day median flow, upto 5957m ³ /day wet	4/02/2019	1/07/2048	Land		11905	1810	1434308	Average from 4 years' data period from Oct to Sep each year. Calculated with the area as 62.5ha.
Shannon & Mangaore	1548	3.9	603	Screening	Oxidation Pond; Floating Wetland	↘	Median flow ranges from 414 to 570m ³ /day, peak flow upto 3607m ³ /day	11/07/2012	11/07/2034	Land	No	-	-	-	Not applicable to this plant as the consent is for controlling seepage which has no specific size of area.
Shannon LITS															

Tokomaru Wastewater Treatment Plant

Context

- Population Served: The Tokomaru WWTP is located approximately 20 kilometres southwest of Palmerston North. The plant serves a population of around 600 residents.
- Treatment Technologies and Processes: Wastewater from households gravitates to a low point in the sewer network, where it is pumped via a pressure main to the treatment plant. Upon entry, the sewage is screened before flowing into an oxidation pond. The treated effluent is subsequently pumped into a purpose-built wetland, where the effluent either evaporates or infiltrates into the ground. During winter periods and any periods of sustained wet weather, there is a controlled discharge into the Centre Drain adjacent to the ponds, leading to the Linton Main Drain and ultimately the Tokomaru River.
- Resource Consents: The existing discharge consent expired on 30 June 2023. An application (APP-2000008605.03) for a new discharge consent has been lodged (December 2022), with processing on hold under section 92(1) of the RMA as of February 2023.
- Receiving Environment: Centre Drain – Dilution Ratio is 1.0 and therefore standards do not apply. If HDC were to construct a pipeline to convey the wastewater direct to a new discharge point to the Tokomaru River, the dilution ratio would be 307 (High). This is not currently proposed, but the standards open up this option.
- Calculated Average Dry Weather Flow (ADWF): 126 m³/day for current community; 155 m³/day with growth (year 2040).
- Replacement Cost (Recalculated 31/3/2025): \$1.8M (including cost of land).
- Annual Depreciation (Recalculated 31/3/2025): \$124,000.

Key Challenges and Unique Features: Managing effluent discharge during winter months and sustained wet weather periods to prevent discharge to water. Receiving environment (Centre Drain) often has no upstream flow and therefore dilution ratio is 1 under the standards. Land has been identified for a 100 percent to land discharge option but the infrastructure for conveyance and land disposal and wastewater treatment plant upgrade costs present significant funding challenges.

Effluent treatment is by screening, oxidation pond and wetland.

For approximately half of the year (summer period), treated wastewater is discharged via seepage through the base of the wetland. When there are higher flows and / or limited soakage to ground within the wetland, treated wastewater is discharged from the wetland to Centre Drain via a bark filter.

Design volumes are estimated at 37,500 m³/year for the current community. Thirty percent growth in wastewater influent is predicted by 2040.

A network CCTV survey undertaken in 2018 identified no significant inflows and infiltration. Smoke testing carried out in 2020 similarly identified few on-property stormwater connections and/or inflow points into the network.

Figure 19: Existing Plant Layout



Wastewater Characteristics

Table 17...Flow Data

Year	Inflow to WWTP	Flow between Pond and Wetland	Discharge to Centre Drain
2020-2021	20,476	11,830	14,542
2021-2022	44,046	20,003	15,830
2022-2023	34,596	39,371	33,001
2023-2024	34,704	23,549	12,831

Table 18 Effluent Characteristics ...

Parameter	Current	Future (2040)
Population	454	586
Average Flow	120 m3/day	155 m3/day
Peak Flow	577 m3/day	745 m3/day
BOD	27 kg/day	35 kg/day
TSS	32 kg/day	41 kg/day
NH3	3 kg/day	4 kg/day
TP	1 kg/day	1.3 kg/day

The annual plant monitoring report for July 2023 to June 2024 indicated that the existing plant is generally performing very well and assessed highly compliant against its existing (now expired) consent, albeit with four consent requirements assessed as Low Risk Non-compliances and one as Moderate Non-compliance. However, more recently an Abatement Notice has been received from the consent authority (Horizons Regional Council) regarding the frequency of meeting of the Tokomaru

Wastewater Working Party (in that HDC had not met the minimum consent requirements for this), and a formal warning relating to ammonia levels in the Centre Drain (which had been measured at levels above those specified in the consent conditions). The latter is attributable to overflow from the plant due to rainfall events and the high-water table, alongside adjacent farm activity, as well as the fact that the current wastewater treatment plant does not treat for ammonia.

Receiving Environment

The current receiving environment for treated effluent is the Centre Drain (which joins the Tokomaru River – via Linton Drain - approximately 4.1 km downstream of the discharge point) and shallow groundwater via the base of the wetland. The wetland can therefore be considered to act as a rapid infiltration basin and this discharge is not covered by the wastewater standards and will need to be consented under the normal RMA process.

The current discharge point is Centre Drain which is often dry upstream of the discharge during summer periods. Therefore, the dilution ratio for the current discharge point is 1.0 and the minimum dilution ratio (10) for the standards to apply is not met. If, however, the Council were to pipe the treated effluent to a new discharge point direct into the Tokomaru River, the discharge would be within the high dilution ratio range of the standards.

From the proposed small plant standard, the proposed treatment standards for high dilution ratio receiving environments are as follows, noting that they only apply if the discharge were to be piped direct to Tokomaru River.

Table 19... Discharge Standard - Tokomaru River

Category	cBOD5 (mg/L)	Total Suspended Solids (mg/L)	Ammoniacal Nitrogen (toxicity) (mg/L)	E.Coli (Public Health) (cfu/100mL)	Enterococci (Public Health) (cfu/100mL)
	Annual Median	Annual Median	Annual 90%ile	Annual 90%ile	Annual 90%ile
Rivers and Streams					
High Dilution Ratio	20	30	25	32,500	Not Required

Based on the Annual Monitoring report for July 2022 – July 2023, the plant would not currently fully meet this standard.

Alternatively, data from 2024 suggests that the existing wastewater treatment plant may meet this standard with only minor upgrades which could include the addition of UV. However, this is based on the current configuration whereby the majority of treated effluent is discharged via the base of the wetland which acts as a rapid infiltration basin. The extent of upgrade required to meet the above effluent quality standards if the rapid infiltration basin is not part of the system has not been assessed.

A number of options have been identified for the potential upgrade of Tokomaru wastewater treatment plant, which can be defined as hybrid variants and a combination of modular technologies to meet the performance requirements.

- 2-Stage Facultative Pond.
- Primary Sedimentation with Trickling Filter.
- Packaged Membrane Bioreactor.
- Thermatic Digestion.

The reported cost of these options in 2024 were:

Table 20... Estimated Cost of Options

Option	Pond	Filter	Membrane	Thermatic
Capex	\$2.8m	\$2.6m	\$4.5m	\$4.5m
Annual Opex	\$36.6k	\$58.6k	\$103.3k	\$154k
NPV	\$3.3m	\$3.3m	\$5.8m	\$6.5m

The Facultative Ponds and Sedimentation with Tricking Filter have been identified as being the preferred options.

The current proposal is for disposal to land, with a discharge area of approximately 13.7 hectares, with discharge to water (Centre Drain) in exceptional circumstances.

Figure 20: Discharge to Land Proposal.

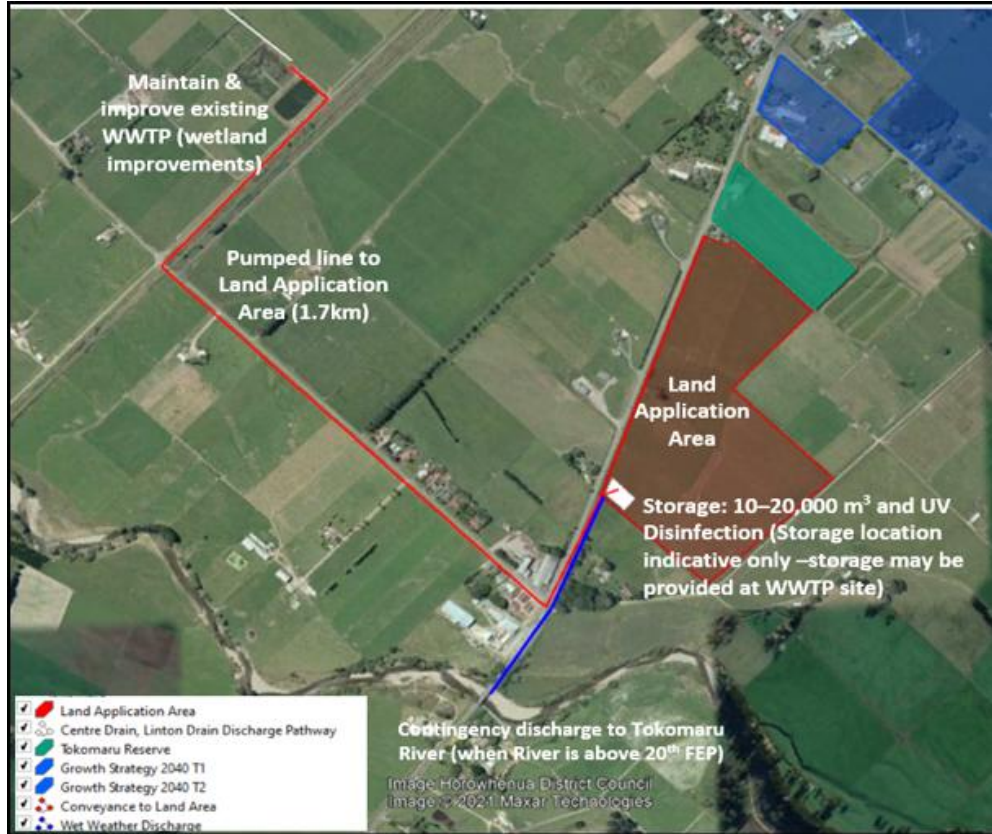


Table 21... Plant Upgrade Comparison

Option	Pond	Filter	Membrane	Thematic
Quality (BOD/TSS/NH3/T/N)	25/30/15/25	10/20/3/25	<5/<5/<20	25/30/25
Programme	1.5 – 2 years	1 year	1 year	?
Capital Estimate	\$2.8m	\$2.6m	\$3.8m	\$4.5m
Asset Life	20 – 25 years	50 Years	15 – 20 years	15 – 20 years
Opex Cost	\$36.6k	\$58.6k	\$103.3k	\$155k
Desludging	\$600k in 20 years	Inc	Inc	\$600k in 20 years
Membrane Replacement			8 years	
NPV	\$3.9m	\$3.4m	\$5.8m	\$7.1m
50yr Carbon	3,053t	1,266t	2,030t	3,653t

Table 22... Total Project Cost Estimate (Facultative Pond Option).

