Ridgeburn Development

Ridgeburn WWTP Peer Review

Ridgeburn Limited

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1 Introduction

Ridgeburn Limited proposes to construct the Ridgeburn subdivision in Queenstown Lakes District with approximately 1,200 dwellings and commercial areas. It will contain its own wastewater treatment plant (WWTP) and treated effluent disposal system. BPO Limited has prepared a design report for the proposed WWTP.

Lutra has carried out a peer review of the WWTP design, the results of which are detailed in this document. The review was carried out based on the guidelines set out in Engineering New Zealand's Practice Note 2: Peer Review[1], as a "Specific peer review".

The following BPO documents were reviewed:

- "Ridgeburn Wastewater Treatment Plant Design Report", Project No "J9024", Issue "Final", Date: 18 Mar 2026.
- Four BioWin[2] models

The WWTP design appears to be in the **concept design stage**, focussing on process design and rough footprint requirements. The report provides a simplified plan view of the plant, without providing specific equipment or building sizes. The report does not include civil, geotechnical, electrical and automation design information.

1.1 Objectives

Our understanding of Ridgeburn Limited desired outcomes are to:

- Confirm that the treatment infrastructure is sized for the correct flows and loads (basis of design)
- Confirm that the proposed technological solution is suitable to achieve the proposed treatment outcomes.
- Confirm the viability of the proposed WWTP system, and to ensure that there are no "fatal flaws".
- Review the provided design for risks, potential issues, and opportunities that may not have been detailed in the design report.

1.2 Exclusions

Lutra is unable to comment on the design and sizing of the treated effluent land disposal system, as this is outside of Lutra's expertise.

2 Summary

Based on the concept design information provided, Lutra did not encounter a critical flaw in the design of the WWTP. Table 1 contains a high-level summary of important aspects that were reviewed.

Table 1 – Summary assessment

Aspect	Assessment
Are the proposed wastewater flows and pollutant loads that enter the WWTP sensible and reproducible?	Yes. Refer to section 3.1 for more details.

[1] See https://www.engineeringnz.org/engineer-tools/engineering-documents/practice-notes-and-guidelines/

[2] BioWin is a computer simulation tool for wastewater treatment process engineering

Aspect	Assessment
Are the proposed discharge quality targets in line with best practice and legislation?	The adequacy of the TN and TP design targets and consent condition targets ultimately depends on the site-specific assessment of the selected land discharge system. This is described by (WGA, January 2026). We are unable to comment on their site-specific assessment as this is not our area of expertise. However, from a general point of view, both the treatment targets and proposed consent targets seem adequate for land disposal and are similar to or better than other treated effluent land disposal systems that we are aware of. Refer to section 3.2 for details.
Is the proposed technical solution able to meet the proposed discharge quality?	Yes. The component sizing and the BioWin computer simulation models were reviewed and found adequate. Refer to sections 3.2 and 3.3 for details. The proposed technical solution should be able to meet the target design values, as well as the proposed resource consent values.
Treatment technology options assessment – is the selected process suitable?	Yes, the selected SBR process, ultrafiltration, and UV are suitable for the Ridgeburn development. Refer to section 3.5 for details.
Are the proposed consent conditions reasonable?	Yes. Refer to section 3.6.

3 Comments to specific sections

3.1 Basis of design – influent flows and loads

The basis of design is developed by assigning a typical occupancy factor to each dwelling. The selected occupancy factor used for the “House + Land” category is 3, and a resultant population of 3,186. This is conservative, other sources use a factor of 2.7.

The basis of design flows (m^3/d) and loads (kg pollutant/d) are determined by using a per capita factor or Population Equivalent (PE) (litre/person/day, or gram/person/day). The selected factors overall are reasonable, both for dwellings (House + Land, Affordable Houses, Hotel), and for industrial areas. We noted that the nitrogen per capita factor for “House + Land” was above typical values. As a result, the calculated overall nitrogen pollutant load into the plant may be slightly overestimated compared to what will arrive at the plant, but this is not of concern.

The design wastewater temperature of 7°C is reasonable.

3.2 Discharge environment and effluent quality targets

3.2.1 Treated effluent quality targets

The required level of treatment is dependent on the discharge environment, e.g. to freshwater, to land, or to ocean.

We understand that the WWTP will discharge treated effluent to land, as outlined in (WGA, January 2026). The land application is described as low spray disposal onto the Morven Hillslope (52.34 ha available irrigation area), and subsurface irrigation in the Residential terraces onto 12 ha of available irrigation area. Please note that we are unable to comment on the assessment of the impact of the treated effluent discharge to the receiving environment as this is outside of our specialization.

