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Fonterra Longburn Treated Wastewater Discharge to Manawatū River

Resource Consent Application and Assessment of Environmental Effects
17 September 2021

Fonterra Ltd

FOR LODGEMENT

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Client:	Fonterra Ltd		
Report Title:	Resource Consent Application and Assessment of Environmental Effects		
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Report Issue:	FOR LODGEMENT	Date:	17 September 2021

Prepared:	Good Earth Matters Consulting Limited	Date:	17 September 2021
Authorised for Issue:	Annette Sweeney	Date:	17 September 2021
On behalf of:	Good Earth Matters Consulting Limited		

Application for
Resource Consent

Form A: Administration Form

horizons
REGIONAL COUNCIL

The purpose of this Administration Form (Form A) and the relevant Activity Information and Assessment Form (Form B) is to provide the applicant with guidance on information that is required under the Resource Management Act 1991. Please note that these forms are to act as a guide only, and Horizons Regional Council reserves the right to request additional information.

Failure to provide the required information and payment will delay the processing of your application. If you do not provide adequate information then we will not be able to process your application, and will return it to you. If you do not pay the required fees, we may stop processing your application until payment is received.

1 APPLICANT DETAILS

CONTACT DETAILS – This section applies to the applicant ONLY. Please use Section 2 for consultant details. Should any of these details change, at any time, please notify us as soon as possible.

For **individuals**, you must provide the full names of all individuals (such as John Robert Smith and Mary Jane Williams). For **companies and other incorporated entities** you must provide the company name, registration number and registered office details. You must also provide the name of a person or persons who will represent your company and be responsible for the consent.

For **partnerships and unincorporated entities** (such as private or family trusts or unincorporated societies) we must have the details of all authorised partners, trustees, members or officers. We may also request a copy of your society's rules to verify your status as a formal body or society.

Full name/s of applicant: Fonterra Limited
This is the name/s that the consent will be issued to

Director/Chief Executive: CEO Miles Hurrell; Fonterra contact for this application: Cathy Campbell

Company registration number: 920718
We will not accept applications made in the name of unregistered companies

Applicant's postal address: PO Box 7902,
92A Russley Road, Christchurch, 8449 New Zealand

Applicant's residential address: 92A Russley Road,
Christchurch, 8449 New Zealand
If different from postal address above

Applicant's email address: cathy.campbell@fonterra.com

Applicant's phone number/s

Home: ……… Business: + 64 21 242 6586 Mobile: + 64 21 242 6586 Fax: ………

2 APPLICANT CONSULTANT/AGENT DETAILS

(If applicable)

Name/Company name: Good Earth Matters Consulting Ltd

Contact person: Annette Sweeney

Postal address: PO Box 1268
Palmerston North, 4440

Email address: annette.sweeney@goodearthmatters.com

Phone number/s

Home: ……… Business: 06 353 7560 Mobile: 027 223 5280 Fax: ………

3 PARTNERSHIP/UNINCORPORATED ENTITY DETAILS

For partnerships or unincorporated entities (such as private or family trusts or unincorporated bodies or societies) you must provide details of all authorised partners, trustees or members. Any consent granted will then include these names (where possible), and all individuals will be legally responsible for the consent and any associated costs. Should these persons, or their contact details change, then you must notify us. Include details of all further partners/trustees/members on a separate page if necessary.

Name of person ....

Status ....
(Such as partner or trustee)

Residential address ....

Name of person ....

Status ....
(Such as partner or trustee)

Residential address ....

Name of person ....

Status ....
(Such as partner or trustee)

Residential address ....

4 WHO SHOULD WE SEND APPLICATION CORRESPONDENCE TO?

○ Applicant ● Consultant/Agent

Preferred address for service:

○ Residential address ○ Postal Address ○ DX number ● Email ○ Fax

Note: *All further costs will be invoiced directly to the Applicant unless otherwise specified*

5 RESOURCE CONSENT/S SOUGHT

Please select each of the following consents you are applying for. **Please note all prices are GST inclusive.**

○ Drilling of a Well
Fixed initial deposit $575.00

○ Surface Water Take
Fixed initial deposit
Stock Water: $977.50
Irrigation: $1,207.50
Other: $1,150.00

○ Groundwater Take
Fixed initial deposit
Stock Water: fee $885.50
Irrigation: $1,863.00
Other: $1,115.00

○ Dairyshed Discharge
Fixed initial deposit $885.50

○ Land use Intensive Farming and Associated Discharges
Fixed initial deposit $1,725.00

○ Land Disturbance/Vegetation Clearance *(infield consents)*
Fixed initial deposit $200.00

○ Land Disturbance/Vegetation Clearance (e.g. Earthworks)
Fixed initial deposit $920.00

○ Land Disturbance/Vegetation Clearance (e.g. Forestry activities including NES Production Forestry)
Fixed initial deposit $920.00

○ Transfer of Consent
Fixed initial deposit $100.00

○ Works in a Waterbody
Fixed initial deposit $885.50

○ Gravel Extraction
Fixed initial deposit $1,667.50

○ On-site Wastewater discharge
Fixed initial deposit $885.50

○ Discharge to Air
Fixed initial deposit $1,150.00

○ Discharge to Land
Fixed initial deposit $885.50

● Discharge to Water
Fixed initial deposit $1,150.00

○ Change of Consent Conditions
Fixed initial deposit
Administration conditions: $500
All other conditions: $885.50

○ Transfer of activity location
Fixed initial deposit $885.50

5A PROVIDE A BRIEF DESCRIPTION OF THE ACTIVITY TO WHICH THIS APPLICATION RELATES

The discharge of treated wastewater from the Fonterra and Goodman Fielder Longburn manufacturing sites to the Manawatū River. Refer to attached AEE.

5B ARE THERE ANY CURRENT OR EXPIRED CONSENTS RELATING TO THIS PROPOSAL?

If yes, please provide consent number(s) and description.

- [x] YES
- [ ] NO

Consent No. APP-2003010585.02, being the existing water permit authorising discharge of treated wastewater to the Manawatū River which expires 23 March 2022.

5C IF THIS IS A RENEWAL OR REPLACEMENT APPLICATION, DO YOU AGREE TO SURRENDER YOUR CURRENT CONSENT SHOULD THIS APPLICATION BE GRANTED?

- [x] YES
- [ ] NO

5D ARE THERE ANY OTHER CONSENTS REQUIRED FROM HORIZONS REGIONAL COUNCIL?

If yes, please state the type of consent required and status.

- [x] YES
- [ ] NO

For the earthworks / land disturbance associated with the construction of a treated wastewater (permeate) storage facility. This is a controlled activity and will be sought prior to construction of the storage facility (proposed to be constructed within 3 years of commencement of discharge consent).

5E DO YOU REQUIRE ANY OTHER RESOURCE CONSENT FROM ANY LOCAL AUTHORITY FOR THIS ACTIVITY?

If yes, please state the relevant authority, type of consent required and status.

- [ ] YES
- [ ] NO

Land use consent and earthworks consents for construction of storage facility from the Palmerston North City Council. Applications will be lodged separately.

6 VALUE OF INVESTMENT (RENEWAL APPLICATIONS ONLY)

Please complete this section ONLY if your application is to renew an existing consent. Select the value below of your investment which is dependent on this consent. Please note this must be on the book/market value (as opposed to replacement value).

- [ ] < $10,000
- [ ] $10,000 – 50,000
- [ ] $50,000 TO $250,000
- [ ] $250,000 - $1,000,000
- [ ] $1M TO 5 M
- [ ] $5M - $50M
- [x] >$50 M

If the scope of the investment relating to the activity(ies) which is reliant on the granting of this application is significant, you will need provide evidence of this valuation with the application; such as a valuation or other credible indication of current/recent market value.

7 LOCATION OF PROPOSED ACTIVITY

Is the activity in a coastal marine area? ◯ Yes ◉ No
(As defined in the RMA 1991)

Property address ....

Legal description ....
(This can be found on your rates invoice)

Valuation number/s ....

Map reference (NZTM 2000) .... E .... N ....
(If known)

7A IF THE OWNER AND/OR OCCUPIER OF THE ACTIVITY SITE DIFFERS FROM THE APPLICANT, PLEASE PROVIDE THEIR NAMES AND CONTACT DETAILS

Owner Name ....

Postal address ....

....

Email address ....

Phone number/s

Home .... Business .... Mobile .... Fax ....

Please note that written approval is required from this landowner and should accompany this application.

8 FIXED INITIAL DEPOSIT FOR APPLICATION

Please refer to the table in Section 5 for the relevant lodgement fee required with your application.

This fee is **REQUIRED** when an application is submitted and is an initial deposit towards the final cost of processing the application. Failure to pay the fee upon lodging your application may result in rejection of your application.

Please note that this initial deposit payment may not cover the full cost of processing the application. In accordance with Section 36(3) of the RMA, Council reserves the right to recover actual and reasonable costs for consent applications where the costs exceed the initial preliminary deposit. In some instances, where additional information is sought by either party, costs can increase and additional charges may be invoiced. Any additional charges will be payable in accordance with the schedule of additional charges laid out in our Annual Plan. Any additional costs will be invoiced following a decision on your application.

Payment Method for Deposit

- Internet banking to the credit of Horizons Regional Council (see below)
- Cheque made payable to Horizons Regional Council (to be lodged with application documents)
- Cash (to be paid at Horizons Regional Council Office, Victoria Avenue, Palmerston North)

Name of account	Bank	Branch	Account No.	Suffix
Horizons Regional Council	02	0630	0024883	003

Note:
Payer Particulars – Applicant surname or party making payment on behalf of applicant
Payer Code – CONSENTS
Payer Reference – Company name or surname of applicant

Please write below what you have entered for the PayerCode/Payer Reference details when making your deposit online.

	C O N S E N T S	
Payer Particulars	Payer Code	Payer Reference – Name of Applicant

Total amount paid $ .... Payment date ....

Is the Council required to quote a purchase order number on future invoices for this application?

◯ Yes ◯ No Order Number ....

9 FINAL CHECKLIST

Have you attached the following?

- ✔ Activity Information and Assessment form/s as ticked above (Form B)
- ✔ Detailed map showing location and all required points of reference as requested on the activity application form.
- ✔ Fixed initial deposit payment

If you have already dealt with a member of Horizons Regional Council regarding your application, please specify their name.
Jasmine Mitchell; Sara Westcott; Logan Brown

Please contact the consents team on freephone **0508 800 800** if you require assistance with your application.

10 APPLICANT DECLARATION

I Annette Sweeney confirm the information contained within this application and additional information is true and correct at the time of submission.

Signature of applicant [signature] Date 17/09/2021
(Or person authorised to sign on behalf of the applicant)

Please email your application to **regulatory.administrator@horizons.govt.nz** or alternatively you can post your application to:

Horizons Regional Council
11-15 Victoria Avenue
Private Bag 11025
Manawatu Mail Centre
Palmerston North 4442

IMPORTANT INFORMATION – PLEASE READ CAREFULLY

Official Information

Horizons Regional Council takes your privacy seriously. Any information you provide with this application, including documentation provided in support of your application, is official information. It will be used to process your resource consent application and, together with other official information, assist in the management of the region's natural and physical resources.

This information will be held and administered by Horizons Regional Council in accordance with the Local Government Official Information and Meetings Act 1987 and the Privacy Act 1993.

Your information may be disclosed in accordance with the terms of these Acts. It is therefore important you advise the Council if your application includes trade secrets and/or commercially sensitive material. You have the following rights with regard to the information held about you:

- To access your personal information.
- To request incorrect information to be amended.
- To expect the information to be safely stored and used by or disclosed to authorised users only.
- To expect your personal information to be accurate and consistent in accordance with sound practices of record keeping and information systems management.

Failure to provide the necessary information will mean that Horizons Regional Council will be unable to process your application.

Consent Holder Costs – All Consents

Once granted, most resource consents will incur an annual research and monitoring charge and a compliance monitoring charge pursuant to Section 36 of the Resource Management Act. Please contact us if you have any queries regarding your deposit/fee, processing costs or the annual charges for your activity.

Ongoing Responsibilities

If your application is granted you will be responsible for complying with your consent conditions and payment of your consent charges until your consent expires. If you wish to cancel (surrender) your consent, transfer responsibility to another party, or make changes to your consented activity before it expires, you must submit notice to us in writing or make an application to change your consent.

Application for
Resource Consent: Discharge to Water (General)

Form B: Activity Information and Assessment Form

horizons
REGIONAL COUNCIL

A complete Administration Form (Form A) MUST accompany this Activity Information and Assessment Form (Form B) when lodging your application. The purpose of this form is to provide the applicant with guidance on information that is required under the Resource Management Act 1991. These forms are to act as a guide only, and Horizons Regional Council reserves the right to request additional information.

APPLICANT NAME Fonterra Limited
(Refer to Form A)

1 APPLICATION PURPOSE

What is the purpose of this application *(select one)*

- ○ New consent
- ● Renewal of consent

Consent number APP-2003010585.02 Expiry date 23 March 2022

Consent term sought 25 years
(Max. 35 years)

Resource consents are typically aligned with the relevant common catchment expiry dates in Policy 12-5 of the One Plan.

2 LOCATION

Location of the proposed discharge Manawatū River

Address Near the end of an unnamed road that intersects with Walkers Road.

Map coordinates (NZTM 2000) E 1817026 N 5524740

Legal description LOT 1 DP 482384
A detailed site map will be required with this application.

What is the name of the water body that the discharge is into?
If the water body is unnamed then please note this and state which water body it is a tributary to.

Manawatū River

According to Schedule A of the One Plan, what Surface Water Management Zone is this in?

Lower Manawatū (Mana_11a)

You can access this information via http://www.horizons.govt.nz/publications-feedback/one-plan/part-3-annexes/schedules

Describe the present state of the waterbody at the proposed location of the discharge. Please provide any reports or results of any testing you have undertaken.

Parameters to include in your description are; flow information, water colour/clarity, width of channel, average depth, land use surrounding the waterbody, bed material (e.g. rocky, silty, etc), bank material, streamside vegetation, erosion, fish life, invertebrate life, aquatic plants.

Please refer to attached AEE.

What is the quality of the receiving waterbody before the discharge?

Provide sample results and interpretation of these results (e.g. against guideline values).

Please refer to attached AEE.

3 DESCRIPTION OF PROPOSED ACTIVITY

What are the contaminant/s of concern to be discharged?

A contaminant is considered any substance which is likely to change the water into which it is discharged in any way. Water can also be a contaminant.

Please refer to attached AEE.

What is the source of the contaminant and/or process that results in the discharge?

(e.g. municipal wastewater, industrial processes, water treatment, rural activity, contaminated stormwater, other).

Please refer to attached AEE.

Is the discharge treated in any way before being discharged? ◉ Yes ○ No

Name the treatment system and describe the treatment process

(include the design specifications such as capacity of the system).

Please refer to attached AEE.

If sludge/solid waste is generated as part of the treatment process, please state what happens to this sludge.

Additional consent will be required for the discharge of sludge to land.

Solid waste generated as part of the treatment process is discharged to land on third party farms as authorised under resource consent ATH-2019202710.00.

Describe the contaminant/s and expected quality of the discharge after treatment but before it enters its receiving environment. *Please provide the results from any water quality testing of the discharge. If you do not have this information, you will need to test your discharge. Indicate which contaminants have been identified in the discharge by ticking the boxes. Explain how the samples were taken (e.g. spot sample or composite sample) and attach the sampling results (laboratory analytical certificates) to this application.*

- ☐ Temperature °C
- ☐ Suspended solids g/m^3
- ☐ Faecal coliforms cfu/100 mL
- ☐ Toxic substances (e.g. PAHs, phenols) g/m^3
- ☐ Ammonia g/m^3
- ☐ pH
- ☐ BOD_5 g/m^3\
- ☐ Heavy metals g/m^3
- ☐ Dissolved and total nutrients g/m^3
- ☐ Oil/grease g/m^3

Refer to attached AEE for details

Date/s sample taken.. Name of sampler..

Location/s sample taken...

Date/s of analysis: .... Analysis conducted by ....

Indicate the sampling area(s) on the site map in Section 7.

Where appropriate describe the following

Physical characteristics of the discharge *(such as temperature, suspended solids, turbiduty).*

Please refer to attached AEE.

Inorganic chemical characteristics of the discharge *(such as pH, free ammonia, organic nitrogen, total kjeldahl nitrogen, nitrites, nitrates, inorganic phosphorus, sulphate, metals).*

Please refer to attached AEE.

Organic chemical characteristics of the discharge *(such as BOD5, VOC's).*

Please refer to attached AEE.

Biological characteristics of the discharge *(such as faecal coliforms, specific micro-organisms, toxicity)*.

Please refer to attached AEE.

Provide details of the expected quality of the receiving waters (AFTER the point of discharge, at a point after reasonable mixing). Provide sample results for existing discharges or provide anticipated results.

Please refer to attached AEE.

Indicate which contaminants have been identified in the receiving waters by ticking the boxes.
Attach the sampling results (laboratory analytical certificates) to this application.

- ☐ Temperature °C
- ☐ Suspended solids g/m^3
- ☐ Faecal coliforms cfu/100 mL
- ☐ Toxic substances
- ☐ Ammonia and dissolved reactive phosphorus
- ☐ pH
- ☐ BOD_5 g/m^3\
- ☐ Heavy metals
- ☐ Nitrates
- ☐ Dissolved Oxygen g/m^3

Refer to attached AEE

Date/s sample taken.. Name of sampler..

Location/s sample taken..

Date/s of analysis: .... Analysis conducted by ....

Please indicate the sampling locations (e.g. upstream, downstream, point of discharge) on your attached site plan.

Describe the method of the discharge.

Describe what measures will be put in place to prevent erosion or scour at the point of discharge.

Please refer to attached AEE.

Describe the discharge outlet structure *(e.g. 300mm pipe, multi port diffuser, gravel trench etc).*

Please refer to attached AEE.

Is the discharge continuous or intermittent? ○ Continuous ● Intermittent

What will be the maximum discharging period?

.... hours per day

.... days per week

.... weeks per year

Refer to attached AEE

Describe the expected volume and frequency of the discharge.

Maximum flow rate .... litres per second

Maximum daily discharge .... cubic metres per day

Average dry weather flow ....

Peak wet weather flow ....

Max. volume per annum.....................................

Refer to attached AEE

Please confirm that there are no other resource consents required for any other associated activities
(e.g. consent for the outlet strucutre, diverison and/or discharge to land).

Refer to attached AEE

4 RULE ASSESSMENT

A number of the activities under Chapter 14 of the One Plan are permitted activities as long as you can meet certain conditions and standards. Please ensure your activity is not a permitted activity under Chapter 14 of the One Plan. If you require assistance, please contact the consents team at Horizons on freephone 0508 800 800.

Please indicate which rule of the One Plan your activity falls under Rule 14-30

Chapter 14 can be accessed via *http://www.horizons.govt.nz/publications-feedback/one-plan.*

5 ASSESSMENT OF ENVIRONMENTAL EFFECTS

For your application to be considered, an assessment of environmental effects must be included. Please answer all of the questions below. Additional information may need to be provided depending on the scale and significance of your proposal.

Considering the Surface Water Management Zone your proposed activity is in, are there any Schedule B values identified for this reach of the river? ● Yes ○ No

You can access this information via *http://www.horizons.govt.nz/publications-feedback/one-plan/part-3-annexes/schedules*

If 'Yes', please identify these values and describe how you intend to avoid, remedy or mitigate adverse effects of the proposed discharge on each of these values?

Please refer to attached AEE.

If there are any other discharges within the same catchment, what is the combined effect of these discharges (including the proposed discharge) on the receiving environment?

Please refer to attached AEE.

Describe any noticeable change in the colour/clarity of the receiving waters that may result from the discharge.

Please refer to attached AEE.

What environmental effects were considered when choosing the proposed method of disposal and location *(e.g. water table, dilution rates/mixing potential, proximity to waterbody)*?

Please refer to attached AEE.

What are the cultural effects of the proposed discharge? Are there any statutory acknowledgements associated with the water body?

Please refer to attached AEE.

6 GOOD MANAGEMENT PRACTICES AND MITIGATION MEASURES

Please include a description of the monitoring or good management practices to be undertaken to help avoid, reduce, remedy or mitigate the actual and potential effects on the environment.

What monitoring and management do you proposed to ensure any potential adverse effects on the environment are avoided, remedied or mitigated? *(E.g. discharge monitoring, receiving water monitoring, ecological surveys, toxicity tests)*. **Include details on what is to be monitored, when, how and why.**

Please refer to attached AEE.

What contingency measures are proposed to deal with any system malfunction or failures so as to prevent unauthorised, uncontrolled, or only partially treated discharge to the environment?

Please refer to attached AEE.

Describe how the equipment controlling the discharge to prevent equipment failure will be maintained and operated
(E.g. measures to exclude stormwater from the system, desludging, equipment maintenance).

Please refer to attached AEE.

What will be done to minimise and remediate any effects in the event of equipment failure?

Please refer to attached AEE.

7 CONSIDERATION OF ALTERNATIVES

Please include a description of any possible alternative locations or methods for undertaking the activity and why these alternatives have not been selected.

Please refer to attached AEE.

8 CONSULTATION/AFFECTED PARTIES

Please include evidence of any consultation undertaken for this application. This may include (but not be limited to) consultation with adjoining landowners, other consent holders in the immediate area, Iwi, government departments/ministries (e.g. DOC), territorial authorities and recreational associations (e.g. Fish and Game New Zealand). Please ensure that you have considered any statutory acknowledgements in the Horizons Region. For more information visit (http://www.horizons.govt.nz/about-our-region-and-council/iwi-and-hapu/statutory-acknowledgements).
If you are in doubt about who you should be talking to the call a member of the consents team on freephone **0508 800 800**.

Please provide details of those you have identified as parties who may be affected. If you have discussed your proposal with any of these parties, please record any comments made by them and your response to them, and submit this with your application.

Name: Please refer to attached AEE.

Address ....

....

☐ Affected party approval form attached

Name ....

Address ....

....

☐ Affected party approval form attached

Name ....

Address ....

....

☐ Affected party approval form attached

Name ....

Address ....

....

☐ Affected party approval form attached

9 NATIONAL ENVIRONMENTAL STANDARDS

NATIONAL ENVIRONMENTAL STANDARDS FOR SOURCES OF HUMAN DRINKING WATER (NES-DW)

Are there any public water supplies that could be affected by your proposal? ○ Yes ● No

An assessment under the NES-DW will need to identify any sources of human drinking water that supply more than 25 people that might be affected by the discharge. Horizons Regional Council holds a list of such water supplies within its region and will be able to provide assistance when identifying water supplies within the vicinity of the activity.

Discussion with the water supply operator may also be beneficial in determining whether the supply could be affected and what measures can be taken to ensure the quality of the water supply is maintained.

Please refer to attached AEE.

Please state any other NES that you consider may be relevant to your activity and provide an assessment against that NES.

Please refer to attached AEE.

10 **RELEVANT STATUTORY PROVISIONS**

The Resource Management Act 1991 requires this application to include an assessment of the proposed activity against the One Plan. Answering the following questions will satisfy this requirement. If you are unable to answer the questions below, or you believe your proposal is inconsistent with the relevant policies and documents discussed, it is recommended you seek professional planning assistance to help you with your application. For a complete copy of the One Plan visit *http://www.horizons.govt.nz/publications-feedback/one-plan.*

REGIONAL POLICY ASSESSMENT

The objectives and policies of Chapter 2 (Resource Management Issues of Significance to Hapu and Iwi) and Chapter 5 (Water) are relevant to this application.

Is the activity consistent with the relevant provisions of the Regional Policy Statement? ● Yes ○ No

Please provide reasons for your answer above

Please refer to attached AEE.

Please list any other relevant objective and /or policies of the Regional Policy Statement and provide an assessment of the activity against those objectives and/or policies.

Please refer to attached AEE.

REGIONAL PLAN ASSESSMENT

Objective 14-1 and Policy 14-1, 14-3, 14-4, 14-8 and/or 14-9 of Chapter 14 of the Regional Plan may be relevant to this application.

Is the activity consistent with the relevant provisions of the Regional Plan? ● Yes ○ No

Please provide reasons for your answer above

Please refer to attached AEE.

If there are other sections of the One Plan or any national planning document (e.g. NZ Coastal Policy Statement) that you consider are relevant, please provide an assessment of the activity against those relevant objectives/policies of the One Plan and/or national document.

Please refer to attached AEE.

11 ADDITIONAL INFORMATION REQUIRED WITH THIS FORM

- [x] Administration Form (Form A)
- [x] A SITE plan to scale showing:
  - Site boundary
  - Location of the discharge point/s
  - Sampling locations
  - Location of roads and property boundaries
  - Location of any waterbodies in the vicinity of the discharge area
  - Location of any bores/wells in the vicinity of the discharge area
  - Locality of the discharge and system design
  - Buildings and residential properties
  - Location of any sensitive sites (e.g. historical places, sites of importance to iwi) in the proximity of the site
  - Any rare, threatened or at-risk habitats
- [x] Sampling results detailed Section 3 (if relevant)
- [x] Management Plans (if applicable)
- [ ] Affected party approval form/s

Please contact the consents team on freephone **0508 800 800** if you require assistance with your application.

GLOSSARY

DAF	Dissolved Air Floatation, being one of the wastewater treatment processes used to treat the wastewater from the Longburn site.
DRP	Dissolved Reactive Phosphorus
FEP	Flow Exceedance Percentile. For example, the 20^{th} FEP is the flow in the river which is statistically exceeded 20% of the time.
HSE	High Strength Effluent as defined in the current consent for the Longburn Site. Under the current consent, all wastewater is classified as HSE irrespective of the degree of treatment or strength, excluding permeate from the Whole Milk Reverse Osmosis plant which is classified as LSE.
Longburn Site	The Fonterra and Goodman Fielder Longburn processing sites, being the properties legally described as: Lots 1-4 DP 85957; Pt Lot 7 DP 2848; Lot 2 DP 426930; and Lots 1 and 3 DP 426930.
LSE	Low Strength Effluent as defined in the current consent. This is the WMRO permeate.
Permeate	This is the portion of wastewater that passes through the reverse osmosis membrane and has a significant reduction in contaminants compared to the incoming wastewater.
Retentate	In relation to the WWRO, this is the high strength waste stream which is produced by a RO plant and contains the contaminants which are "retained" as the produce is passed through the reverse osmosis membranes. For the Longburn site, the WWRO retentate is discharged direct to land. In relation to the WMRO, the retentate is the concentrated raw milk produce which is transported off-site.
RO	Reverse Osmosis, being one of the wastewater treatment processes used to treat the wastewater and whole milk at the Longburn site.
sCBOD5	Five Day Soluble Carbonaceous Biological Oxygen Demand
SIN	Soluble Inorganic Nitrogen
WMRO	Whole Milk Reverse Osmosis, being the Reverse Osmosis plant on the site that is used to concentrate raw milk prior to transport off-site.
WWRO	Wastewater Reverse Osmosis, being the Reverse Osmosis plant on the site that treats the wastewater stream.

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Fonterra Longburn Treated Wastewater Discharge to Manawatū River

Assessment of Environmental Effects
17 September 2021

Fonterra Ltd

FOR LODGEMENT

TABLE OF CONTENTS

Appendices

1 INTRODUCTION

The Fonterra Longburn manufacturing site is a key strategic site for Fonterra enabling the collection of milk from throughout the Manawatū-Whanganui region, and its subsequent processing and transfer to other manufacturing sites within the network. The Longburn site is strategically located between state highway and railway transport links, enabling it to play a critical role in ensuring that Fonterra is able to meet its statutory obligations to process all supplied raw milk.

Adjacent to the Fonterra Longburn site is Goodman Fielder's Longburn manufacturing site which also accepts raw milk and produces the Meadow Fresh range of milks and yoghurts, as well as specialist yoghurt and other products.

The combined Longburn site, being the Fonterra and Goodman Fielder dairy manufacturing sites, provides employment to approximately 300 persons and contributes in the order of $25 million per annum to the local economy.

The process-wastewater management system which is the subject of this application services both the Fonterra and Goodman Fielder sites. While the wastewater treatment system is managed by Fonterra, there is a contractual arrangement in place which requires Fonterra to accept the Goodman Fielder wastewater and, in turn, requires Goodman Fielder to manage their wastewater within specified limits, and share in the capital and operating cost of the system, including obligations required to meet resource consent conditions. Therefore, while this application has been lodged by Fonterra, and Fonterra will be the consent holder, the application has been prepared in partnership with Goodman Fielder.

In summary, the wastewater management system consists of:

- Active manufacturing and site water reduction initiatives, stormwater management and waste management systems to reduce the waste product entering the wastewater system;
- Treatment of process wastewater via Dissolved Air Floatation (DAF) and Reverse Osmosis (RO);
- **A combined discharge management regime** consisting of
  a. **Irrigation of treated wastewater to two Fonterra owned farms** which are managed specifically for wastewater management purposes. This activity is authorised under resource consent ATH-2011013049.01 which expires in July 2033. The discharge of treated wastewater to land under this consent is not part of this application, except that the ability to discharge to land has been assessed in full to ensure that the proposed wastewater system utilising this consent is the Best Practicable Option and can be undertaken in a manner which is fully compliant with the land discharge consent.
  b. **Discharge of treated wastewater to the Manawatū River** subject to minimum flows in the Manawatū River, and soil moisture conditions being such that discharge to land is not appropriate. This discharge is authorised by resource consent APP-2003010585.02 which expires 23 March 2022. **The renewal of the discharge to river consent is the subject of this application.**
  c. **Discharge of solids from the wastewater treatment process to third party farms throughout the area for beneficial reuse** as a soil conditioner and slow-release fertiliser. The discharge of solids is authorised under resource consent ATH-2019202710.00 which expires July 2033.

For the avoidance of doubt, the wastewater system does not receive, treat or discharge any human effluent. The wastewater from staff facilities on both the Goodman Fielder and Fonterra sites is collected via a separate system which is connected to the Palmerston North City Council's wastewater network. **This application does not involve any discharge of human wastewater.**

A separate stormwater system for the Goodman Fielder and Fonterra sites keeps stormwater separate from the process wastewater. Stormwater is discharged to Reserve Road Drain and Francis Drain which then eventually flows to the Oroua River. Stormwater discharges are separately consented via resource consent 102500/1 which expires in March 2024.

Fonterra is seeking a resource consent to enable discharge of treated process wastewater to the Manawatū River in circumstances when it is unable to discharge sufficient quantities to land on either of its two dedicated wastewater management farms. In preparing this resource consent application, Fonterra has recognised that there are strong community and stakeholder expectations to avoid, as much as possible, any discharges to water, as well as strong direction via national and regional objectives and policies under the RMA to improve freshwater quality. These drivers have been instrumental in the consideration of options and the selection of the preferred option for which consent is now sought.

Since resource consent was granted in 2007, Fonterra has been implementing a programme of continuous improvement of its wastewater management system. The improvements implemented over the term of consent are summarised in Figure 1.1 and discussed in more detail in Section 2.4.4.

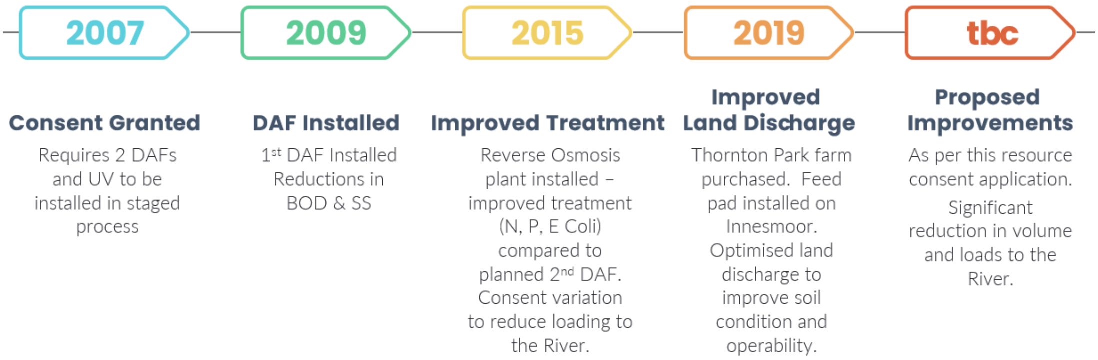

Figure 1.1: Summary of Wastewater Improvements

The proposed discharge regime represents a continuation of the ongoing improvement programme which Fonterra has been implementing at the site since the previous consent was granted. In summary, the proposal for which consent is sought has been determined through a comprehensive options analysis and includes:

- **Construction of a large storage facility** to be located on one of Fonterra's wastewater management farms. The purpose of this facility is to be able to minimise the contaminant load and volume of wastewater discharged to the Manawatū River. The storage facility will provide storage so that more wastewater can be discharged to land and ensure that discharges to the River are only undertaken in circumstances that will minimise potential effects on the River.
- **A more restrictive regime for discharging to River** than the existing consent, as summarised in Figure 1.2 and Table 1.1.

The proposed discharge regime has been adopted as:

- It enables wastewater (including the low strength WMRO which currently can be discharged on a year-round basis without any river flow cut-off to be satisfied) to be removed from the River during the summer period as well as during winter when the River is below 56 m^3/s.
- It enables Fonterra to reduce the effect of the discharge on annual average in-river Soluble Inorganic Nitrogen (SIN) concentrations by 46%.
- It enables Fonterra to reduce the effect of the discharge on annual average in-river Dissolved Reactive Phosphorus (DRP) concentrations by 39%.

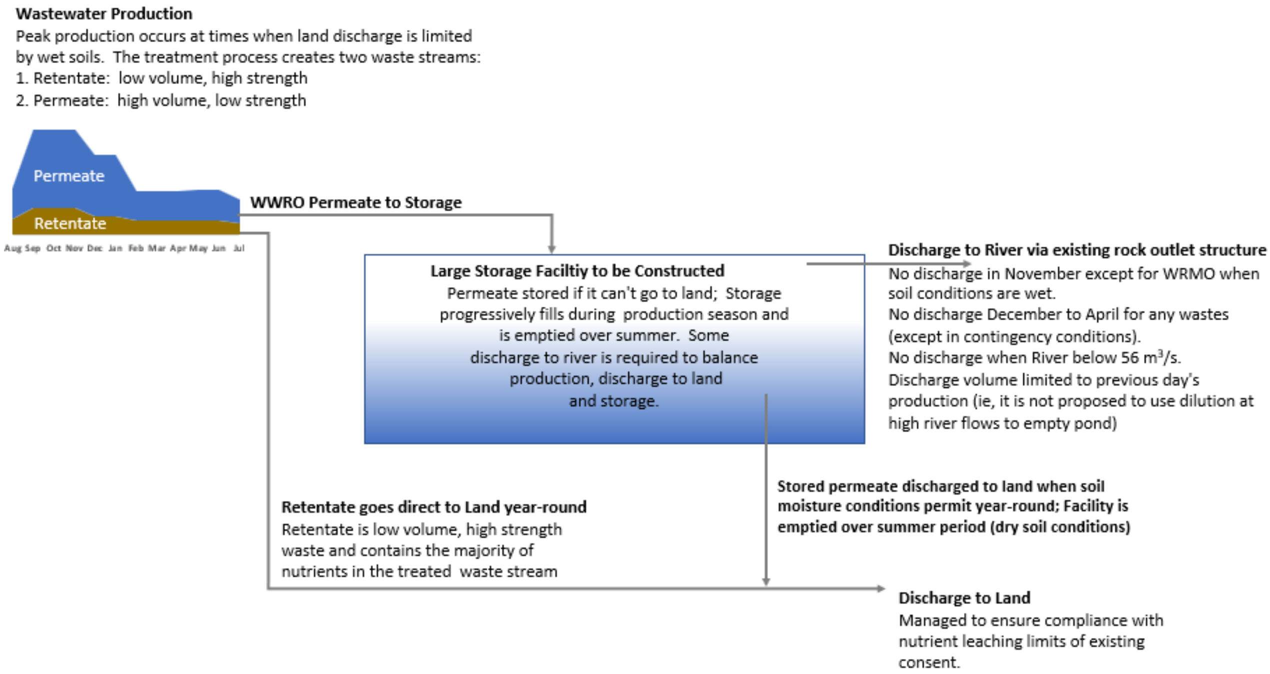

Figure 1.2: Conceptual Diagram of Proposed Discharge Regime

Table 1.1: Comparison of Existing and Proposed Discharge to River Regime

Parameter / Aspect of Discharge Regime	Existing Consent	Proposed Discharge (as per this application)
Maximum Discharge	6,000 m^3/day	3,000 m^3/day
River Cut-off (minimum flow before discharge can occur)	37 m^3/s for High Strength Effluent No restriction for low strength effluent	56 m^3/s
November Discharge	Low Strength Effluent (Whole Milk RO Permeate) may be discharged irrespective of river flow and up to 2,500 m^3/day	Whole Milk RO Permeate may be discharged if soil moisture conditions are such that it cannot be discharged to land. Up to 1,000 m^3/day may be discharged.
December to April	2,500 m^3/day of Low Strength Effluent (Whole Milk RO Permeate) may be discharged irrespective of river flow.	No discharge to River.
Contingency Discharge	Consent enables discharge to river to increase with flows, so that large amounts can be discharged during high flows. No provision for contingency HSE discharge during flood flows in summer.	Up to 4,000 m^3/day may be discharged when the River is in flood (above the 20th Flow Exceedance Percentile) and if the wastewater cannot be irrigated.
Wastewater Quality	No specific quality standard set for wastewater. Contaminant loads are able to be increased as river flow increases.	Maximum annual load limits to be specified for key parameters (refer section 6.1). It is not proposed to increase contaminant load to the River as the river flow increases.

As noted in the BPO reports attached as Appendices C1 to C3 the other options that have been carefully considered by Fonterra include further storage, additional treatment and additional land area, as well as options for connecting to the municipal (PNCC) wastewater system. These options, however, are not feasible or are not preferred for reasons set out in this AEE and supporting documentation in the Appendices. The option as summarised above has been identified as the Best Practicable Option.

Resource consent is therefore sought to authorise discharge of treated process wastewater from the Longburn Site (servicing Fonterra and Goodman Fielder manufacturing sites at Longburn). A consent term of 25 years is sought for reasons as set out in Section 8.6.1 of this report.

This document has been prepared to support an application for resource consent from the Manawatū-Whanganui Regional Council for the activity described above. It has been prepared in accordance with Section 88 and the Fourth Schedule of the Resource Management Act. The structure of this report is as follows:

1. Introduction & Overview of the Proposed Discharge
2. Describes the Proposal in Detail including the site, manufacturing activities, wastewater treatment and discharge qualities, options considered and the details of the preferred option
3. Describes the Receiving Environment for the discharge, being the Manawatū River.
4. Details the regulatory framework for the proposal and identifies the resource consents required.
5. Presents an Assessment of Environmental Effects of the proposed discharge.
6. Summarises proposed mitigation measures and consent conditions.
7. Summarises consultation undertaken.
8. Assesses the proposal against the relevant objectives and policies of national, regional and district planning instruments.
9. Provides an assessment of the activity against Part 2 of the RMA

2 DESCRIPTION OF PROPOSED ACTIVITY

This part of the report details the proposed activity, including details of the existing wastewater management system and improvements which have been made during the term of the existing consent. The wastewater stream which is to be managed under the consent is detailed, and an overview of the best practicable option process and alternatives considered is provided. For a more detailed documentation of the Best Practicable Option process, refer to the BPO reports in Appendices C1 to C3.

This section of the report concludes with setting out the principles adopted for selecting the preferred option and provides details of the proposed wastewater management and discharge regime.

2.1 Site Location & Legal Descriptions

The Fonterra Longburn site is located at 1 Reserve Road, Longburn, approximately 2.5 km south-west of Palmerston North. The site is located within the Palmerston North City Council's boundary. The site location including the manufacturing sites serviced by the system and the location of the wastewater treatment and discharge sites is shown in Figure 2.1.

Figure 2.1: Site Location

Legal Description of Sites Serviced by Wastewater System

The sites which are serviced by the wastewater system are:

- Fonterra Longburn's manufacturing site, 2 Reserve Road, on property legally described as Lot 1 and 2 DP 85957, Record of Title WN53C/912, Valuation Reference 14050 001 00 (approximate area 6.9 ha). The existing wastewater treatment plant is located on this property.
- Fonterra Longburn's site at 1 Reserve Road, on property legally described as Lot 2 DP 426930, Record of Title 505988, Valuation Reference 14050 003 00 (approximate area 4.6 ha).
- Fonterra's Braeburn property being Lots 3 and 4 DP 85957 and Pt Lot 7 DP 2848, Record of Title WN53C/913, WN53C/914, and WN27C/590 respectively; Valuation Reference 14461 122 00 (approximate area 53ha). This property is currently not used for manufacturing. While there are currently no plans to expand operations into this property during the term of consent, any minor development into this property could be connected to the wastewater treatment facility and therefore this property has been included here. The application does not provide for any significant growth as wastewater volumes have been based on the existing manufacturing processes and therefore inclusion of this property in the site description does not provide for any growth which would result in a material change to the wastewater volumes or composition.
- The Goodman Fielder manufacturing site, located at 15 Reserve Road on property legally described as Lots 1 and 3 DP 426930, Record of Title 505987, Valuation Reference 14050 002 00 (approximate area 2.5 ha).

Wastewater Treatment Areas

Treated wastewater is discharged to either of two Fonterra owned farms which are managed primarily for wastewater treatment, or to the Manawatū River. The farms are shown in Figure 2.1 above. The wastewater treatment areas are:

- Manawatū River Discharge site located off Walkers Road at approximate map grid reference NZTopo50 BM34 1686 2486 on property legally described as Lot 1 DP 482384; Record of Title 678568; Valuation Reference 14461 067 00. The discharge site is within the Palmerston North City Council jurisdiction.
- Thornton Park Wastewater Management Farm located at 353 Karere Road, and legally described as follows and all within Valuation Reference 14430 135 20, approximately area 211 ha:
  - Lot 2 DP 483031, Record of Title 680478
  - Lots 1 DP 14496, Record of Title WN550/186
  - Lot 2 DP 14496, Record of Title WN596/268
  - Lot 3 DP 77399, Record of Title WN44D/921
  - Lot 4 DP 77399, Record of Title WN44D/922
  - Lots 2-4 DP 90226, Record of Title WN57C/965
  - Pt Rural Sec 25 Karere District, Record of Title WN353/177

  Thornton Park is located within the Manawatū District Council jurisdiction, except for Lot 4 DP 77399 which is located within the Palmerston North City Council jurisdiction.
- Innesmoor Wastewater Management Farm located at 130 Walkers Road, and legally described as follows, all within Valuation Reference 14461 060 00 (approximate area 121 ha):
  - Pt Lot 1 DP 54397, Record of Title WN37D/995
  - Lot 6 DP 77563, Record of Title WN43D/361
  - Lot 1 DP 65295, Record of Title WN34A/976
  - Lot 2 DP 65369, Record of Title WN34A/975
  - Lot 9 DP 84633, Records of TitleWN52B/72

  Innesmoor farm is located within the Palmerston North City Council jurisdiction.
- The discharge consent for discharging wastewater to land also authorises discharges to Pt Sec 20 and Pt Sec 21 Karere SD which is land adjacent to Innesmoor farm and operated by Fonterra as part of Innesmoor farming operations under lease arrangements. Pt Sec 20 is 22.3 ha in area and its valuation reference is 11461 051 00 and Record of Title is WN 353/187.

In addition to the above sites, solids captured in the wastewater treatment process are also discharged via direct injection to land at multiple third-party farm sites throughout the area. The solids are sought after by landowners as a soil conditioner and slow-release fertiliser and the discharge of the solids in this manner provides for beneficial reuse of an otherwise waste produce and also reduces the need for synthetic fertilisers on the receiving properties. The discharge of solids to these properties is authorised by resource consent ATH-2019202710.00 which was granted in September 2019 and expires 1 July 2033.

2.2 Overview of Manufacturing Activities Contributing to the Wastewater System

Fonterra Site

The Fonterra Longburn manufacturing site services the dairy farming sector in the Manawatū-Whanganui Region. It is a long-standing dairy manufacturing site, having been established in 1966. Milk is collected from throughout the region by a tanker fleet based at Longburn. The majority of milk collected is transported to other Fonterra manufacturing facilities throughout the country via the road and rail networks. Some initial manufacturing is carried out on site via a reverse osmosis process (known on site as Whole Milk Reverse Osmosis or WMRO) which removes water content from the raw milk and allows for more efficient transportation of the raw milk product.

The site also undertakes processing of milk on site during the peak of the milk season. The site needs to operate its casein manufacturing for up to 90 days per season.

Wastewater at Fonterra's Longburn site is generated from:

- The cleaning (known as clean-in-process or CIP) of Fonterra's plant which includes milk treatment, casein and the WMRO plants
- Boiler blow-down
- The cleaning of milk tankers and rail tankers
- The permeate from the WMRO plant, being the water which is removed from the raw milk prior to transport.

The site sources and treats its own water from its groundwater bores located on the site, with the abstraction of water authorised via resource consent ATH-2001008270.02 which expires July 2043. Fonterra has an active water efficiency programme aimed at minimising water use as far as practicable. This is relevant as water use on the site is directly related to the amount of wastewater which is produced. In recent years, initiatives to reduce water use and wastewater production have included:

- An upgrade to the hoop wash which resulted in 20% reduction in time washing tankers and a reduction in water use of approximately 200L/wash. On peak days, this results in water use savings of up to 40,000 Litres per day.
- Installing water guns on all hoses on site which prevents hoses being accidentally left on.
- Improvements to the wash and unloading bays which has saved approximately 16,000L/day in water use.

Goodman Fielder Site

Goodman Fielder New Zealand (GFNZ) is one of the largest branded food manufacturers and suppliers in New Zealand. GFNZ has 13 manufacturing sites and many depots and warehouses throughout New Zealand and has over 1800 employees. Its Longburn Dairy factory is one of GFNZ largest factories and produces a range of over 200 different products including fresh white milk, flavoured milk, cream, yoghurt, cream cheese, sour cream, custard and dairy desserts. The factory is of key importance as it supplies a large portion of the North Island's packaged fresh white milk and is a major supplier of dairy foods product for all of New Zealand. Goodman Fielder does not have any other site that could absorb the volume of products made at Longburn.

Goodman Fielder receives water supply from Fonterra and discharges its process wastewater to the Fonterra system for treatment and discharge. There is a contractual arrangement between Goodman Fielder and Fonterra for these services. The contractual arrangement specifies volume and quality limits that must be met by Goodman Fielder and requires Goodman Fielder to pay their portion of the cost of the system including consenting, capital works and operations and maintenance. The contract therefore provides a commercial incentive to Goodman Fielder to minimise its waste stream (in terms of volume and loading) as far as practicable and to undertake any activities which may be required to ensure compliance with consent conditions.

Over the last five years, Goodman Fielder has achieved a 10% reduction in the average daily volume of its wastewater while at the same time increasing production at the site. Wastewater volume and load reduction initiatives have included:

- **Operational improvements** such as clean in place optimisation; reduction of chemical use; reduction of wash cycles; modifications to fruit skid plant; installation of sensors on bottle water washes; and installation of guns on hoses.
- **Investment in new plant** including replacement of the secondary hot water tank, a new bulk packing line which reduces the number of washes required per week; installation of cooling water reuse system on the dairy dessert plant and changing the monitoring system to move to a chemical free system on the cooling towers.
- **Diversion of high strength waste streams to beneficial reuse:** Goodman Fielder has installed a collection system which diverts milk waste which typically occurs at the start and end of production runs, to a collection system for that material to then be used off-site as pig feed. Previously, this material was sent to the wastewater system.

Human Sourced Wastewater

The wastewater system does not accept any waste from ablutions and staff facilities at either the Fonterra or Goodman Fielder sites. All human sourced wastewater from the sites is conveyed in a separate network and is connected to the Palmerston North City Council's wastewater system. There is no human sourced wastewater in the waste stream which is the subject of this consent application.

Stormwater

Stormwater from both sites is collected via a separate stormwater system and discharged to the north-west of the sites into Francis Drain which connects to the Oroua River via a rural drainage network. The stormwater discharge is separately consented via resource consent 102500/1 which expires in March 2024.

2.3 Overview of Existing Wastewater Treatment System

Figure 2.2 provides a schematic overview of the existing wastewater and treatment system. In summary, the treatment system consists of a buffer tank (to average out flow variations coming into the system arising from variability in production runs); treatment using Dissolved Air Floatation (DAF) and Reverse Osmosis (RO) processes; and then discharge to either the wastewater management farms or to the Manawatū River. Permeate from the Fonterra site's Whole Milk Reverse Osmosis plant is also discharged to the River as discussed below.

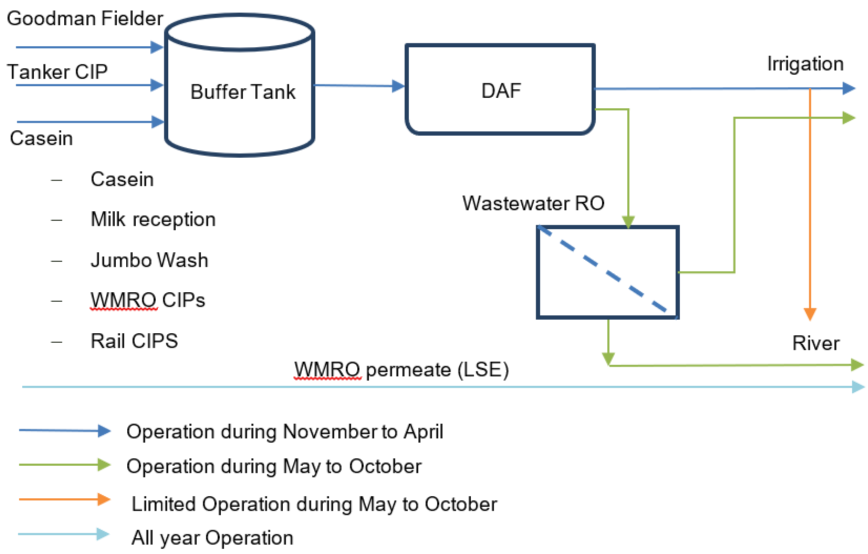

Figure 2.2: Overview of Existing Wastewater System

Buffer Tank (The White Tank)

Wastewater from the Fonterra and Goodman Fielder manufacturing sites is first received into the buffer tank (known colloquially on site as 'the white tank'). The purpose of the buffer tank is to provide flow balancing storage and mixing of waste streams so that a relatively consistent wastewater stream can be fed into the treatment process. This helps to avoid shock loading of the treatment system by high strength or high flow production runs which could otherwise have an impact on the efficacy of the treatment process.

Dissolved Air Floatation (DAF)

The Dissolved Air Floatation (DAF) treatment plant was installed in 2009. The DAF treatment process is used to remove protein, fat and suspended solids from dairy wastewater using pH adjustment to create flocs. A portion of the wastewater is saturated with air under pressure which, when combined with the pH adjusted wastewater, creates small bubbles which attach to the particles and flocs and float them to the top of the DAF tank. The flocs which are floated to the top are known as DAF solids. Once floated to the top, they are removed using a scraper thereby removing protein, fat and suspended solids from the wastewater. The removed DAF solids are either injected into farmland for beneficial reuse (separately consented) or sent to composting facilities.

In compliance with the land discharge consent conditions, treated wastewater from the DAF process is suitable to go directly to land without adverse effects. Therefore, when the discharge is occurring direct to land (i.e. whenever soil conditions enable land discharge), the wastewater from the DAF system is sent directly to the wastewater management farms for discharge.

Wastewater Reverse Osmosis (WWRO)

The WWRO plant was installed in 2015. A reverse osmosis (“RO”) plant uses a partially permeable membrane to separate ions, particles and other molecules from a liquid stream. The water and contaminants are placed under pressure using pumps and the water is ‘pushed’ through the membrane, while holding back the majority of contaminants. The outcome of the Reverse Osmosis plant is that it essentially separates the wastewater into two components parts:

- The **permeate** is the liquid that passes through the membranes. It is the lower strength of the two waste streams and is the waste stream which then can be discharged to the Manawatū River. In accordance with the existing resource consent for the Manawatū River discharge, permeate is only discharged to the River when the river flow is above 37 m^3/s (half median flow) and only during the months of May to October. There is no discharge of WWRO permeate to the River from 1 November to 30 April. The conditions of the resource consent are discussed further below.
- The **retentate** is the portion of wastewater that does not pass through the membranes (i.e., is retained) and is therefore a higher strength, but lower volume, waste stream. The retentate is discharged to land in order to avoid discharging the retained contaminants to the River.

Whole Milk Reverse Osmosis (WMRO)

Fonterra has a Whole Milk Reverse Osmosis (WMRO) plant on the site as part of its manufacturing operations. The WMRO plant is not part of the wastewater treatment process but is used to concentrate milk received at Longburn to enable efficient and more sustainable (lower emissions) transfer of raw milk to other manufacturing sites throughout the country, but in particular Whareroa in South Taranaki. In essence, this process is used to remove a portion of the water from the raw milk in order to concentrate the milk for transport. In this case, the "retentate" portion of the RO process is the raw milk product which is transferred to another site for manufacturing.

The permeate from the WMRO process is the water which is extracted from the raw milk. This is discharged to the Manawatū River in accordance with the consent conditions. Prior to installing the WMRO plant, Regional Council confirmed (letter dated 28 April 2014, attached as Appendix A2) that the WMRO permeate is classified as Low Strength Effluent under the consent and can therefore be discharged to the Manawatū River on a year-round basis irrespective of River flows.

2.4 Overview of Existing Consent & Improvements Made

The existing resource consent was granted in 2007 with an expiry date of 23 March 2022. Consent was granted following appeal to the Environment Court and with a change to the previously consented activity to include installation of treatment processes with one DAF to be installed in 2009 with a second DAF to be installed and commissioned five years later.

2.4.1 Variation to Existing Consent to Enable Improved Treatment Process to be Installed

The first DAF was installed as proposed. However, when it came to install the second DAF, Fonterra undertook a Best Practicable Option review and identified that improved treatment could instead be provided by installing a Reverse Osmosis Plant. A change of consent conditions was sought and granted in order to enable the RO plant to be installed as an alternative to the second DAF. The change of consent conditions was granted on the basis that the proposal would provide a better treatment and improved discharge quality compared to installing the second DAF. The proposal to change the treatment process to reverse osmosis included Fonterra offering a reduction in the contaminant loading limits authorised by the consent. The outcome of the change of conditions was therefore an improved treatment process compared to that for which consent was granted, and a subsequent reduction in the contaminant loading to River that was authorised by the consent.

The grant of consent and subsequent change of conditions to enable the improved treatment process to be installed is summarised in Figure 2.3 below.

November 2003: Resource Consent Application Lodged

- Application lodged to renew the site's existing consent to discharge washwater and wastewater (at the time untreated) to the river.
- Proposal did not include treatment but sought to manage effects by:
  a) Preferential discharge to land;
  b) No discharge of process wastewater in bathing season or when the river was below half median; and
  c) Flow related mass loading conditions

March 2007: Consent granted following appeal

- Following an appeal to the Environment Court, the consent was granted which required Fonterra to complete a Best Practicable Option review and install treatment.
- Minimum treatment required was for a Dissolved Air Flotation (DAF) plant to be installed by August 2009 and second DAF plant and Ultraviolet (UV) treatment to be commissioned by December 2014.

2009: First DAF Plant Installed

- As required by the resource consent, the first DAF plant was installed to treat process wastewater prior to discharge to the River.

2015: Reverse Osmosis (RO) Plant & Change of Conditions

- The Best Practicable Option review identified Reverse Osmosis as the preferred option, rather than the second DAF Plant and UV. This provides a higher level of treatment than what was originally proposed and approved via the consent decision.
- A change of consent condition was granted which:
  a) allowed some additional time to install and commission the RO plant; and
  b) lowered the consent limits for discharge of DRP and E Coli to reflect the improved treatment.

Figure 2.3: Overview of Consent History & Change of Conditions

2.4.2 Low Strength & High Strength Effluent

The existing consent defines the wastewater stream as comprising two components being Low Strength Effluent (LSE) and High Strength Effluent (HSE), with LSE being able to be discharged to the river on a year-round basis irrespective of river flow.

Low Strength Effluent is defined in the resource consent as condensate, cooling water and pump seal water. Regional Council has also advised that the WMRO Plant wastewater can be discharged under the LSE consent conditions (refer letter attached as Appendix A2). The HSE and LSE terms are specified in the resource consent and, despite the terminology, define the waste steams according to their source location, not the strength of effluent.

As part of this application, a detailed review of all waste streams has been undertaken and it has been identified that, despite the WMRO being defined as Low Strength Effluent and being low in all parameters measured under the consent it does, in fact, have a significant urea loading which contributes to the overall nitrogen loading into the River. Therefore, Fonterra propose to remove the 'low strength' and 'high strength' classification from the consent with all treated wastewater to be considered under the same discharge regime. This will be more similar to the low strength effluent discharge regime but with the addition of a minimum flow requirement to ensure overall improvement in water quality over the existing discharge.

2.4.3 Overview of Discharge Consent Conditions

A copy of the **existing** resource consent is included in Appendix A1. The conditions under which discharges to the River may occur are specified in conditions 1 to 3 of the consent and summarised as follows:

- At all times, the discharge is to be prioritised to land if soil moisture conditions are suitable.
- From 1 May to 31 October, up to 6,000 m^3/day of wastewater (comprising any combination of LSE and HSE) may be discharged subject to the River flow being above 37 m^3/s.
- From 1 November to 30 April:
  - No HSE may be discharged.
  - Up to 2,500 m^3/day of LSE may be discharged. There is no river flow cut-off and therefore this can be discharged under low flow conditions.
- At all times, the daily mass loading limits (Condition 2 and repeated in Table 2.1) must be met. This allows the contaminant load to be increased as the River flow increases (i.e., the higher the river flow, the more contaminants may be discharged). There are some operational challenges in ensuring compliance with this condition as the amount that can be discharged is a calculation based on River flow (which can be known at the time of discharge), and wastewater quality (which is not known until laboratory results are returned at a later date). This means that the operators are required to estimate the wastewater quality on any given day in order to make an assessment as to how much wastewater can be discharged.
- Condition 3 of the consent requires that RMA s107 effects[1] not occur in the River as a result of the discharge.

[1] *S107 effects relate to conspicuous oil or grease films, scums or foams, or floatable or suspended materials; emission of objectionable odour; conspicuous changes in colour, clarity or visibility.*

Table 2.1: Daily Mass Loading Limits (Condition 2)[2]

Parameter	November to April		May to October	
	95 Percentile	Maximum	95 Percentile	Maximum
Total $CBOD_5$	15 Q	30 Q	50 Q	60 Q
Dissolved $CBOD_5$	9 Q	18 Q	30 Q	40 Q
NH_4-N	2 Q	4 Q	2 Q	4 Q
TSS	6 Q	12 Q	25 Q	35 Q
DRP	0.1 Q	0.3 Q	0.15 Q	0.2 Q
E.Coli (CFU)	0.86 trillion *Q	8.6 trillion *Q	0.1 trillion *Q	0.17 trillion *Q

Conditions for Monitoring and Reporting

In addition to the conditions summarised above which specify the volume, contaminant loads and conditions under which wastewater can be discharged to the Manawatū River, the consent also includes conditions which require:

- Signage at the discharge point to advise the public of the discharge;
- Ensuring detritus and sediment does not accumulate in the area upstream of the discharge such that it may affect mixing of the discharge with the river flow;
- Monitoring of the discharge including daily and weekly effluent testing and monthly in-river sampling;
- Macro-invertebrate sampling in the River on six occasions throughout the term of the consent;
- Annual reporting to Regional Council detailing the monitoring undertaken and assessing the effects of the discharge on the receiving environment. The annual report is also provided to specified parties who submitted on the consent application; and
- Establishment of a liaison group involving submitters on the consent application with annual meetings of the liaison group.

Conditions 4 and 5 of the consent relate to the Special Powders Unit which is no longer on site and there are no plans to re-establish this process.

Compliance History

Horizons Regional Council's most recent compliance report for the wastewater discharge to river consent is for the year ending June 2020. That report assesses that compliance has been achieved with all conditions of the consent[3].

[2] *Note that Condition 2 was changed in June 2015 as a consequence of adoption of the Reverse Osmosis Plant compared to the originally planned second DAF. As part of the s127 variation process to enable the revised treatment process and delays in commissioning, Fonterra offered an amendment to the loadings associated with HSE which can only occur in winter. This has inadvertently resulted in the summer DRP and E Coli limits being higher than the winter limit. Previously the winter limits had been higher than those in summer.*

[3] *The Regional Council has assessed condition 3 as "comply – at risk". This assessment means that compliance has been achieved but there is a future risk of non-compliance. In this instance, the condition is for the discharge to not cause, after reasonable mixing, a decrease in the horizontal visibility of the river of a specified amount. The consent does not*

For the 2018-2019 and 2017-2018 years, Regional Council has also assessed the activity as fully compliant.

Fonterra also undertakes a self-assessment of its compliance on an annual basis via the annual report required as condition of consent. The last four compliance assessments undertaken by Fonterra have found that compliance with all conditions of consent has been achieved consistently, except for the following:

- In the 2020-2021 year, there was a technical non-compliance with condition 14 as there was a delay in the annual audit of monitoring by an IANZ accredited laboratory. The audit was delayed due to a change in laboratory service providers.
- In the 2018-2019 year, there was a non-compliance as the 95th percentile limit for DRP loading in the discharge was exceeded twice within 20 days in July 2018. The discharge did comply with the maximum DRP loading limit at all times. This non-compliance was investigated internally, and Horizons were informed of the non-compliance and measures taken to prevent a reoccurrence. No DRP exceedances have occurred since this date. The Regional Council assessed the consent as fully compliant for this period.
- In the 2017-2018 year, *E. coli* levels in the discharge exceeded the consent limit on 3 August 2017. An investigation was carried out and it found that there was a process issue with the WWRO plant which was immediately rectified, and the non-compliance and remedial actions were reported to Regional Council. *E. coli* also exceeded the consent 95th percentile limit on 3-5 June 2018 which, upon investigation, was found to be caused by a sump pump failure. The failure was rectified, and the incident reported to Regional Council. The Regional Council assessed the consent as fully compliant for this period.

Other than the three incidents noted above, Fonterra's self-assessment has shown that the site is fully compliant with the consent conditions. Furthermore, the above non-compliances demonstrate a practice of early identification of non-compliances and immediate investigation, reporting and implementation of remedial measures.

2.4.4 Improvements Made During the Term of the Consent

Reverse Osmosis Plant: Better quality treatment than envisaged in the consent

As noted above, significant improvements in wastewater treatment quality have been achieved throughout the term of the existing consent, including installation of treatment that produces a better quality of treated wastewater than authorised under the consent. As a result of this improvement, Fonterra sought a change to consent conditions that lowered the consent limit for DRP and *E. coli* able to be discharged under the consent by 45%. In practice, the effluent quality of the RO treated wastewater is 80% better than would have been expected with a 2nd DAF plant.

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require horizontal visibility (black disc) monitoring to be undertaken and the Regional Council report acknowledges that black disc monitoring is not safe at this location. The Regional Council acknowledges that Fonterra has been measuring turbidity in lieu of black disc and therefore the "at risk" assessment relates to the form of testing, rather than any effect on the River.

Condition 12 has also been assessed as "comply – at risk". As above, the assessment is that compliance has been achieved. The "at risk" element here relates to the fact that Fonterra is not monitoring at the downstream monitoring site specified in the consent condition but is monitoring at the first safely accessible site downstream of the reasonable mixing zone. The compliance assessment notes that a variation to consent should be sought to clarify the monitoring point. A variation has not yet been sought, however, Fonterra is seeking, via this application, a monitoring condition which enables its staff to undertake the required monitoring at the first safely accessible site downstream of the reasonable mixing zone.

The installation of the RO plant, compared to the originally proposed second DAF plant, has also meant that volumes of wastewater discharged to the River have been reduced by approximately 30%.

The decision to adopt the Best Practicable Option in 2015 has therefore resulted in a significant improvement to wastewater quality and a significant reduction in the key parameters of volume, DRP and *E. coli* compared to what was envisaged when the consent was granted in 2007.

Operational and Management Improvements

The improved treatment discussed above provides a significant improvement in environmental outcomes compared to those which were considered at the time of the grant of consent. In recent years, Fonterra has also undertaken a series of improvements to the wastewater system to improve the overall performance and reduce the volume and contaminant loads to the River. These include:

- **Purchase of Thornton Park farm:** Prior to 2019 the farm was owned by a third party and was not managed primarily for wastewater discharges. Fonterra purchased this property and has since operated the farm for the primary purpose of wastewater management. This has resulted in changes to farm operations including some destocking (almost halving the number of dairy cows), in order to optimise the amount of wastewater which can be discharged to land within the conditions of the land discharge consent.
- **Improved in-river monitoring to assess effects of the discharge.** The current wastewater system operates as a batch process and does not discharge on a continuous 24-hour basis. In-river monitoring has not always been carried out at times that the discharge was occurring. This was identified in 2019 and since that date, in-river monitoring has been targeted at times when the discharge is occurring, to ensure that potential effects of the discharge are adequately monitored.

2.5 Characterisations of Wastewater Required to be Managed

The Options report included in Appendix C1 discusses the quality of wastewater which has historically been discharged under the resource consent. This information along with expected future production and manufacturing demands has been analysed by Fonterra's Environment Technical Group (ETG) to confirm the characteristics of wastewater that will be required to be managed under the resource consent that is being sought. The wastewater characteristics and profile take into account the following matters:

- Historic monitoring results for the site are not necessarily representative of the wastewater volumes and strength that will be required to be managed under the new consent. This is because, until recent years, the Fonterra manufacturing site was not operating at or near full capacity. For a considerable period of the existing consent's term, limited manufacturing was carried out at the site, and the Fonterra Longburn site primarily operated as a transfer station by concentrating milk (via the WMRO plant) for transport to other sites for manufacturing. With increasing milk production throughout the lower North Island, this is no longer the case, and the site is now required to process milk via the casein line during the peak of the season. Internal reviews at Fonterra have confirmed that the site needs to be able to operate with one casein line running for up to 90 days per season, and it is on this basis that the wastewater volumes and characteristics are defined.
- Fonterra is contractually required to accept and treat a specified volume of wastewater from Goodman Fielder. As noted above, there are commercial incentives within the contract for Goodman Fielder to manage volumes and contaminants discharged, however, the system and the consent need to be able to accept the volume and strength of wastewater which is set in the contract with Goodman Fielder.
- Milk production is a seasonal operation with the peak of the milking season over September to January resulting in increased wastewater volumes during that period. Wastewater volumes and

influent strength vary throughout the year based on site operations and milk production in the surrounding area.

Wastewater Volumes

Table 2.2 and Figure 2.4 below shows the wastewater volumes which the system is required to be able to treat and discharge on a month-by-month basis.

Table 2.2: Wastewater volumes by month for the Longburn site
Figures are average m^3/day for each month

	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Total Wastewater	1,630	2,830	2,830	2,830	1,963	1,963	1,513	1,513	1,513	1,580	1,580	1,220
The above wastewater is treated via DAF and RO; the RO process splits the wastewater into two streams as follows:												
Retentate (discharge direct to land)	543	943	943	All wastewater is discharged to land during this period and therefore discharge is direct from the DAF. It is inefficient to operate the RO during this period, as the RO essentially separates the wastewater into two streams which would then be merged together when discharged to land. The exception is when soils are wet. The WWRO may be operated to enable permeate to be stored, with only retentate discharged to land.						527	527	407
WWRO Permeate	1,087	1,887	1,887							1,053	1,053	813
WMRO Permeate	-	800	800	800	800	800	-	-	-	-	-	
Total permeate managed under this consent	**1,087**	**2,687**	**2,687**	**800**	**-**	**-**	**-**	**-**	**-**	**1,053**	**1,053**	**813**

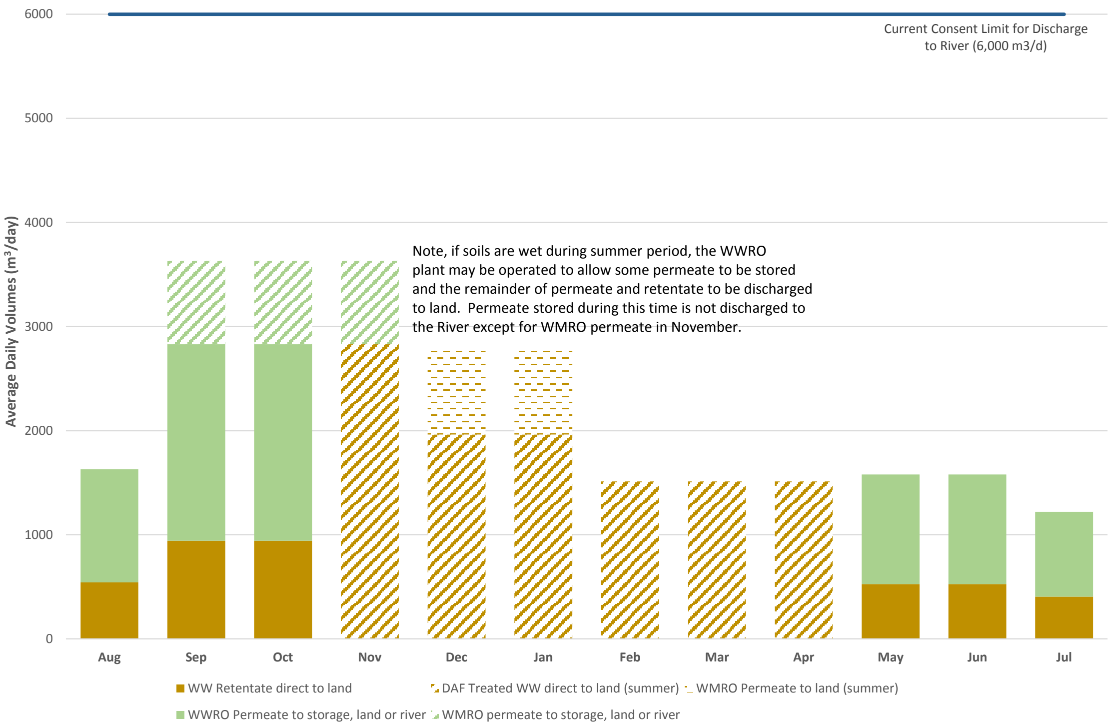

Figure 2.4: Average Daily Discharge Volumes
Brown bars indicate waste streams direct to the land; Green colouring indicates permeate streams which will be managed through this consent (and will be managed via storage, to land when soil moisture conditions allow, or to River)

Treated Wastewater Strength

Table 2.3 below sets out the composition of the treated WWRO permeate and WMRO permeate which are the waste streams which will be discharged to the River[4].

Table 2.3: Treated Wastewater Quality to be Discharged to the River
(From 2019 to 2021 financial years, being 1 August to 31 July).

Parameter	WWRO Permeate		WMRO Permeate	
	Average	90%ile	Average	90%ile
Total $cBOD_5$ (g/m^3)	236	366	26	73
Soluble $cBOD_5$ (g/m^3)	229	356	15	52
COD (g/m^3)	344	592	54	166
Total Nitrogen (g/m^3)	13	23	61	88
Ammonia-N (g/m^3)	2.6	5.9	3.0	6.7
SIN (g/m^3)	8	13	3	7
TSS (g/m^3)	18	29	7.2	29.5
Total Phosphorus (g/m^3)	1.4	2.3	1.4	3.6
DRP (g/m^3)	0.8	1.4	0.15	0.9
E. coli (cfu / 100 mL)	2729	20,535 (95th percentile)	62	99

2.6 Consideration of Options & Alternatives

Figure 2.5 summarises the process which was followed to identify the BPO. The options considered are described in more detail in the BPO reports attached as Appendices C1 to C3.

As stated below, the BPO process has been informed via a process of on-going engagement with stakeholders and tangata whenua. This engagement has ensured that tangata whenua and community expectations have been able to be taken into account alongside internal input from technical advisors in order to identify the BPO in terms of the wider environment, community and mana whenua, and not solely from an internal Fonterra perspective.

4 Table 2.3 specifies the wastewater strength for waste streams which are proposed to be discharged to the River. The strength of wastewater which is discharged direct to land (being WWRO retentate or DAF treated wastewater is given in Table 6 of the technical report included in Appendix C1).

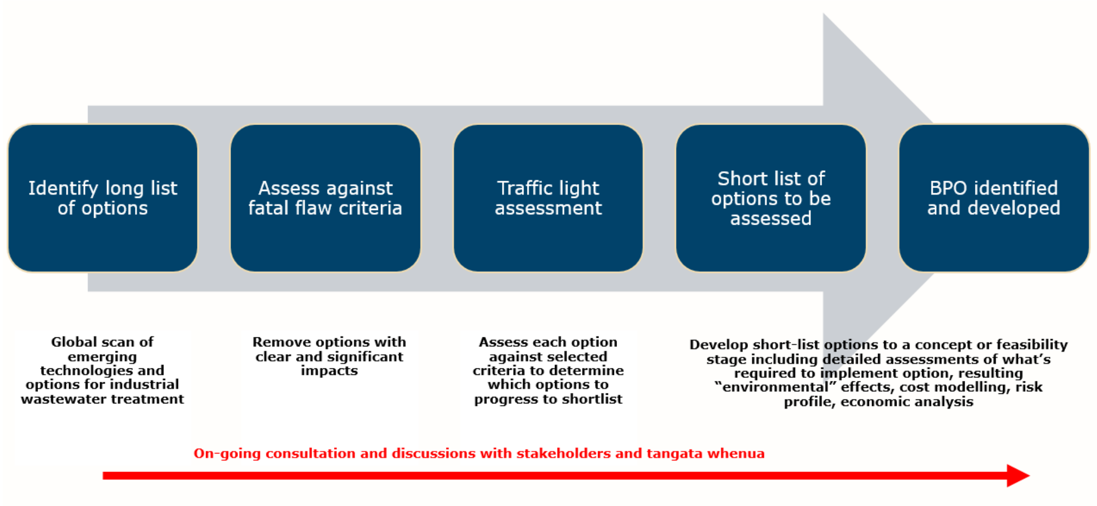

Figure 2.5: Summary of BPO Process

2.6.1 The Long List of Options

The Long List of Options involved 26 options all of which are described and assessed in the reports attached as Appendix C1. In summary, the options broadly fell within one of three main categories, all of which had several sub-options within them. These are summarised in Table 2.4 below.

In addition to the options summarised in Table 2.4, the following options were initially identified in the long-list of options, but were discounted very early in the assessment process as they were considered to be "fatally flawed" options:

- All wastewater discharged to the river (Option B). This option was considered to have significant adverse cultural effects, would be contrary to the National Policy Statement on Freshwater Management and One Plan, and inconsistent with the Manawatū River Leaders Accord to which Fonterra is a signatory and participant.
- Managed aquifer recharge (Option F). This option was considered to be contrary to policy direction to protect groundwater resources set out in the National Policy Statement on Freshwater Management and was considered to have several technical complexities such that it would not be possible to confirm if there were any adverse effects on the groundwater resource.
- Discharge to ocean (Option G). The capital cost of this option was prohibitive and the option was not considered to be consistent with principles of managing wastewater within the area within which it is generated.

Table 2.4: Summary of Long List Options

Option Category		Details	High-level assessment
A: Cease all discharges to the Manawatū River and discharge all wastewater to land (3 sub-options)		Under this option, there would be no discharge to the River in any circumstances (noting that short term discharge to River consent would be required to provide timeframe for implementation). It would require Fonterra to acquire, consent and develop 200 ha of ***effective*** irrigation area in addition to the existing irrigation farms.	There is limited land of sufficient area and appropriate soils within proximity of the site (noting soil requirements, and setbacks from sensitive activities, property boundaries, sites of cultural significance and wāhi tapū and waterways, etc.). There are also significant consenting challenges associated with applying irrigation to land due to regulatory requirements relating to nutrient loading and leaching limits.
C: Combined discharge to land and river	Existing treatment & using storage to reduce wastewater to the River	This is the preferred option which has been taken forward to optimisation (refer section 2.6.2). This option involves construction of large (nominally 75,000m^3 for purpose of long list option assessment) storage facility to enable more wastewater to be discharged to land. It would include an increased minimum flow required in the River before discharge can occur and it would require all discharges to the River to be ceased during summer periods.	This option would reduce the overall volume and contaminant load discharged to the Manawatū River. It enables more effective irrigation of wastewater to land at more suitable times by storing wastewater during the wetter months for irrigation during summer, and therefore also reduces impacts on soils. The storage facility also provides core infrastructure that would be needed for any future proposals to further reduce wastewater discharges to the River.
	Combined discharge to water and land with improved treatment prior to discharge	This option involves the construction of a biological wastewater treatment plant to reduce the contaminant load of the discharge. The discharge regime (i.e. river cut-off flows and no deferred storage for irrigation) would generally be the same as the existing consent, albeit with slightly improved wastewater quality.	There is a significant cost required to construct a new biological WWTP ($30-40M) which would only result in a relatively minor reduction in contaminant loads being discharged to the Manawatū River. Treatment would likely require significant chemical use and create additional by-products (sludges etc) that would need to be managed separately. This option would "lock-in" capital for the next 30+ years, and reduce Fonterra's flexibility to alter the discharge regime in the future.
D: Discharge into a municipal system (PNCC or MDC)		This option would keep the existing wastewater irrigation farms for discharge of retentate, but with all permeate waste streams being discharged to either the Manawatū District or Palmerston North City wastewater systems. It would require construction of a new pump station and pipelines for discharge and connection to the municipal system. The existing treatment system would be maintained for pre-treatment prior to discharge to the municipal system and trade waste charges would apply. It is likely that some form of storage would be required to regulate flows, including their timing, into the municipal system and to support the land-based discharge to the Fonterra farms, particularly when it is wet.	The Manawatū District wastewater system is too far away from the site for this to be a feasible alternative. The PNCC system would not be able to accept waste until after their wastewater resource consent process and treatment upgrades are completed, if at all. There is uncertainty around the timing for the treatment plant upgrade (~2030) and therefore renewal of the Fonterra consent is required. It is unknown yet what the preferred option will be for the Palmerston North wastewater treatment plant. If it involves a river discharge, then adopting this option would still result in the Fonterra wastewater being discharged to the River albeit via a third-party. A storage facility would still required to support land discharge, particularly in wet weather (spring).

Options regarding additional treatment to achieve an improved wastewater quality were assessed. However, these were not identified as a preferred option given it would result in only minor improvements to the River water quality. As discussed in the ecological assessment report, the existing discharge is not having a more than minor adverse effect on the River water quality. Improving the discharge quality would have a very minor improvement but would not result in significant reduction in loadings to the River, nor would it address effects of the discharge on the mauri of the River. It would also increase the use of chemicals in the process and would create additional waste streams (sludges) that would need to be managed. Further, the significant investment in treatment (both capital and operating) would likely preclude future options to reduce discharges to the River.

The feasibility of obtaining further land for wastewater irrigation was also assessed. It was identified that approximately 200 ha of effective irrigation area would be required to be able to cease discharge to the River completely. Allowing for buffer areas around dwellings, property boundaries and sensitive areas such as water courses and potentially wāhi tapu, significantly more than 200 ha of land would be required. A land availability assessment was undertaken and it was found that there are few land holdings within a 10 km radius of Longburn of sufficient size to be suitable for this purpose. Land availability, cost and consenting matters has meant that this option was not adopted as the preferred option. For this option a storage facility would still be required to be able to store wastewater at times when soil conditions preclude discharge to land. The preferred option still provides flexibility for additional land to be incorporated into the system at a later date should this option become viable.

The land assessment was based on Fonterra ownership of any new wastewater irrigation farms, including ownership of the irrigation infrastructure required. Fonterra's policy is to own the wastewater irrigation farms that it requires to be able to manage its wastewater. This ensures that the farms are able to be managed primarily for the purpose of wastewater management and the system is optimised to be able to reduce wastewater volumes being discharged to the River. Fonterra seeks to ensure it is not in a position whereby it is reliant on third party farm operations to be able to operate its wastewater system.

That said, stakeholders have raised options as to allowing third party farms to utilise stored wastewater that could provide for beneficial reuse of the stored wastewater and further reduce the amount of wastewater over and above what would be achieved through the BPO. Fonterra has not, at this time, pursued making the stored wastewater available for third party use for the following reasons:

- It would not change what is sought by way of this consent application. Any third-party supply arrangements are unlikely to be able to be consistently relied upon throughout the term of consent and therefore consent needs to be sought on the basis that all wastewater must be managed through the Fonterra owned wastewater farms and the river discharge.
- Any discharge of treated wastewater to third party farms would require a separate resource consent for the discharge and may (depending on current farming operations) also trigger a further consent requirement as an intensive land use under the One Plan. Such consents are likely to introduce consent conditions and compliance requirements which deter the third-party farms from seeking access to the treated wastewater. Further, Fonterra would not be able to ensure compliance with such consent conditions.
- The cost of infrastructure required to convey the wastewater to the third-party farms is likely to deter the third-party farms from seeking access to the treated wastewater.

Notwithstanding the above, Fonterra has not ruled out making treated wastewater available to a third-party farm should the landowner wish to invest in the necessary consents and infrastructure. However, as stated above, this would not change what is required to be sought by way of this consent.

Connection to the PNCC municipal wastewater system was not identified as a preferred option as it would not be able to be implemented until PNCC had completed its current BPO and wastewater resource consent process and its preferred option has been implemented. This means that the option would unlikely be available to Fonterra for 5-10 years and therefore renewal of Fonterra's River discharge consent would still be required. Even if a discharge to the municipal system was to be enabled at a later date, the existing treatment would likely still be necessary to provide pre-treatment and a large storage facility would be required to enable flow balancing.

The preferred option involving large scale storage, deferred irrigation to the existing wastewater farms and a subsequent reduction in the amount of wastewater discharged to the River was therefore adopted as the BPO. In selecting this as the preferred option, Fonterra was extremely cognisant of the regulatory, iwi and community drivers to remove all discharges to the Manawatū River. While the preferred option requires renewal of the discharge consent of the Manawatū River, it is one which results in a significant reduction in the volume, contaminant loading and cumulative effects on the river. Further, it provides flexibility to support future initiatives to further reduce wastewater to the River if other options become feasible at a later date. This is because all options which would result in further reductions or cessation of discharge to the River require large scale storage for implementation.

2.6.2 Development of the Preferred Option

Having identified the storage and deferred irrigation as the preferred option for reducing the wastewater discharge to the River, a series of sub-options were then developed in order to refine and optimise the proposal.

As discussed above, the WWRO process essentially splits the wastewater into two streams – the retentate and the permeate. The proposed discharge regime is for all retentate to be discharged directly to land. The waste streams which the discharge to River regime needs to consider is the permeate wastewater stream from the WMRO and WWRO plants. **The proposal is for permeates only to be discharged to the River between 1 May and 31 October each year and when the River flow is above 56 m^3/s, except that WMRO permeate only may be discharged to the River during November when soil moisture conditions are such that it is not suitable for discharge to land (refer Section 2.7.3).**

While the intent is that only permeates are discharged to the River, this application is also seeking a contingency condition to allow treated wastewater from the DAF unit and / or a combined permeate and retentate stream to be discharged to the River only when the River is in flood (i.e. above the 20th FEP flow) and the irrigation farms are inundated and cannot accept wastewater. This is discussed further in Section 2.7.4.

In order to achieve the above discharge regime, a storage facility is proposed which will generally contain a blend of WWRO and WMRO permeates. The proposed operating regime is for WWRO and WMRO permeates to go to the storage facility from where the operator will determine whether or not permeates can be discharged to land, stored further or discharged to the River. The operational procedures for how the system will be managed to give effect to prioritising wastewater to land and operating in accordance with the River discharge regime are proposed to be detailed in the site's Wastewater Operational Procedures.

Key Design Principles

A suite of key design principles has been developed to guide the option investigation, assessment and implementation of the BPO. These are:

- Only permeate wastewater streams will be able to be discharged to the River. Discharge of permeate to the River will only occur when River flow is above a specified cut-off flow (and if not met, permeate will be placed in storage for subsequent discharge to land or the River as a part of the mixed waste stream that will arise from the storage facility. This principle ensures that all permeate (including the WMRO permeate) is subject to a cut-off flow (or discharged to land). Further it is proposed that the cut-off flow will be higher than the current cut-off flow of 37 m^3/s that separately applies to high strength wastes.

- All retentate will be discharged to land. Direct irrigation of retentate to land will take priority over irrigation of permeate. This principle ensures that the higher-strength retentate waste stream, which contains the majority of the contaminant load, will be discharged to land and not to River. Retentate is required to be discharged directly to land and not via the storage facility as it is not suitable for storage given its higher strength.
- The discharges to the Manawatū River and the storage facility will be carefully managed to ensure that:
  - The storage facility is progressively filled during the production season such that, as far as possible, it is close to full effective storage volume at the start of summer. This will require operational judgment and balance to manage the varying wastewater volumes against the amount discharged to land or stored. The objective will be to reduce, as far as operationally practicable, the amount of wastewater discharged to the River while keeping within sustainable land discharge limits. Filling the storage facility too early in the winter season may mean that more wastewater is discharged to the River towards the end of winter / early spring.
  - The storage facility must be able to be emptied via irrigation to land over the summer months so that the effective storage volume is emptied prior to the next production season (starting 1 May each year). This ensures that storage is available for use during the next production season. This does mean that there is a practical limit to how big the storage facility can and should be. The maximum storage size is the volume that is able to be discharged to the wastewater irrigation farms without overloading (in addition to that which is directly irrigated) those irrigation areas from a hydraulic or nutrient loading perspective.
  - The irrigation consent conditions (nutrient leaching, soil moisture, rotation periods, etc) are able to be met and the irrigation system can be managed without adversely affecting soil health and pasture quality.
- Contingency conditions enabling the discharge of WMRO permeate to the Manawatū River when there is a wet November and discharge of treated wastewater in exceptional circumstances are also sought. Providing for contingency conditions means that consent limits can be set based on normally expected conditions. The alternative is to set conditions (i.e. discharge limits) which provide for the worst case emergency scenario, however, in practice, such conditions do not adequately incentivise or require management of the discharge in a way which prioritises and optimises storage and discharge to land.

Options considered for Optimisation

An initial storage volume sizing was determined as part of the option assessment discussed above. The initial sizing was developed through a basic water balance model considering wastewater volumes and their variation throughout the year, river flow statistics, and seasonal variability in irrigation capacity. This initial water balance suggested a storage volume in the order of 75,000 m^3 total storage would likely be required. This initial storage volume was then used to develop and assess a series of scenarios as discussed below. It was found that, the total storage volume was required to be increased to 95,000 m^3 in order to optimise the effective storage volume for reduction of wastewater to River and to provide for rainfall captured in the storage facility as well as contingency storage in the event of a wet start to the summer irrigation season.

Five sub-options were identified and assessed as set out in Table 2.5. The sub-options were assessed through an iterative process taking into account the following matters:

- The degree to which the sub-option reduces the volume and contaminant loads to the River;

- The degree to which the sub-option contributes to the overall catchment reductions required to achieve the One Plan water quality targets; and
- The ability to empty the storage facility via irrigation to land over the summer season without adversely affecting the soil health or exceeding consent limits with respect to hydraulic load, rotation periods or nutrient leaching.

The way in which the sub-options were analysed is described in Section 4 of the Aquanet report included in Appendix D. In summary, a model was developed and used to assess how each sub-option would operate for each day over a 20-year period. Essentially, for each day of the 20-year period, the model:

- Considered how much of the wastewater that was produced would be able to be discharged to land (with varying land irrigation volumes for each month), based on Fonterra's estimates of land discharge capability;
- Determined how much could be discharged to River (based on historic river flow measurements) under the discharge regime being assessed; and
- Determined how much would need to be stored.

This determined the storage volume required to be able to implement the discharge regime of each scenario and provided an assessment of the effects of the discharge on in-river concentrations of water quality variables such as nutrients. In all scenarios, there was no discharge to the River during summer months (November to April) irrespective of River flows.

Prior to modelling the improvement scenarios, a baseline scenario was modelled assuming the current discharge regime (i.e. discharge of WMRO throughout summer with no river cut-off flow; and no discharge of other waste streams when the river is below 37 m^3/s or during summer) and with the design baseline wastewater volumes and concentrations as discussed in Section 2.5. This was used as a baseline level of contaminant loads into the River against which the various sub-options can be assessed. It must therefore be noted that the percentage reduction in in-river nutrient concentrations identified in Table 2.5 below are reductions from the baseline model which is already significantly below the amount of contaminants which could be discharged under the existing consent.

Three of the sub-options (sub-options 1 to 3) assume that the maximum volume that can be discharged to the River on any day (subject to it being in the winter months and river flows being above the cut off flow) is the amount of wastewater that was produced the previous day[5]. Essentially this assumption means that the storage facility can only be emptied by discharge to land. It avoids any "dumping" of wastewater to the river when the river flows are high.

Two of the sub-options (options 4 and 5) allow for increased discharge to the River as its flows increase. This would enable the storage levels to be drawn-down (emptied) during the winter months when the river flows are high. These sub-options have been used to test whether there is an ability to further reduce the effect of the discharge on in-river nutrient concentrations by increasing discharge volumes when the River is high (i.e., at less vulnerable flows).

Sub-Option 1 adopts a starting point of a nominal storage volume of 95,000 m^3 to be provided by way of a pond or similar storage facility. Allowing for dead storage volumes, rainfall allowance, contingency storage and freeboard, a storage facility of this size has an effective storage volume of 63,719 m^3. This is determined as follows:

5 *The previous days' production is a proxy for the current day production. From a logistical point of view, the previous day's production needs to be assumed so that a limit can be set at the start of the day for how much can be discharged.*

Total storage volume			**95,000 m^3**
Less	5% dead storage at base (outlet is slightly above bottom to avoid discharge of solids)	4,750 m^3	
Less	Rainfall allowance (average annual rainfall and area)	16,531m^3	
Less	Contingency storage for November (to allow additional storage if there is a wet start to irrigation season)	10,000m^3	
Provides effective storage volume of:			**63,719 m^3**

Table 2.5: Summary of Optimisation Sub-Options

	Option	Effective Storage Volume	Can storage be emptied in summer?	River Flow Cut-Off	Reduction in In-River concentration compared to 2019 baseline	
					DRP	SIN
1	This sub-option assesses the potential improvements that can be achieved with a storage volume of 95,000 m^3 which is in the order of the maximum volume that can be emptied onto the wastewater irrigation farms during summer periods under the existing irrigation consents and with optimisation of farming practices. The maximum volume that can be discharged to the River, subject to cut-off flows, is the prior day's production volume.	63,719 m^3	✓	56.5 m^3/s	39%	48%
2	This sub-option seeks to find the required storage and River cut-off flow that would result in a 57% reduction in average in-river effects on DRP concentrations compared to the baseline (refer Section 2.5). Manawatū River water quality is such that reductions of 57% DRP and 21% SIN would be required from all dischargers in order for the River to meet the One Plan targets. Sub-Option 1 achieves the required reduction for SIN but does not achieve the required DRP reduction (assuming that all discharges are required to reduce their contribution by the same amount). This sub-option therefore seeks to identify the storage volume required to achieve the DRP reduction as well as the SIN reduction target. The maximum volume discharged to the River, subject to cut-off flows being achieved, is the prior day's production volume.	103,803 m^3	×	72 m^3/s	57%	64%
3	This sub-option sets a river discharge cut off flow of 80 m^3/s. This river cut off flow has been selected as it is one of the options considered by PNCC in relation to its wastewater treatment plant discharge. Modelling of this sub-option seeks to identify the storage volume required to adhere to this cut-off flow as well as the reduction in effects of the discharge on DRP and SIN in-river concentrations that would be achieved. The maximum volume that can be discharged to the River, subject to cut-off flows being achieved, is the prior day's production volume.	121,983 m^3	×	80 m^3/s	66%	71%
4	This sub-option includes a flow proportional discharge whereby discharge volumes can increase as River flows increase. This enables some drawdown of the storage facility during the winter months. A River cut-off flow of the median flow (74 m^3/s) has been assumed meaning that discharge can only occur on average 50% of the time. In this sub-option, discharge volumes progressively increase up to a maximum of 2,670 m^3/day (which is roughly the maximum production rates). This means that the stored volume can only be drawn down when production is not at peak volumes.	113,412 m^3	×	74 m^3/s	64%	70%
5	This sub-option is as per Sub-Option 4 but in this case the discharge volume progressively increases with River flow up to a maximum of 4,000 m^3/day. This could enable some drawdown of the stored volume even when production is at its peak. The maximum discharge volume of 4,000 m^3/day is still a significant reduction on the current consented maximum of 6,000 m^3/day.	99,307 m^3	×	74%	56%	63%

Sub-Option 1 has been selected as the preferred sub-option and is the proposal for which resource consent is now sought. The way in which this will be implemented and operated is detailed in Section 2.7. This was selected as the preferred sub-option for the following reasons:

- It enables all wastewater (including the low strength WMRO which currently can discharge on a year-round basis without any river flow cut-off to be satisfied) to be removed from the River during the summer period as well as any time during the year that the River is below 56 m^3/s. This is a significant increase in river flow cut-off and a significant reduction in the number of days on which wastewater can be discharged to the River. With the existing discharge regime, wastewater is able to be discharged, on average, up to 75% of the time. For the 20-year period modelled, it is projected that a discharge would occur, on average 40% of the time under the proposed discharge regime.
- It enables Fonterra to reduce the effect of its discharge on in-river annual average SIN concentrations by 46% compared to the baseline scenario[1]. This is higher than the reduction that is required to be achieved across the catchment in order to meet the One Plan targets for SIN (21%).
- It enables Fonterra to reduce the effect of its discharge on in-river annual average DRP concentrations by 39% compared to the baseline scenario. While this is less than the reduction required to be achieved across the catchment to meet the One Plan target for DRP (57%), it is nonetheless a significant reduction.
- The above improvements in terms of the River discharge effects are able to be achieved with a storage volume which ensures the stored wastewater can be discharged to land over the summer period without adversely affecting soil health or causing any non-compliances with hydraulic or nutrient loadings to the wastewater farms.

Sub-Option 1 is considered the BPO as it represents the best method for minimising actual and potential effects on the environment, taking into account that:

- the nature of the discharge being treated dairy process wastewater (i.e. no human wastewater);
- it removes the discharge from the River at sensitive times being summer periods and lower river flows;
- it represents an appropriate level of capital investment commensurate with the environmental improvements that will be realised; and
- while removal of the discharge from the river at all times is not yet feasible, it provides a significant step towards that objective being achieved in the future.

It is therefore considered that the proposed option and sub-option represents the BPO as defined in Part 1, Section 2 of the RMA.

The following section details how the BPO will be implemented and operated.

1. *A reduction of in-river effects of 46% for SIN is as per Table 23 of Aquanet's which relates to the future effects assessment incorporating more recent data than was available at the time that the options assessment summarised in Table 2.5 was undertaken. This is the reason for the difference between 46% reduction in effects quoted here compared to the 48% reduction estimated in Table 2.5.*

2.7 Details of Proposed Wastewater Management and Discharge Regime (BPO)

The proposed discharge wastewater management system has been shown schematically in Figure 1.2. In summary it involves:

- Ongoing waste reduction at source
  - Fonterra and Goodman Fielder will continue existing initiatives and programmes targeted at water use reductions, process efficiencies and separation of gross solids for reuse.
- Wastewater treatment using DAF and RO processes including ongoing use and optimisation of existing treatment processes.
- Split Discharge Regime with First Priority to Land
  - Retentate (high strength) waste stream will be discharged direct to land when ground conditions allow therefore prioritising the majority of contaminants to land. Only permeate may be discharged to the River.
  - Permeate will be directed to storage in a new 95,000 m^3 storage facility (to be constructed within three years of commencement of consent). The storage facility will be progressively filled during the production season and will be emptied during peak irrigation season (summer period).
  - Stored permeate and retentate will discharged to land when soil conditions allow. The discharge of the retentate (higher strength) streams to land takes precedence over the permeate streams.
  - Permeate is to be discharged to the River during winter months subject to the river flow being above 56 m^3/s. The maximum amount discharged will be equivalent to the previous day's production and no more than 3,000 m^3/day. The limit to the previous day's production means that the storage facility can only be emptied by discharging to land. The proposal does not involve emptying the storage facility via discharge to the River.
  - Generally there will be no discharge to the River between 1 November and 30 April. However, a November discharge condition is sought for WMRO only to be discharged to the River if soil moisture conditions are such that it cannot be discharged to land. The proposed November discharge condition does not allow for WWRO permeate to be discharged to the River in November. See Section 2.7.3 for more details.
  - A contingency condition is also sought for discharge to River when the River is above the 20th Flow Exceedance Percentile (FEP) and wastewater irrigation farms are inundated with rainwater or floodwater. See section 2.7.4 for more details.

As discussed earlier, the proposal represents a continuation of the ongoing improvement process which has been implemented since the existing consent was granted. The proposal therefore involves continuing with existing initiatives and programmes with respect to minimisation of waste at source, as well as the existing DAF and RO treatment processes. The significant improvement which is being implemented at this stage is the addition of large-scale storage to be able to increase the amount of wastewater discharged to land in a sustainable manner, whilst also significantly reducing the volume discharged and in-river effects of the discharge. Further, it allows the wastewater which is discharged to River to occur under river flow conditions and timing that minimise the potential effect of the discharge.

2.7.1 Construction & Commissioning Timeframe

Timeframe for Construction and Commissioning of Storage Facility: 3 Years

Fonterra is seeking to secure resource consent for the discharge to river before commencing the detailed and construction of the storage facility. This is normal practice for any consent applicant or consent holder, in order to ensure there is certainty as to the activity's ability to operate under a new consent, as well as certainty as to consent conditions which may influence design of any capital upgrades.

If constructed as a pond or similar, it will be lined with a liner with a permeability that does not exceed 10^{-9} m/s. This liner permeability standard is that specified in the One Plan for storage facilities for a range of other wastewaters.

The storage facility will be constructed to provide the following minimum storage volumes:

- A "dead" volume storage below the bottom outlet level. This provides for a minimum depth of wastewater at all times in order to protect the liner. Feasibility design indicates this storage volume is in the order of 4,750 m^3.
- An effective storage volume no less than 63,750 m^3. This is the effective storage volume available for storage of permeate.
- An allowance for rainfall capture equivalent to the average annual rainfall for the site. The volume required will be determined based on the final shape and area of the storage facility, but is estimated to be approximately 16,500 m^3 if constructed as a pond or similar type of facility.
- An allowance for additional storage during November of 10,000 m^3 as discussed in Section 2.7.3 below.
- Sufficient freeboard allowance to prevent overflows if constructed as a pond or similar type of facility.

Fonterra propose a consent condition which will require the storage facility and new discharge regime to be implemented within the first three years of grant of consent. Fonterra seeks to implement the proposed improvements as soon as possible, however, the three-year timeframe is proposed in order to provide sufficient time for detailed design, obtaining earthworks consents for the construction activity[6], and that the earthworks can be undertaken during the normal earthworks construction season (i.e. summer period). In addition to the construction of the storage facility, a number of infrastructure improvements are required to be able to fully commission the system. These include:

- Connecting pipework from the existing discharge pipeline to the new storage facility, and outlet pipework from the storage facility to the irrigation system and river discharge outlet structure.
- Installation of power and telemetry systems for pumps and controls at the storage site.
- Outlet controls (i.e. pumps, valving, meters and telemetry) in order to be able to control the discharge rate on a daily basis to match the previous day's production and to allow for a 24 hour discharge to the River, rather than the existing practice of a pulse discharge during operating periods.

The three-year timeframe provides for the above works to be undertaken including sufficient contingency to allow for timing of grant of consent and the possibility of a wet construction season which may delay implementation. The timing of grant of consent is relevant as a grant date in spring / summer may mean that design is still occurring during the first construction season.

6 *This will be a controlled activity under Rule 13-2 of the One Plan and therefore there is certainty that this consent will be able to be secured, however, it cannot be sought until detailed design is completed and the construction methodology for management of sediment is confirmed.*

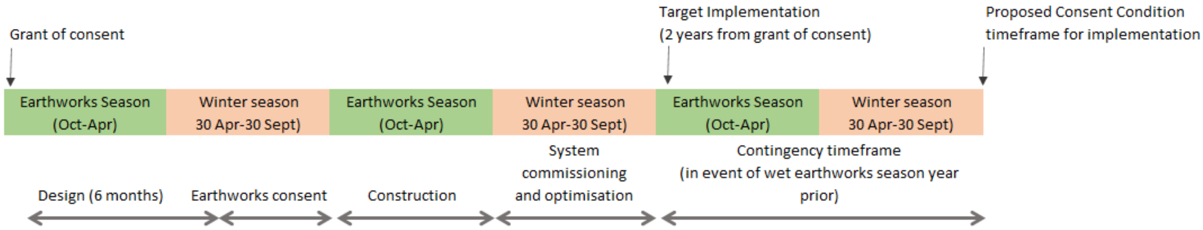

Figure 2.6: Implementation Timeframe

Proposed Discharge Regime During 1st 3 Years

The proposed discharge regime during the first three years of grant of consent relies on existing infrastructure. However, it is recognised that the existing consent authorises discharges in excess of what is required. Therefore, rather than propose a carry-over of the status quo consent conditions, Fonterra is proposing the following:

- Maximum discharge to the River of 3,000 m^3/day between 1 May to 31 October, with no discharge allowed when the river is below 37 m^3/s. This is half of the daily wastewater volume authorised by the existing consent.
- Only WMRO to be discharged to the River between 1 November to 30 April and the maximum discharge to the river to be limited to 1,000 m^3/day. This is less than half of the WMRO daily volume authorised by the existing consent.
- All wastewater shall be treated via reverse osmosis processes (DAF and RO for wastewater, and RO for whole milk) prior to discharge to the River.
- Only permeate (plus rainwater collected in the storage facility) shall be discharged to the River. All retentate shall be discharged to land.
- Where soil moisture conditions allow, permeate shall be discharged to land as a priority over discharge to the River.

The above reflects the current operating regime and reduces the consented discharge limit to that which reflects current peak production including some contingency allowance to provide for daily variation. The contingency to allow for daily variation is required as the figures provided in Table 2.2 present monthly average discharge volumes, as opposed to peak daily volumes. Until the storage facility is constructed, there is no storage within the system and therefore the consent needs to provide for peak daily production.

During this period, the ongoing focus on site processes regarding efficiency of water use and reduction of contaminants at source (as per Section 2.2) will continue on a Business-as-Usual basis.

2.7.2 Operation & Discharge Regime Once Storage Facility is Commissioned

At the Fonterra and Goodman Fielder manufacturing sites, an ongoing focus on production efficiency, water use efficiency and minimising waste at source will continue. These efficiency and source control measures are driven by, and managed via business sustainability initiatives and, as such, are not proposed to be conditioned as matters for the consent.

Treatment processes will continue as per the existing treatment which has been summarised in Section 2.3. This includes:

- Buffer storage for flow balancing to ensure that there is a consistent feed of influent into the treatment process in order to optimise treatment efficiency

- Dissolved Air Floatation (DAF) as the primary treatment system. Where the discharge will be direct to land, and not via the storage facility or to the river, DAF treated wastewater may be discharged directly to land without additional treatment. Discharge direct to land of DAF treated wastewater is appropriate and does not have any change to the effects of the discharge to land compared with discharging RO treated waste to land. The RO process essentially separates the wastewater from the DAF process into a high strength low volume retentate stream and a low strength high volume permeate stream. If both of these waste streams are being discharged at the same time direct to land, there is no benefit in separating these waste stream through the RO process only to have them re-blended again via direct discharge to land. The RO process is therefore only used where permeate is being stored and / or discharged to the river.
- Reverse Osmosis treatment to further reduce contaminant load on wastewater to be stored and / or discharged to the River.

Following treatment, the RO retentate will be discharged directly to land without storage. The retentate is unsuitable for storage as it would lead to algae growth and odour issues if stored. The retentate is a low volume (generally less than 1,000 m^3/day) but higher strength wastewater as the RO process essentially retains contaminants from passing through the RO membranes, and this 'retained' waste stream is the retentate. The retentate stream is discharged direct to land in all circumstances.

The WWRO permeate waste stream and the permeate from the WMRO process will be discharged direct to the storage facility. As described earlier, the retentate from the WMRO process is the raw milk product and is transported to another Fonterra site for manufacturing.

The storage facility will be managed to progressively fill during the winter season. The intention is to be able to target the effective storage volume to be near fill prior to the commencement of the summer irrigation period. The volume of wastewater which is contained within the storage facility at the start of the summer period, essentially represents wastewater that is prevented from being discharged to the River.

During the winter season, when production (and therefore wastewater generation) is at peak, the capacity for the land to accept wastewater is typically at its lowest. The storage facility essentially enables that peak wastewater production to be decoupled from the land's capability to accept the wastewater as wastewater is stored and then discharged to land over summer.

The proposed storage volume is not sufficient to prevent discharges to the River during the winter season[7]. Therefore, the level in the storage facility will be carefully managed to ensure that it is progressively filled throughout the season (as opposed to filling up within the first few months and then needing to increase discharge to the River later in the season). Management of the storage level will require judgement as to rate of filling taking into account soil moisture conditions for discharge to land, long term weather projections and River flows. It is proposed that this be managed via Wastewater Operational Procedures, with the consent conditions specifying a series of criteria, or 'rules' which inform the operational decision making. These criteria or rules would be:

- There shall be no discharge to the River between 1 November and 30 April, except as per conditions for the November discharge regime and contingency discharge as set out in sections 2.7.3 and 2.7.4 below.
- Levels in the storage facility will be managed to achieve a fill, or near fill, effective storage volume at the end of October each year, as far as practicable. Note that "fill" in this context means the

7 *As discussed in Section 2.6.2, larger storage volumes have been considered, however, the feasible storage volume is limited to the amount of wastewater which can be sustainably discharged to land over the summer season. Larger storage volumes would likely require 'dumping' of excess wastewater to River at the start of the next winter season as soon as River flows are above the cut-off flow.*

effective storage volume plus any rainfall as has been collected over the winter season. It does not include filling of the 10,000 m^3 storage volume provided for November month as discussed in Section 2.7.3 below.

- When soil moisture conditions allow over the winter period, stored permeate shall be discharged to land in accordance with the irrigation consent.
- Stored permeate may be discharged to the River subject to the following criteria being met:
  - River flows must be above 56 m^3/s, as determined by the average daily flow at the Teachers College gauging site.
  - Discharge rates are set such that the daily discharge volume is evenly spread out over a 24-hour period.
  - Discharge volume on any day shall not exceed the prior day's total volume of RO permeate produced (combined volume of WWRO and WMRO) plus an allowance for rainfall (nominally 100m^3). A metering tolerance of 5% is also to be provided. This is because the system will be based on metering volumes from the exit of both RO plants being used to set the discharge flow rate which will be measured on the discharge pipeline. As per Horizons Regional Council's standard conditions for metering of water takes and discharge permits, flow meters are required to be calibrated to be accurate to $\pm$5% and therefore this meter accuracy needs to be provided for when assessing compliance with the operational intent that the discharge on any day is not more than the prior day's production plus rainfall allowance (being rainfall collected in the storage facility).
  - The maximum daily discharge to the River is 3,000 m^3/day.
  - All discharges of permeate will be from the storage facility. There is to be no direct discharge of permeate from the RO treatment plants to the River unless it is direct discharge of WMRO permeate as per the November discharge condition (refer section2.7.3 below) or unless it is necessary to bypass the storage facility for emergency or maintenance purposes.
  - There shall be no discharge of retentate to the River.

All discharges to the River will be via the existing outlet structure as described in Section 3.

2.7.3 November Discharge Regime

The proposed regime has been designed to give effect to the existing consent's requirement that there be no discharge of high strength effluent to the River between 1 November and 30 April. Further, the objective is for there to be no discharges of wastewater between 1 November and 30 April each year.

However, experience with the existing wastewater system has shown that it can be difficult to manage the system during November as, in this region, November can often be a wet month. Soil moisture conditions may limit the irrigation area from accepting all wastewater which is produced in November. Modelling has shown that this is expected to occur approximately 5 years out of every 20 (i.e., there is typically a 25% chance that soil moisture conditions in November will prevent all wastewater to be discharged to land). For this reason, the storage facility volume includes an allowance for an additional 10,000 m^3 storage volume to be set aside for use during November. This allows for additional WWRO permeate to be stored in the event that soil moisture conditions do not enable all wastewater in November to be discharged to land.

Notwithstanding this additional storage volume, Fonterra is seeking an ability to discharge some WMRO permeate to the River during the month of November. This would generally only be required to occur in November months which are wetter than average in terms of rainfall. Given that it is a "wetter than average" trigger for such a discharge, a condition which enables discharge during November is sought separately from the 'Contingency condition' discussed below. This is because Fonterra seeks that the contingency condition is set aside for very infrequent application and not relied upon by operations unless exceptional circumstances exist.

It is proposed that discharge to the River in November is only enabled when the following criteria are met:

- The consent authority is to be notified prior to any discharges occurring in November.
- Soil moisture conditions are such that the WMRO permeate cannot be discharged to land (with land irrigation capacity being prioritised to the WWRO retentate and permeate streams).
- Only Whole Milk Reverse Osmosis (WMRO) wastewater may be discharged to the River. All other wastewater (WWRO retentate and WWRO permeate) is to be stored or discharged to land.
- The maximum daily discharge shall not exceed 1,000 m^3/day.

Under the current consent, WMRO may be discharged to the River throughout the November to April period at rates of up to 2,500 m^3/day and irrespective of river flow. The November discharge condition therefore represents an improvement from the existing consent during the November period in that discharges to the River in November will only occur when soil moisture conditions prevent discharge to land; and with a reduced maximum daily volume of 1,000 m^3/day. Notification to the consent authority is also required in order to exercise the November discharge condition which provides ability for the consent authority's compliance staff to verify the necessity of the November discharge.

2.7.4 Contingency Discharge

Section 2.7.2 has described the normal operation of the proposed system and Section 2.7.3 has described how the system will be managed when there is a wet November. However, there remains the possibility of a significant weather event or flood that may prevent discharge to land and require a contingency discharge to the River. The type of situation which would require such a discharge would be an event similar to the February 2004 floods in the Manawatū River.

A contingency discharge to River is sought to enable a discharge if there is a significant wet weather or flood event that precludes discharge to land.

It is sought that a contingency discharge be authorised which provides for a discharge to River as follows:

- The consent authority is notified prior to exercising the contingency discharge.
- A discharge to River may occur between 1 November and 30 April in the event that irrigation farms are subject to inundation from significant wet weather or flood events.
- The discharge to River may only occur if the River flows are above the 20th FEP flow (164,281 m^3/s). This River flow is such that the river is in flood, and the One Plan targets are not applicable based on the definition within Schedule E.
- Both permeate and retentate waste streams may be discharged to the River. This includes permeate and retentate that is produced as well as stored permeate. Stored permeate is able to be discharged to the River in order to free-up storage volume for storage of wastewater after the flood event and prior to the wastewater irrigation farms being dry enough to receive discharges to land.
- The maximum daily discharge shall not exceed 4,000 m^3/day.

The above does not require that any available storage volume within the storage facility is utilised prior to discharge to the River in this event. This is because the River flows are such that any effects of the discharge will be negligible and available storage volume is best retained for use to store wastewater after the flood event has receded. This storage is necessary as there will likely be a delay between the time that the River flows fall below the 20th FEP and the wastewater irrigation farms having dried out sufficiently such that they can begin to receive wastewater irrigation.

2.7.5 Proposed Monitoring and Reporting

It is proposed that the system be managed and operated in accordance with Wastewater Operational Procedures which will be developed and provided to the Regional Council within three months of commissioning of the storage facility and proposed discharge regime.

A monitoring and reporting programme is proposed to be implemented which includes:

- Metering and recording of daily discharge volumes, including telemetry for information to be provided to Horizons on a daily basis as per Policy 14-8 of the One Plan.
- Weekly 24-hour flow composite sampling of the wastewater quality which is discharged to the River, in the weeks that a discharge to the River is occurring.
- In-River monitoring of the water quality in the River at a site upstream of the discharge and at the first safely accessible monitoring site downstream of the reasonable mixing zone. Grab samples are to be taken monthly, at times when the discharge is occurring. In months that there is no discharge to the River, in-river monitoring will not be required.
- Notification to Regional Council prior to discharges occurring under the November or contingency discharge regimes.
- An annual monitoring report to be provided detailing all monitoring undertaken during the year, an assessment of the monitoring results and compliance with consent conditions, and details of any actions undertaken to address any non-compliances. The report shall also include a commentary as to how the discharge has been operated in accordance with the WOP.

Further details are provided in Section 6.1 of this report which sets out a framework for consent conditions which are offered by the applicant.

3 DESCRIPTION OF RECEIVING ENVIRONMENT

The receiving environment for the discharge of treated process wastewater is the Manawatū River, with the discharge point being located at the end of Walkers Road, Longburn. For the purposes of this application, and in particular, the considerations with respect to the effects of the discharge on water quality, the existing environment is considered to be the Manawatū River water quality as it is currently upstream of the existing discharge. This is considered to be representative of the existing environment taking into account natural conditions, permitted land uses, and other consented activities, but excluding the effects of the existing Longburn site discharge.

The discharge is via a rock outfall structure at the discharge site shown in Figure 3.1. The wastewater flows beneath the rock surface and enters a side stream of the Manawatū River.

Figure 3.1: Discharge Site
(Note: Wastewater flows through the sub-surface of the rock structure)

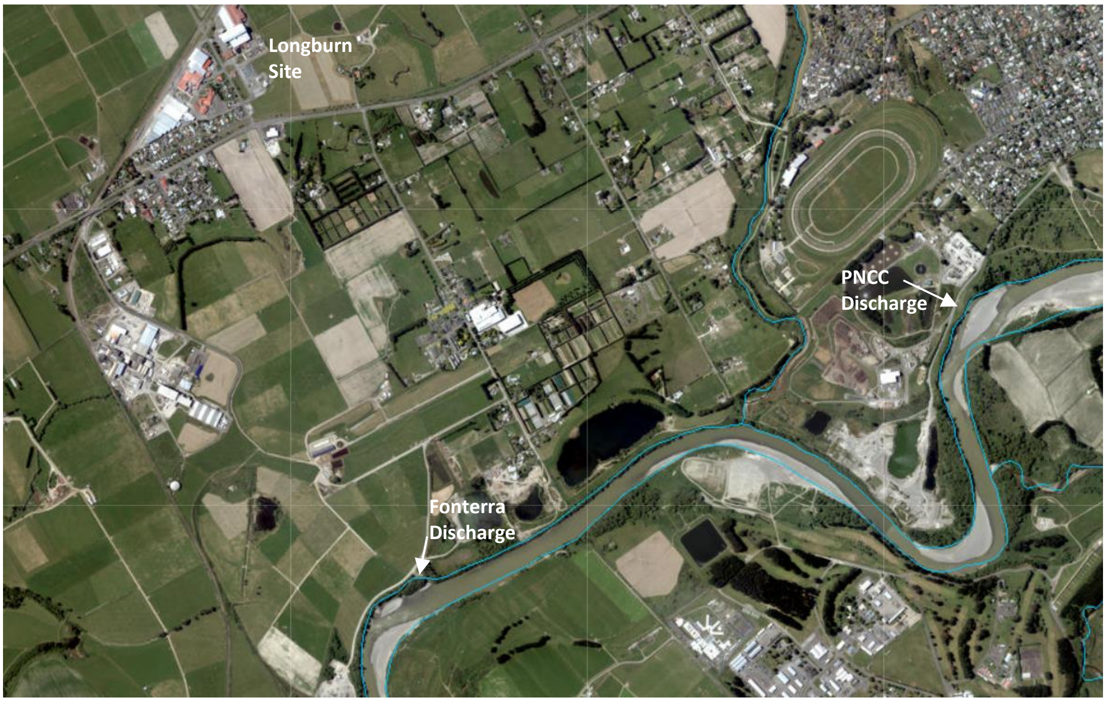

Figure 3.2: Discharge Point to the Manawatū River (General Location)

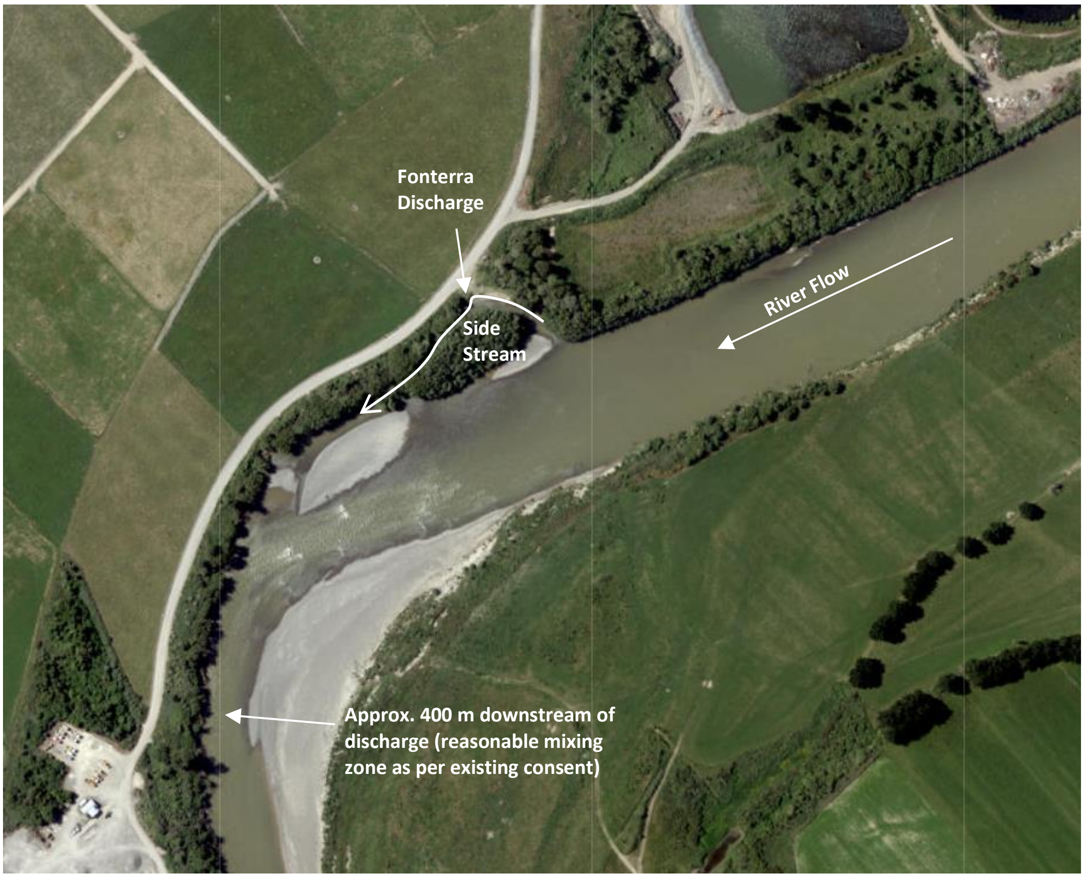

Figure 3.3: Close Up of Discharge Point to Manawatū River

3.1 Statutory Acknowledgement Area

The discharge is within a Statutory Acknowledgement Area for Rangitāne o Manawatū. A copy of the Statutory Acknowledgement Area description which describes the area and Rangitāne's relationship with the awa is included in Appendix F.

3.2 Receiving Environment Classification under the One Plan

Horizons Regional Council's One Plan, which is the combined Regional Policy Statement and Regional Plan, defines Water Management Zones and sub-zones and specifies values for which each water management zone or sub-zone are to be managed.

The discharge point is located within the Lower Manawatū (Mana_11) Water Management Zone and the Lower Manawatū (Mana_11a) Water Management Sub-zone as defined in Schedule A of the One Plan. The values for which this zone and sub-zone are to be managed are defined in Schedule B of the One Plan.

The zone-wide values and the management objective associated with those values (as per Table 5.2, Policy 5-1 of the One Plan) are presented in Table 3.1 below.

Table 3.1: One Plan Values and Management Objectives for the Lower Manawatū

Value Group	Value Assigned to Mana_11a (zone wide values unless specified below)	Management Objective as per Table 5.2, Policy 5-1 of the One Plan
Ecosystem Values	Life Supporting capacity: Hill mixed	The water body and its bed support healthy aquatic life / ecosystems.
	Sites of Significance - Riparian: This value is a reach specific value which applies across the entire Mana_11a sub-zone in order to protect gravel and sand habitat for dotterel.	Sites of significance for indigenous riparian biodiversity are maintained or enhanced.
Recreational and Cultural Values	Aesthetics	The aesthetic values of the water body and its bed are maintained or enhanced.
	Contact Recreation	The water body and its bed are suitable for contact recreation.
	Mauri	The mauri of the water body and its bed is maintained or enhanced.
	Sites of Significance - Cultural: This value is a reach specific value and applies across the entire Mana_11a sub-zone in relation to the 'density of cultural and historical significant sites including wāhi tapu and taonga' for Rangitāne o Manawatū.	Sites of significance for cultural values are maintained.
	Amenity: This value is a reach-specific value and applies to, and upstream of, the Palmerston North City urban area and therefore upstream of the discharge point. This value therefore does not apply to the discharge or its receiving environment.	The amenity values of the water body and its bed (and its margin where in public ownership) are maintained or enhanced.
	Trout Fishery (III: Other): This value is a reach specific value and applies across the entire Mana_11a sub-zone.	The water body and its bed sustain healthy rainbow or brown trout fisheries.
Water use	Industrial Abstraction	The water is suitable as a water source for industrial abstraction or use, including for hydroelectricity generation.
	Irrigation	The water is suitable as a water source for irrigation.
	Stockwater	The water is suitable as a supply of drinking water for livestock.
Social / Economic Values	Existing Infrastructure	The integrity of existing infrastructure is not compromised.
	Capacity to Assimilate Pollution	The capacity of a water body and its bed to assimilate pollution is not exceeded.
	Flood Control and Drainage: This value is a reach specific value and applies across the entire Mana_11a sub-zone in relation to the Lower Manawatū Scheme.	The integrity of existing flood and river bank erosion protection structures and existing drainage structures is not compromised and the risk associated with flooding and erosion are managed sustainably.

3.3 Manawatū River Water Quality and Life Supporting Capacity at, and in the vicinity of, the Discharge Point

The current state of the Manawatū River at, and around, the point of discharge has been assessed by Aquanet Ltd in their report included at Appendix D. The receiving environment is described in the Aquanet report as follows:

> *The Manawatū River arises in the Ruahine Ranges, runs through the Manawatū Gorge and flows into the sea at Foxton Beach / Manawatū Estuary. The Longburn dairy plant discharge flows into a reach that is currently impacted by cumulative effects, and nutrient concentrations do not meet the relevant Horizons One Plan targets upstream of the discharge. Of particular note is the contribution of the Palmerston North City Council (PNCC) Totara Road Wastewater Treatment Plant (WWTP) discharge to degraded water quality. This discharge enters the Manawatū River ~3.5 kilometres upstream of the Longburn Plant, and significantly increases both nitrogen and phosphorus concentrations in the Manawatū River.*

The Aquanet Ltd report found that the water quality upstream of the Fonterra discharge met the One Plan Schedule E water quality targets for the following parameters:

- Ammonia-N
- Change in Clarity
- Particulate Organic Matter (POM)
- pH and Change in pH
- Temperature
- Soluble $cBOD_5$
- Dissolved Oxygen

The water quality upstream of the Fonterra discharge does not meet the One Plan Schedule E water quality targets for the following parameters:

- Soluble Inorganic Nitrogen (SIN)
- Dissolved Reactive Phosphorus (DRP)
- *E. coli*
- Clarity

In terms of the National Objectives Framework for water quality set out in the National Policy Statement for Freshwater Management (NPSFM), Aquanet found that:

- unionised ammonia (NH_3-N) concentrations upstream of the Longburn discharge were assigned to attribute state C for ammonia toxicity under the NPSFM, and failed to meet the national bottom line for this attribute;
- NO_3-N concentrations in the Manawatū River upstream of the Longburn Plant were assigned to attribute state A under the NPSFM;
- *E. coli* concentrations upstream of the Longburn Plant fell into attribute state E under the NPSFM, meaning that it is not considered suitable for primary contact recreation.

3.4 Hydrology – River Flow Statistics

The relevant flow statistics for the River in this stretch are determined via the Regional Council's Teacher's College flow gauging site and are as follows:

- 20th Flow Exceedance Percentile (FEP): 164.3 m^3/s.
  This is the flow which statistically, is exceeded 20% of the time and represents the River being in flood / high flows. The One Plan Schedule E targets do not apply to flows that are above the 20% FEP.
- Mean Flow: 116.6 m^3/s
- Median Flow: 73.4 m^3/s
  The median flow means that, statistically, the River will be above this flow 50% of the time, and will be below this flow 50% of the time.
- Half Median Flow: 36.7 m^3/s

4 REGULATORY FRAMEWORK - ACTIVITY STATUS OF PROPOSED ACTIVITY

This section of the report sets out the regulatory framework relevant to this application and identifies the resource consents required for the proposed activity. For an assessment of the activity against the relevant objectives and policies, refer to Section 8 of this application.

4.1 Discharge of Treated Process Wastewater to the Manawatū River

Section 15 of the Resource Management Act (RMA) states that no person may discharge any contaminant into water unless the discharge is expressly allowed by a national environmental standard or other regulations, a rule in a regional plan, or a resource consent.

There is no national environmental standard, no other regulations and no rule in the regional plan[8] that permits the activity. Therefore, a resource consent is required for the proposed activity as per Section 15 of the RMA.

The relevant Regional Plan is Part II of Horizons Regional Council's One Plan. There is no proposed plan relevant to this application.

As the proposed activity is not provided for in any specific rules within the One Plan, the relevant rule is the "Default Discharge Rule", Rule 14-30 which is as follows:

14.11 Rules - Default Discharge Rule

Rule	Activity	Classification	Conditions/Standards/Terms	Control/Discretion Non-Notification
14-30 ***Discharges*^ of water^ or *contaminants*^ to *land*^ or water^ not covered by other *rules*^ in this Plan or chapter**	The *discharge*^ of *water*^ or *contaminants*^ into surface *water*^ pursuant to s15(1)(a) RMA or *discharge*^ of *contaminants*^ onto or into *land*^ pursuant to ss15(1)(b), 15(1)(d) or 15(2A) RMA which are not regulated by other *rules*^ in this Plan, or which do not comply with the *permitted activity*^, *controlled activity*^ or *restricted discretionary activity*^ *rules*^ in this chapter.	**Discretionary**		

The proposed activity therefore falls to be considered as a **Discretionary Activity** under Rule 14-30 of the Regional Plan.

8 *Rule 14-26 of the Regional Plan (One Plan, Part II) provides for some discharges as a permitted activity, however this rule only permits discharges up to 50 m^3/day. The proposed activity clearly exceeds this threshold without needing to consider whether there is compliance with the other permitted activity criteria. Therefore, the proposed activity is not provided for by a rule in the Regional Plan.*

4.2 Manawatū River Discharge Structure - Maintenance

The proposal does not include any physical works on the existing discharge structure. The structure was upgraded in late 2017 in order to remove the "end of pipe" discharge and provide a rock structure through which the wastewater can filter prior to discharge below surface level to the Manawatū River.

While no physical works are proposed, maintenance of the structure may be required during the term of the consent. In terms of the use and maintenance of the structure, the relevant rules are as follows:

- Rule 17-4 which provides for the **use of the structure as a Permitted Activity.** There are no permitted activity criteria specified in this rule. (i.e. no criteria that need to be satisfied in order to confirm permitted activity status)
- Rule 17-5 which provides for the maintenance and upgrade of structures and ancillary removal of bed material and plants as a Permitted Activity. This rule requires that the activity be undertaken in compliance with the general conditions of Section 17.3 of the One Plan. Any likely maintenance and upgrade activities would be able to meet the general conditions of Section 17.3. Rule 17-5 also includes a criteria which constrains the discharge of any removed bed material or plants to land. If any maintenance works required removal of bed material or plants, these would be disposed of to an approved site (e.g. landfill, or separately consented site) and compliance with criteria (b) of Rule 17-5 would be achieved.
- Rule 17-15 provides for 'Activities Affecting Schedule B Value of Flood Control and Drainage' as a Discretionary Activity, however, the activity description for Rule 17-15 specifically states that this rule is for activities "except as regulated by Rule 17-5". It is considered that any proposed maintenance or upgrade of the structure would be regulated under Rule 17-5 and consent for such activities under Rule 17-15 is not required.

Therefore, it is considered that any maintenance or upgrade of the structure in order to ensure the proper functioning of the discharge, would be able to be undertaken as Permitted Activity under Rule 17-5.

4.3 Discharge of Treated Wastewater to Land on Innesmoor and Thornton Park Farms

The discharge of treated wastewater to land, being the Fonterra owned Innesmoor and Thornton Park farms which are managed primarily for wastewater discharge purposes, will be undertaken in accordance with the existing resource consent for this activity. Resource consent APP-20090131720.01, which expires March 2033, authorises the discharge of treated wastewater to land and the discharge will continue to operate in compliance with this consent.

An assessment of the proposed discharge regime's ability to operate in accordance with the land discharge consent APP-20090131720.01 is included in Appendix C2. This concludes that the proposed discharge regime is able to be undertaken in compliance with the consent conditions. The assessment has been undertaken assuming that the storage facility is completely full at the start of the summer period including the November storage allowance and any rainfall allowance (i.e., the 95,000 m^3 of stored permeate and rainfall is required to be discharged to land over the summer period in addition to the wastewater that is generated by the Longburn site over summer). This is a worst-case scenario in terms of volume of wastewater to be discharged to land over the summer period and therefore it is a conservative estimate. The assessment also assumes that the storage facility does not begin to be emptied until December each year, and therefore the ability to empty the storage facility is not reliant on having favourable conditions in November, but does require that in particularly wet years discharge of WMRO permeate to the River can continue under certain conditions.

The assessment noted that some minor changes to farming operations (i.e. altered fodder crop regime in small areas of the farms) will be required to ensure compliance with the consented nitrogen leaching limits. Fonterra confirms that these changes to the farming operations will be undertaken at the time (or prior to) the storage facility being operational. Annual reporting under the discharge to land consent including provision of Overseer nutrient balances on an annual basis will ensure that compliance is achieved.

4.4 Storage Facility Construction & Operation

While there are multiple ways in which the required storage volume can be provided, it is likely that this will be achieved by construction of storage facility on the Innesmoor Farm property. If this is the case, construction and operation of the storage facility will require the following resource consents:

- Land Use Consent from Palmerston North City Council as a Discretionary Activity under Rule R9.8.2 of the District Plan in relation to a ' rural industry' located within a Rural Zone.
- Land Use Consent from Palmerston North City Council as a Non-Complying Activity under Rule R6.3.8.1 for the District Plan in relation to earthworks for construction.
- Land Use Consent from Horizons Regional Council as a Controlled Activity under Rule 13-2 of the One Plan for large scale land disturbance for construction.
- Discharge to Air Consent from Horizons Regional Council as a Discretionary Activity under Rule 15-17 for any discharge of odour or other contaminants from the storage facility.

The above consents do not form part of this application and as noted Fonterra will seek resource consent for the above activities as a separate application. The reasons for this are that the effects of the storage facility are limited in both time (construction effects) and location given any effects from the storage facility will be limited to the subject and adjacent properties. For completeness, Appendix G identifies the consents required for the storage facility and provides an assessment of the applicant's ability to obtain the necessary consents.

4.5 Summary of Resource Consents Required

Tables 4.1 and 4.2 summarise the above analysis and identify the resource consents required to undertake the proposed activity and for the proposal overall.

Table 4.1: Summary of Resource Consents Required for Activity

Activity	Activity Status and Resource Consent Required	Status
Discharge of Treated Process Wastewater to the Manawatū River	Discharge permit required as a Discretionary Activity under Rule 14-30 of the One Plan	This is the subject of this application. Fonterra holds a resource consent for this activity which expires March 2022. This application seeks to obtain a replacement consent to enable the activity to continue in accordance with the proposal set out in this document.
Use of the Discharge Structure	No consent required Permitted Activity under Rule 17-4	n/a
Maintenance of the Discharge Structure	No consent required Permitted Activity under Rule 17-5	n/a
Discharge of Treated Wastewater to Land	Fonterra already holds resource consent for this activity. Existing consent APP-2009013720.01 expires 2033.	Resource consent is held for this activity.

Table 4.2: Additional Resource Consents Required for the Proposal

Activity	Activity Status and Resource Consent Required	Status
Storage Facility Construction & Operation	Land use consent for earthworks as a Non-Complying Activity under District Plan Rule R6.3.8.1.	Application to PNCC is currently being prepared and will be lodged separately to this application.
	Land use consent for operation of the storage facility as a rural industrial activity as Discretionary Activity under District Plan Rule R9.8.2.	
	Land use consent as a Controlled Activity under Regional Plan Rule 13-2 for land disturbance during construction.	A separate application will be lodged prior to construction. Consent must be granted by Regional Council.
	Discharge to Air Consent from Horizons Regional Council as a Discretionary Activity under Rule 15-17 for any discharge of odour or other contaminants from the storage facility.	A separate application will be lodged with Regional Council for this activity.

5 ASSESSMENT OF ENVIRONMENTAL EFFECTS

5.1 Effects on Cultural Values and Mauri of the Manawatū River

The Manawatū River is an awa of significant cultural value for mana whenua. It is subject to a Statutory Acknowledgement Area for Rangitāne, and the One Plan identifies the river as being a 'site of significance – cultural' due to the "density of cultural and historical sites of significance including wāhi tapu and taonga" for Rangitāne o Manawatū. The River is also of cultural significance to other iwi and hapū.

In order to understand and assess the potential effects of the discharge on the cultural values and mauri of the Manawatū River, Fonterra has engaged with Rangitāne, Ngāti Raukawa, Ngāti Kauwhata, and Muaūpoko Tribal Authority. The details of this engagement are summarised in Section 7.1.

This engagement is ongoing and a position as to the impact of the discharge on the cultural values and mauri of the River has not yet been confirmed. Fonterra acknowledges that the continued discharge of treated wastewater to the River is likely to have an impact on the cultural values and mauri of the River. That notwithstanding, iwi and hapū groups that have been engaged with have acknowledged the fact that the discharge does not contain human wastewater and that complete removal of the discharge from the River is not viable at this time.

Mitigation has been explored in relation to the discharge structure and whether additional land passage and / or riparian planting would be an appropriate mitigation measure. Rangitāne o Manawatū has advised that they consider that changes to the discharge structure and land passage would not be a necessary cultural effects mitigation measure, however they would like to see improvements to the riparian vegetation in this area. Fonterra is continuing to explore riparian planting improvement options noting that it does not hold ownership of the riparian area.

5.2 Effects on Water Quality and Ecosystems in the Manawatū River

The effects of the current and proposed discharge on the Manawatū River have been assessed by Aquanet Ltd and are detailed in their report attached in Appendix D. This assessment has been undertaken in terms of the observed and modelled effects of the existing discharge, and modelled effects from the proposed discharge taking into account the improvements arising from the proposed discharge regime. The effects on water quality have also been assessed in terms of the observed and likely changes in water quality, as well as whether or not the relevant targets of the One Plan and the National Bottom Lines set out in the National Policy Statement for Freshwater Management are met.

5.2.1 Effects of the Existing Discharge

The effects of the existing discharge are relevant in terms of understanding the potential improvements as a result of implementing the preferred option, and also to assess the likely effects which will occur between grant of consent and implementation of the proposed option. The proposed storage facility is programmed for completion within three years of grant of consent, and therefore the benefits of implementing the proposed option will not be realised until after that date.

The effects of the existing discharge are summarised in Section 3.4 of the Aquanet Ltd report which states:

> *"The available data indicates that in the past the discharge may have resulted in statistically detectable increases in NO_3-N and SIN, concentrates in the Manawatū River and decreases in visual clarity. However, it appears there is limited potential for this to have resulted in adverse ecological effects due to the prevailing water quality conditions upstream exceeding relevant guideline levels, or downstream concentrations/ levels not being degraded beyond guideline levels by the discharge. Nevertheless, it is worth noting that the available data record may not provide a full picture of the past effects of the discharge due to:*
>
> - *Some downstream samples being collected when the discharge was not operating;*
> - *The discharge potentially not being fully mixed at the downstream site under some flow conditions, leading to cumulative effects being over estimated; and*
> - *The pulse nature of the discharge meaning that the instantaneous effects of the discharge measured through water quality sampling may be greater than the effects on daily average concentrations, which may be more important in understanding the effects on factors such as periphyton growth.*
>
> *That the discharge is unlikely to have had a detectable effect on aquatic life is supported by the results of ecological monitoring which shows that while the Manawatū River at Longburn is generally in poor to fair ecological health, there is no indication that the discharge is having adverse effects on aquatic communities (plant or macroinvertebrate) in this stretch of the river."*

The Aquanet report also discusses a survey undertaken of the side stream of the Manawatū River into which the discharge enters. This side stream is within the reasonable mixing zone for the discharge. The purpose of the side stream survey was to assess for any evidence of sewage fungus, odour, scum, floatables or any other effects identified in section 107 of the RMA. The Aquanet report states that no evidence of any such effects was found.

In summary, the assessment undertaken by Aquanet Ltd concludes that the existing discharge is unlikely to have a detectable effect on aquatic life. This is supported by ecological monitoring which does not indicate that the discharge is having adverse effects on aquatic communities.

Based on the above conclusion, along with the limited timeframe that the existing discharge will continue (up to three years from grant of consent), **it is considered that actual and potential effects of the existing discharge occurring for a further three years on the water quality and aquatic communities of the Manawatū River are less than minor.**

5.2.2 Effects of the Proposed Discharge

The Aquanet Ltd report has identified that the proposed discharge regime will result in benefits to the River primarily through the following improvements:

- The complete removal of discharges to the River during late spring to early autumn. At present, WMRO is discharged to the River during this period irrespective of river flows.
- An increase in the river cut-off flow such that no wastewater will be discharged when the river is below 56.5 m^3/s. This is a significant increase from the existing flow cut-off which is 37 m^3/s.
- Improved treatment performance through use of the WWRO plant for all wastewater (whereas in previous years, some wastewater discharged to the River had only been treated via the DAF). It should be noted that this improvement is not dependent on the storage facility and therefore has already been implemented by Fonterra.
- A change from the current pulse discharge regime (i.e. discharging only over a few hours per day) to a continuous 24 hour per day discharge. As noted in the Aquanet report, this will mean that the instantaneous effects of the discharge will no longer be greater than the effects of the daily average concentrations as may be occurring at present.

The outcome of the proposed discharge regime is that it will result in significant reductions in the effect of the discharge on in-river annual average concentrations, as set out in Table 5.1.

Table 5.1: Percent Reduction in in-River concentration effects from the Proposed Discharge Regime

Parameter	% Reduction in in-River annual average effects of the Discharge to River (for all flows below 20th FEP)
Soluble Inorganic Nitrogen	46%
Dissolved Reactive Phosphorus	39%

The Aquanet report concludes that:

> *"In the future it is expected that the effects of the discharge on both DRP and SIN concentrations will be unlikely to be detectable and the potential for adverse ecological effects caused by nutrients in the discharge will be significantly reduced by eliminating the discharge at times where the risk of periphyton growth is highest (low flows and late spring to early autumn). Furthermore, the discharge's negligible current effect on ammonia toxicity risk are expected to be further reduced, as will its effects on human health effects as it is not predicted to cause an increase in median and 95th percentile E. coli concentrations going forward.*
>
> *The discharge is not currently having an effect on periphyton or macroinvertebrate community health, and this is likely to remain the case in the future."*

Aquanet has concluded that the effects of the discharge in terms of DRP and SIN are unlikely to be detectable; the existing negligible effects on ammonia toxicity will be reduced, and the discharge will not cause an increase in median and 95th percentile *E. coli* concentrations in the river. Further, the discharge is not currently having an effect on periphyton or macroinvertebrate community health and this will continue to remain the case. For these reasons, **it is considered that the effects of the proposed discharge regime on the Manawatū River water quality and ecosystems will be less than minor.**

In terms of cumulative effects, it is noted that the Manawatū River does not meet One Plan Schedule E water quality targets upstream of the discharge for SIN, DRP, *E. coli*, and Clarity (refer Table 8 of Aquanet report). These parameters and the effect of the discharge in terms of cumulative effects has been assessed as follows:

- **Soluble Inorganic Nitrogen (SIN):** This One Plan target for average SIN is exceeded upstream of the discharge at all flows above the half median flow. Historical monitoring data indicates a small increase in SIN concentrations downstream of the discharge in all flows except those above the 20th FEP. The proposed discharge regime will result in a reduction of potential effects in relation to SIN. Aquanet has modelled that the effect of the proposed discharge regime will be less than 0.2% increase in SIN concentrations between upstream and downstream. Further, the effect of the discharge on in-river average annual SIN concentrations will be reduced by 46% compared to the baseline (current) scenario. This is well in excess of the overall reduction which is required from across the catchment in order for the River to meet the One Plan targets.
- **Dissolved Reactive Phosphorus (DRP):** The One Plan target for average DRP is exceeded upstream of the discharge, however, Aquanet has concluded that "the discharge does not appear to be increasing the magnitude or frequency of exceedances at the downstream site". Aquanet has modelled that the effect of the proposed discharge regime will be less than 0.1% increase in DRP concentrations between upstream and downstream. The effect of the discharge on in-river average annual concentrations will be reduced by 39% compared to the baseline (current) scenario. This does not meet the overall reduction required across the catchment in order for the River to meet the One Plan targets (57%), however it remains a significant reduction, particularly considering the existing discharge is not currently having a measurable effect on DRP levels in the River.
- ***E. coli*:** There are two One Plan targets for *E. coli* each of which applies at different river flows and times of the year.
  - *E. coli* must not exceed 260 per 100 mL between 1 November and 30 April when the river flow is at or below median flow. At present, this standard is met more frequently downstream (66% of the sampling occasions) than it is upstream (57% of sampling occasions). At present, treated process wastewater is not discharged to the River during the summer period, however, WMRO permeate is discharged. The proposal is to remove all discharges from the River between 1 November and 30 April (except for the wet November and contingency discharge provisions discussed below), and therefore the proposed discharge regime will not have any effect on the ability of the River to meet the *E. coli* summer target.
  - *E. coli* must not exceed 500 per 100 mL year-round when the river is at or below the 20th FEP. The upstream and downstream water quality does not currently meet this standard, however, Aquanet has identified that there is a statistically significant decrease between the upstream and downstream sites. Aquanet has modelled that the effect of the proposed discharge will be to increase *E. coli* levels in the River by no more than 0.5%.
- **Clarity:** Neither the upstream or downstream sites meet the visual clarity standard of the One Plan, however, Aquanet has found that there is no statistically significant difference in visual clarity between the upstream and downstream monitoring sites. Comparison of paired sampling results (i.e. visual clarity on any given sampling day), shows that on 58 out of 61 samples, visual clarity had improved downstream of the discharge.

The above assessment has been based on the permeates being mixed within the storage facility but did not consider potential changes in water quality for the stored permeability. A storage assessment has separately been undertaken by Beca Ltd which identified that some changes to the concentrations of chemical forms of nitrogen and phosphorus, as well as total suspended solids and particulate organic matter are likely to occur. Qualitatively it is expected that the degree of relative improvement will be slightly better than originally predicted for DRP and slightly worse for SIN. However, Aquanet has concluded that the conclusions relative to the nature, scale or risk of effects on water quality or ecology will change in any material way.

Taking the above assessment into account, it is considered that the effects of the proposed discharge in terms of cumulative effects is less than minor.

5.2.3 Effect of Discharges during Wet Novembers

As discussed in Section 2.7.3, Fonterra is seeking the ability to discharge treated wastewater permeate to the River during November in certain circumstances. Currently, when there is a wet start to the summer period (i.e., in November), the hydraulic capacity of irrigation areas can be less than required for all wastewater to be discharged to land. Under the current consent, all WWRO is already discharged to land in November, and that will continue to be the case. However, the proposal seeks to also remove WMRO permeate from the River during the summer period.

The challenges of managing the irrigation during wet Novembers will therefore be increased as the WMRO permeate waste stream (approximately 800 m^3/day on average) will also need to be discharged to the River. In 5 of the last 20 years, the hydraulic conditions were likely such that the additional WMRO permeate would not be able to be discharged to land during November without increasing the risk of runoff or ponding.

Allowance to discharge WMRO permeate direct to River during wet Novembers is therefore sought as discussed in section 2.7.3. It is proposed that WMRO permeate only be allowed to be discharged to the River in November when it cannot be discharged to land or stored, and with prior notification to the consent authority. This represents a significant reduction in discharge to the River compared to the existing consent which allows WMRO permeate to be discharged to the River at any time during November (and for the remainder of the summer period).

The effects of the discharge of WMRO permeate to the River during November will therefore be better than the effects of the current discharge.

Aquanet has assessed the effect of exercising the November discharge on the SIN and DRP reductions which have been modelled to occur with the proposed discharge regime. This assessment assumed that the November discharge was exercised every year and therefore it provides a conservative (worst-case) assessment. It was found that discharging WMRO permeate to the River during November did not materially change the overall in-river outcomes of the proposed discharge regime, including the relative reduction in the discharge’s overall effects on in-river DRP and SIN concentrations.

The effects of the proposed November WMRO permeate discharge is therefore considered to be less than minor.

It is further noted that the existing consent's exclusion of High Strength Effluent from the River from 1 November to 30 April is based on the dates considered to be the summer bathing / contact recreation season. Any discharge to occur during November will only be WMRO permeate which has *E. coli* levels of less than <100 per 100 mL. This is well below the *E. coli* water quality target for contact recreation purposes. Further the discharge will only occur when the River flows are in excess of 56 m^3/s and it is unlikely that the river would be suitable for contact recreation purposes at these flows. It is therefore considered that the effects of the November discharge of WMRO permeate on contact recreation will be less than minor.

5.2.4 Effect of Contingency Discharges

A contingency discharge is sought in the event of a significant weather event or flood which means that the irrigation areas are subject to inundation from flood or surface waters. The conditions under which the contingency discharge would occur have been set out in Section 2.7.4.

The contingency discharge is to be exercised only when the River flow is above the 20th percentile FEP. In this instance, the discharge represents no more than 0.00003% of the River flow. Further, the One Plan water quality targets as defined in Schedule E do not apply when the River is above the 20th percentile FEP and it follows that discharges above the 20th percentile FEP will not impact on the ability of the river to meet the One Plan targets.

The contingency discharge is expected to be exercised only rarely throughout the term of consent (e.g. no more than once every 10 years on average). The effects of such a discharge are therefore low probability and low consequence effects. **The effects of the contingency discharge are therefore considered to be negligible.**

5.3 Effect on Land Discharge - Irrigation to Wastewater Farms and Nutrient Leaching

The proposed discharge regime will result in more wastewater and contaminants being discharged to the two wastewater irrigation farms that Fonterra owns and manages for that purpose. The irrigation of treated wastewater to these farms is authorised under resource consent APP-2009013720.01 which expires in July 2033.

Fonterra has undertaken an assessment of the proposed discharge regime on the ability of the discharge to land to be undertaken in compliance with the irrigation consent, as well as taking into account likely nutrient leaching limits that may be applied at the time of renewal of those consents. While it is difficult to predict what the acceptable environmental limits will be at the time of consent renewal (2033), nutrient leaching limits as set out in Table 14.2 of the One Plan have been considered. The subject farms are on soil with land use capability class II and III. According to Plan Change 2 version of the One Plan, improvements required over the nitrogen leaching limit is expected to reduce to 30-35 kg N / ha / year by year 20 after the intensive land use rules have legal effect. With respect to dairy farming (which is the secondary use for the wastewater irrigation farms), the intensive land use rules have legal effect from August 2020 and therefore the 20-year limit is expected to be reached in 2030, shortly before the irrigation consents are due for renewal.

In order to ensure that the proposed wastewater system will be able to operate within consented and expected limits, Fonterra has undertaken Overseer modelling of the irrigation activity for the recent period and then for the proposed irrigation regime with the storage facility in place. This assessment is included in Appendix C2 and an electronic copy of the overseer model will be provided to Horizons upon lodgement of this consent application.

For recent years (current discharge regime), the assessment shows that:

- Nitrogen loading rates have been well below the current consented limits of 300 kg N / ha / year.
- There has been an increase in nitrogen loading on Thornton Park over the past three years. This is a result of the property being purchased by Fonterra in 2018 so that it can be managed primarily as a wastewater irrigation farm. This has meant that Fonterra has been able to discharge more wastewater to Thornton Park than previously, thereby reducing wastewater discharge to the River. Therefore, the increase in nitrogen loading to Thornton Park in the last two seasons represents a reduction in nitrogen discharged direct to the River.
- Nitrogen leaching limits have been within the consented leaching limits for both farms.

At present, all retentate from the wastewater treatment system is discharged to the farms. This will continue to be how retentate is managed. The effect of the proposed discharge regime is that more permeate will be discharged to land because of being able to store the permeate so that it can be discharged to land when soil moisture conditions allow. This means that the farms will receive a higher hydraulic loading but only a marginally higher nutrient loading (given that the higher strength retentate is already discharged to land).

The modelling undertaken for this assessment assumes that the stored wastewater volume at the start of the summer period is 95,000 m^3. This is greater than the amount of permeate modelled as being removed from the River in the freshwater ecological assessment undertaken by Aquanet. This is because the storage volume comprises not just the permeate diverted from the River discharge, but also assumes that the 10,000 m^3 November and rainwater storage volume allowances are taken up in full. The Overseer modelling also assumes that the storage facility does not begin to be emptied until December and therefore makes appropriate allowance for the wet November scenario as discussed in Section 2.7.3. The Overseer modelling has therefore assumed a worst case scenario and provides a conservative (high) estimate of effects.

Modelling of the proposed discharge regime was first undertaken assuming no changes to the on-farm management or irrigation regimes. This is scenario “WW Storage Facility” in Table 2 of the report in Appendix C2. This indicated that nitrogen leaching would marginally exceed the consented limit on both Innesmoor and Thornton Park (exceedances of up to 2 kg N/ha/yr or 5%). Given this model result, further analysis was undertaken assuming changes to the cropping regime for the wastewater irrigation farms. These were:

- Innesmoor Farm: Changing the 14ha of irrigated land which currently has a chicory crop to be 7.6 ha of irrigated chicory and 6.4 ha of non-irrigated chicory. The result of this scenario is that modelled nitrogen leaching is 40 kg N/ha/yr, compared to the consent limit of 42 kg N/ha/yr. This can be further reduced to 36 kg N /ha/yr with increased imported feed. Changes to the stocking rates are not required to achieve compliance with nitrogen leaching limits.
- Thornton Park: Removal of the current 22 ha of chicory crop and use of increased imported feed will reduce the nitrogen leaching to 32 kg N/ha /yr which is less than the consent limit of 37 kg N/ha/yr. Changes to the stocking rates are not required to achieve compliance with nitrogen leaching limits.

The overall nitrogen loads to each farm is estimated at 188 kg N/ha/yr for Innesmoor and 197 kg N/ha/yr for Thornton Park. This remains well below the current consent limits for nitrogen loading to each farm (300 kg N/ha/yr).

Fonterra propose to implement these changes to on-farm practices stated above to ensure that nitrogen leaching remains within consented limits. Further, the modelling has identified that additional on-farm practices could be implemented to further reduce nitrogen leaching if required, such that compliance with the Table 14-2 Year 20 limit would be able to be achieved at the time of consent renewal. Potential measures include further changes to cropping regimes; complete reliance on imported feed over fodder crops; or reductions in stocking rates. These additional changes are not required to be able to achieve compliance with the wastewater irrigation consent or to achieve acceptable nitrogen loading and leaching levels. The fact that further on-farm changes to reduce nutrient leaching are available confirms the sustainability of the proposed wastewater management system.

Given the proposed wastewater irrigation is able to comply with the existing consent conditions and expected nutrient leaching limits from the One Plan, it is considered that the effects of the proposed discharge regime in terms of the land treatment and discharge aspect are less than minor.

5.4 Economic Wellbeing

An assessment of the contribution of the Fonterra and Goodman Fielder dairy manufacturing sites to the regional economy is included in Appendix E. This has found that together the two manufacturing sites provide employment to approximately 300 persons and contribute $25 million per year directly to the economy via wages and purchase of goods and services. The total contribution to the economy (i.e. direct and indirect impacts) of the two manufacturing sites is estimated to be in the order of 600 full time equivalent jobs, $42 million in wages and salaries, and $8.4 million in retained expenditure in the Region.

The economic assessment concludes that:

"The continued operation of manufacturing activities at Fonterra and Goodman Fielder's Longburn sites will maintain the economic wellbeing of the people and communities within Palmerston North City and the Manawatū-Whanganui Region by:

(a) Maintaining significant direct and indirect employment opportunities for local residents;

(b) Maintaining significant direct and indirect wages and salaries for local residents;

(c) Maintaining significant levels of direct and indirect expenditure with local businesses;

(d) Maintaining population and economic activity levels within local communities thereby maintaining the breadth and quality level of services available to local residents and businesses;

(e) Providing greater employment choice for local residents; and

(f) Fonterra and Goodman Fielder continuing to pay rates to the Palmerston North City and Horizons Regional Councils and contributing to assist local community activities."

The ability for the Fonterra and Goodman Fielder manufacturing sites to continue to operate is dependent on having access to a wastewater management system that is able to operate in a sustainable manner with all necessary resource consents. Grant of consent therefore has the impact of enabling these economic benefits to continue to be realised and the estimated contributions to the local economy to continue.

5.5 Overall Assessment

In summary, it is found that:

- While tangata whenua acknowledge that there is no human wastewater within the discharge, and that the proposal represents a reduction in wastewater to the River, discharge of any wastewater to River still has an effect on the mauri of the awa. Fonterra is continuing to engage with mana whenua to confirm cultural effects and determine any appropriate mitigation measures.
- Effects on the water quality and life supporting capacity, including cumulative effects, are considered to be less than minor. This is based on the fact that effects of the current discharge are considered to be less than minor, and the proposal represents a significant reduction in the wastewater volume to the River, and significant reduction in in-river effects.
- The wastewater discharge to land required to give effect to the proposal is able to be carried out within the consent limits of the existing discharge to land consent and within sustainable nutrient and hydraulic loading limits.
- The ability of Fonterra to operate the wastewater system for the Longburn dairy manufacturing sites enables significant economic benefits to be realised for the local economy through the ongoing operation of the Goodman Fielder and Fonterra diary manufacturing sites.

6 PROPOSED MITIGATION MEASURES

The proposal in and of itself is a significant mitigation measure in terms of reducing effects on the River. The way in which effects on the river will be reduced via implementing the proposal are summarised in Section 5.2. Further, the proposal provides a critical infrastructure element (large scale storage facility) which provides flexibility for Fonterra to implement additional measures to reduce wastewater discharge to the river in the event that additional land and / or access to municipal wastewater systems become feasible in the future.

The Assessment of Environmental Effects detailed in Section 5 above has identified that the effect of the discharge to River on land and on the water quality in the Manawatū River and its life supporting capacity is less than minor. Therefore additional mitigation measures to address water quality effects are not required. As section out in Section 5.3, there are also additional mitigation measures available to Fonterra in terms of on-farm practices to reduce nitrogen leaching from the wastewater farms, if necessary, to ensure compliance with consent conditions and / or any future nitrogen leaching limit as may be necessary.

The Assessment of Environmental Effects, however, has identified that there are potential effects on the mauri and cultural values of the awa. Fonterra is working with iwi and hapū regarding potential mitigation measures for any cultural effects.

6.1 Proposed Consent Conditions & Monitoring

The following summarises a proposed consent condition framework for consideration by the consent authority. It is recognised that the application will be subject to matters raised during the consent process. Specific wording of proposed conditions has not been put forward, as it is considered appropriate to understand any matters raised by the consent authority and submissions prior to formulating detailed consent condition wording.

That notwithstanding, it is expected that a suite of consent conditions will be imposed, and Fonterra is offering the following for consideration.

Activity Authorised	Discharge of treated process wastewater from the Longburn Site (Fonterra and Goodman Fielder manufacturing sites) to the Manawatū River. The activity to be undertaken in general accordance with all application documents.
Discharge Limits: Within the First 3 Years of Consent (Before storage facility is in place)	From the commencement of the consent until a date being the 1st of May three years after commencement of the consent, the consent holder may discharge WWRO and WMRO permeate to the Manawatū River in the following circumstances: • Where soil moisture conditions allow (as defined in the Wastewater Operational Procedures (WOP), permeate shall be discharged to land as a priority over discharge to the Manawatū River. • Only permeate shall be discharged to the Manawatū River. All retentate shall be discharged to land. • Maximum discharge to the Manawatū River of 3,000 m^3/day between 1 May to 31 October, with no discharge allowed when the river is below 37 m^3/s. • Only WMRO permeate to be discharged to the Manawatū River between 1 November to 30 April and the maximum discharge to the river to be limited to 1,000 m^3/day. All wastewater shall be treated via reverse osmosis processes (DAF and RO for wastewater, and RO for whole milk) prior to discharge to the Manawatū River.
Discharge Limits from year 3 onwards (i.e. after Storage Facility is in place)	**Normal Operations** From the 1st of May in the year after a date 3 years from commencement of consent, the discharge shall be operated in accordance with the Wastewater Operational Procedures (WOP) and, except as specified in the 'November' and 'Contingency' consent conditions, shall meet the following limits:

- Where soil moisture conditions are suitable, permeate shall be discharged to land as a priority over discharge to the Manawatū River.
- The discharge shall only comprise permeate from the Whole Milk Reverse Osmosis (WMRO) and Wastewater Reverse Osmosis (WWRO) plants, including permeate from the storage facility.
- There shall be no discharge between 1 November and 30 April each year.
- There shall be no discharge when the Manawatū River is at or below 56 m^3/s as measured at the Teachers College flow gauging site. The River flow shall be obtained from Regional Council once per day and the flow at that time shall apply for the purpose of compliance with this consent for that day or following 24 hours.
- The discharge volume shall not exceed 3,000 m^3/day.

WMRO Permeate November Discharge
From the 1st of May in the year after a date 3 years from commencement of consent, the consent holder may discharge WMRO permeate to the Manawatū River in the following circumstances:

- The consent authority shall be notified prior to any discharges occurring in the November to April period.
- Only WMRO permeate may be discharged to the Manawatū River. This discharge may be direct to the Manawatū River and not via the storage facility and shall only occur when soil moisture conditions prevent discharge to land (as defined in the WOP).
- The discharge volume shall not exceed 1,000 m^3/day.

Contingency Discharge
From the 1st of May in the year after a date 3 years from commencement of consent, the consent holder may discharge WMRO permeate to the Manawatū River in the following circumstances:

- The consent authority is notified prior to exercising the contingency discharge.
- A discharge to the Manawatū River in the event that irrigation farms are subject to inundation from flood or extreme rainfall events, as defined in the WOP. Discharge may comprise of permeate, retentate and / or discharge wastewater directly from the DAF (An advice note is suggested to confirm that this is DAF wastewater only and DAF solids are authorised for discharge to third party farms under consent ATH-2019202710.00).
- The discharge to the Manawatū River may only occur if the Manawatū River flows are above the 20th FEP flow (164 m^3/s) as measured at Teachers College gauging site.
- The discharge volume shall not exceed 4,000 m^3/day.

Discharge Quality Limits

Discharge quality limits are proposed as load limits for 1 May to 30 October each year (kg/year) for relevant parameters for the discharge.

- Total Nitrogen: 6,500
- Dissolved Reactive Phosphorus: 450

Wastewater Operational Procedures

The discharge shall be operated in accordance with Wastewater Operational Procedures which detail the procedures to be followed, including details as to how the storage facility is to be managed, to give effect to the following:

- Wastewater is to be prioritised for discharge to land as far as practicable. This shall include details as to how the following operational decisions are made:
    - Whether soil moisture conditions are suitable for discharge to land
    - Whether the summer discharge condition enabling WMRO Permeate to be discharged to the River is required to be exercised
    - Whether the contingency discharge condition is required to be exercised.
- The discharge volume to the Manawatū River is to, generally, be no greater than the prior day's production.
- The storage facility is to be progressively filled during the winter production season with the objective of filling the effective storage volume prior to the summer period.
- Location of monitoring sites and monitoring protocols for undertaking the monitoring required under the consent.
- Procedures for managing and controlling wildlife on the storage facility.

The Wastewater Operational Procedures shall be provided to the consent authority no later than three years following commencement of the consent.

The Wastewater Operational Procedure shall be reviewed no less than every three years. Any updates to the Wastewater Operational Procedures are to be provided to the consent authority within three months of the update.

Storage Facility Construction & Commissioning

Prior to the 1st of May in the year after a date 3 years from commencement of consent, the consent holder shall construct and commission a storage facility or alternative infrastructure as necessary in order to operate in accordance with the discharge regime specified in this consent.

The consent holder shall, no later than the 1st of May in the year after a date 3 years from commencement of the consent, certify to the Regional Council that the storage facility or alternative infrastructure referenced above has been constructed and commissioned.

Monitoring and Reporting

Metering and recording of daily discharge volumes, including telemetry for information to be provided to Horizons on a daily basis.

Weekly monitoring of the discharge quality during times that the discharge to the Manawatū River is occurring.

- Samples to be collected post storage
- 24-hour flow composite samples
- Total N, Ammonia, SIN, DRP, $ScBOD_5$, *E. coli*, Total Suspended Solids, Volatile Suspended Solids.

S107 effects condition

The discharge shall not cause any of the following in the Manawatū River after reasonable mixing (400 m downstream of the discharge):

- the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:
- any conspicuous change in the colour or visual clarity:
- any emission of objectionable odour:
- the rendering of fresh water unsuitable for consumption by farm animals:
- any significant adverse effects on aquatic life.

Receiving environment (in-River) monitoring.

The consent holder shall collect grab samples from the Manawatū River at a point upstream of the discharge and at the first safely accessible location

	downstream of the reasonable mixing zone (defined as 400 m downstream of the discharge point) on a monthly basis when the discharge is occurring. The monitoring locations are to be defined in the WOP. Samples to be analysed by an IANZ accredited laboratory for Total N, Ammonia, SIN, DRP, $ScBOD_5$, *E. coli*, TSS, VSS An annual monitoring report to be provided detailing all monitoring undertaken during the year, an assessment of the monitoring results and compliance with consent conditions, and details of any actions undertaken to address any non-compliances. The report shall also include a commentary as to how the discharge has been operated in accordance with the WOP.
Review	Standard review clauses as per Regional Council's standard conditions.

7 CONSULTATION

Fonterra has sought to actively engage with iwi, hapū and stakeholders in the preparation of this application. The purpose of the consultation has been to inform the consideration of options to understand impacts of the discharge on cultural values and mauri of the river, and to identify how the proposal can be developed to avoid, remedy or mitigate potential effects. The following provides a summary of the consultation undertaken.

7.1 Iwi and Hapū consultation

Rangitāne o Manawatū

Fonterra has engaged with Rangitāne o Manawatū and to enter into a constructive ongoing relationship with Rangitāne that will endure beyond the current consent process. Fonterra has met with representatives of Rangitāne o Manawatū (TMI) on several occasions over the past two years, in addition to engagement via email correspondence. This engagement has been in relation to this application, as well as to other consent processes for the site (discharges of whey and DAF solids to land) and Fonterra Research and Development Centre site near Massey. This engagement has resulted in Fonterra entering into an implementation programme for identifying and assessing cultural values on Fonterra owned and third party land receiving WWTP Solids and whey from the Longburn site, as well as Fonterra supporting the FoodHQ initiative to undertake riparian planting on the Turitea Stream.

In relation to the discharge of wastewater from the Longburn site to the Manawatū River, Rangitāne have indicated their preference for all wastewater discharges to be removed from the River and their position that direct discharges to the River do not provide for the cultural values and mauri of the Awa. However, Rangitāne have also advised that they understand that Fonterra is not able to remove all of its wastewater discharge to the River at this time, and that the current proposal represents a significant reduction in waste to the River.

Fonterra has also engaged with Rangitāne in terms of the discharge structure and has discussed whether or not improvements to the structure or discharge method would be an appropriate means of mitigating effects of the discharge on the mauri of the River. Rangitāne has, at this time, advised that they consider the existing discharge structure is appropriate and further land passage prior to discharge is not considered necessary. Rangitāne has indicated that they would like to see improvements to the riparian vegetation in this area.

Ngāti Raukawa

Fonterra has also sought to actively engage with Ngāti Raukawa and similarly develop and enter into a constructive ongoing relationship that will endure beyond the current consent process. Fonterra has met with representatives of Ngāti Raukawa and Raukawa ki te Tonga on several occasions over the past two years, in addition to engagement via email correspondence. Discussions with Ngāti Raukawa have focused on taking a long-term view to build relationships and understanding with Fonterra across all of Fonterra's activities in the rohe.

Ngāti Raukawa has previously provided Fonterra with a statement of cultural values in respect of the discharge of whey to third-party land and Fonterra is currently in the process of entering into a contractual arrangement with Ngāti Raukawa for a similar assessment of cultural values with respect to the wastewater to River discharge.

Muaūpoko Tribal Authority

Fonterra met with Muaūpoko Tribal Authority in May and August of 2021 to provide an overview of the Manawatū River wastewater discharge in terms of the current system and the proposed discharge regime. Discussions have focused on agreeing a pathway to identifying and understanding the impacts of the discharge to the River as well as building relationships and understanding of cultural values in relation to all of Fonterra's activities in the rohe.

Ngāti Kauwhata

Fonterra engaged with Ngāti Kauwhata via phone and email throughout mid-2021 to discuss the treated wastewater discharge to the River. Advice from Ngāti Kauwhata was that the primary iwi that Fonterra should be engaging with was Rangitāne o Manawatū.

7.2 Community and Stakeholders

In preparing this application, Fonterra has actively engaged with key stakeholders and the community in order to ensure that all parties have an understanding of the current site operations and nature of the discharge; to gauge initial reaction to the proposals and to inform decisions on the BPO; and to ensure that stakeholders have a good understanding of the proposal and the reasons why the preferred option has been selected.

Fonterra recognises that there is significant community and stakeholder interest in the Manawatū River and that all parties will likely be seeking to be involved in the process through submissions and presentation at hearings. For this reason, Fonterra has engaged in a manner which is focused on achieving an understanding of the issues and the proposal and has not sought affected party approvals or written confirmation of the position of any of the stakeholders. The following parties have been engaged with throughout the process:

- Department of Conservation
- Fish and Game Council
- MidCentral District Health Board
- Longburn Community & Wastewater Community Group via a community meeting held on 7 July 2021. Annual meetings with the community groups have also been held in November or December during the term of the consent.
- Manawatū River Leaders Accord.

8 SECTION 104(1)(B) ASSESSMENT

Section 104(1)(B) of the Resource Management Act states that:

"(1) When considering an application for a resource consent and any submissions received, the consent authority must, subject to Part 2, have regard to - …

(b) any relevant provisions of:

(i) a national environmental standard

(ii) other regulations:

(iii) a national policy statement:

(iv) a New Zealand coastal policy statement:

(v) a regional policy statement or proposed regional policy statement:

(vi) a plan or proposed plan;"

Form 9 and Clause 2(1)(g) of the Fourth Schedule of the Resource Management Act require an application for resource consent to include an assessment of the activity against the relevant provisions of a document referred to in section 104(1)(b). The following provides this assessment.

8.1 National Environmental Standards

There are currently nine National Environmental Standards in effect under the RMA. Of these, four are potentially relevant to this application and are assessed as follows[9].

8.1.1 National Environmental Standards for Freshwater 2020

The Resource Management (National Environmental Standards for Freshwater) Regulations 2020 regulate specific activities in relation to farming, wetlands, reclamation of rivers, and structures in watercourses which may affect fish passage.

None of the activities subject of this application are regulated under the National Environmental Standards for Freshwater. Sub-part 3 of the NES does regulate structures within watercourses where these may affect fish passage. The discharge structure for discharge to river is an existing structure, does not affect fish passage as it is located on the bank of the river, and is not a structure which is regulated under the NES.

While not part of this application, the discharge regime does rely on Fonterra's existing wastewater to land consent which authorises irrigation of treated wastewater on to two farms. These farms are managed primarily for wastewater treatment purposes but are also used for dairy farming. Regulations 20 and 21 relate to irrigation of dairy farmland. As no increase in area is proposed, the wastewater irrigation is such that the activity does meet the Permitted Activity criteria under Regulation 20 of the NES.

Therefore, there is nothing within the National Environmental Standards for Freshwater that requires further consents to undertake the activity, or that must be had regard to in determining the application.

9 The remaining five National Environmental Standards relate to Electricity Transmission Activities, Marine Aquaculture, Plantation Forestry, Storing Tyres Outdoors, and Telecommunication Facilities. They regulate activities which do not form part of the proposal and are therefore not relevant to this application.

8.1.2 National Environmental Standards for Sources of Human Drinking Water 2007

The Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007 precludes the grant of consent for certain activities which occur upstream of an abstraction point for a registered drinking water supply which services more than 500 persons.

The proposed activity is a discharge to water and therefore consideration must be given to any abstractions from the Manawatū River downstream of the discharge point which serve more than 500 persons. There are no registered water supplies serving more than 500 persons which source water from the Manawatū River downstream of the discharge point[10] and therefore there is nothing in this National Environmental Standard which precludes grant of consent.

Regulation 12 requires, in certain circumstances, a consent condition to be placed on discharge consents which occur upstream of a water supply which serves more than 25 persons. There are no registered water supplies servicing more than 25 persons which source water from the Manawatū River downstream of the discharge point and therefore the condition specified in Regulation 12 is not required to be imposed on any consent that may be granted.

For the avoidance of doubt, there are no registered drinking water supplies (as per the NZ Drinking Water Register dated March 2021) sourcing water from the Manawatū River downstream of the discharge point serving any number of persons. Further, the One Plan's Schedule B 'water supply' value does not apply to the Manawatū River at, or downstream of, the discharge point.

8.1.3 National Environmental Standards for Air Quality 2004

The Resource Management (National Environmental Standards for Air Quality) Regulations 2004 regulate specified air discharge activities and defines national ambient air quality standards. The proposed activity, including any associated activities for which consent will be sought separately, does not include any activities or discharges of contaminants which are regulated under the National Environmental Standards for Air Quality.

Therefore, there is nothing in the National Environmental Standard for Air Quality that precludes grant of consent, or which needs to be had regard to in determining the application.

8.1.4 National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health

The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protection Human Health) