Infrastructure Assessment

Prepared for:
GIBBONS CO.

MCKENZIE & CO.

DOCUMENT CONTROL RECORD

PROJECT: RIDGEBURN

CLIENT: GIBBONS CO.

REVISION	DATE	ORIGINATOR	CHECKER	APPROVER	DESCRIPTION
A	17/04/25	JK	RS		DRAFT
B	08/05/25	JK	RS		DRAFT
C	12/05/25	SH	JK	JK	DRAFT
D	15/05/25	SH	JK	JK	FINAL
E	23/05/25	SH	JK	JK	FINAL

1. EXECUTIVE SUMMARY

This infrastructure assessment investigates the infrastructure requirements to support the proposed approximately 1,242 residential lot and commercial Ridgeburn development. The assessment focuses on the existing infrastructure on site, the requirements to service the development, and the proposed solutions.

The proposed infrastructure will meet all relevant standards for earthworks, roading, stormwater, wastewater, water supply, and utilities. The servicing strategy prioritises sustainability, resilience, and compliance with current regulatory requirements.

- Earthworks will be required to form roads and lot platforms. Earthworks will be designed to minimise site disturbance by closely following existing land contours.
- A transport network will be constructed, including a central loop road, smaller local roads, on and off-road trails for pedestrians and cyclists to enable a connected multimodal network.
- Stormwater treatment and flood risk mitigation will be proactively addressed through the inclusion of swales, soakage, attenuation basins and site contouring measures, ensuring the development remains resilient to the effects of climate change and natural hazards.
- Wastewater will be conveyed to a private wastewater treatment plant, ensuring all flows are treated appropriately before discharged to ground. An option exists for wastewater to be collected from existing public network, treated on-site and discharged to ground, to alleviate existing constraints on the public network.
- Water supply can be provided through multiple sources, from an on-site bore, river abstraction, or a possible connection to the public network. A water reservoir system will be constructed on Morven Ferry Hill to provide pressure and firefighting capacity, ensuring a resilient overall system. The development will comply with all obligations under Taumata Arowai.
- Power and internet have both received confirmation of connection feasibility. Solar power is proposed to be implemented to reduce demand on the existing network and provide long term sustainability.

The report confirms that infrastructure can be provided to support the Ridgeburn development, without relying on servicing from the public network. The development can be fully serviced on-site, independent of the public network.

2. INTRODUCTION

McKenzie & Co. Consultants have been engaged by Gibbons Co. ("the applicant") to assess the infrastructure requirements for the proposed development of approximately 1,242 residential dwellings, associated infrastructure, retail, and short-term accommodation at the Ridgeburn site.

The applicant is submitting a referral application under the Fast-Track Approvals Act (FTAA) 2024, which aims to expedite developments that align with the public interest, deliver significant economic and community benefits, and address urgent infrastructure needs. This report confirms that:

- The proposed development can be appropriately serviced.
- The development is not at risk of flooding caused by the effects of climate change or natural hazards
- A sustainable and adaptable infrastructure strategy has been outlined.

PROPOSED DEVELOPMENT

The proposed development aims to create a residential community consisting of approximately 1,242 residential dwellings of various typologies, supported by infrastructure, retail spaces, and short-term accommodation. The development will be serviced with key infrastructure such as road networks, stormwater management, wastewater systems, and water supply, while adhering to sustainable design principles.

This engineering report provides a high-level assessment of the existing civil infrastructure and outlines the required infrastructure works, including:

- Earthworks
- Roading
- Three waters
- Utility servicing

The document also addresses how the development will manage the effects of climate change and natural hazards, ensuring resilience and sustainability.

The proposed development masterplan is shown Figure 1 below.

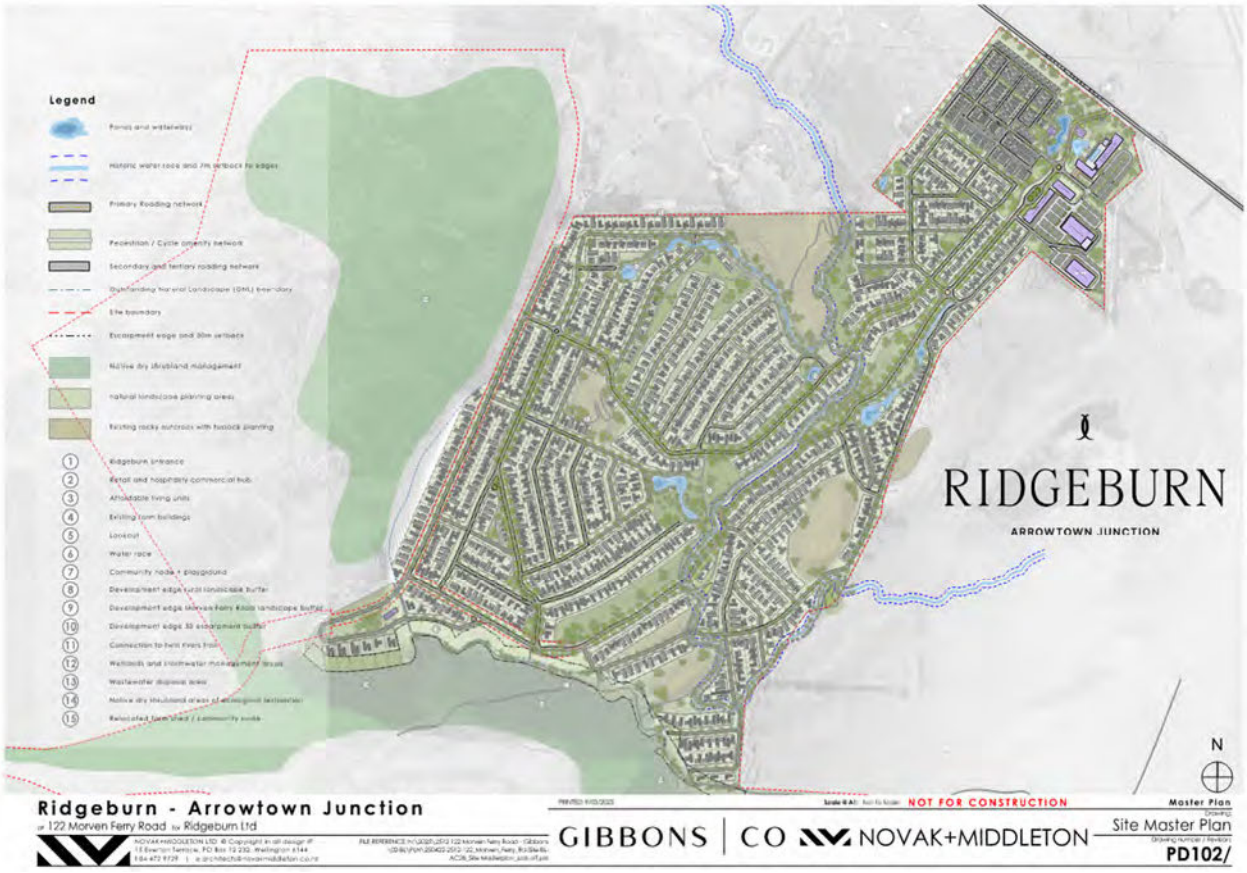


Figure 1 – Project Masterplan

3. EARTHWORKS

REQUIREMENTS:

Earthworks will be necessary to contour the site to suit the proposed roads, and lots shown in masterplan, and to form access and platforms for the supporting infrastructure.

CURRENT LANDSCAPE:

The land is currently utilized for light grazing and cropping, with undulations, streams and rocky outcrops. The site contour is suitable for development due to being generally flat and with minimal constraints due to streams and wetlands. An existing water race runs through the site, which will need to be protected and retained. This will be a constraint on roading and earthworks levels.

PROPOSED WORKS:

Earthworks will be designed to minimize site disturbance by following existing contours as closely as possible and minimizing material leaving site or being imported into the site.

Best practice guidelines for erosion and sediment control will be implemented in line with Otago Regional Council (ORC) guidelines, ensuring minimal environmental impact.

CLIMATE CHANGE ADAPTATION:

The earthworks strategy will account for potential climate change impacts, such as increased rainfall and soil erosion, by implementing erosion control measures and considering longer-term soil stability.

SUMMARY

Earthworks will be required to form roads and lot platforms. Earthworks will be designed to minimise site disturbance by closely following existing land contours.

4. ROADING

REQUIREMENTS

Connections and upgrades to the existing roading network, including new internal roads to accommodate development traffic.

CURRENT INFRASTRUCTURE

The site is currently accessed via Morven Ferry Road, with residential and rural access immediately from State Highway 6.

PROPOSED INFRASTRUCTURE

A transport network will be constructed, including a central loop road and smaller local roads providing access to residential lots. The road reserve will include footpaths and cycle facilities.

Off-road trails for pedestrian and cycle movements will also be provided to enable a connected multimodal network.

It is currently proposed that the road network will remain privately owned and operated by a residents' society to enable roads to maintain a special character.

TRAFFIC IMPACT

A Traffic Assessment, prepared by Traffic Concepts, outlines the expected traffic volumes and required upgrades to the surrounding road network to accommodate the additional traffic generated by the development.

SUMMARY

A transport network will be constructed, including a central loop road, smaller local roads, on and off-road trails for pedestrians and cyclists to enable a connected multimodal network.

5. STORMWATER

SYSTEM REQUIREMENTS

- Safe and effective conveyance of 2%, 5%, 10%, 20% & 1% Annual Exceedance Probability flows.
- Compliance with QLDC engineering standards for stormwater management.
- Climate change adaptation, for all rainfall events.

CURRENT INFRASTRUCTURE

The site is not connected to the public stormwater network, however the site borders the Kawarau River on the southern border, and the Arrow River is at the end of Morven Ferry Rd.

Existing discharge points are via an irrigation scheme channel that traverses the site and discharges downstream to 138 Morven Ferry Rd, which could reach capacity during larger rainfall events. This is illustrated below in Figure 2. Plans showing existing Overland Flow paths are included in Appendix A.

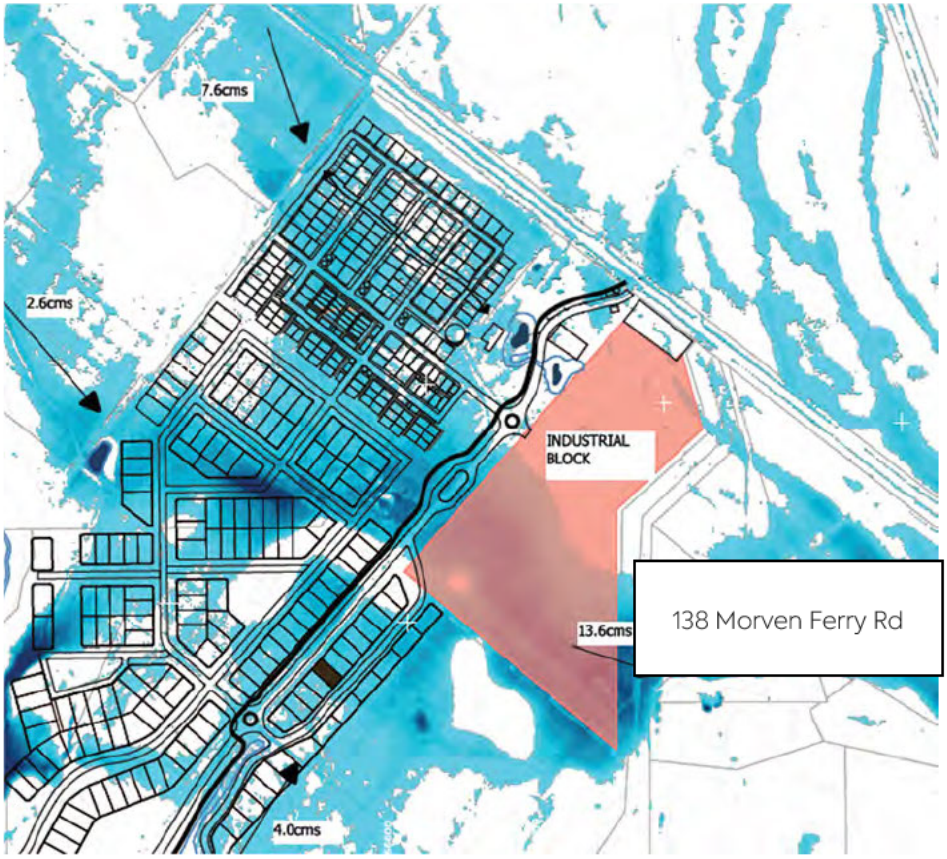


Figure 2 – Pre-Development Flows – 1% AEP including 3.8-degree climate change.

PROPOSED INFRASTRUCTURE

This project supports adaptation, resilience, and recovery from flooding natural hazards.

Stormwater from events up to the 10 % AEP will be conveyed via roadside swales, with culverts under roads where necessary. Discharge will be to soakage, the existing water race, Morven Ferry Road, and the natural outlet at the boundary with 138 Morven Ferry Rd. This mimics pre-development scenario.

Flows above this will be contained within the road corridors and overland flow paths, with lots and commercial buildings, being raised above these levels to provide the required freeboard.

On-site attenuation will be implemented to manage flows and ensure they are limited to pre-development levels before discharge. These may be in existing streams, and low points on the site, and could also be in depressions shaped within the proposed car parks in the commercial zone and other landscaping areas. Indicative attenuation areas are shown below in Figure 3.

Flows to the wetlands will be managed to closely replicate pre-development conditions through the use of catchment delineation and offline attenuation ponds designed to regulate discharge rates.

Stormwater will be discharged to soakage where feasible, with any remaining flows directed to the existing discharge points along the site boundary. Attenuation basins will be provided to limit flows to pre-development levels.

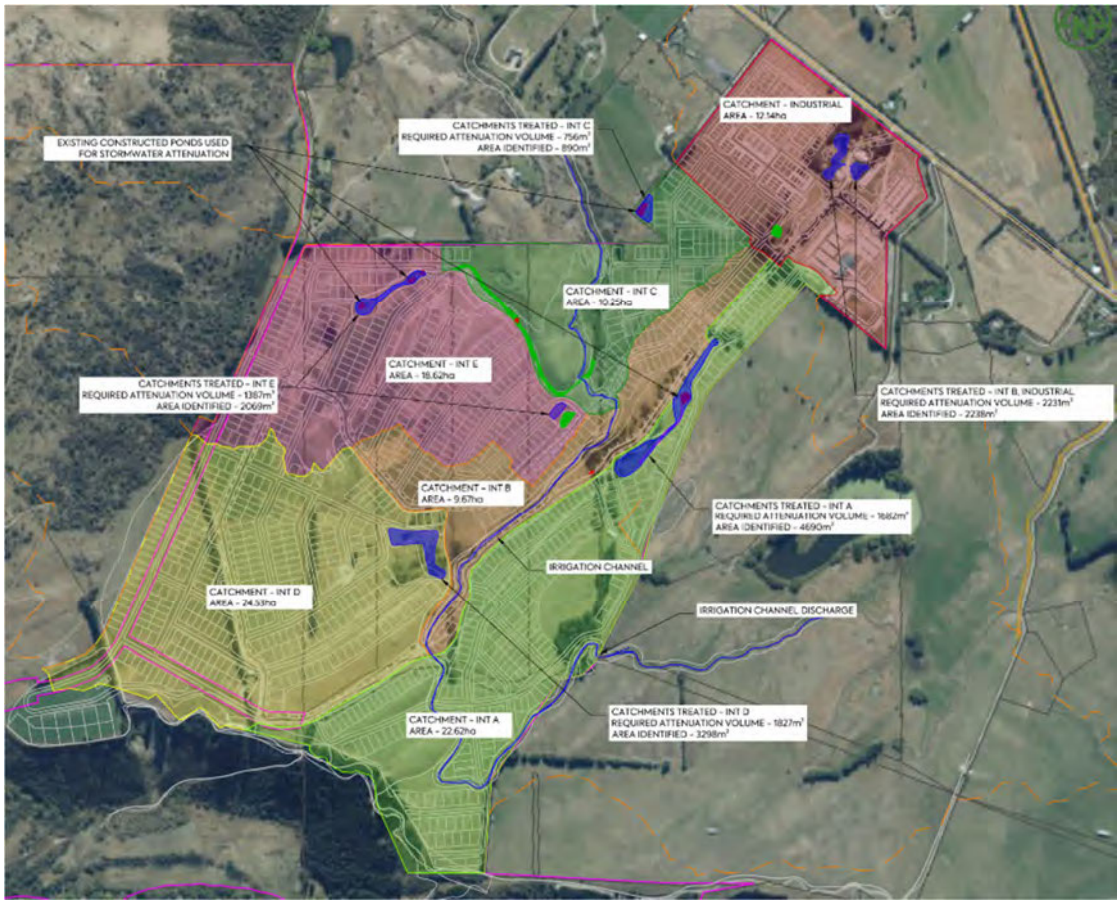


Figure 3 – Options for on-site attenuation for the 1% AEP event

Conveyance channels can be formed to ensure flows from upstream are safely conveyed through the site, without flooding buildings or creating hazards. Indicative flow paths have been modelled around the proposed residential development as shown below in Figure 4.

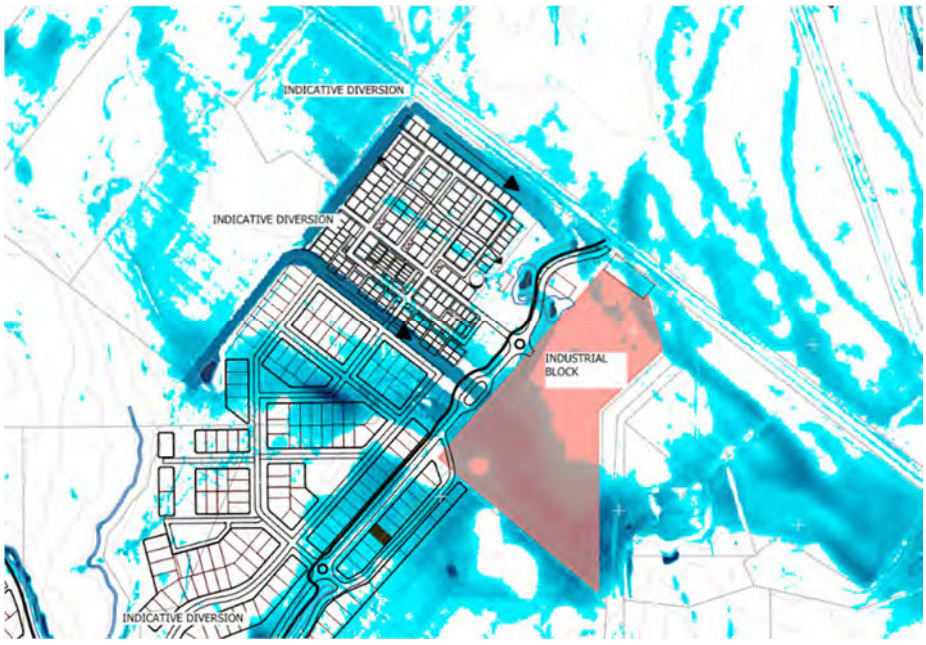


Figure 4 – Option for flood Mitigation to pass upstream flows through the site.

The overland flowpath through the commercial area shown in red, would follow the proposed

landscape areas, car parking areas, and road areas to the existing low point. Floor levels would be set above this flood level to provide the appropriate freeboard.

A significant portion of the development site will remain permeable surface in natural ground conditions or as recreation reserve. These areas will allow recovery from large storm events by infiltration and evapotranspiration.

CLIMATE CHANGE CONSIDERATIONS:

The stormwater management system will take future climate change scenarios into account for anticipated changes in rainfall patterns. This would include larger attenuation basins, sizing of swales to cater for these events, ensuring building platforms have required freeboard for these events.

SUMMARY:

The current infrastructure is not connected to a public network. A new stormwater network can be constructed to provide water treatment, flow management and resilience from flood events. Significant overland flows pass through the site during large storm events, which can be managed to pass safely through the site, without affecting upstream or downstream properties. Climate change will be considered, for future resilience.

6. WASTEWATER

REQUIREMENTS:

- Capacity for approximately 1070 m^3/day.
- Internal site network capable of handling wastewater flows.
- Treatment systems designed to discharge to land or facilitate water recycling for non-potable uses.

CURRENT INFRASTRUCTURE:

The site is not connected to a public wastewater network; existing dwellings use private systems.

Wastewater infrastructure servicing adjacent communities and future developments, is at, or near full capacity. Issues exist within existing networks and discharge locations.

PROPOSED PIPE NETWORK INFRASTRUCTURE:

Two private wastewater network solutions are considered: a gravity system and a low-pressure sewer system.

A gravity system:

- Would be preferred for potential future vesting with Queenstown Lakes District Council (QLDC) if this option were to be available in the future.
- This system would discharge to a pumpstation near the low point of the site. This would subsequently pump to the WWTP.

low-pressure system:

- Is more suitable for private networks, offering reduced treatment requirements due to lower peaking factors due to lower infiltration into the pipes. The result of the lower Peak Factor means less wastewater requiring treatment and discharge.
- This would pump directly into the WWTP.

Hybrid system:

- Both systems could be incorporated to take advantage of benefits from both systems.

WASTEWATER TREATMENT – ON-SITE WASTEWATER TREATMENT PLANT (WWTP):

A private on-site WWTP is proposed, utilising advanced treatment technologies such as membrane bioreactors (MBR) or moving bed biofilm reactors (MBBR). Treated effluent will be discharged to land via a disposal field located on the flat terrace adjacent to the Kawarau River. A similar system has recently been successfully implemented in the Cardrona Valley.

Due to the proposed wastewater disposal field located within the proximity of the Kawarau River

(150m), the treatment plant will be designed to produce high-quality effluent, particularly with respect to pathogen and nitrogen removal, to protect downstream water quality. A high level of treatment is proposed to ensure robust environmental protection.

WASTEWATER DISPOSAL FIELD:

Infiltration testing and soil bore logging were undertaken by Kirk Roberts Consulting, with results presented in a memo dated 8 May 2025. Three infiltration tests (SK-01 to SK-03), located within the proposed disposal field footprint, and recorded design soakage rates ranging from 1.75 to 16.13 $L/m^2/hr$. These results indicate the proposed discharge area can accommodate the design Peak Wet Weather Flow (PWWF), with appropriate factors of safety applied.

Additional testing (SK-04 and SK-05), outside the disposal field boundary, also demonstrated high infiltration rates, confirming favourable and relatively uniform subsurface conditions across the site.

A bunded storage area is proposed along the terrace edge as a conservative, last-resort containment measure to prevent any treated effluent discharge to the Kawarau River should infiltration capacity be temporarily exceeded.

The proposed disposal field is located approximately 150m away from the Kawarau River, and approximately 15m higher than the water level in the river.

IRRIGATION FEASIBILITY AND LAND AREA REQUIREMENTS:

Based on standard wastewater design assumptions, the following key parameters have been adopted:

- Average Daily Flow (ADF): approximately 1,070 m^3/day
- Peak Wet Weather Flow (PWWF): approximately 4,790 m^3/day, based on a peak factor of 4.5 × ADF
- Lowest measured soil infiltration rate: 7.8 $L/m^2/hr$.
- Applying a Factor of Safety of 2, the conservative design infiltration rate is 3.9 $L/m^2/hr$, equivalent to 0.094 $m^3/day/m^2$.
- Based on this infiltration rate, a minimum direct infiltration area of 5.1 hectares (Ha) of area is required to dispose of the full PWWF volume per day.
- A suitable disposal field area exceeding 12 Ha has been identified on-site, providing capacity and operational redundancy.

The identified field area is anticipated to be sufficient when applying appropriate safety margins to account for seasonal variability, potential system inefficiencies, and long-term performance reliability. Final design will confirm soil characteristics across the full area and include provisions for rotation, rest periods, and contingency capacity as needed.

SLOPE CONSTRAINTS AND IRRIGATION METHODOLOGY:

The proposed disposal field slopes have been reviewed, with only areas with slopes flatter than 1 in

4 being proposed as suitable. Minor earthworks could be undertaken to form flatter slopes where necessary.

While subsurface drip irrigation (below frost depth) is typically suited to cold-climate installations, spray irrigation offers operational flexibility—allowing for precise application control across varied terrain. The final irrigation method will be selected based on further site-specific evaluation.