Element	Capital Cost	Project Cost	Project Cost with 20% Contingency
Treatment Upgrade	\$2,800k		
Pump & Pipeline	\$793k		
Storage	\$3,223k		
Irrigation System	\$430k		
Total Capital Cost	\$7,246k		
Project Delivery		\$3,261k	
Total Project		\$10,507k	\$12,608k

Due diligence was undertaken prior to the acquisition of the land application site and a detailed site assessment was undertaken including shallow groundwater bores and soil testing across the site. A formal assessment, as required by the proposed national standard for discharge to land, however, has not been undertaken.

Based on the information from the site assessment, the land application site would be Class 3 at best based on groundwater being <5.0m below surface. Therefore, the following parameters would apply.

- Total nitrogen (kg/ha/year) – 150.
- Total Phosphorus (kg/ha/year) – 20.
- E.coli (cfu/100ml) - <1,000.

The proposed land disposal regime has been developed to a concept/preliminary design level. With the land area available, the loading rates will be approximately 100 kg N/ha/yr and 35-40 kg P/ha/yr. The proposed nitrogen loading rate would meet the standards (subject to the Class 3 categorisation being confirmed), but additional phosphorus removal would be required to meet the phosphorus loading rate.

Some of the land has been assessed as poorly draining with some areas underlain by a clay layer. Therefore, there is a risk that the site may be categorised as Class 5 and the standards would not apply.

Council Concerns

The proposed wastewater standards have highlighted some concerns by council. An assessment on the impact of the proposed standards was compiled by Good Earth Matters on behalf of HDC to emphasise the changes and impacts the proposed standards may impose on the Tokomaru Wastewater Treatment Plant.

Table 23... Schedule of Council Concerns

Consents Required (Current WWTP & Proposal)	Impact of Wastewater Standards (including amendments to RMA via the LG (Water Service) Bill)
Discharge of Treated Wastewater to Land (Irrigation Area): Discretionary.	Depends on Category/ Class as per site specific risk assessment. If Class 3 then additional treatment to the significant upgrade already proposed would be required to meet the phosphorus loading rate. There is a risk that that site will be classified as Class 5 and the standards would not apply.
Land Use Consent for Intensive Farming Activity (Controlled).	Does not appear to change the need to obtain this consent (unclear at this stage). This consent will likely limit the nutrient and hydraulic loading able to be applied to the land as grant of consent is based on compliance with nitrogen leaching limits. The need to obtain this consent is likely to result in a more restrictive land irrigation regime than possible if the standards were to apply.

Consents Required (Current WWTP & Proposal)	Impact of Wastewater Standards (including amendments to RMA via the LG (Water Service) Bill)
Discharge Permit for Human Effluent storage and treatment facility: Discretionary Activity.	Unclear at this time. The regional rules require consent for the irrigation storage pond due its proposed location (set back distance of 150 m from public road not met), This could be avoided by relocation of the storage pond into centre of site (noting that this impacts land available for irrigation) This consent is also required for the WWTP site as the ponds are also within 150 m of a public road. This cannot be avoided given size of the site.
Discharge Permit for Treated Wastewater to water (Centre Drain): Discretionary.	Wastewater standards do not seem to apply due to minimum dilution ratio not being met at the Centre Drain current and proposed discharge point. As noted above, if HDC were to pipe the treated effluent to a new discharge point direct to the Tokomaru River.
Discharge to Air: Discretionary.	Wastewater standards do not change need for this consent.
Discharge permit for discharge to ground via base of existing wetlands: Discretionary:	This discharge is essentially a rapid infiltration basin and is therefore excluded from the wastewater standards.

Other Comments

The above assessment highlighted concerning areas for HDC specifically; with previous tests and assessments on the land at Tokomaru, HDC may most likely be non-compliant with the proposed standards. This may force a decision to discharge to water, which may affect the current relationships already formed with the local Iwi and community groups.

If HDC decides to discharge to the Tokomaru River and receive a 35-year consent, then there will be cost savings. However, if this process does not include the consent to discharge to air or land use for intensive farming, then the approval and consultation process may be much longer than the status quo. There may also be further resistance due to impact on the receiving environment if all councils in the region discharge to water.

HDC have concerns that the cost of reporting to two regulators, Horizons Regional Council and WSA, will increase costs. It is not yet clear whether all consenting relating to the operation of wastewater treatment plant will fall to one regulator.

Providing the cost estimates below with this much uncertainty was challenging and therefore the cost and time savings included in this case study are indicative at best and have a low degree of confidence.

Cost Assessment

Cost information has been supplied for the proposed plant upgrade and disposal to land proposal, under the current arrangements (status quo), and national standard for land discharge.

Table 24... Cost Assessment

Activity	National Environmental Performance Standard - Land Discharge					Impact	Comments
	Status Quo Cost \$ (cost over 6 years)	Estimated Cost \$	Cost Reduction \$	Cost Reduction %			
Resource Consent							
Regional Council Fees	\$ 18,404	\$ 7,500	\$ 10,904	59%		↓	Status quo costs are only cost to date. Expect \$50-100k final costs. Estimated costs are only if it complies with standard and no other consents are required. And if additional consents are required, Regional Council will engage technical consultants as part of the consent process to ensure compliance / peer review due diligence.
Council Internal Staff Costs	\$ 137,380	\$ 48,000	\$ 89,380	65%		↓	If TWWTP comply with WW standards, then this cost will be reduced to the estimated amount. However, this can easily double up, or higher, if TWWTP does not comply with standards and in consideration of the additional consent applications and related projects.
Technical Consultants - paid to Consultants but may not be all for resource consent application but other investigations	\$ 283,728	\$ 150,000	\$ 133,728	47%		↓	If existing WWTP complies, then these costs would be minimal. If it doesn't comply, still need to do optioneering, concept and prelim design along with land purchase negotiations and technical assessment (site soil testing and groundwater bores) of land disposal area. (Included below)
Assessment of Environmental Effects (AEE) - paid to an environmental institution with no further details so other costs may be included	\$ 142,250	\$ 100,000	\$ 42,250	30%		↓	Could be lower if the WW standards cover all activities. But the \$100k is probably reasonable given the other consents (e.g. land use for intensive farming & discharge to air) will still be required.
Wastewater Characterisation Report							
Hydrological and Hydrogeological Assessment							
Community engagement	\$ 75,000	\$ 50,000	\$ 25,000	33%		↓	This will still be a necessity due to other consents that will still need to be applied (see J11). Too many unknowns to be quantified in an amount as public opinions can go either way which can drive costs up significantly.
Iwi engagement							
Cultural Impact Assessment	\$ 110,000	\$ 20,000	\$ 90,000	82%		↓	Amount allowed as a review of previous work may still be necessary. However, comments in J14 and J11 apply here too and can drive costs up.
Ecological Impact Assessment							
Monitoring and Management Plan - sampling costs	\$ 17,642	\$ 35,284.70	-\$ 17,642	-100%		↑	Anticipation of stronger monitoring and reporting requirements being needed.
Noise Assessment (if applicable)							
Site Investigation - incl risk assessment	\$ 76,709	\$ 100,000	-\$ 23,292	-30%		↑	Allowance for on-site risk assessment due to potential increased complexity
Climate Change and Resilience Assessment							
Public Consultation and Stakeholder Engagement - hall hire & refreshments cost	\$ 300	\$ 500	-\$ 200	-67%		↑	
Alternative Options Analysis							
Compliance with National Environmental Standards							
Visual Impact Assessment (if applicable)							
Cumulative Effects Assessment							
Peer Review							
Land Purchase - land cost and land deposit costs	\$ 641,383						
Legal Fees	\$ 2,901						
Design							
Council Internal Staff Costs							
Technical Consultants - Design							
Surveying	\$ 6,250	\$ 6,250	\$ -				
Design and Engineering Report	\$ 63,823	\$ 50,000	\$ 13,823	22%		↓	
Peer Review		\$ 10,000					
Construction							
Capital Works (minor projects)	\$ 66,726	\$ 100,000	-\$ 33,274	-50%		↑	Additional work identified to wetland
Bark Filter Construction	\$ 10,000						
Upgraded power/load requirements (could include solar, battery and generator)		\$ 50,000					
Procurement		\$ 250,000					
Council Internal Staff Costs		\$ 41,000					
MSQA							
Operation (Annual Cost)							
Annual Operating Costs - Labour (how often are plants visited)	\$ 27,223	\$ 30,000	-\$ 2,778	-10%		↑	Increased site monitoring anticipated
Annual Operating Costs - Materials/Chemicals	\$ 26,617	\$ 45,000	-\$ 18,384	-69%		↑	Increased chemical use anticipated
Annual Operating Cost = Power	\$ 1,600	\$ 10,000	-\$ 8,400	-525%		↑	Increased energy costs anticipated
Removal of Geobag	\$ 50,000	\$ 50,000					
Compliance Monitoring and Testing	\$ 24,621	\$ 35,000	-\$ 10,379	-42%		↑	Increased sampling and testing anticipated.
Reporting to Regional Council	\$ 5,801	\$ 10,000	-\$ 4,199	-72%		↑	Increased reporting anticipated.
Reporting to Taumata Arowai		\$ 10,000					
Enforcement of consent conditions							

Time Assessment

An assessment of potential time savings has also been undertaken.

Table 25... Time Assessment

Activity	Status Quo - Existing Estimated Time (months)	National Environmental Performance Standard - Land Discharge Estimated Time (months)	Estimated Cost if Infrastructure Design Solution Adopted (i.e. Modular Package Plants). Estimated Time (months)	Comments
Resource Consent				
Gather information & prepare reports	12	3	3	Timeline is estimated based on compliance with WW Standards. However if non-compliant, then this timeline will be longer especially with the additional consents that may be required for land use.
Consultation and Engagement with Community and Iwi	9	9	6	Timeline is based on current condition of plant and with the assumption that we may not comply with new standards, requiring a lengthier consultation period with Iwi groups/community
Develop preferred option and prepare consent application	9	6	6	
Lodge Application	1	1	1	
Consideration by Consent Authority - after lodgement	3	3	3	Too many unknowns currently to determine a better estimate of time. There may be other consents to apply for to discharge to air and for land use which may take longer than the estimated time.
Determination of Application by Consent Authority	15	6	6	
Site-specific risk assessment		15	15	
Design				
Detailed Engineering Design of Plant and Monitoring Requirements	6	12	3	Allowing for longer timeframe for design (excl modular units) due to competing priorities with design consultants
Construction				
Works				
Procurement	6	6	6	This is any tendering process timeline
Fabrication & Procurement (Modular Plants)	3	6	9	Allowing for longer delays and lead times given the demand for these units and possibly shipping from offshore
Construction of works	6	12	4	Allowing longer timeframe (excl modular units) in anticipation of stricter requirements with the standards
Post Construction				
Annual Operations	12	12	12	
Compliance Monitoring and Testing	12	12	12	
Reporting to Regional Council	1	1	1	
Reporting to Taumata Arowai (assuming quarterly reporting)		4	4	
Enforcement of consent conditions	12	12	12	

Appendix C: Case Study - Thames Coromandel District Council



Background

As of the 2023 New Zealand Census, the Thames-Coromandel District has a population of 31,995, marking a 7.0 percent increase from 2018 and a 22.2 percent rise since 2013. The district covers an area of 2,207.59 Km², resulting in a population density of approximately 14.7 people per Km².

The district has a predominantly European population with a significant Māori presence. The district's aging population is a notable trend, with a median age substantially higher than the national average. Ethnic diversity is present but less pronounced compared to urban centres. Economic indicators show lower median incomes and a smaller proportion of high earners compared to national figures.

Thames Coromandel and in particular the Matarangi wastewater treatment plant, was chosen as a case study due to the significant summer population fluctuations and the challenges experienced in obtaining a new discharge consent for the plant.

Overview of Wastewater Network

TCDC operates eleven wastewater treatment plants to manage the district's growing population and tourism-driven seasonal demands. These plants serve urban and rural areas across the district, each employing different treatment technologies depending on the needs, size, and environmental considerations.

Wastewater treatment faces several significant challenges. One of the primary issues is the seasonal variability in population. Many of the district's towns experience a large influx of tourists during the summer months, which puts considerable strain on the capacity of wastewater treatment systems designed for smaller, year-round populations. This increase in load can lead to inefficiencies in treatment and difficulty meeting regulatory discharge standards, particularly in relation to nutrient removal.

Aging infrastructure is another concern. Several of the wastewater treatment plants in the district were built decades ago and are not be equipped to handle the increased demands of modern wastewater treatment. These older systems require costly upgrades to meet current environmental and regulatory standards. This issue is compounded by the need for on-going maintenance to prevent failures, which can lead to non-compliance with discharge conditions.

Environmental protection is a critical issue, particularly when it comes to meeting the standards for nutrient removal. High levels of nitrogen and phosphorus in treated effluent contribute to water quality degradation in local waterways, including eutrophication, which can affect aquatic ecosystems. Ensuring that each plant meets environmental standards for nutrient discharge is a challenge, particularly for those plants that lack advanced tertiary treatment processes.

The wastewater network comprises:

- 397 km of wastewater mains.
- 134 wastewater pumping stations.
- 11 wastewater treatment plants.
- 5,846 Chambers.

Table 26... Plant Overview

Plant Name	Population Equivalent	Annual Predicted Population Growth	Treatment Capacity (m3/day)	Primary Treatment	Secondary Treatment	Tertiary Treatment	Discharge Consent		
							Resource Consent (Date Granted)	Resource Consent (Date Expires)	Receiving Environment (Water/Land)
Matarangi	651	709	1100	Yes	Yes	Yes	27/02/2014	1/12/2020	Discharge to gravel trenches and then to the tributary of Mapuriki stream
Cormandel	1743	1782	-	Yes	Yes	Yes	13/01/2012	1/12/2026	Discharge to Water (Whangarata Stream)
Cooks Beach	459	555	-	Yes	Yes	No	4/07/2021	31/07/2051	Irrigation to Forested land surrounding WWTP 23.4 ha- 75 kg/ha/day TN limit
Hahei	250	-	-	Yes	Yes	No	7/12/2017	15/12/2030	Wigmore Stream
Oamaru Bay	30	-	-	Yes	Yes	No	4/11/2009	1/06/2024	Sub-surface irrigation (7000m2, 7mm per day max)
Onemana	130	-	-	Yes	Yes	No	19/12/2001	30/11/2021	Soakage Trench system
Opito Bay		-	-	Yes	Yes	Yes	23/10/2014	23/10/2034	Sub-surface drip irrigation - 4mm per day limit
Pāuanui	1068	-	-	Yes	Yes	Yes	30/11/2005	30/11/2030	Ⓜ Rapid infiltration
Thames	7212	-	-	Yes	Yes	Yes	19/01/2021	31/01/2041	Waihou River
Whangamatā	4269	-	-	Yes	Yes	Yes	28/06/2007	31/12/2036	Land - 68 ha Tairua Forest (spray)
Whitianga	6230	-	-	Yes	Yes	Yes	28/02/2011	28/02/2041	Mostly to Ngarahutunoa Stream

Matarangi Wastewater Treatment Plant

Context

- Population Served; Permanent residential population of 651 people which increases to around 7,000 people during the peak summer period (24 December to 10 January)(2023 population figures).
- Treatment Technologies and Processes: Inlet screen, three oxidation ponds in series, membrane filtration unit (MBU), UV disinfection and diffusion beds.
- Receiving Environment: The discharge is to freshwater by means of a drain which flows to the Mapauriki Stream and ultimately Whangapoua Harbour, but with prior land contact (diffusion beds).The plant is within a Coastal Marine Area (CMA).
- Resource Consent: The existing discharge consent expired on 1 December 2020. An application (APP-141878) for a new consent has been submitted with processing suspended under section 91A of the RMA as of 27 May 2020. The application was publicly notified. An Environment Court Hearing was held on 16 July 2024. Except for ammonia nitrogen, the effluent quality is generally in compliance with the existing consent conditions.
- Capacity and Performance Metrics: The off-peak average flow is 240m³/day; the peak period average flow is 907 m³/day; the peak period peak day flow is 1414 m³/day.
- Calculated Average Dry Weather Flow: 551 m³/day.
- Discharge Quantity: Maximum discharge volume limit 650 m³/day.

Figure 21: Existing Plant Layout

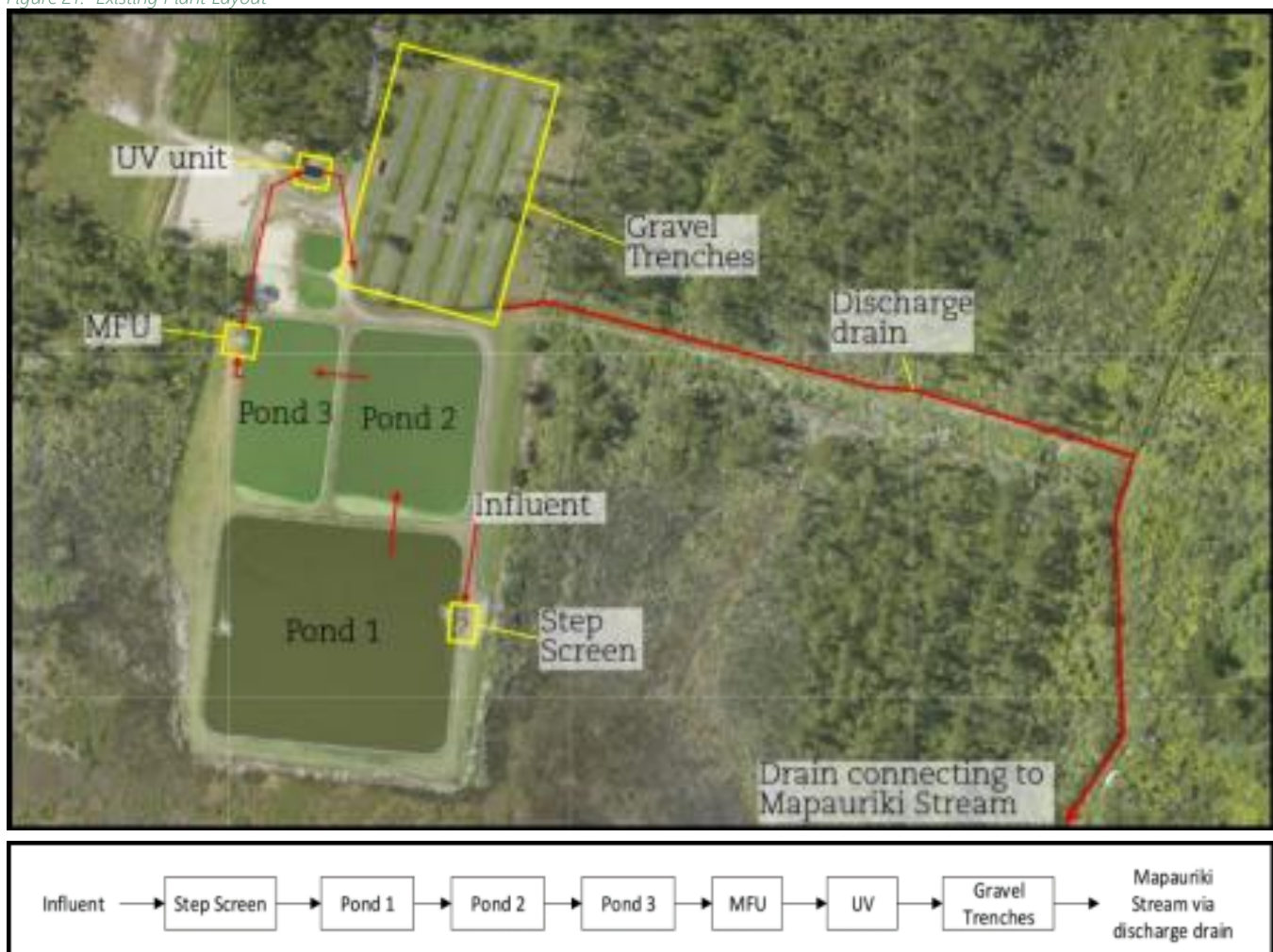


Figure 22: Matarangi Wastewater Treatment Plant Discharge Drain



Figure 23: Matarangi WWTP Diffusion Beds



Wastewater Characteristics

An application to renew the existing discharge consent for the plant has been prepared by Harrison Grierson in 2020 on behalf of TCDC. This has been framed around initial options work dating from 2016. There has subsequent been an Environment Court Hearing to consider this application. There is therefore a considerable amount of information available on the current plant performance and wastewater characteristics.

Table 27... Influent Quantity November 2017 to June 2022

Parameter	Flow	Flow/dwelling ⁽²⁾
Off-peak average	315m ³ /d	0.22m ³ /d
Peak period ⁽¹⁾ average	979m ³ /d	0.69m ³ /d
Peak period peak day	1464m ³ /d	1.03m ³ /d

⁽¹⁾Peak period from 24th December to 10th January each year.

⁽²⁾Based on 1,411 connected properties.

Table 28... Contamination Concentrations During the 2023- 2024 Christmas/New Year Peak Period

Parameter	Concentration (mg/L)		load (kg/d)	
	Median	90 th percentile	Median	90 th percentile
Carbonaceous Biological Oxygen Demand (CBOD5)	285	464	133	211
Total Suspended Solids (TSS)	304	401	150	180
Ammonia Nitrogen	48	70	22	30
Total Kjeldahl Nitrogen (TKN)	67	80	31	35

Parameter	Concentration (mg/L)		load (kg/d)	
	Median	90 th percentile	Median	90 th percentile
Total Phosphorus (TP)	8	10	4	5
Enterococci	3.7x10 ⁶	7.3x10 ⁶	-	-
E. Coli	1.5x10 ⁷	2.8x10 ⁷	-	-

Table 29... Effluent – Plant Performance over 5 years (CBOD5 and TSS)

Period	Carbonaceous Bod5 (Cbod5)		Total Suspended Solids (Tss)	
	Average (Mg/L)	95 th ile (Mg/L)	Average (Mg/L)	95 th ile (Mg/L)
Consent	5	12	15	40
July 2018-June2019	2.9	5.6	4	10.6
July 2019-June2020	1.7	4.9	2.5	10.7
July 2020-June 2021	2	5.7	3.2	6.3
July 2021-June 2022	1.1	2.8	3.5	10
July 2022-June 2023	0.9	2.1	3.5	7.8

Table 30...Effluent – Plant Performance over 5 Years (Nutrients)

PERIOD	TOTAL NITROGEN		TOTAL PHOSPHORUS		AMMONIACAL NITROGEN	
	Average (mg/l)	95 th ile (mg/l)	Average (mg/l)	95 th ile (mg/l)	Average (mg/l)	95 th ile (mg/l)
Consent	-	-	-	-	1	3
July 2018-June 2019	10.5	17.9	1.6	4.3	3.1	14.3
July 2019-June 2020	8.2	19.7	2	3	1.7	10.7
July 2020-June 2021	12.3	31.6	2.7	3.6	4.2	18.2
July 2021-June 2022	10.5	20.3	1.9	3.2	2	10.3
July 2022-June 2023	10.5	16	1.5	2	0.8	2.2

Table 31... Effluent – Plant Performance over 5 Years (Pathogens)

PERIOD	FAECAL COLIFORMS		ENTEROCOCCI	
	Average (no./100mL)	95 th ile (no./100mL)	Average (no./100mL)	95 th ile (no./100mL)
Consent	250	3000	-	-
July 2018-June2019	193	746	161	226
July 2019-June2020	22	78	6	19
July 2020-June 2021	34	148	9	30
July 2021-June 2022	135	486	56	520
July 2022-June 2023	1.6	1.6	1.2	1.8

Table 32...: Effluent Quality in Peak Periods

YEARS	PERIOD	CARBONACEOUS BOD5 (CBOD5)		TOTAL SUSPENDED SOLIDS (TSS)		FAECAL COLIFORMS		AMMONIACAL NITROGEN	
Consent		5	12	15	40	250	3000	1	3
2017-2018	Christmas/ New Year	3.8	6.9	3.7	5.5	28.6	108.2	1.5	4.7
2019	Early January, Easter and late December.	2.5	6.9	2.7	11	66.7	722.6	2.3	16.1
2020	Early January, Easter and late December.	1.9	5.8	2.1	4.9	6.5	25.1	0.3	0.7
2021	Early January, Easter and late December.	0.8	1.1	4.1	6.1	8.5	12.8	0.4	0.5
2022	April-May	0.65	0.84	3.9	8.2	1.6*	1.6*	1.4	5.3
2023-24	Late December-End of January	1.1	2.1	23.5	79	1.8*	2.6*	0.66	1.2

Options Assessment

The existing plant needs to be upgraded to service future growth, improve discharge quality, and build resilience. Also, the current plant is not capable of removing nitrogen and phosphorus consistently and reliably.

TCDC have gone through an extensive options assessment process for both the proposed plant upgrade and discharge options. The influent loads during the peak summer period being critical for the plant upgrades proposed.

Options considered for the plant upgrade included:

- Construction of additional oxidation ponds.
- Retrofitting Oxidation Pond 2 into an Intermittently decanted aerated lagoon (IDAL) and Pond 3 as a decant pond.
- Installation of Aquamats.
- Use of Biofiltro (media bed using earthworms and microorganisms to remove contaminants).
- Construction of new concrete sequence batch reactor (SBR) tanks.

The final decision on what type of system will be installed for the plant upgrade has not yet been made, pending the determination of the consent.

However, the cost of the SBR tank option has been estimated to be (2016):

- Capital Expenditure - \$10m to \$14.4m
- Annual Operating Expenditure - \$430,000 to \$621,000.

Discharge options shortlisted through a multi-criteria analysis were:

Table 33...Shortlisted Discharge Options

Option	Description	Estimated Cost (2016)
Discharge to Ocean	Treated Effluent pumped through a 1.3km pipeline and a 2km outfall pipe in Pacific Ocean	\$5m - \$7m
Discharge to Land	Treated Effluent stored in a 4000m ³ storage tank before being pumped to farmland south of Matarangi and discharged via sprinkler irrigation	\$12m - \$17m

Option	Description	Estimated Cost (2016)
Discharge to constructed wetland then to water	Treated effluent is discharged via a constructed wetland installed in Pond 1. Once effluent is polished by the wetland, discharge is to the estuary.	\$4m - \$5m
Discharge through rock filter	Treated effluent is passed through a rock filter before discharge to the estuary	\$0.2m - \$0.3m

The constructed wetland was included in the original consent application as the preferred option. However, on-going consultation with stakeholders' post lodgement resulted in abandoning this option in favour of using the existing diffusion beds. It is assumed that effluent would continue to be discharged to the drainage ditch and Mapauriki Stream.

Receiving Environment

The receiving environment for treated effluent is the existing drain which flows to the Mapauriki Stream and ultimately Whangapoua Harbour

The challenge for this plant is the peak summer loading. Based on the data provided above it is unlikely the plant will meet the proposed small plant standard annual cBOD5 load of 85kg/day or less, and therefore the proposed national standard for discharge to water would apply. (Estimated cBOD5 peak period average in 2045 is 183 kg/day).

The existing drainage ditch is assessed to have a dilution ratio <10.

An assessment has been on the dilution ratio for the Mapauriki Stream.

- The calculated flow for the stream is 8l/s (1991-2021) which equates to 691m³/day.

The effluent discharge volumes are detailed in the table below.

Table 34... Effluent Flows (Nov 17 to Feb 20)

Parameters	Flow (m ³ /day)
Average Off-Peak	271
Average Peak Period	414
Peak Period Peak Day	650

It was not possible for TCDC to provide detailed costs and time assessments for the Matarangi wastewater treatment plant. The Council has been going through a consent renewal process with an application submitted in 2020. A new consent has still to be issued.

To date costs incurred have been identified as being:

Table 35... Current Assessment Costs

Activity	Cost Incurred
Regional Council Fees	\$28,232
Assessments to Support Consent Application	\$617,915
Council Internal Staff Costs	\$149,048
Total	\$795,196

To date the time periods are:

Table 36... Current Time Assessment

Activity	Approximate Time
Resource Consent	
Gather information & prepare reports	24 Months (2018-2020)
Consultation and Engagement with Community and Iwi	24 Months (2018-2020)
Develop preferred option and prepare consent application	24 Months (2018-2020)
Lodge Application	12 Months (2020)
Consideration by Consent Authority	On-going since 2020 including Environment Court Hearing

It is worth noting that a significant amount of time and cost has been expended to date over a period of seven years with no outcome or firm timeline in obtaining a new consent.

Appendix D: Modular Plants - Input from Industry

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National Wastewater Discharge Standards Package Treatment Plants for Small Communities

Introduction

Significant infrastructure cost savings can undoubtedly be achieved through the adoption of national wastewater discharge standards. Standardized requirements provide clarity in planning and enable cost-effective treatment solutions for small communities.

Key Areas for Cost Savings

GFS has identified the following key areas where significant savings can be achieved:

1. Reducing Planning Uncertainty by Focusing on Outcomes

- Current resource consent renewals involve extensive investigation, consultation, and reporting before discharge requirements are determined.
- If the required discharge outcome is clearly defined, planning efforts can be focused on achieving the standard rather than navigating regulatory uncertainty.

2. Utilizing Oxidation Ponds for Buffering

- Ponds provide natural buffering, which minimizes peak loading to any new treatment plant.
- GFS has demonstrated that retaining oxidation ponds while adding downstream treatment is an extremely economical upgrade solution.
- The required discharge standard determines the level of treatment needed.

Case Study: Matarangi Wastewater Treatment Plant (WWTP)

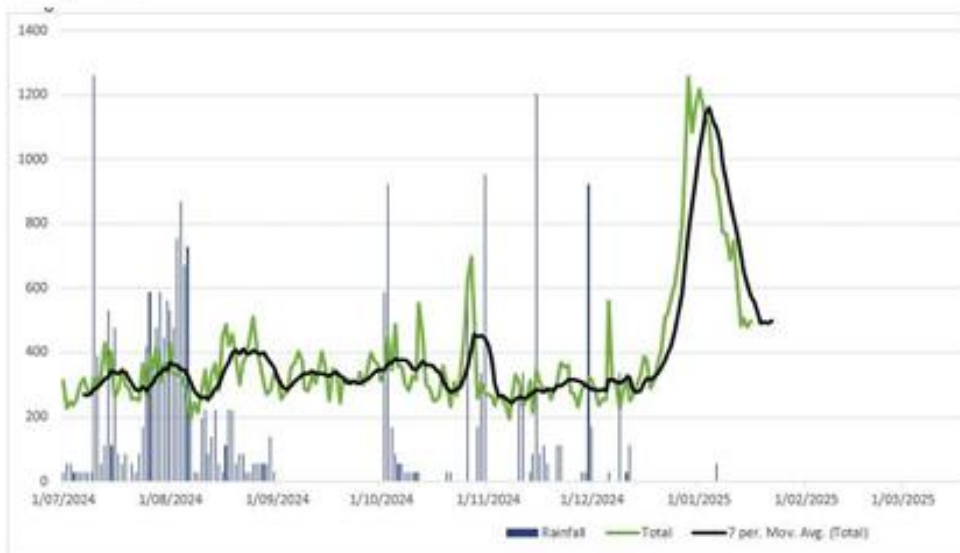
Existing System and Consent Conditions

- **Current Infrastructure:** Oxidation pond with downstream ultrafiltration
- **Maximum Discharge Limit:** 650 m³/day
- **Typical Inflow:** 400-450 m³/day for most of the year, with peak inflows reaching 1200 m³/day for approximately 10 days over the Christmas/New Year period.
- **Discharge Limits:**
 - TSS, E. coli & BOD controlled via ultrafiltration
 - NO₃ & NH₄ reduced via oxidation ponds

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Matangi Flows



Capital Investment

- Initial 700 m³/day ultrafiltration plant (2020): \$940,000
- Capacity Upgrade to 1100 m³/day (2022): \$505,000

Resource Consent Renewal Considerations

The Thames-Coromandel District Council (TCDC) is currently undergoing a resource consent renewal process. GFS does not have access to the associated costs. However, some objectors to the renewal suggest removing the oxidation ponds entirely.

Demonstration of High-Quality Treated Effluent

To illustrate the effectiveness of further downstream processing, GFS installed and tested a package membrane bioreactor (MBR) capable of treating 150-200 m³/day of oxidation pond effluent. The results consistently achieved:

- **NH₄**: <1 mg/L
- **NO₃**: <1 mg/L
- **P**: <1 mg/L
- **TSS**: <10 mg/L
- **BOD**: <2 mg/L
- **E. coli**: <1.6 cfu/100ml

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EFFBUSTER – package MBR

Cost Comparison: Package Plant vs. Traditional Design

The EffBuster plant (MBR) has demonstrated that high-quality treated effluent can be achieved by deploying proven package plant solutions in conjunction with existing infrastructure.

- **EffBuster Package Plant Solution (800 m³/day capacity):** \$4,500,000
- **TCDC Long-Term Plan Cost for New Treatment Plant (including oxidation pond removal):** \$22,042,000

Conclusion

Adopting a national wastewater discharge standard would streamline regulatory processes and reduce infrastructure costs by focusing on outcomes. Retaining existing oxidation ponds and implementing cost-effective package plant solutions can provide high-quality treatment at a fraction of the cost of traditional new plant construction.



wastewater specialists

Figure 24: Modular Plant Indicative Costs

Population	Peak Wet Weather Flows (200L/person)	Budget Estimate for Supply and Installation of New AdvanTex™ Wastewater Treatment Plant	Influent Wastewater Characteristics (post pond or secondary wastewater system)	Required Effluent Quality
200	40 m ³ /day	<ul style="list-style-type: none"> • 2 x 25m³ post anoxic tank & filtrate return • 1 x 25m³ recirculation tank and pumping • 2 x AdvanTex AX100 pods and fan • 1 x 25m³ treated effluent tank and irrigation pumps • 1 x UV disinfection unit • 1 x control panel • 1 x flow meter <p>\$350,000 + GST</p>	<ul style="list-style-type: none"> • BOD₅: <50 mg/L • TSS: <100 mg/L • Faecal coliform: <10,000 cfu/100mL 	<ul style="list-style-type: none"> • BOD₅: <20 mg/L • TSS: <30 mg/L • Faecal coliform: <10,000 cfu/100mL
500	100 m ³ /day	<ul style="list-style-type: none"> • 4 x 25m³ post anoxic tank & filtrate return • 4 x 25m³ recirculation tank and pumping • 3 x AdvanTex AX100 pods and fan • 3 x 25m³ treated effluent tank and irrigation pumps • 1 x UV disinfection unit • 1 x control panel • 1 x flow meter <p>\$700,000 + GST</p>		
1000	200 m ³ /day	<ul style="list-style-type: none"> • 8 x 25m³ post anoxic tank & filtrate return • 6 x 25m³ recirculation tank and pumping • 6 x AdvanTex AX100 pods and fan • 4 x 25m³ treated effluent tank and irrigation pumps • 1 x UV disinfection unit • 1 x control panel • 1 x flow meter • <p>\$1.2 million + GST</p>		

Innoflow Case Study: Piopio Township Community Wastewater Scheme

Site	Piopio Township, Waikato (existing, brownfield)
District Council	Waitomo District Council
Regional Council	Waikato Regional Council
Population	198 homes and business (with a potential of up to 250) 1 x school 135m ³ / day average 227m ³ /day peak
Resource Consent Effluent Quality Limits	cBOD ₅ : <20 mg/L TSS: <30 mg/L TKN: <30 mg/L NH ₃ -N: <10 mg/L TP: <15 mg/L Faecal Coliforms: <500 MPN/100mL
Decentralised Scheme Details	198 x on-lot pumped and gravity discharge septic tanks Liquid only pressure sewer 15 x AdvanTex™ AX100 textile recirculating packed bed reactors. Ultraviolet disinfection unit Remote telemetry control panel Treated effluent discharge via rock outfall to surface water (Mokau River)
Scheme Start Up Date	2012
Cost of Scheme	Supply and installation, \$3.45 million + GST

Innoflow Case Study - Ongare Point Community Wastewater Scheme

Site	Ongare Point (existing community, brownfield)
District Council	Western Bay of Plenty District Council
Regional Council	Bay of Plenty Regional Council
Population	58 homes 40m ³ / day average 38m ³ /day peak
Resource Consent Effluent Quality Limits	cBOD ₅ : <20 mg/L TSS: <20 mg/L E. coli: <500 MPN/100mL
Decentralised Scheme Details	58 x on-lot pumped septic tanks Liquid only pressure sewer 4 x AdvanTex™ AX100 textile recirculating packed bed reactors. Ultraviolet disinfection unit Remote telemetry control panel Treated effluent discharge via 55,400m ² pressure compensating dripline line field
Scheme Start Up Date	2019
Cost of Scheme	Supply of 58 x on-lot tanks; \$487,350 + GST Supply and installation of wastewater treatment plant and land application system: \$780,400 + GST Installation of tanks and sewer provided by a separate contractor, not included in above prices.



1. Where do you see efficiencies being generated through the proposed consenting requirements?
 - *The new standards will provide clear requirements on treatment requirements and final effluent quality.*
 - *A single national standard applied to resource consents will allow similar treatment processes to be used and proven across the country.*
 - *Longer consents (35 years) will help to plan for long term investment*
 - *If there is a clear path to determine the category of receiving environment that applies, the concept design and budget cost phases should be simpler, faster and more accurate. Thus far consenting processes have been a lot of back and forth between process engineers and people writing AEE, both often on a consulting basis. Going forward Councils will be less reliant on consultants and will be able to approach OEMs directly for design proposals and budget costs. This will save time and cost.*

2. Where do you see efficiencies being generated through the proposed environmental performance standards?
 - *Previously the effluent parameters had no consistency across the country and all of the wastewater plant designs are therefore bespoke.*
 - *There will be efficiencies in standardised designs if there are a sufficient number of similar projects, similar capacities and quantities of scale.*
 - *Standard treatment modules could potentially be utilised for the various treatment steps. E.g. aeration module, clarification module, UF treatment module.*

3. Where do you see efficiencies being generated through the infrastructure design solutions, in particular modular plants?
 - *Standardised modules or treatment process will save time and cost if there are sufficient quantities of scale.*
 - *Early in the process (before the standards are released) OEMs will need to have a clear picture of how many sites need to be upgraded, their capacities, what the compliance bottlenecks are and their current performance.*
 - *Modular plants with standard designs will need to have proof of previous performance, or follow a set of design guidelines.*
 - *Modular plant designs would allow capacities to be increased in an efficient way (by adding identical modules) or by having modules that cater for the various treatment steps that relate to different receiving environments. For example, tertiary treatment modules for TSS removal when required.*
 - *Modular designs if standardised can be pre-designed, with SIDs and HAZOPs already completed and signed off. This reduces the need for third party reviews and the customisation that often results from this.*
 - *Components within the plants can be standardised by the OEMs, such as analytical instrumentation, PLC hardware etc etc. This helps to support maintenance and spares and reduces stock holding.*

4. What efficiencies do you see in a move to the standardisation of small wastewater treatment plants?
 - *There will only be efficiencies if there are sufficient quantities of scale in the market, so that OEMs can invest in standardising their designs.*
 - *If small wastewater treatment plants can be standardised, and OEMs are turning over frequent sales, the design costs and lead times will be more efficient.*
 - *Standardised small plants can typically be delivered in 20 – 24 weeks if there is a clear path forward.*

5. What opportunities and risks do you see in adopting a regional approach to consenting and procurement?
 - *Hardly any. Receiving environment will differ from site to site even across a region, the chances of quantities of scale within a region are small.*

6. Has any consideration been given to the extraction of energy from wastewater treatment processes to power plant and reduce energy consumption?
 - *Not within Filtec. This is typically for large municipal scale.*

7. What would be the optimum size of a plug and play modular plant (i.e. 1000 people connected, or 500 people connected?), noting the possibility of future expansion?
 - *This very much depends on the technologies that are required and that depends on the answers to question 3. For instance, a modular (transportable) MLE plant will have a much smaller capacity than a modular UV treatment plant. To more accurately answer this question, we need to understand what the demand looks like, i.e. what is the problem that needs fixing?*
 - *Modular wastewater plants are typically transportable and limited to road transport dimensions.*
 - *1000 people would be approximately 250 m³/d versus 125 m³/d for 500 people. Transportable plants typically range from 50 – 200 m³/d.*

8. How would you incorporate solar/ generator into modular plants without power supplies (possibility has a linkage to question 7)?
 - *Solar and other types of sustainable energy struggle to provide a secure base load. When there is a need to consistent compliance with a discharge consent, a plant cannot rely on the availability of sun or wind. Luckily WWTPs are related to centres where people live and these centres mostly come with electricity supply, so connecting to the network is mostly not insurmountable.*

9. How do you currently manage Stormwater I&I with modular plants?
 - *As soon as there are serious discharge standards, the best bang for buck where it comes to I&I is to fix the network rather than foresee for x times the ADWF treatment capacity (with x sometimes up to a factor 10). District councils do not like to hear this because they are used to aerations ponds (i.e. with no serious discharge standards) that can take a lot of I&I without too much deterioration of treatment (since the requirement is low to begin with). These WW standards will force a paradigm shift with many district councils where it comes to I&I.*
 - *For the inevitable wet weather contribution (but also the diurnal peaks) a buffering system may be the best investment, possibly existing ponds can play a role in this.*

10. How could infrastructure design solutions further streamline the consenting process and reduce costs?
 - *In a future version of the standards (or a guideline to them) mention could be made of treatment processes and what sort of performance they will / are guaranteed to provide.*
 - *This could look a lot like the current DWQAR where a certain treatment set-up allows registering a certain log credit removal provided some design and operational requirements are met.*

11. How could standardisation of wastewater infrastructure lead to procurement efficiencies?
 - *If there are economies of scale, this could allow OEMs to hold stock and import equipment and materials in bulk. It could reduce transport costs and lead times.*

12. How could standardisation lead to less need for investment in inventory and wider ranges of spare parts?
- *If standard equipment and instrumentation is used, OEMs can hold spares for a range of customer sites in a national stock holding arrangement. Filtec currently does this for Trojan UV equipment. The councils and consultants would have to allow the OEMs to utilise their own preferred equipment.*
13. What would be the approximate cost and treatment process of a standard modular plant (also refer to question7)?
- *The cost of a modular plant will vary greatly depending on the type of treatment process required and final effluent quality parameters. We first need to understand what is the problem that needs fixing. There will likely be a common denominator across the sites that qualify for such plant, we'd need to understand this better, before we can make any useful comment here.*
 - *The treatment processes may include:*
 - *Fine screen (primary screening).*
 - *Flow balancing.*
 - *Activated sludge, or MABR, MBBR, or MBR bioreactor.*
 - *Secondary clarifier for solids separation.*
 - *Optional tertiary treatment including MMF or UF.*
 - *Filtec can develop costs for these plants once more information is available, around the scale of the market and treatment capacities required.*
14. Other questions and comments:
- *The proposed ammoniacal nitrogen limits of 1 – 3 mg/L for certain receiving environments would be very challenging and difficult to guarantee. This will attract the need for reasonably advanced technologies with a corresponding price tag.*
 - *We would like to understand how many small wastewater treatment plants will require upgrades or new infrastructure. Their current performance and current/future capacity would help us to understand which modular plant capacities may be required.*

TECHNICAL PROPOSAL
CONTAINERIZED WATER TREATMENT PLANT
CERAMIC MEMBRANE TECHNOLOGY
CAPACITY 220 M3/DAY



MattenPlant Pte Ltd
84 Toh Guan Road East, #05-10, Singapore 608501
T: (65) 6759 2977
E: contact_us@mattenplant.com

1. Technology

A Cembrane membrane is a proprietary Silicon Carbide (SiC) ceramic membrane material. It is a solid-liquid separation technology that can be used to filter various sources of contaminated water such as:

- Suspended solids
- Bacteria, viruses & algae
- Oil & Hydrocarbons
- Heavy metals
- Dissolved substances when combined with integrated absorption

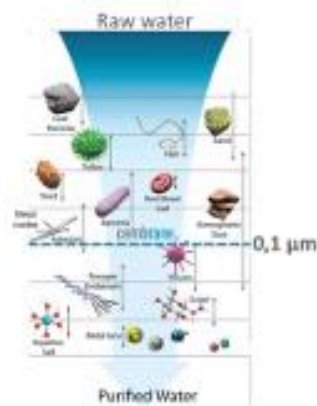


Figure 1 Illustration of effective micron rating of a Cembrane membrane

Our proprietary Silicon Carbide (SiC) membrane & module provides some unique advantages in water & wastewater treatment:

- High flux rate reduces footprint, energy & chemical consumption
- Chemically inert provides high chemical resistance & no permeability decline
- Negatively charged surface reduces fouling of organics and oil
- Extremely hard & durable makes it easy to clean
- High solids loading capability from few ppm to several % of TSS loading
- Simplified flow sheet combine filtration with sedimentation, flotation & absorption into one process step

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84 Toh Guan Road East, #05-10, Singapore 608501
T: (65) 6759 2977
E: contact_us@mattenplant.com

2. Operational Capabilities

A Membrane membrane and module is highly durable and hence able to effectively treat wide range of water sources.

Operational Capabilities	
Solids loading tolerance (TSS)	1 ppm – 50,000 ppm
Temperature	2-60°C
Abrasive media in feed water	No limitations
Chemical tolerance	pH 2-13
Fat, Oil & Grease tolerance	Up to 400 ppm
Intermittent operation & dry storage	Allowed
Operational flux rate	1-1000 LMH

3. Application Area

Drinking water

Surface- & sea water
Ground water both sweet & brackish
Backwash water recovery
Pre-treatment to Reverse Osmosis

Industrial wastewater

Scrubber wastewater
Coal chemical industry
Food & Beverage
Electronic & Semiconductor industry
Produced water
Pharma
Mining
Oily wastewater
Petrochemical
Pulp & paper

Municipal wastewater

MBR & Sludge thickening of activated sludge
Treated Sewage Effluent (TSE)
Storm water overflow

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84 Toh Guan Road East, #05-10, Singapore 608501
T: (65) 6759 2977
E: contact_us@mattenplant.com

4. Filtration principle & how it works.

The filtration principle is submerged outside in, where clean water is drawn through the membrane with suction pressure. Suspended solids & bacteria are rejected on the membrane surface forming a cake layer while clean water is passing through the membrane body and is collected at both end caps.

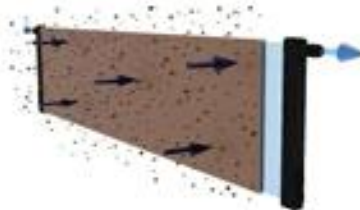


Figure 2 Illustration of outside-in filtration principle on a single membrane sheet

The permeate water from each of the membrane sheets is collected inside both ends of the module permeate lines and finally runs through the top permeate manifold. During backwash, the flow rate is reversed to push off the solids build up on the membrane surface.

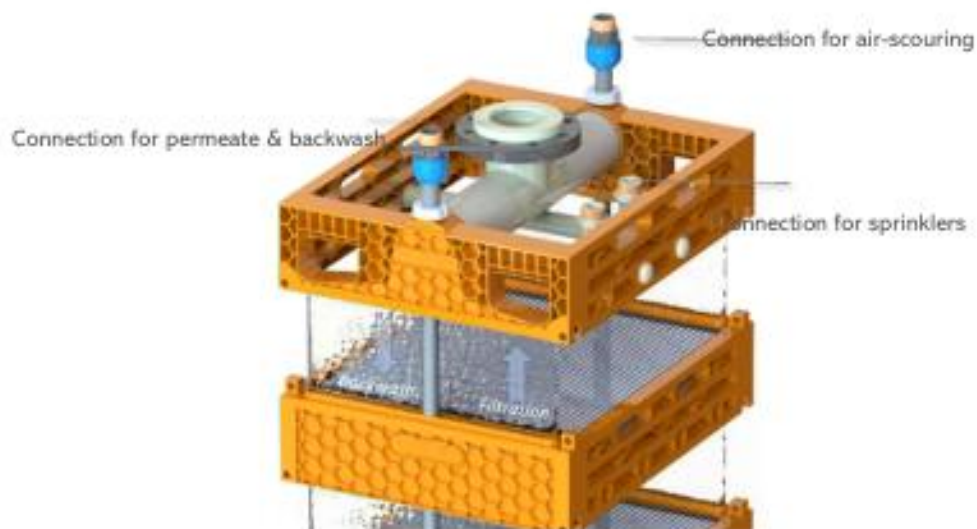


Figure 3 Illustration of water flow through the integrated permeate channels inside the membrane module.

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84 Toh Guan Road East, #05-10, Singapore 608501
T: (65) 6759 2977
E: contact_us@mattenplant.com

5. Sprinkler cleaning feature

Top permeate module comes with integrated sprinkler system. Two pipes with engineered hole pattern, provides an even water jet distribution over the membrane modules.

The sprinkler system serves two main purposes:

1. After membrane tank is drained, spraying of permeate-, tap- or service water to mechanically remove debris & sludge trapped between the membranes.
2. Chemical spray cleaning over the membranes. The capillary forces of the membrane will absorb the chemical solution and clean the membranes where it is needed.

This has the following advantages:

- a. Replaces conventional CIP cleaning
- b. Reduces chemical consumption with 97% compared to conventional CIP
- c. Keeps chemicals on the feed side & doesn't come into contact with permeate line

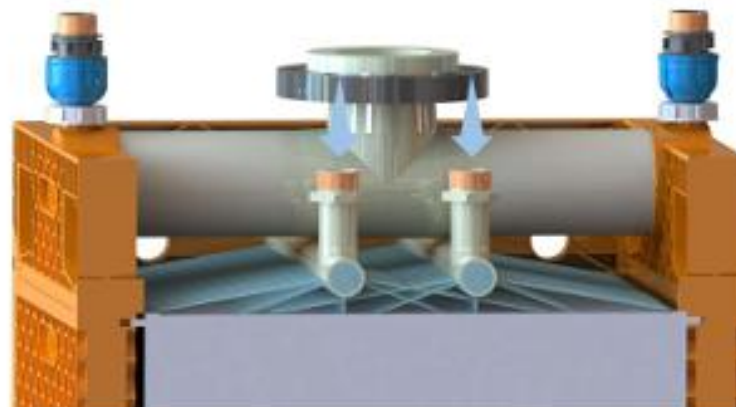


Figure 4 Illustration of module tower cross section showing sprinkler spray in action

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84 Toh Guan Road East, #05-10, Singapore 608501
T: (65) 6759 2977
E: contact_us@mattenplant.com

6. Process flow sheet

This versatility of Cembrane SiC ceramic membrane technology, enables a wide range of usecases and allows the user to combine several process steps into one:

- Membrane filtration
- Sedimentation
- Flotation
- Absorption

With UF membrane filtration!

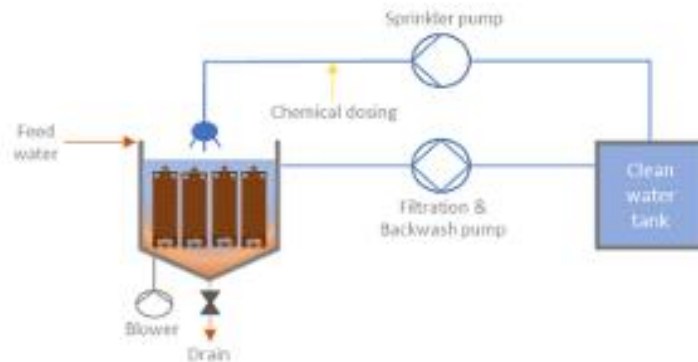


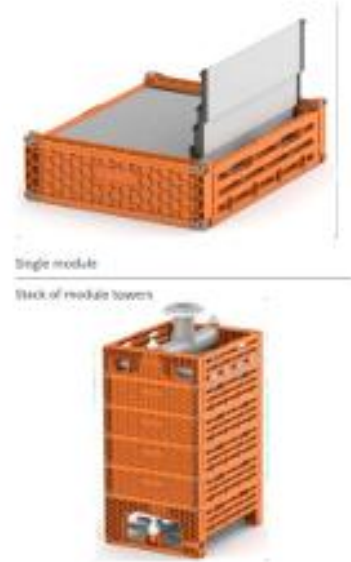
Figure 5 Simplified general flow sheet

7. Product – Module towers & racks

The membrane sheets are fitted in a square module consisting of several membrane sheets that are individually interchangeable. The modules are submersible & can be stacked individually on top of each other up to 15 modules in total. The membrane surface area is the determining factor for the capacity of the installation, the more surface area the more flow through the plant.

Filtered water from each single plate is collected inside the module housing and transported to the top header integrated in both module housing sides.

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84 Toh Guan Road East, #05-10, Singapore 608501
T: (65) 6759 2977
E: contact_us@mattenplant.com



Key features

- Lifting from top module
- Applicable in saline & aggressive water (No Steel parts)
- Reinforced ceramic & module structure
- Improved packing density
- Integrated aeration, permeate & sprinkler inside module tower
- Bottom connection to permeate line



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T: (65) 6759 2977
E: contact_us@mattenplant.com

8. Membrane specification



Classification	
Item code	SICFS-00163-DO-T-145-561
Membrane type	Submerged Flat sheet
Operation mode	Out-to-in filtration
Pore size	0,1 µm
Clean water permeability	>3.000 LMH/bar @20° C
Material	
Membrane material	Silicon Carbide (SiC) ceramic
End-cap material	PPS 40% Glass fill
O-ring	EPDM (Viton or NBR on demand)
Potting material	PU
Dimensions	
Membrane surface area	0,164 m ²
Length	575 mm
Width	145/154 mm
Thickness	6/11 mm
Weight	0,9 kg

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84 Toh Guan Road East, #05-10, Singapore 608501
T: (65) 6759 2977
E: contact_us@mattenplant.com

10. Containerized WTP Design

Treatment Capacity

This system is designed with the capacity of 220 M3/Day

Inlet Water Characteristics

Parameter	Unit	Values
TDS	mg/l	≤500
Iron	mg/l	≤1
Manganese	mg/l	≤0,5
COD/BOD	mg/l	15/6
Total Organic Carbon	mg/l	< 10
Total Suspended Solids	mg/l	< 500
Turbidity	NTU	< 500
Oil & Grease	mg/l	<0,5
Temperature	°C	20-30

Expected Product Water Quality

Parameter	Unit	Values
TDS	mg/l	≤500
TSS	mg/l	0,5
Turbidity	NTU	0,2
Iron	mg/l	0,2
Manganese	mg/l	0,2
TOC	mg/l	4
COD/BOD	mg/l	5/2
Oil & Grease	mg/l	N.D

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84 Toh Guan Road East, #05-10, Singapore 608501
T: (65) 6759 2977
E: contact_us@mattenplant.com

Process Description

The feed water coming from a surface water source shall be pre-conditioned with Alum salt coagulant followed by pH adjustment and oxidation. The chemical reaction must be completed in a retention tank for up to 10-20 minutes with a slow mixer. The pretreated water then will be sent to the Buffer Tank.

From the buffer tank, the water will be sent to the Filtration Tank. The filtration pump will process the water through a ceramic membrane. A backwash pump will provided to backwash the ceramic membrane, as per sequence set by the PLC system. Chemical cleaning is also provided, to maintain the membrane performance.

The filtered water then will be sent to the UV system for the disinfection purpose, and will be sent to the final product tank.

Main Equipment List

- a. Standard Container 20 Ft
- b. Water Intake, consists of
Water Intake Pump, submersible type, non clogging, capacity 10 m³/hour, Head 15 meter
Flexible Hose, 2 inch size, 20 meter length
- c. Chemical Injection System, consists of
3 sets Chemical Dosing Pumps
3 sets of Chemical Tank, PE Material, 150 liter capacity
- d. Coagulation, Flocculation & Sedimentation Tank, includes lamella settler
- e. Ceramic membrane tank
- f. Ceramic Membrane
- g. Filtration Pump
- h. Backwash Pump
- i. Sprinkler Pump
- j. NaOH Sprinkler Pump
- k. Acid Sprinkler Pump
- l. Chemical Tank
- m. Blower for aeration
- n. Backwash Tank
- o. UV Disinfection System
- p. Electrical Control System
- q. Interconnecting Pipe, Fitting, Valve
- r. Interconnecting Cable

MattenPlant Pte Ltd
84 Toh Guan Road East, #05-10, Singapore 608501
T: (65) 6759 2977
E: contact_us@mattenplant.com

Appendix E: Modular Plants - Examples

Jack's Point:

Jack's Point is a residential development located near Queenstown. The community is situated along the shores of Lake Wakatipu, offering picturesque views of the Southern Alps.

Initiated in 2002, the Jack's Point development was envisioned to include approximately 900 luxury homes, a clubhouse with amenities, a golf course, and extensive walking and biking trails. Given the development's commitment to preserving the natural environment and its distance of over 8 kilometres from the nearest public wastewater network, an on-site wastewater treatment solution was considered necessary.

Challenges:

- **Distance from Council Services:** Connecting to the existing municipal wastewater treatment plant was impractical due to the significant distance and the plant's limited capacity to handle additional flow.
- **Variable Terrain:** The development's undulating landscape and shallow bedrock posed challenges for traditional gravity-fed sewer systems.
- **Environmental Considerations:** Strict nitrogen-reduction limits were imposed to protect the local ecosystem, necessitating an efficient treatment system.

Solution:

Developers selected a decentralised wastewater treatment approach designed by Innoflow Technologies. The system comprises:

1. **Orenco® Liquid-Only Sewer:** This system utilises interceptor tanks at individual residential lots to pre-treat wastewater, allowing for efficient pumping through small-diameter pipes that follow the terrain.
2. **AdvanTex® Secondary Wastewater Treatment:** Chosen for its modularity, low operational requirements, and effective nutrient reduction capabilities.
3. **Subsurface Drip Irrigation:** Treated effluent is dispersed through subsurface driplines into nearby fields, which are used for grazing and cropping, aligning with the community's environmental goals.

Outcomes:

- **Environmental Compliance:** The system meets stringent nitrogen-reduction requirements, safeguarding the local environment.
- **Community Integration:** The low-profile design minimises visual impact, and the system operates quietly and without odour, resulting in no complaints from residents.
- **Operational Efficiency:** The decentralised approach offers flexibility, scalability, and cost-effectiveness, with lower overall operating costs compared to traditional systems.

Mahia Peninsula:

Mahia Peninsula is, situated on the northern Hawke's Bay coastline and is an area known for its holiday homes along both sides of the peninsula.

In June 2022, a developer from the Mahia Peninsula sought an efficient wastewater treatment solution for a four-bedroom home in a high-water table coastal area. Having previously installed a BIOROCK system and been impressed by its performance, the developer aimed to implement a similar system for the new development.

Challenges:

- **High Water Table:** The coastal location presented challenges related to a high-water table, necessitating a system capable of effective operation under such conditions.
- **Remote Location:** The area's remoteness resulted in high transportation and power supply costs, making it essential to install a system that was both cost-effective and energy-efficient.

Solution:

The ECOROCK-2000 treatment plant was selected for its lightweight design and suitability for high water table areas. The system included a 4,000-litre filtered primary tank, with treated effluent pumped to specifically designed Low-Pressure Effluent Dosing beds along the property boundaries.

Outcomes:

- **Cost Savings:** The ECOROCK system requires only one maintenance visit per year. Additionally, the system's design eliminates the need for continuous power and mechanical components like compressors or air pumps, leading to further savings.
- **Environmental Compliance:** The system effectively treats wastewater to meet environmental standards, ensuring the protection of the surrounding natural environment.

Paparoa Community Wastewater Network Upgrade:

Challenge:

Paparoa's 28 properties (18 residential, 10 commercial) relied on aging septic tanks, many of which were failing, posing public health and environmental risks. Kaipara District Council (KDC) sought a cost-effective, consentable solution that accommodated future growth while minimising land use disruption and cultural impacts.

Solution:

Three key components were evaluated with detailed cost analysis:

1. Pipe Network:

- Gravity sewer system (\$600K – \$660K) – Lower operational costs and high reliability.
- Alternative: Low-pressure system (\$660K – \$700K) – More flexible but higher maintenance costs.

2. Modular Treatment Options:

- Inflow AdvanTex (\$450K) – Modular, secondary treatment, suitable for drip irrigation.
- Lotic EC-AOP (\$710K) – Advanced treatment, higher capacity (81,800L/day), no UV needed.
- Excluded Oxyfix (\$350K) – Insufficient for soil requirements.

3. Disposal Systems:

- Drip Irrigation (PCDI)(\$100K) – Requires 15,600m² of KDC land.
- Land Passage System(\$100K+UVdisinfection \$100K+UVdisinfection \$70K) – Minimises land use but needs consent.

Table 37... Cost Comparison of Shortlisted Options

Option	CAPEX (P50 Estimate)	Annual OPEX
1. Gravity + AdvanTex + PCDI	\$1.43M	\$10K
2. Gravity + AdvanTex + Land Passage	\$1.51M	\$12K
3. Gravity + Lotic EC-AOP + Land Passage	\$1.77M	\$20K

Outcome:

- Recommended Option (1): \$1.43M CAPEX – Cost-effective, uses drip irrigation but requires significant land.
- Alternative Option (2): \$1.51M CAPEX – Preserves KDC land but requires UV disinfection and cultural consent.
- Future-Proof Option (3): \$1.77M CAPEX – Highest capacity for expansion, lowest long-term risk.

Appendix F: Report Findings Summary

Table 38...Summary Table

National Environmental Performance Standards (NEPS) – Impact Summary for Small Wastewater Treatment Plants						
Activity	Description	Direction		Risk	Opportunities	Assumptions
		Short Term (1 to 5 years)	Long Term (5 to 10 years)			
Investment Planning	Strategic decision-making regarding funding, timing, and the type of wastewater infrastructure to be developed. Aligning long-term planning with national standards, cost assessments, and predicting future demand.	Cost – Decrease	Complexity - Decrease	<ul style="list-style-type: none"> Inaccurate forecasting of loading and demand. Misalignment with evolving national standards and regulations. Transition from current arrangements to proposed NEPS, although partially mitigated by transition arrangements for plants operating on expired consents. 	<ul style="list-style-type: none"> Early understanding of required environmental performance providing greater certainty of cost. Increased budget predictability. Access to a national costing database (over time) for cost estimation (opex and capex). 	
		Time – Neutral	Complexity - Decrease			
		Complexity – Neutral	Complexity - Decrease			
Design	Preliminary and detailed designs for the wastewater treatment plant. Including selecting technologies, determining plant capacity, and ensuring the design complies with environmental performance standards.	Cost – Decrease	Cost – Decrease	<ul style="list-style-type: none"> Design complexities and delays due to local conditions. Poor or incomplete data on existing plant performance. Articulating clearly the potential opportunities to deliver solutions that are incentivised through the proposed regulatory process. Ensuring clear definition of where the point of discharge is to the receiving environment is. Water Service Organisations (WSOs) will still need to manage local issues including I&I and temperature differentials. 	<ul style="list-style-type: none"> Lower design costs through certainty of environmental performance required. Lower design costs through standardised systems. Predictability of performance outcome required reducing re work. Use of Infrastructure Design Solutions to provide cost and time efficient solutions, particularly for smaller plants. 	<ul style="list-style-type: none"> Infrastructure Design Solutions standard implemented in 2026. Modular designs will meet National Environmental Performance Standards NEPS without the need for bespoke solutions. Modular designs have pre-certification of performance. Scope of work excluded trade waste. WSO procurement policy and practices will enable or encourage use of standardised process equipment.
		Time – Decrease	Time – Decrease			
		Complexity - Decrease	Complexity - Decrease			
		Technology Adoption - Neutral	Technology Adoption - Increase			

National Environmental Performance Standards (NEPS) – Impact Summary for Small Wastewater Treatment Plants						
Activity	Description	Direction		Risk	Opportunities	Assumptions
		Short Term (1 to 5 years)	Long Term (5 to 10 years)			
Consultation	Engagement with stakeholders, including local communities, iwi, and regulatory bodies, to discuss and align the project with their interests and concerns. Includes public meetings, submissions, and addressing potential concerns regarding environmental impact and design.	Cost – Decrease	Cost – Decrease	<ul style="list-style-type: none"> Increased community resistance to wastewater upgrades/lack of social licence to operate. Misalignment with local environmental priorities. Pre-existing agreements with Iwi, and/or other Policy Statements that may encourage a greater level of engagement and consultation. 	<ul style="list-style-type: none"> Development of a suite of standardised consultation material aligned to NEPS, providing common and consistent messaging. Accelerated outcomes for improvement of receiving water quality by expediting new consents and re-consenting existing discharges. 	<ul style="list-style-type: none"> No pre-existing agreements with Iwi, or other Policy Statements that may encourage a demand for a greater level of engagement and consultation. There will be a reduction in the number of consenting liaison/stakeholder groups.
		Time – Decrease	Time – Decrease			
		Complexity - Neutral	Complexity - Decrease			
Resource Consent	Approval from regulator to build and operate a wastewater treatment plant. Involves ensuring compliance, obtaining discharge consents, and meeting environmental standards in the NEPS.	Cost – Decrease	Cost – Decrease	<ul style="list-style-type: none"> Short-term misalignment of understanding during transition between current and proposed consenting processes. NEPS may introduce complexity by the introduction of thresholds and exemptions. Managing the paradigm that discharge to water and discharge to land are both potential acceptable solutions. (ie no default preference to discharge to land). The level of professional external input and advice required into the consenting process will reduce. Reduction in the ability of Iwi and hapu to influence treatment outcomes, reducing the ability of mana whenua to exercise guardianship over land and water. 	<ul style="list-style-type: none"> Standardised designs simplifying consent pathways. Reduced legal and consultancy costs. Predictable regulatory environment improves planning timelines. NEPS will harmonise consenting processes and reduce delays. Reduced complexity and increased transparency for Iwi, hapu and communities engaging in the consenting process. 	<ul style="list-style-type: none"> WSOs will adopt NEPS without local enhancements. WSO's obligations to give effect to the Treaty remain unchanged. The need for "other consents" for WWTPs such as air discharge, noise etc will also be streamlined under LWDW legislation of RMA reform.
		Time – Decrease	Time – Decrease			
		Complexity - Neutral	Complexity - Decrease			

National Environmental Performance Standards (NEPS) – Impact Summary for Small Wastewater Treatment Plants						
Activity	Description	Direction		Risk	Opportunities	Assumptions
		Short Term (1 to 5 years)	Long Term (5 to 10 years)			
Procurement	Suppliers, contractors, and service providers are selected for various stages of the wastewater plant upgrade or development.	Cost - Neutral	Cost – Decrease	<ul style="list-style-type: none"> • Procurement efficiencies are not realised due to existing Government or WSO procurement policies. • Existing procurement practices reduce the opportunities for bulk purchase. • Without a minimum volume, cost effective procurement of Infrastructure Design Solutions will not occur (potential regional or national procurement). 	<ul style="list-style-type: none"> • The greatest procurement opportunity will arise through the adoption of Infrastructure Design Solutions. • Bulk procurement through purchasing agreements driving down costs. • Modular components simplify procurement cycles. • Increased supplier competition due to standardisation. • Reduced inventories for spare parts through collaborative action by WSOs across NZ. • The provision of performance certified Infrastructure Design Solutions that will deliver known effluent quality. 	<ul style="list-style-type: none"> • Changes in local and national procurement practices will take at least 5 years to implement, resulting in a delay before bulk purchase and supply changes efficiencies can be realised. • Aggregated procurement and commonality of components.
		Time- Neutral	Time – Decrease			
		Complexity- Increase	Complexity - Decrease			
Build	The physical building or upgrade of the wastewater treatment plant, including site preparation, and plant installation.	Cost – Neutral	Cost – Decrease	<ul style="list-style-type: none"> • Understanding where the environmental performance risk allocation sits for the use of infrastructure design and modular solutions. • Some risk around providing power to remote locations. 	<ul style="list-style-type: none"> • Infrastructure Design Solutions will reduce construction time and complexity, allowing for faster and more efficient builds. • Maximising the benefits of existing infrastructure (for example oxidation ponds) to 	<ul style="list-style-type: none"> • Infrastructure Design Solutions will align with standardised construction approaches.
		Time – Neutral	Time – Decrease			
		Complexity - Neutral	Complexity - Decrease			

National Environmental Performance Standards (NEPS) – Impact Summary for Small Wastewater Treatment Plants						
Activity	Description	Direction		Risk	Opportunities	Assumptions
		Short Term (1 to 5 years)	Long Term (5 to 10 years)			
					<ul style="list-style-type: none"> add value to treatment processes Use of sustainable energy sources to provide power for remote plants. 	
Operation & Maintenance	The day-to-day operation of the plant, maintaining equipment and systems.	Cost – Increase	Cost - Neutral	<ul style="list-style-type: none"> Operational cost increases due to complex operational monitoring, but mitigated through commonality around SCADA systems and platforms. 	<ul style="list-style-type: none"> Operational efficiency will improve with reduced variability in plant designs. Reduced complexity in operations due to standardised systems and fewer parameters to be analysed and reported on in discharge Predictable maintenance schedules. Reduced and standardised inventory. 	<ul style="list-style-type: none"> There will be a transition from passive treatment processes. The use of infrastructure design solutions will standardise treatment practices. WSOs take the opportunity to uplift opportunities from infrastructure design solutions.
		Time – Neutral	Time - Decrease			
		Complexity - Increase	Complexity - Decrease			
Compliance Monitoring & Reporting	Data is collected and reported to regulators and stakeholders, ensuring that the plant meets all performance standards.	Cost – Neutral	Cost – Decrease	<ul style="list-style-type: none"> Many existing consents for small plants have monitoring framed around quantity rather than quality. There may be increased costs due to more robust reporting requirements, but this is mitigated by a reduction in the frequency of monitoring in the NEPS. Potential for inconsistent reporting due to site-specific variables. Data integration challenges from different treatment systems. 	<ul style="list-style-type: none"> Standardised reporting frameworks will simplify compliance tracking. Standardised and transparent monitoring and reporting requirements. Development of standard consenting formats and reporting frameworks through a national digital platform providing real time performance data in a standard format. (National Data Standards). 	<ul style="list-style-type: none"> Regional Councils will adopt a small suite of “standard” consent forms and standard monitoring requirements (for different receiving environments) – no more bespoke consents and monitoring requirements. 35-year duration consents will eventually make setting up standardised digital platforms very cost effective. A transition to centralised compliance monitoring and enhanced use of IOT and AI
		Time – Neutral	Time - Decrease			
		Complexity - Neutral	Complexity - Decrease			

National Environmental Performance Standards (NEPS) – Impact Summary for Small Wastewater Treatment Plants						
Activity	Description	Direction		Risk	Opportunities	Assumptions
		Short Term (1 to 5 years)	Long Term (5 to 10 years)			
						to monitor and report on plant performance in real time.
Workforce Training and Development	Ensuring that operators and maintenance staff are adequately trained to run and maintain the plant.	Cost – Increase	Cost – Decrease	<ul style="list-style-type: none"> Increased cost, time commitment and complexity in training in the short - term. Difficulty in finding skilled workers for new systems. 	<ul style="list-style-type: none"> Shared resources across regions reducing current key personnel risk. Centralised training resources. Increased professionalism and status for operators with defined training pathways. With Infrastructure Design Solutions, training becomes more streamlined as the same systems and protocols are used across different sites, improving workforce mobility and efficiency. Development of a competency framework for plant operators. The use of IOT and AI to support workforce. 	<ul style="list-style-type: none"> Transition to a mobile, highly trained professional workforce, with aligned competency frameworks. Anticipated larger WSO enterprises will create and support dedicated Operational groups and share these services with adjacent WSOs.
		Time – Increase	Time - Decrease			
		Complexity - Increase	Complexity - Decrease			