The New Zealand government has very recently (21 November 2025) released national discharge standards for wastewater for any newly consented WWTP, which come into force on 19th December 2025[3]. Clause 86 states that regulations for the discharge to land of treated wastewater are not applicable for non-publicly owned WWTP and may thus not apply in this case. The applicable discharge standards will thus have to be agreed with the consenting authority.

The design treatment targets and proposed consent condition targets for Year 4 and 5 are summarised in Table 2. For more analysis and commentary on the proposed consent conditions, refer to section 3.6.

Table 2 – WWTP design effluent quality and proposed consent conditions

Parameter	Unit	(1) Design report – summer	(2) Design report – winter	(3) Proposed consent condition
Reference		(BPO Limited, 18 March 2026), Table 6: Targeted Treatment Quality	(BPO Limited, 18 March 2026), Table 6: Targeted Treatment Quality	(BPO Limited, 18 March 2026), Table 19: Year 4 and 5 proposed Consent limits
$CBOD_5$[4]	mg/L	2	2	9
Total suspended solids (TSS)	mg/L	2	2	10
Total Phosphorus (TP)	mg/L	8	8	8
Total Nitrogen (TN)	mg/L	4	10	10
Total Ammoniacal Nitrogen (NH3)	mg/L	2	8	8
E. coli	cfu/100 mL	10	10	10

Generally, the targeted and modelled treatment standard in columns (1) and (2) in the above table is good for discharge to land. The $CBOD_5$ and TSS target values are lower (better) than what is usually required for land discharge, but it is understood that the high quality will have additional benefits, such as minimising odour potential. Table 3 below provides individual comments.

The adequacy of the TN and TP design targets and consent condition targets ultimately depends on the site-specific assessment of the selected land discharge system. This is detailed by (WGA, January 2026). We are unable to comment on their site-specific assessment as this is not our area of expertise. However, from a general point of view, both the treatment targets and proposed consent targets seem adequate for land disposal and are similar to or better than other treated effluent land disposal systems that we are aware of.

[3] The Wastewater Environmental Performance Standards (WEPS), https://www.legislation.govt.nz/regulation/public/2025/0258/latest/LMS1540800.html

[4] Carbonaceous biochemical oxygen demand in five days

Table 3 – Comment on design effluent targets for individual pollutants

Parameter	Unit	Design report – summer	Design report – winter	Comment
$CBOD_5$	mg/L	2	2	Very high standard of treatment. To put this into context, this value would meet the new WEPS[3] for discharge to low-dilution freshwater.
Total suspended solids (TSS)	mg/L	2	2	Very high standard of treatment. To put this into context, this value would meet the new WEPS[3] for discharge to low-dilution freshwater.
Total Phosphorus (TP)	mg/L	8	8	Average to poor "stated" standard of treatment. However, we anticipate that the plant itself is able to achieve an effluent quality of 4 mg/L or less without the addition of external chemicals for phosphorus removal.
Total Nitrogen (TN)	mg/L	4	10	Summer value is high standard of treatment. To put this into context, this summer value would meet the new WEPS[3] for discharge to low-dilution freshwater. The winter value is considered sufficient.
Ammonia (NH3/4)	mg/L	2	8	Summer value is high standard of treatment. The winter value is considered sufficient.
E. coli	cfu/100 mL	10	10	Very high standard of treatment.

3.2.2 Is the proposed technical solution able to meet the target discharge quality

The stated design targets are achievable with the proposed treatment system, with the possible exception of $CBOD_5$. The stated value may be achievable with the system. However, for similar treatment systems[5] the usual design target is 5 mg/L. Both 2 and 5 mg/L are a very high standard of treatment, and the system will be able to achieve the proposed consent targets. To put this into context, even a value of 5 mg/L would meet the new WEPS[3] for discharge to freshwater.

The $CBOD_5$ targets for applying treated effluent to land (as is the case here) is usually less stringent than when discharging to water, so a slightly higher $CBOD_5$ target may be acceptable.

The proposed consent condition targets are achievable with the proposed treatment system. Refer to section 3.6 for more details.

3.3 Process modelling and plant sizing

Lutra reviewed the four BioWin computer simulation models[6] provided by BPO in November 2025. The models and simulations were found to be set up adequately for sizing purposes, and that the computer simulations support the stated treated effluent quality.

Lutra reviewed the following information in each of the four models.

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[5] Membrane Bioreactor (MBR), which is a different configuration but also an ultrafiltration (UF) application

[6] "GiobbsonCo single SBR full year summer settings high O2.bwc", "GiobbsonCo single SBR full year winter settings high O2.bwc", "GiobbsonCo single SBR summer.bwc", "GiobbsonCo single SBR winter.bwc"

- Inflow and influent characteristics
- Component characteristics (reactor volumes and areas)
- Operational setpoints and simulation parameters
- Results of the computer simulations

In January 2026, the basis of design changed slightly in that the maximum design flows (m^3/d) were lowered from 1,500 m^3/d to 1,204 m^3/d, while the overall pollutant load (kg pollutant/d) to treat remained as previously[7]. As a result, the influent pollutant concentrations have increased slightly (concentration = load / flow).

We were not provided with updated BioWin models in January 2026. In our professional opinion, the impact on the real-world treatment plant performance should be minimal, as the overall pollutant load remains the same. We remain therefore satisfied with the validity of the provided BioWin computer simulation.

3.4 Selected treatment process and process description

This section comments on the overall treatment process including ancillaries, the estimated footprint of the plant, and highlights some aspects that are important for considering in future design stages.

The plant design contains all necessary equipment that is needed to achieve the stated effluent quality. The physical **footprint** seems appropriate; however, the plant and equipment could require re-arrangement once access requirements and duty and standby requirements are considered in the next design phase. The plant configuration needs to ensure that all equipment can be **accessed for maintenance**. Some equipment will need lifting with a Hiab truck. In addition to access, protection from vehicle strike of critical equipment is also an important consideration for the layout.

The **commissioning** of the treatment system in Phase 1 with very low flows (average 75 m^3/d, approximately 8% of the design flow and load) may be challenging and will need to be thought of during the next design stage, as it could influence equipment selection and hydraulic design. However, in general, SBR systems are more flexible to accommodate variable flows and loads than other types of activated sludge plants.

An important consideration for any WWTP is the **disposal of the produced waste activated sludge**. The design states that this is dewatered and transported to landfill. This is a common disposal mechanism. It is recommended that landfill availability and disposal costs (including transport costs) are considered early in the design to ensure feasibility of this aspect.

The total nitrogen target of 4 mg/L requires the ongoing addition of a chemical to provide **supplemental carbon** for the microorganisms. This chemical addition is required regardless of the type of activated sludge system. The owner of the plant should be aware of the magnitude of these costs. Methanol is currently mentioned as the carbon source. Both methanol and ethanol are high-risk substances due to flammability and explosion hazards[8]. There are alternative substances which are safer for handling, such as acetic acid or sodium acetate, and it's understood that the design supports usage of such an alternative. The carbon source should be considered and determined in the next design stage.

[7] This is because the overall load is based on a "per person basis" and population, and these values remained the same.

[8] This resource provides a good overview of supplemental carbon sources: https://www.epa.gov/sites/default/files/2019-08/documents/external_carbon_surces_for_nitrogen_removal_fact_sheet_p100il8f.pdf

In our opinion, the **odour treatment** assessment (page 32) is accurate, and the provided treatment through the bark filter is adequate and commonly utilized. We note that any dewatered sludge (cake) storage bins in outside areas will also need to be connected to the odour treatment system.

The report does not mention specifically which processes have **duty and standby** units. Installed standby units allow the plant to operate when a duty unit is out of service due to fault or planned maintenance. We recommend that this is defined in the next design phase. It is common to have installed standby units for all equipment that is critical in achieving the targeted effluent quality and quantity to allow maintaining compliance with the resource consent. While the two SBR reactors may be duty only (meaning both are required to treat the full design flows and loads), providing at least two reactors is best practice as it allows to take one reactor out of service for short durations during periods of low flows.

Screening (2mm) followed by grit removal – the two mm screening is required for the membrane filtration plant. Because most of the grit will be removed in the screen(s), the grit sedimentation channel downstream could be underutilized. However, it is indeed best practice to place grit sedimentation downstream of the first screening location, so there are limited options in this case. If the expected fats, oils and grease amounts are low, a circular grit separation chamber could also be considered.

The treated effluent tank / **irrigation tank** is currently sized at 1,500 m^3, the maximum daily plant influent flow. Its size needs to be determined together with the treated effluent irrigation system design. The tank needs to store any treated effluent that is not able to be immediately irrigated. Depending on where the compliance sampling point is going to be, the designers could consider covering the tank to prevent introduction of foreign matter or recontamination.

The design report describes a **back-up power generation unit**. This is reasonable and recommended.

3.5 Technology assessment and selection

The selected sequencing batch reactor (SBR) technology is a good fit for the Ridgeburn development. SBRs are suitable to handle variable flows and loads. As the area is developed over time, the existing SBR operation can be modified, or more SBRs can be added, as shown in BPO's concept design. SBR plants usually run automatically but need manual oversight. Some in-depth knowledge is required for performance optimization and troubleshooting, but this is similar to all activated sludge treatment plants.

To achieve a total nitrogen target of 4 mg/L, addition of an external carbon source is required. With such a low target, this addition is needed for any activated sludge process.

To achieve the low target design $CBOD_5$ and TSS values (refer to Table 2), a membrane filtration system as utilized in the concept design is the only possible option.

3.6 Consent conditions

This section relates to section "Treated Effluent Consent Limits" in (BPO Limited, 18 March 2026).

The proposed consent conditions overall appear reasonable.

The section proposes weekly 24-hour flow-composite sampling at the outlet of the irrigation tank to determine compliance. This is a reasonable sampling frequency, and more frequent than the fortnightly frequency that the WEPS[3] prescribes for a treatment plant of this size.

The section proposes to use both a median discharged mass load (kg pollutant per day), and a 95th percentile pollutant concentration (mg/L) as a compliance measure, with different values proposed depending on the staging of the development.

It is understood that the full loads to the WWTP are expected during or after Year 5. At this stage, the maximum load will be discharged to the effluent disposal areas. Table 4 provides the proposed consent values from Year 4 onwards and calculates the theoretical allowable pollutant discharge concentration provided by the median load value, based on the average expected daily flow. The resulting theoretical allowable discharge concentrations based on the median consent target load are close to the proposed 95th percentile upper limit values. In the case of TSS, TP and TN, the calculated values are higher than the 95th percentile concentration, which means the actual median load discharged by the plant would need to be lower than stated. This indicates that the chosen median load values are adequate and not unduly permissible.

In the years prior to full development, despite the proposed 95th percentile concentration being higher than from Year 4 onwards, the overall loads discharged to the disposal areas will be less, which will either result in less area being required for disposal, or the per area loading (kg per hectare per year) is reduced.

The proposed 95th percentile consent concentration values are higher than the target design values (refer to Table 2), to allow for the WWTP start up period when the load is low and the plant may not operate at its optimum yet, and also to capture short periods of potential process upsets. This approach seems also sensible to Lutra.

As mentioned in the text in section 3.2.1, the adequacy of the TN and TP design targets and consent condition targets ultimately depends on the site-specific assessment of the selected land discharge system. This is detailed by (WGA, January 2026). We are unable to comment on their site-specific assessment as this is not our area of expertise. However, from a general point of view, both the treatment targets and proposed consent targets (median load, and 95th percentile concentrations) seem adequate for land disposal and are similar to or better than other treated effluent land disposal systems that we are aware of.

Table 4 – Proposed consent conditions from Year 4 onwards.

Parameter	Median consent target load	95th Percentile Concentration	Calculated "allowable" concentration based on average flow and median permitted load
Unit	kg pollutant/day	mg/L	mg/L
Source:	(BPO Limited, 18 March 2026), Table 19	(BPO Limited, 18 March 2026), Table 19	Calculated[9]
Daily average flow[10]	n/a	n/a	890 m^3/d
$CBOD_5$	6	9	6.7
Total suspended solids (TSS)	12	10	13.5
Total Phosphorus (TP)	12	8	13.5
Total Nitrogen (TN)	12	10	13.5
Ammonia (NH3/4)	6	8	6.7

[9] Median pollutant load (in g per day) / average flow (m^3/d)

[10] From (BPO Limited, 18 March 2026), "Table 20 Anticipated peak flow rates across the 5 phases of project development through to completion", average flow at Completion

4 Conclusions

Lutra did not encounter a critical flaw in the design of the WWTP. The review has found the following:

- the proposed wastewater influent flows and influent pollutant loads are sensible and reproducible
- the proposed consent condition quality for nitrogen and phosphorus is generally in line with similar discharge-to-land systems. However, Lutra is unable to provide certainty on the adequacy as the required effluent quality is dependent on the land discharge system (soil assessment, irrigation system design), which is outside Lutra's area of expertise. The proposed $CBOD_5$ and TSS treatment quality is of a higher standard than similar discharge-to-land systems
- the selected treatment processes are suitable for the Ridgeburn development, and the WWTP is adequately sized to meet the targeted effluent quality

5 References

BPO Limited. (18 March 2026). *Ridgeburn Wastewater Treatment Plant Design Report (version 2026-03-18).*

WGA. (January 2026). *Ridgeburn Development Wastewater Disposal Options and Effects (WGA252389-RP-HG-0002_A).*