OPTIONAL PUMPSTATION AND RISING MAIN TO, OR FROM QLDC NETWORK:

Provision could be provided for a future connection to the QLDC wastewater network via a pump station and rising main. This offers long-term adaptability, allowing transfer to the QLDC WWTP when capacity upgrades are completed.

POTENTIAL INTEGRATION WITH ARROWTOWN RISING MAIN TO REDUCE EXISTING DOWNSTREAM CONSTRAINTS

Two existing rising mains (300 mm and 355 mm in diameter) run south of Lake Hayes, conveying wastewater from Arrowtown and the surrounding areas north and east of Lake Hayes to the Queenstown Lakes District Council (QLDC) Wastewater Treatment Plant (WWTP). Additionally, significant development is underway in the Ladies Mile area, located west of Lake Hayes.

Given the favourable infiltration rates on site and the proximity of a WWTP, there is potential to accept a portion of the flows from these catchments. This could help reduce the load on the existing infrastructure as part of a more integrated and coordinated wastewater network. Infrastructure reports confirm that the Arrowtown-Lake Hayes Pump Station services Arrowtown and Lake Hayes Estate via a rising main system, to the WWTP.

Additional investigations are necessary to verify whether the proposed system has sufficient capacity to handle these redirected flows and to ensure compatibility with the broader network strategy.

The proposed pipeline would intercept wastewater at the intersection of State Highway 6 (SH6) and Alec Robins Road. It would then follow Alec Robins Road to its terminus and continue along the existing paper road corridor to reach the proposed Ridgeburn WWTP. The alignment of the proposed pipe is illustrated in Figure 5 below.

Diverting some or all of this flow from this section to the proposed system could help alleviate pressure on the existing aging pipes and the WWTP.

Figure 5: Potential route for a wastewater pipe from the existing network, to alleviate flows in existing system.

SUMMARY:

There is no existing wastewater network available to the site.

Multiple options are available for feasibly conveying wastewater across the site, including a gravity system to a pump station, low pressure sewer system, or a hybrid approach.

A private wastewater treatment plant with disposal field is proposed, with onsite infiltration testing showing good infiltration rates. Preliminary calculations show that there may be capacity to connect with and alleviate pressure from the existing public network by accepting some of their flows, creating a more well connected and resilient system overall.

7. WATER

REQUIREMENTS:

Total water demand of approximately 998m^3/day, with a peak demand of 75L/s, to service 1,242 residential lots plus commercial allocation.

Onsite water treatment plant to meet potable water standards.

On-site reservoir and booster pumping system for potable and firefighting supply, consisting of four 500 m^3 tanks, with allowance for firefighting reserve.

Optional provision for future connection to the public water network (QLDC).

CURRENT INFRASTRUCTURE:

The site is not serviced by a public water network; existing dwellings rely on tank systems and the

existing on site bore.

An existing borehole on the site (Bore F41/0264, Morven Ferry Road) is permitted for single domestic use, with a shallow depth of 18.3 m, and has a test flow rate of approximately 98 L/min (141 m^3/day). Deeper bores are proposed in the future to access more reliable aquifer supplies capable of supporting development-scale demands.

PROPOSED INFRASTRUCTURE:

A private on-site reticulation network for potable and firefighting water will be required to service the development. The existing bore alone is insufficient to meet projected demand, and additional water is proposed to be sourced from two primary sources:

First priority - on-site bore system:

The first priority in the water supply strategy is to install at least one deep on-site bore in addition to the existing bore. These bores will be subject to hydrogeological assessment and consent where necessary, ensuring they can support supply requirements. The presence of the existing shallow bore with a robust flow of water demonstrates that further bores could be installed to augment the water supply.

Second priority - Kawarau River abstraction:

The second priority for the Ridgeburn development is to abstract up to 1,000 m^3/day of surface water from the Kawarau River. Under Rule 12.1.2.2 of the Regional Plan: Water for Otago, this activity is classified as a permitted activity, provided certain conditions are met. These include:

a) The take does not exceed 100 litres per second, nor 1,000,000 litres per day; and

(b) No more than one such take occurs per landholding; and

(c) No back-flow of any contaminated water occurs to the water body; and

(d) Fish are prevented from entering the intake structure

As the development's demand falls within the thresholds of item (a), and all other criteria will be met, the river abstraction does not require a resource consent. This option provides a reliable, scalable supply and avoids delays associated with consenting processes. A compliance table is outlined below in Table 1.

Two possible inlet locations areas are possible on the Kawerau River –

1) Adjacent to the site, which would require a connection across Crown Land, or
2) At the end of Morven Ferry Rd, which would require a pipeline approximately 3.8km along Morven Ferry Road, to the Ridgeburn development.

Refer to drawing 600 – Water supply, showing the two possible Kawerau River water take locations.

The water take would consist of a screened intake structure in the main channel, and a pump to pump the raw water to the water treatment plant.

Water Treatment Plant

A private water treatment plant will be constructed to treat the water from the Kawerau River supply, plus the bore water supply, to meet potable water standards, and the system operator will be registered under the Water Services Act 2021.

Reservoir

Treated water will be stored in a reservoir located on Morven Ferry Hill, using an existing quarry site. The reservoir will provide system pressure and fire protection capacity. Booster pumps will be installed as needed to maintain delivery pressure throughout the site.

Future integration

A future with the QLDC public water system may be considered once regional network upgrades enable connection.

Figure 6 - Existing bore location

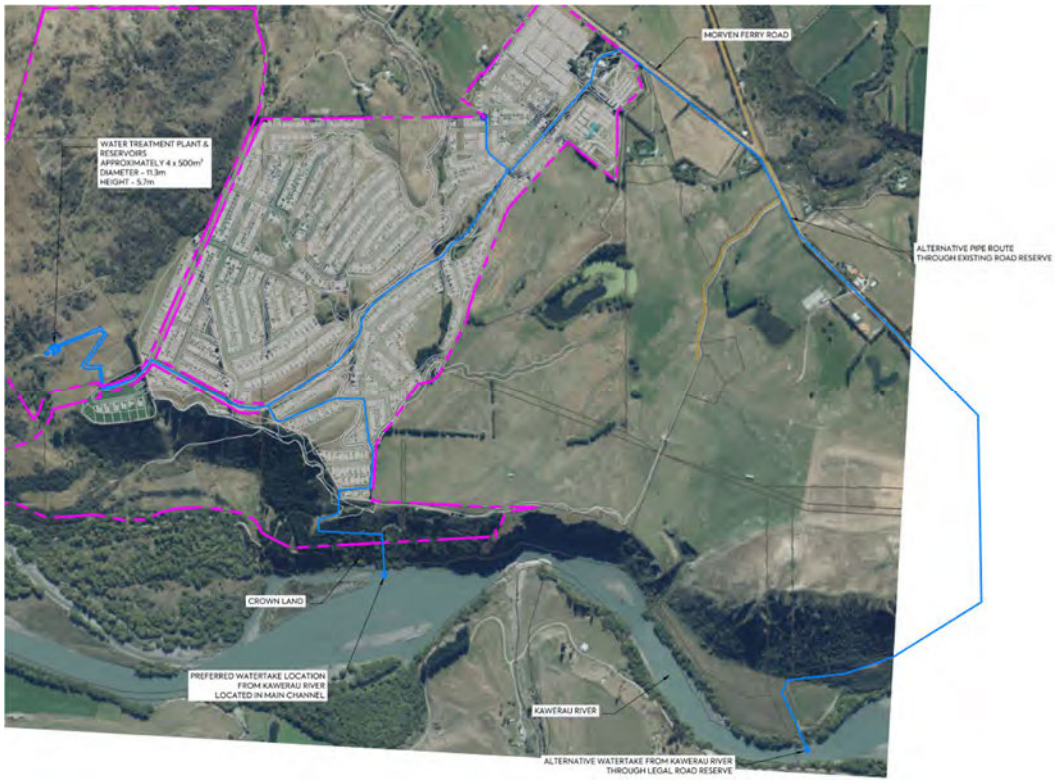


Figure 7 - Kawarau Water take options. Refer to plan 600.

Table 1 - Compliance with Permitted Activity Criteria - Rule 12.1.2.2

Condition	Requirement	Ridgeburn Proposal	Complies?
Maximum daily abstraction	≤ 1,000 m^3/day	998 m^3/day	Yes
Maximum instantaneous rate of take	≤ 100 L/s	75 L/s	Yes
Number of takes per landholding	1	1	Yes
Prevention of backflow	Backflow must be prevented	Backflow prevention to be installed	Yes
Screening to prevent fish entry	Intake must be screened	Intake screen design to be included	Yes
Water source	Kawarau or Clutha/Mata-Au	Kawarau River	Yes

main stems

This table confirms that the proposed water take from the Kawarau River meets all the requirements of a permitted activity under the Regional Plan: Water for Otago, Rule 12.1.2.2.

SUMMARY:

The current infrastructure is not connected to a public wastewater network. There is an existing bore on site which does not meet the flow requirements of the proposed development.

Several water supply options are proposed to feasibly service the development:

- Construct a new bore in addition to the existing, deep enough to access a reliable aquifer
- Abstract from the Kawarau River (up to 1000m^3/day)
- Provision for connection to the nearest public supply when network upgrades are conducted

A water treatment plant will be constructed to treat water to potable standards. All treated water will be stored in a reservoir on Morven Ferry Hill which will provide system pressure and firefighting reserves.

8. UTILITIES

POWER:

Initial discussions with Aurora confirm that the project's power needs can be met through their network. Clearance letter is attached in Appendix B.

Provision for solar readiness is proposed to be incorporated into the planning of the power network, to reduce the demand and reliance on existing power network.

FIBRE:

Tuatahi Fibre has confirmed that its network can be extended to provide connection availability. Clearance letter is attached in Appendix B.

9. PRIVATE INFRASTRUCTURE

The infrastructure proposed for the development is fully self-servicing, thereby removing any reliance on Queenstown's already constrained public infrastructure. The Queenstown Lakes District is currently experiencing significant challenges with its wastewater systems; notably, the Shotover Wastewater Treatment Plant has been subject to enforcement actions following breaches of resource consents, highlighting ongoing capacity and compliance issues. Developers in the region have also faced obstacles arising from inadequate wastewater infrastructure, with some projects requiring substantial pipeline upgrades that are not provided for in the current Long Term Plan.

In addition to being self-sufficient, the development has the potential to assist the wider network

by accepting a portion of wastewater flows from the existing QLDC wastewater network. This approach would reduce flows to Queenstown Lakes District Council's wastewater treatment plant, easing pressure on public infrastructure and supporting future growth in the Queenstown area.

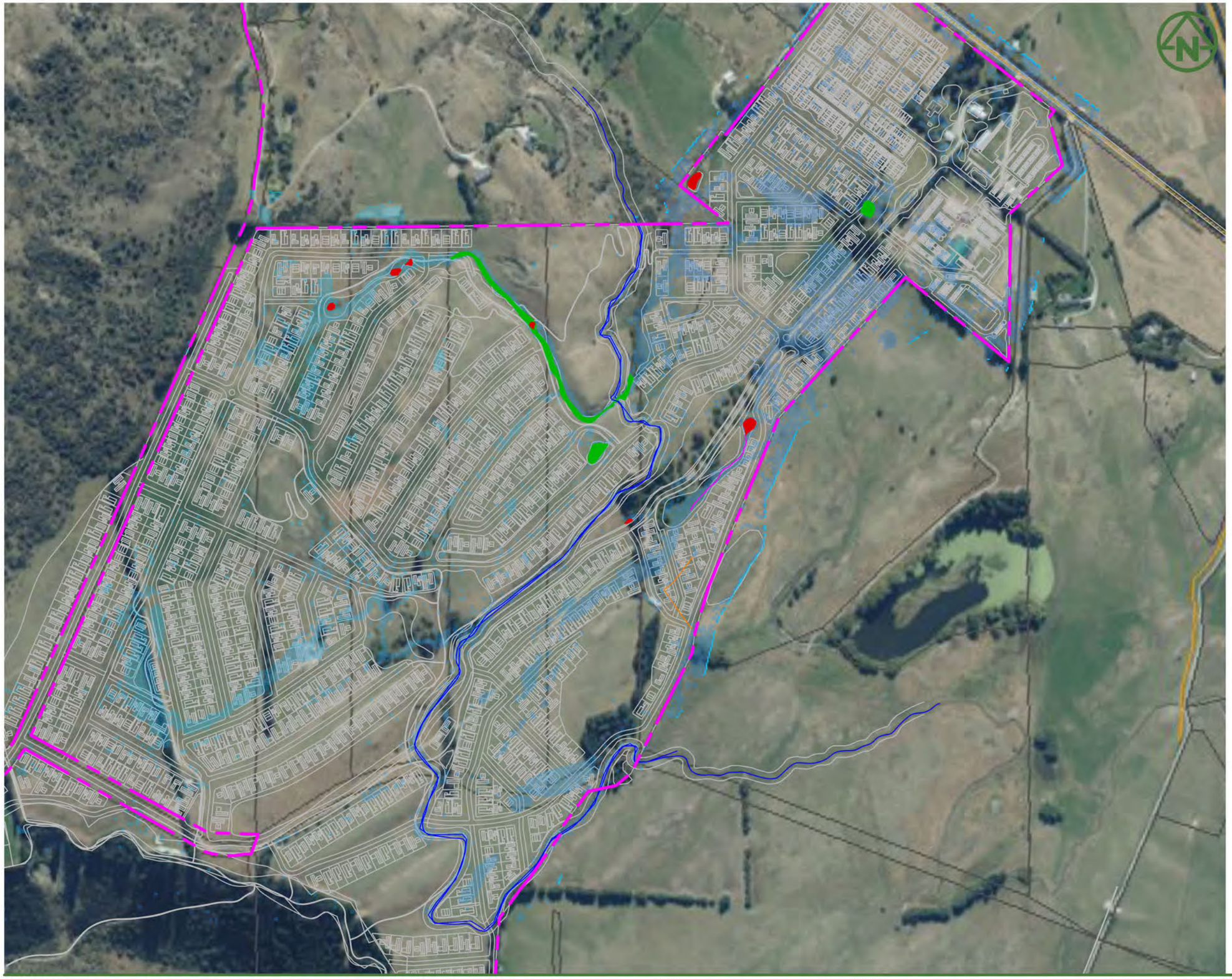
By operating independently — and potentially providing surplus treatment and disposal capacity to the district — the development ensures its own sustainability while contributing positively to the resilience and sustainable expansion of the wider region.

10. SUMMARY

The development at Ridgeburn is appropriately designed to meet the required infrastructure standards, addressing all relevant aspects of earthworks, roading, stormwater, wastewater, water, and utilities. The site will be serviced with sustainable infrastructure, and the effects of climate change and natural hazards will be mitigated through careful planning.

The stormwater and flooding risks will be effectively managed through the implementation of attenuation basins and site contouring, ensuring that the development is not at risk from climate change or natural hazards. Further detailed modeling and updated assessments will be conducted at the substantive application stage.

APPENDIX A – Engineering Drawings



LEGEND:

- SITE BOUNDARY
- IRRIGATION CHANNEL
- EXISTING WETLAND
- EXISTING CONSTRUCTED POND
- 1% AEP FLOOD EXTENTS

MCKENZIE & CO.

REV	DESCRIPTION	DRN BY	CHK BY	APP BY	DATE
A	FIRST ISSUE	SH	JK	JK	08/05/25

CLIENT: GIBBONS CO

PROJECT: DOONHOLME
MORVEN FERRY RD

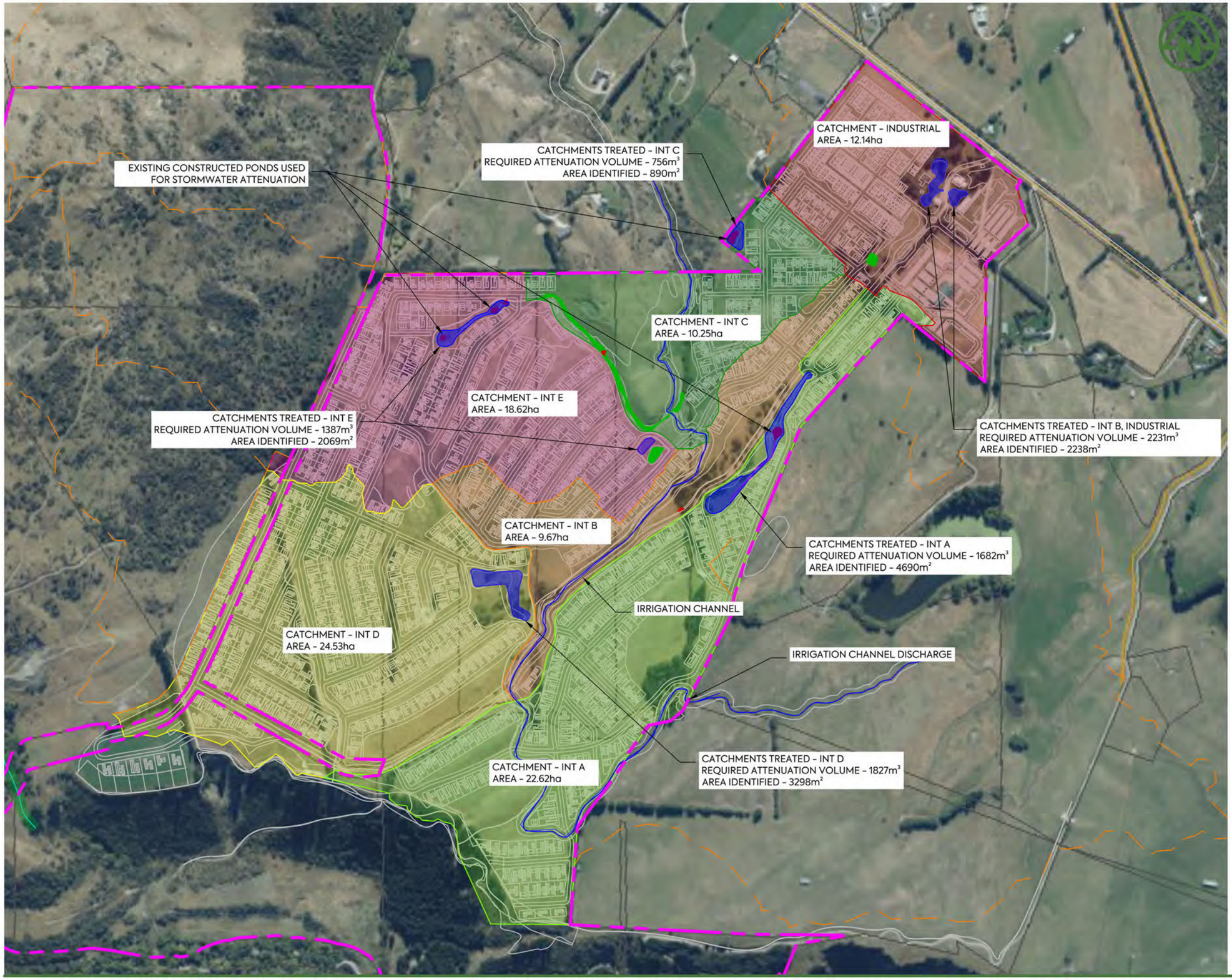
TITLE: STORMWATER
1% AEP FLOOD EXTENTS - INDICATIVE
PRE-DEVELOPMENT

PURPOSE OF ISSUE: FOR DISCUSSION ONLY

SCALE: NTS
DO NOT SCALE

DRAWING NO: 4048-460

REV: A



NOTES:

1. REQUIRED ATTENUATION VOLUME FOR INTERNAL CATCHMENTS IS CALCULATED FOR THE 100YR RAINFALL EVENT FROM HEC-HMS FLOOD MODEL
2. DETENTION POND DEPTH IS ASSUMED TO BE AVERAGE OF 1m ACROSS THE IDENTIFIED AREA

LEGEND:

- EXISTING WETLAND
- EXISTING CONSTRUCTED POND
- POSSIBLE DRY POND LOCATIONS
- ATTENUATION CATCHMENTS

MCKENZIE & CO.

REV	DESCRIPTION	DRN BY	CHK BY	APP BY	DATE
A	FIRST ISSUE	SH	JK	JK	08/05/25

CLIENT: GIBBONS CO

PROJECT: DOONHOLME
MORVEN FERRY RD

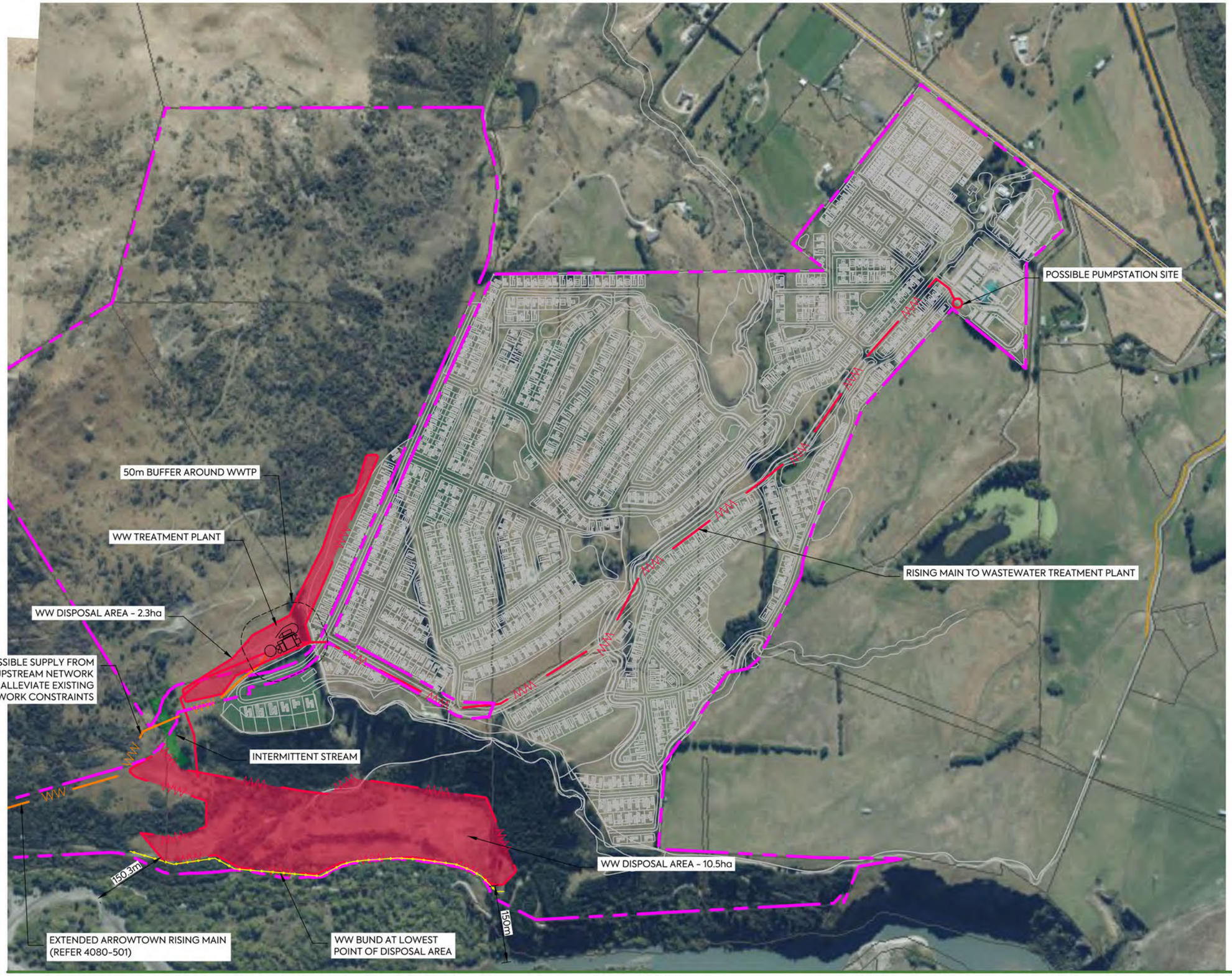
TITLE: STORMWATER
FLOOD ATTENUATION - INDICATIVE

PURPOSE OF ISSUE: FOR DISCUSSION ONLY

SCALE: NTS
DO NOT SCALE

DRAWING NO: 4048-462

REV: A



NOTES:

1. AREA OF WASTEWATER DISPOSAL AREA SUBJECT TO SUBSOIL INFILTRATION RATES

REV	DESCRIPTION	DRN BY	CHK BY	APP BY	DATE
B	MOVED WWTP	SH	JDK	JDK	16/05/25
A	FIRST ISSUE	SH	JK	JK	12/05/25

MCKENZIE & CO.

CLIENT: GIBBONS CO

PROJECT: RIDGEBURN MORVEN FERRY RD

TITLE: WASTEWATER CONCEPT

PURPOSE OF ISSUE: FOR DISCUSSION ONLY

SCALE: 1:7500
DO NOT SCALE

DRAWING NO: 4048-500

REV: B

NOTES:

1. WASTEWATER PIPE ALIGNMENT IS INDICATIVE ONLY
2. CAPACITY OF THE WASTEWATER TREATMENT PLANT TO ACCOMMODATE THE ARROWTOWN WASTEWATER TO BE CONFIRMED AT A LATER DESIGN STAGE

REV	DESCRIPTION	DRN BY	CHK BY	APP BY	DATE
B	WWTP	JK	JK	JK	2025/05/20
A	FIRST ISSUE	SH	CONCEPT	JK	12/05/25

MCKENZIE & CO.

CLIENT: GIBBONS CO

PROJECT: RIDGEBURN MORVEN FERRY RD

TITLE: WASTEWATER ARROWTOWN CONNECTION

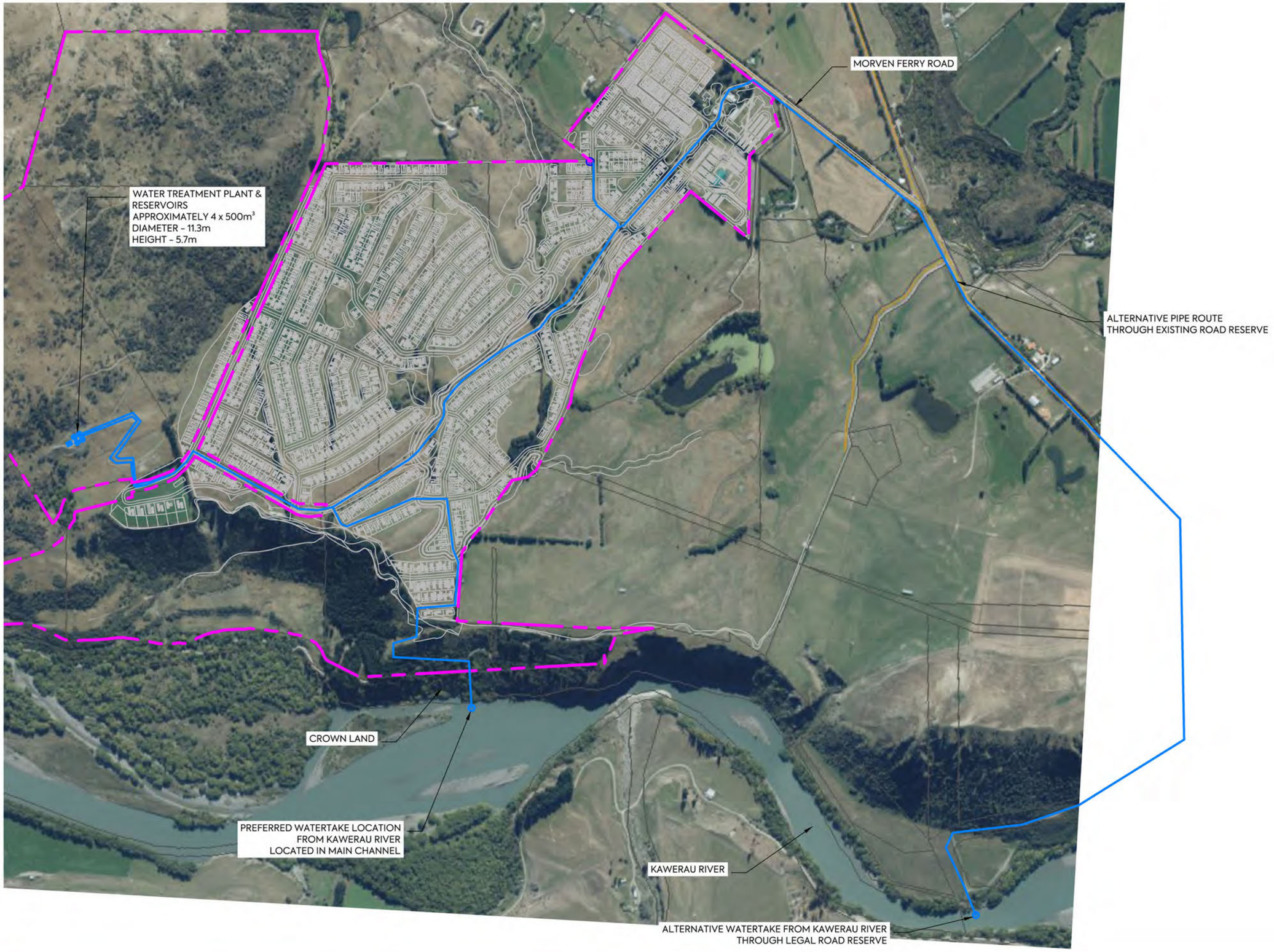
PURPOSE OF ISSUE: FOR DISCUSSION ONLY

SCALE: N.T.S

DO NOT SCALE

DRAWING NO: 4048-501

REV: B



MCKENZIE & CO.

REV	DESCRIPTION	DRN BY	CHK BY	APP BY	DATE
A	FIRST ISSUE	SH	JK	JK	12/05/25

CLIENT: GIBBONS CO

PROJECT: RIDGEBURN
MORVEN FERRY RD

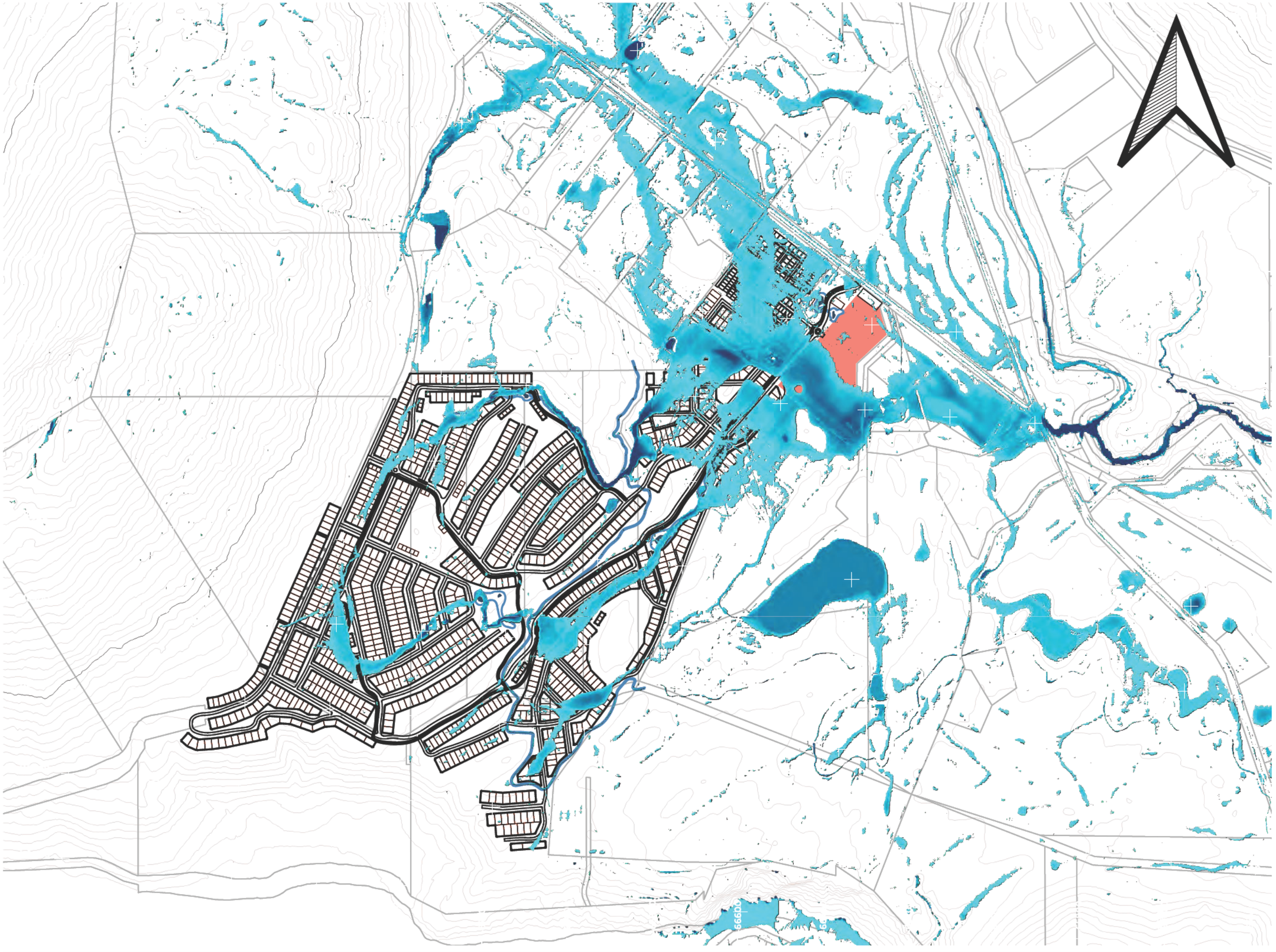
TITLE: WATER
CONCEPT

PURPOSE OF ISSUE: FOR DISCUSSION ONLY

SCALE: NTS
DO NOT SCALE

DRAWING NO: 4048-600

REV: A



NOTES
1. PRE-DEVELOPMENT MODEL
2. ASSUME SOIL CN OF 74
3. OVERALL SITE IMPERVIOUS AREA IS 2%
4. ANY UPSTREAM CULVERTS/ BRIDGES HAS NOT BEEN ACCOUNTED FOR

Pre-Dev
Band 1 (Gray)
- <= 0.1450
- 0.1450 - 0.2400
- 0.2400 - 0.3350
- 0.3350 - 0.4300
- 0.4300 - 0.5250
- 0.5250 - 0.6200
- 0.6200 - 0.7150
- 0.7150 - 0.8100
- 0.8100 - 0.9050
- > 0.9050

MAP PROJECTION:
NZGD2000 / MT NICHOLAS 2000
(EPSG: 2128)

REV	DESCRIPTION	DRN	BYCHK	BY APP	BY DATE
A	FIRST ISSUE	HS	-	-	-

MCKENZIE & CO.

CLIENT: GIBBONS CO

PROJECT: DUNHOLME DEVELOPMENT

TITLE: STORMWATER PRELIMINARY PRE-DEVELOPMENT FLOOD EXTENT

PURPOSE OF ISSUE: FOR DISCUSSION ONLY

SCALE: 1:8,500

DRAWING NO: 4048-4500

REV: A

PLOT DATE ----

NOTES
1. PRE-DEVELOPMENT MODEL
2. ASSUME SOIL CN OF 74
3. OVERALL SITE IMPERVIOUS AREA IS 2%
4. ANY UPSTREAM CULVERTS/ BRIDGES HAS NOT BEEN ACCOUNTED FOR

7.6cms

2.6cms

INDUSTRIAL BLOCK

13.6cms

4.0cms

6680

6700

6600

117800

Pre-Dev
Band 1 (Gray)
- <= 0.1450
- 0.1450 - 0.2400
- 0.2400 - 0.3350
- 0.3350 - 0.4300
- 0.4300 - 0.5250
- 0.5250 - 0.6200
- 0.6200 - 0.7150
- 0.7150 - 0.8100
- 0.8100 - 0.9050
- > 0.9050

MAP PROJECTION:
NZGD2000 / MT NICHOLAS 2000
(EPSG: 2128)

REV	DESCRIPTION	DRN	BYCHK	BY APP	BY DATE
A	FIRST ISSUE	HS	-	-	-

MCKENZIE & CO.

CLIENT: GIBBONS CO

PROJECT: DUNHOLME DEVELOPMENT

TITLE: STORMWATER PRELIMINARY PRE-DEVELOPMENT FLOOD EXTENT

PURPOSE OF ISSUE: FOR DISCUSSION ONLY

SCALE: 1:3,500

DRAWING NO: 4048-4501

REV: A

PLOT DATE ----

WWW.MCKENZIEANDCO.CO.NZ

APPENDIX B – Utility Provider Correspondence.

Tuatahi First Fibre

PO Box 27050
Garnett Avenue 3257
0800 Fibre LTD
tuatahifibre.co.nz

11/04/2025

CONDITIONAL ACCEPTANCE BY TUATAHI FIRST FIBRE LIMITED AS TELECOMMUNICATIONS OPERATOR

Development: Doonholme Development
Location: Morven Ferry Road, Arrow Junction

1. Tuatahi First Fibre Limited (TFF) confirms that a TFF telecommunications connection will be made available for each lot in the development, **providing the developer was to sign a TFF Installation Agreement.** Upon approval of this agreement, TFF will undertake to become the telecommunications operator of the telecommunications reticulation in the proposed development (the "**Subdivision**"), to provide network connections to the lots, in the Subdivision (the "**Reticulation**").

2. The Reticulation will be installed in accordance with:

   (a) the requirements and standards set by the Queenstown Lakes District Council and advised to TFF via the Council's website; and

   (b) the requirements of the Telecommunications Act 2001 and all other applicable laws, regulations and codes (as amended).

3. The Reticulation will be installed by our preferred provider to TFF's satisfaction.

4. TFF will be the owner, operator and maintainer of the Reticulation.

5. One or more retail service providers will be available to supply telecommunications services over the completed Reticulation when service is available, provided that TFF shall not be responsible if the retail service provider's offer to supply such telecommunications services or the number of such providers varies from time to time.

SIGNED for and on behalf of **TUATAHI FIRST FIBRE LIMITED** by:

Signature: *JCampbell*

Name: Jonathan Campbell
Business Development Manager
s 9(2)(a)
s 9(2)(a)

AURORA ENERGY LIMITED
PO Box 5140, Dunedin 9058
PH 0800 22 00 05
WEB www.auroraenergy.co.nz

14/04/2025 REF: 125943

Rob Stewart
McKenzie & Co. Consultants
s 9(2)(a)

Dear Rob,

ELECTRICITY SUPPLY AVAILABILITY FOR A PROPOSED NEW DEVELOPMENT - NEW LARGE COMPLEX
122 MORVEN FERRY ROAD, ARROW JUNCTION 9371 LOT 2 DP 601937 .

Thank you for your inquiry outlining the above proposed development.
Subject to technical, legal and commercial requirements, Aurora Energy can make a Point of Supply[1] (PoS) available for this development.

Disclaimer

This letter confirms that a PoS **can** be made available. This letter **does not** imply that a PoS is available now, or that Aurora Energy will make a PoS available at its cost.

Next Steps

To arrange an electricity connection to the Aurora Energy network, a connection application will be required. General and technical requirements for electricity connections are contained in Aurora Energy's Network Connection Standard. Connection application forms and the Network Connection Standard are available from www.auroraenergy.co.nz.

Yours sincerely

Niel Frear
CUSTOMER INITIATED WORKS MANAGER

[1] Point of Supply is defined in section 2(3) of the Electricity Act 1993.

From: Margaret Singh s 9(2)(a)
Sent: Tuesday, 15 April 2025 4:19 pm
To: Sam Hiha
Cc: James Kitchen
Subject: RE: CONFIDENTIAL: Proposed Doonholme Development

Hi Sam,

Our network planner and scoper for the Queenstown region have come back to me today. Chorus will be able to extend their network to provide connection availability. However, please note that this undertaking would of course be subject to Chorus understanding the final total property connections that we would be providing, roll-out of property releases/dates and what investment may or may not be required from yourselves and Chorus to deliver the infrastructure to and throughout the site in as seamless and practical way as possible.

The cost can only be finalised at the time that you are ready to proceed.

Thanks, and let me know should you require further information.

Kind Regards,

Margaret Singh | Group Account Manager

CHORUS | T | s 9(2)(a)

From: Sam Hiha s 9(2)(a)
Sent: Friday, 11 April 2025 11:36 am
To: Margaret Singh s 9(2)(a)
Cc: James Kitchen s 9(2)(a)
Subject: RE: CONFIDENTIAL: Proposed Doonholme Development

Amazing, thank you Margaret

Sam Hiha
Intermediate Civil Engineer
s 9(2)(a)

MCKENZIE & CO.

DEVELOPING GREAT PLACES AND PEOPLE

Level 6, 41 Shortland Street Auckland 1010
PO Box 259309, Botany 2163
09 320 5707
mckenzieandco.co.nz

APPENDIX C – Infiltration Testing Results

8th May 2025

Cameron Hodgson
Client
Gibbons Developments Ltd
s 9(2)(a) (Via Email)

Attention: Cameron Hodgson

Project Ref: #2555087
Letter Ref: E-LTR-G-002-Rev.B

Morven Ferry Road Wastewater and Stormwater Investigation

Kirk Roberts Consulting were requested to conduct an investigation for Stormwater and Wastewater at Morven Ferry Road, Queenstown. The testing locations were provided to by McKenzie and Co.

- Boreholes were prepared by a 5 tonne excavator with a 200 mm auger.
- All boreholes were pre-soaked for at least 17 hours prior to commencing the testing.
- The Soakage Testing and infiltration rate calculation for Soakage Tests was undertaken in accordance with QLDC COP and Auckland City Council Soakage Design Manual 2003.
- SK1-SK3 were conducted within the upper 2.0 m of soils before the investigations were advanced from 3.3-4.6 m below ground level.

The Site Investigation Plan, Soil Logs and Soakage Test Results are provided in Appendix A- C attached below.

Soak Pit designs and relevant Factors of Safety shall be applied to the results by the Civil Design Engineer.

Please contact Kirk Roberts if you have any queries in relation to the results provided.

Yours faithfully

Ollie Behrent
Geotechnical Team Leader

Attachments

1. Appendix_A_-_Site_Location.pdf
2. Appendix_B_-_Borehole_Logs.pdf
3. Appendix_C_-_SK1-SK5_Falling_Head_Borehole_REV3.pdf

Disclaimer

Third Parties:This letter has been prepared for the sole use of our client, for the particular brief and on the terms and conditions agreed with our client. It may not be used or relied on (in whole or part) by anyone else, or for any other purpose, or in any other contexts, without our prior written agreement. We will not be liable for any loss, damage, cost, or expense incurred by such other persons.

Disciplines are limited to those stated: Although we are a multi-disciplinary organisation, we only provide input on each project from the particular disciplines engaged by our client and expressly stated in this document and our obligations are limited to the inputs expected from those specified disciplines. Please let us know if you would like to engage additional services or disciplines for your project.

TEST PIT RESULTS

KIRK ROBERTS CONSULTING

Client:	Gibbons Developments Ltd	**Job No.:**	2555087
Site Address:	Morven Ferry Road	**Test Pit No.**	TP-1
Town/City:	Queenstown	**Scala Penetrometer:**	
Operator:	MH	**Date:**	05/05/25
Logged By:	MH	**Checked By:**	OB
Logged Date:	05/05/25	**Checked Date:**	07/05/25
		Weather:	Fine
		Datum:	
		Termination:	

Geological Formation	Depth (m)	Elevation	Sample Description	Graphic	USCS	D_r	Water Table	Undrained Shear Strength Su (kPa)	Blows per 100 mm of Penetration
	0.0	0.0	Sandy silty TOPSOIL; dark brown. Moist; with rootlets.	TS TS			Groundwater Not Encountered		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
	0.5	-0.5	Silty SAND, with some gravel, with trace cobbles; brownish grey. Medium dense, moist to wet, non-plastic, sand, fine to medium; gravel, fine to medium, subround to subangular.						
	1.0	-1.0							
	1.5	-1.5							
	2.0	-2.0							
	2.5	-2.5							
	3.0	-3.0	SILT, with trace clay; brownish grey. Medium dense, moist, non-plastic.						
	3.5	-3.5							
	4.0	-4.0	SAND; brownish yellow. Medium dense, moist, sand, medium.						
	4.5	-4.5	Silty SAND, with trace gravel. Medium dense, moist, non-plastic, sand, fine to medium; gravel, fine, subround.						
			EOH: 4.60m						

Remarks:

Scala Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations.

Elevation datum sourced from council GIS LiDAR contours.

TEST PIT RESULTS

KIRK ROBERTS CONSULTING

Client:	Gibbons Developments Ltd	**Job No.:**	2555087
Site Address:	Morven Ferry Road	**Test Pit No.**	TP-2
Town/City:	Queenstown	**Scala Penetrometer:**	
Operator:	MH	**Date:**	05/05/25
Logged By:	MH	**Checked By:**	OB
Logged Date:	05/05/25	**Checked Date:**	07/05/25
		Weather:	Fine
		Datum:	
		Termination:	

Geological Formation	Depth (m)	Elevation	Sample Description	Graphic	USCS	D_r	Water Table	Undrained Shear Strength Su (kPa)	Blows per 100 mm of Penetration
	0.0	0.0	Sandy silty TOPSOIL; dark brown. Moist; with rootlets.	TS			Groundwater Not Encountered		
	0.5	-0.5	Silty SAND, with some gravel, with trace cobbles; brownish grey. Medium dense, moist to wet, non-plastic, sand, fine to medium; gravel, fine to medium, subround to subangular.						
	1.0	-1.0	SILT, with trace clay and sand; brownish grey. Medium dense, moist, non-plastic, sand; fine.						
	1.5	-1.5							
	2.0	-2.0							
	2.5	-2.5	SAND, with minor gravel; greyish. Loose, moist, sand, fine to coarse; gravel, fine, subround.						
	3.0	-3.0	Gravelly SAND; yellowish grey. Medium dense, moist, sand, medium to coarse; gravel, fine, subround to subangular.						
	3.5	-3.5	Unable to auger further due to inferred cobble obstruction. EOH: 3.30m						
	4.0	-4.0							
	4.5	-4.5							

Remarks:

Scala Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations.

Elevation datum sourced from council GIS LiDAR contours.

TEST PIT RESULTS

KIRK ROBERTS CONSULTING

Client:	Gibbons Developments Ltd	**Job No.:**	2555087
Site Address:	Morven Ferry Road	**Test Pit No.**	TP-3
Town/City:	Queenstown	**Scala Penetrometer:**	
Operator:	MH	**Date:**	05/05/25
Logged By:	MH	**Checked By:**	OB	**Weather:**	Fine
Logged Date:	05/05/25	**Checked Date:**	07/05/25	**Datum:**	
				Termination:	

Geological Formation	Depth (m)	Elevation	Sample Description	Graphic	USCS	D_r	Water Table	Undrained Shear Strength Su (kPa)	Blows per 100 mm of Penetration
	0	0	Sandy silty TOPSOIL; dark brown. Moist; with rootlets.	TS TS			Groundwater Not Encountered		
			SILT, with trace clay; brownish grey. Medium dense, moist, non-plastic.						
	2.0	-2.0	SAND; light grey. Medium dense, moist, sand, fine to medium.						
	3.0	-3.0	Gravelly SAND with trace cobbles; yellowish grey. Medium dense, moist, sand, medium to coarse; gravel, fine, subround to subangula; cobbles, subrounded.						
	3.5	-3.5	End of borehole due to borehole collapsing. EOH: 3.50m						

Blows per 100 mm of Penetration: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Remarks:

Scala Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations.

Elevation datum sourced from council GIS LiDAR contours.

HAND AUGER RESULTS

KIRK ROBERTS CONSULTING

Client:	Gibbons Developments Ltd	**Job No.:**	2555087
Site Address:	Morven Ferry Road	**Hand Auger No.**	HA-4
Town/City:	Queenstown	**Scala Penetrometer:**	
Operator:	MH	**Date:**	05/05/25
Logged By:	MH	**Checked By:**	OB	**Weather:**	Fine
Logged Date:	05/05/25	**Checked Date:**	07/05/25	**Datum:**	
				Termination:	

Geological Formation	Depth (m)	Elevation	Sample Description	Graphic	USCS	D_r	Water Table	Undrained Shear Strength Su (kPa)	Blows per 100 mm of Penetration
	0.0	0.0	Sandy silty TOPSOIL; dark brown. Moist; with rootlets.	TS			Groundwater Not Encountered		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
	0.5	-0.5	Gravelly SAND, with minor silt, with trace cobbles; light yellowish brown. Medium dense, dry to moist, non-plastic, sand, fine to medium; gravel, fine to coarse, subround.						
	1.0	-1.0							
	1.5	-1.5							
	2.0	-2.0	EOH: 2.00m						

Remarks:

Scala Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations.

Elevation datum sourced from council GIS LiDAR contours.

HAND AUGER RESULTS

KIRK ROBERTS CONSULTING

Client:	Gibbons Developments Ltd	**Job No.:**	2555087
Site Address:	Morven Ferry Road	**Hand Auger No.**	HA-5
Town/City:	Queenstown	**Scala Penetrometer:**	
Operator:	MH	**Date:**	05/05/25
Logged By:	MH	**Checked By:**	OB	**Weather:**	Fine
Logged Date:	05/05/25	**Checked Date:**	07/05/25	**Datum:**	
				Termination:	

Geological Formation	Depth (m)	Elevation	Sample Description	Graphic	USCS	D_r	Water Table	Undrained Shear Strength Su (kPa)	Blows per 100 mm of Penetration
	0.0		Sandy silty TOPSOIL; dark brown. Moist; with rootlets.	TS			Groundwater Not Encountered		
	0.5	-0.5	Silty SAND, with some gravel; brown. Gravel, fine to medium, subround to subangular.						
	1.0	-1.0							
	1.5	-1.5							
	2.0	-2.0	EOH: 2.00m						

Blows per 100 mm of Penetration: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Remarks:

Scala Penetrometer and Test Bore log tests give an indication of the ground condition at the location of the tests only. While they are representative of typical conditions across the site, they do not identify variations in the ground away from the test locations.

Elevation datum sourced from council GIS LiDAR contours.

KIRK ROBERTS CONSULTING	**JOB TITLE**	Morven Ferry Road		
	ADDRESS	Morven Ferry Road, Queenstown		
	DATE	7/05/2025	**PRODUCED BY**	MH
	JOB No.	2555087	**CHECKED BY**	OB

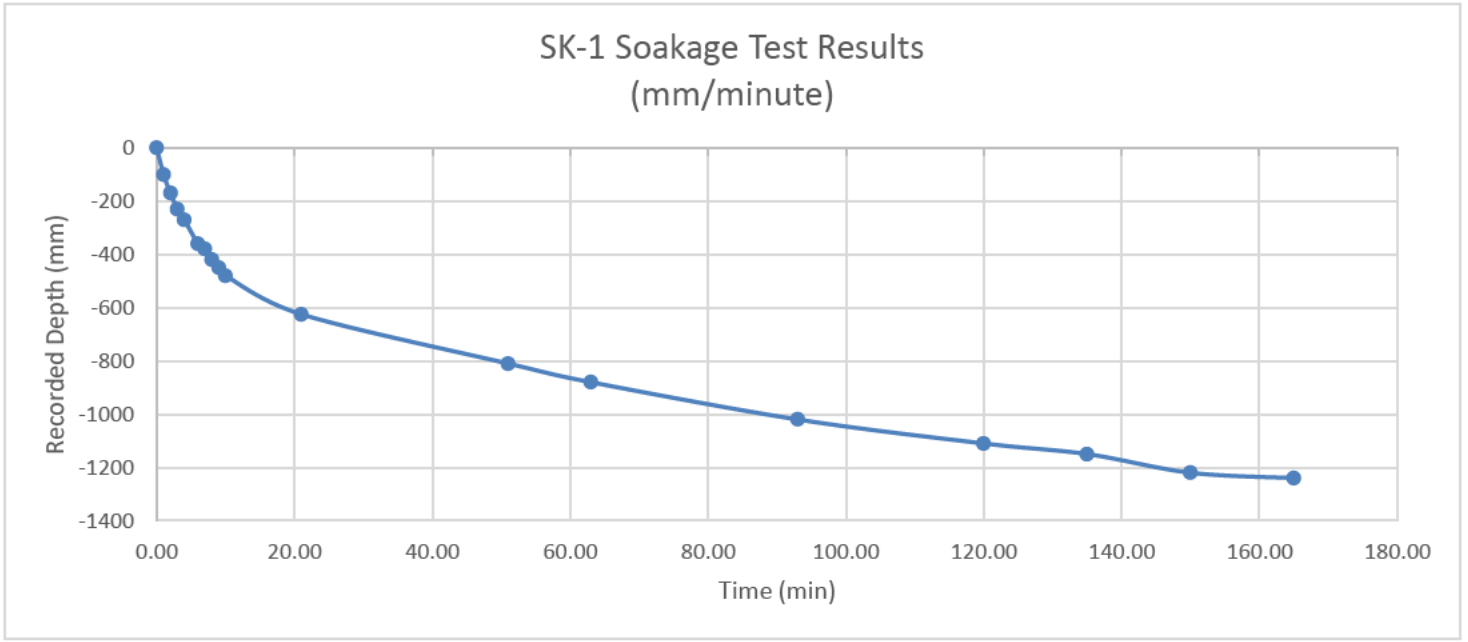
Soakage assessment and calculations undertaken in accordance with QLDC SLUCOP and Auckland City Council Soakage Design Manual 2003.

(a) Percolation rate = $P_t = \frac{D \times gradient \times 1000}{4 \times d^*} =$

SK-1 Borehole Soakage - refer to borehole log for soil profile

Test Hole Diameter	**0.2**	m
Soakage Column Height	**1300**	mm

Time (mins)	Recorded Depth (mm)	Drop (mm)	Drainage Rate (mm/hr)	Test Drainage Surface Area (m^2)	y	x	Percolation Rate L/m2/min
0.00	0	0					
1.00	-100	-100	-6000	0.8482			
2.00	-170	-70	-4200	0.7854			
3.00	-230	-60	-3600	0.7414			
4.00	-270	-40	-2400	0.7037			
6.00	-360	-90	-2700	0.6786			
7.00	-380	-20	-1200	0.6220			
8.00	-420	-40	-2400	0.6095			
9.00	-450	-30	-1800	0.5843			
10.00	-480	-30	-1800	0.5655			
21.00	-625	-145	-791	0.5466			
51.00	-810	-185	-370	0.4555			
63.00	-880	-70	-350	0.3393			
93.00	-1020	-140	-280	0.2953			
120.00	-1110	-90	-200	0.2073			
135.00	-1150	-40	-160	0.1508			
150.00	-1220	-70	-280	0.1257			
165.00	-1240	-20	-80	0.0817	**20.0**	**30.0**	**0.4762**



Soakage Rate	28.6	L/m2/hr
Design Soakage Rate FOS2	**14.29**	L/m2/hr

KIRK ROBERTS CONSULTING	**JOB TITLE**	Morven Ferry Road		
	ADDRESS	Morven Ferry Road, Queenstown		
	DATE	7/05/2025	**PRODUCED BY**	MH
	JOB No.	2555087	**CHECKED BY**	OB

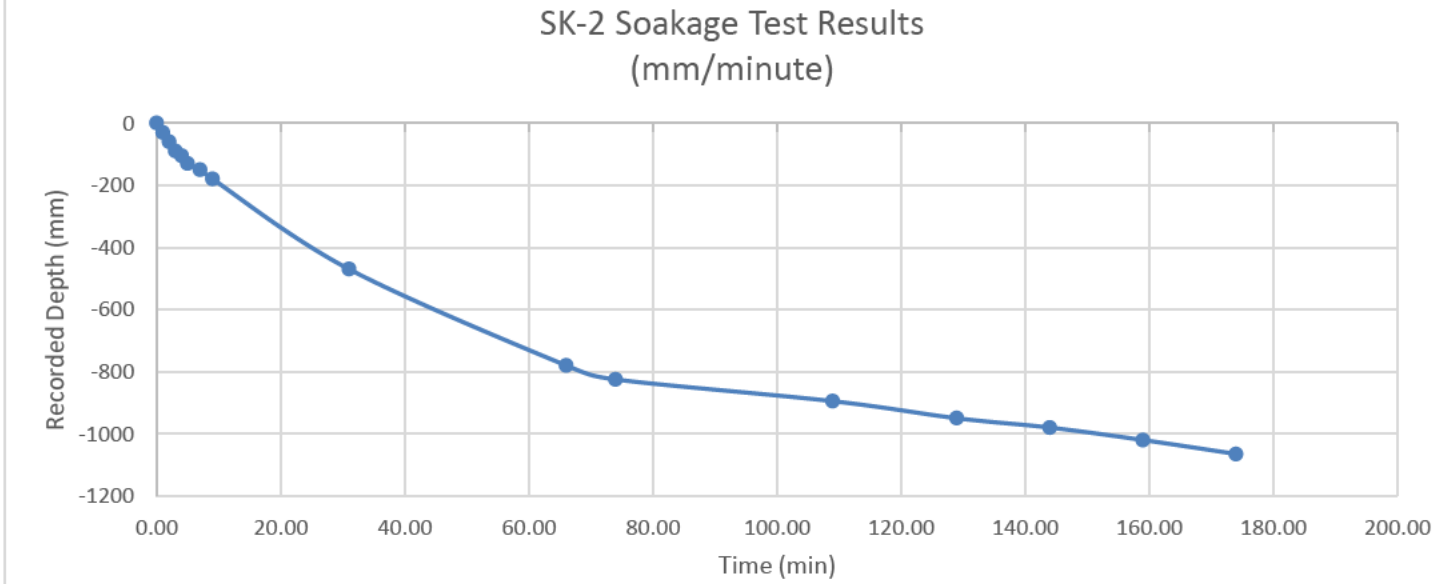
Soakage assessment and calculations undertaken in accordance with QLDC SLUCOP and Auckland City Council Soakage Design Manual 2003.

(a) Percolation rate = $P_t = \frac{D \times gradient \times 1000}{4 \times d^*} =$

SK-1 Borehole Soakage - refer to borehole log for soil profile

Test Hole Diameter	**0.2**	m
Soakage Column Height	**1620**	mm

Time (mins)	Recorded Depth (mm)	Drop (mm)	Drainage Rate (mm/hr)	Test Drainage Surface Area (m^2)	y	x	Percolation Rate L/m2/min
0.00	0	0					
1.00	-30	-30	-1800	1.0493			
2.00	-60	-30	-1800	1.0304			
3.00	-90	-30	-1800	1.0116			
4.00	-105	-15	-900	0.9927			
5.00	-130	-25	-1500	0.9833			
7.00	-150	-20	-600	0.9676			
9.00	-180	-30	-900	0.9550			
31.00	-470	-290	-791	0.9362			
66.00	-780	-310	-531	0.7540			
74.00	-825	-45	-338	0.5592			
109.00	-895	-70	-120	0.5309			
129.00	-950	-55	-165	0.4869			
144.00	-980	-30	-120	0.4524			
159.00	-1020	-40	-160	0.4335			
174.00	-1065	-45	-180	0.4084	**45.0**	**30.0**	**0.1299**



Soakage Rate	7.8	L/m2/hr
Design Soakage Rate FOS2	**3.90**	L/m2/hr

KIRK ROBERTS CONSULTING	**JOB TITLE**	Morven Ferry Road		
	ADDRESS	Morven Ferry Road, Queenstown		
	DATE	7/05/2025	**PRODUCED BY**	MH
	JOB No.	2555087	**CHECKED BY**	OB

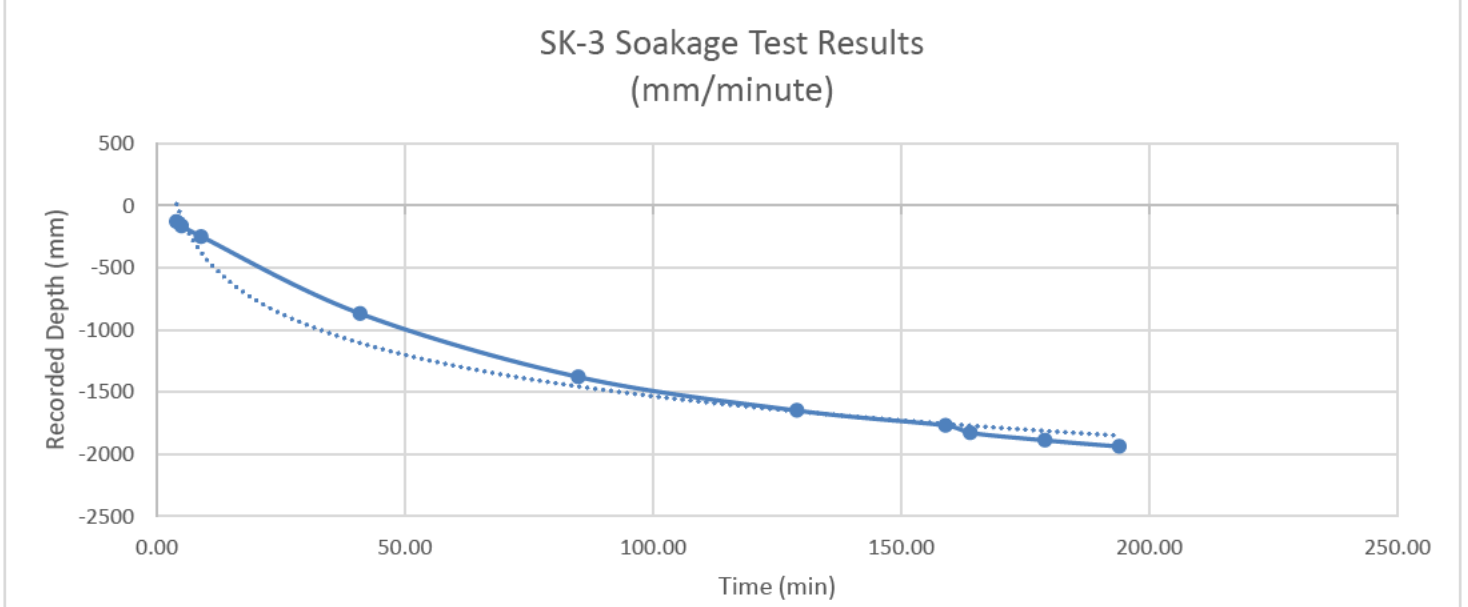
Soakage assessment and calculations undertaken in accordance with QLDC SLUCOP and Auckland City Council Soakage Design Manual 2003.

(a) Percolation rate = $P_t = \frac{D \times gradient \times 1000}{4 \times d^*} =$

SK-1 Borehole Soakage - refer to borehole log for soil profile

Test Hole Diameter	**0.2**	m
Soakage Column Height	**2070**	mm

Time (mins)	Recorded Depth (mm)	Drop (mm)	Drainage Rate (mm/hr)	Test Drainage Surface Area (m^2)	y	x	Percolation Rate L/m2/min
0.00	0						
1.00	-50	-50	-3000	1.3320			
2.00	-85	-35	-2100	1.3006			
3.00	-110	-25	-1500	1.2786			
4.00	-130	-20	-1200	1.2629			
5.00	-165	-35	-2100	1.2504			
9.00	-250	-85	-1275	1.2284			
41.00	-870	-620	-1163	1.1750			
85.00	-1380	-510	-695	0.7854			
129.00	-1650	-270	-368	0.4650			
159.00	-1770	-120	-240	0.2953			
164.00	-1830	-60	-720	0.2199			
179.00	-1890	-60	-240	0.1822			
194.00	-1940	-50	-200	0.1445	**50.0**	**30.0**	**0.5376**



Soakage Rate	32.3	L/m2/hr
Design Soakage Rate FOS2	**16.13**	L/m2/hr

KIRK ROBERTS CONSULTING	**JOB TITLE**	Morven Ferry Road		
	ADDRESS	Morven Ferry Road, Queenstown		
	DATE	7/05/2025	**PRODUCED BY**	MH
	JOB No.	2555087	**CHECKED BY**	OB

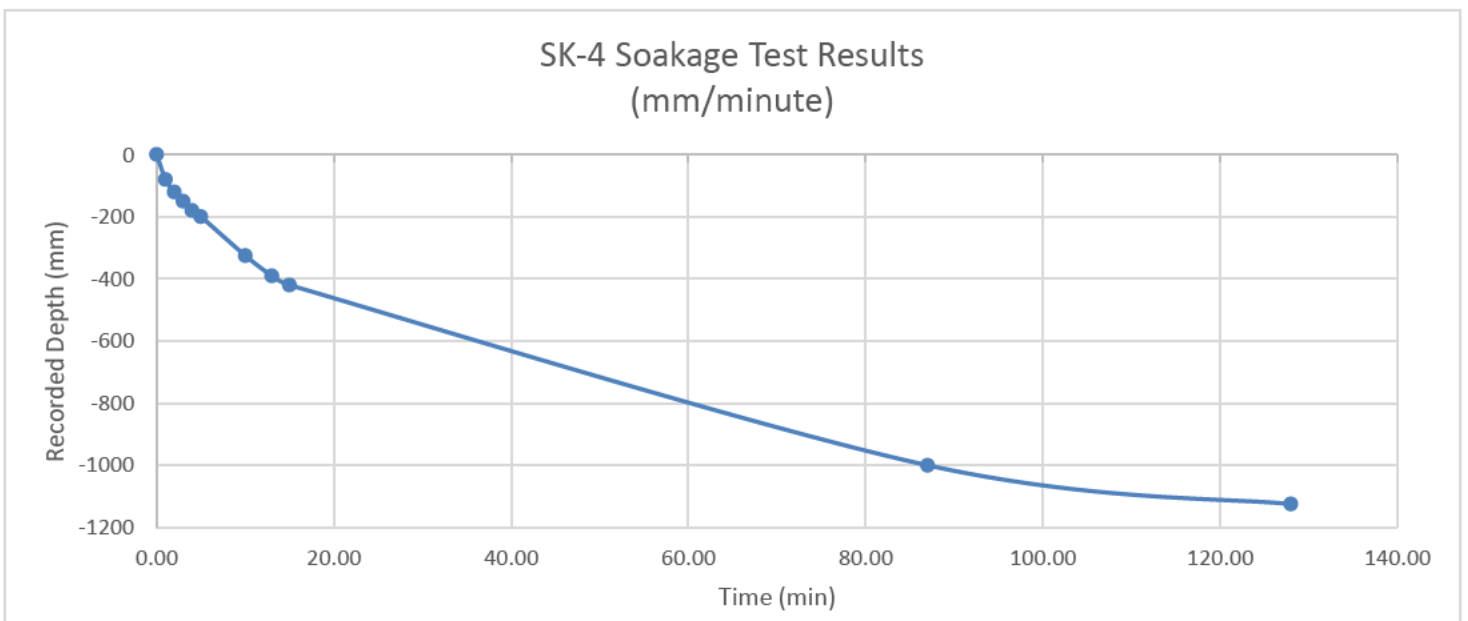
Soakage assessment and calculations undertaken in accordance with QLDC SLUCOP and Auckland City Council Soakage Design Manual 2003.

(a) Percolation rate = $P_t = \frac{D \times gradient \times 1000}{4 \times d^*} =$

SK-1 Borehole Soakage - refer to borehole log for soil profile

Test Hole Diameter	**0.2**	m
Soakage Column Height	**1200**	mm

Time (mins)	Recorded Depth (mm)	Drop (mm)	Drainage Rate (mm/hr)	Test Drainage Surface Area (m^2)	y	x	Percolation Rate L/m2/min
0.00	0	0					
1.00	-80	-80	-4800	0.7854			
2.00	-120	-40	-2400	0.7351			
3.00	-150	-30	-1800	0.7100			
4.00	-180	-30	-1800	0.6912			
5.00	-200	-20	-1200	0.6723			
10.00	-325	-125	-1500	0.6597			
13.00	-390	-65	-1300	0.5812			
15.00	-420	-95	-1140	0.5812			
87.00	-1000	-610	-495	0.5404			
128.00	-1125	-705	-374	0.5215	**705.0**	**113.0**	**0.7297**



Soakage Rate	43.8	L/m2/hr
Design Soakage Rate FOS2	**21.89**	L/m2/hr

KIRK ROBERTS CONSULTING	**JOB TITLE**	Morven Ferry Road		
	ADDRESS	Morven Ferry Road, Queenstown		
	DATE	7/05/2025	**PRODUCED BY**	MH
	JOB No.	2555087	**CHECKED BY**	OB

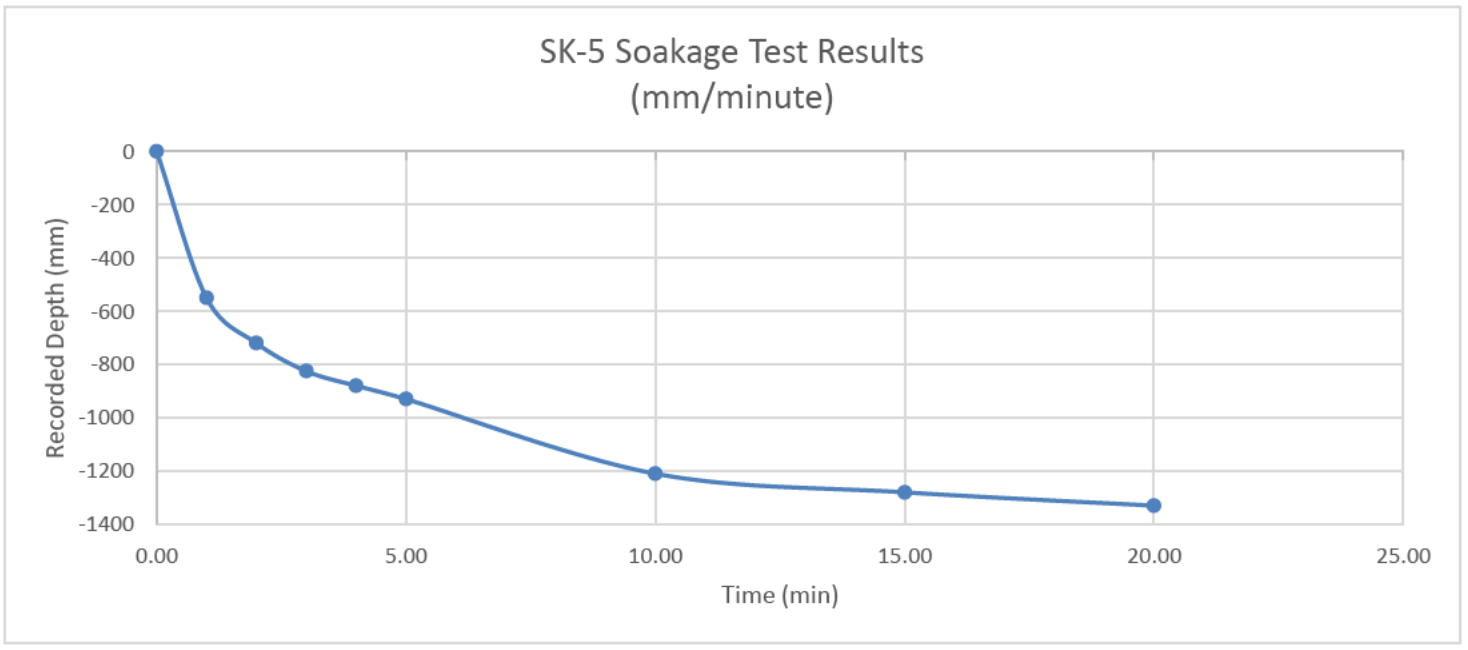
Soakage assessment and calculations undertaken in accordance with QLDC SLUCOP and Auckland City Council Soakage Design Manual 2003.

(a) Percolation rate = $P_t = \frac{D \times gradient \times 1000}{4 \times d^*} =$

SK-1 Borehole Soakage - refer to borehole log for soil profile

Test Hole Diameter	**0.2**	m
Soakage Column Height	**1350**	mm

Time (mins)	Recorded Depth (mm)	Drop (mm)	Drainage Rate (mm/hr)	Test Drainage Surface Area (m^2)	y	x	Percolation Rate L/m2/min
0.00	0	0					
1.00	550	-550	-33000	0.8796			
2.00	720	-170	-10200	1.2252			
3.00	825	-105	-6300	1.3320			
4.00	880	-55	-3300	1.3980			
5.00	930	-50	-3000	1.4326			
11.00	1210	-280	-2800	1.4640			
16.00	1280	-70	-840	1.6399			
21.00	1330	-120	-1440	1.6839	**120.0**	**10.0**	**0.2190**



Soakage Rate	13.1	L/m2/hr
Design Soakage Rate FOS2	**6.57**	L/m2/hr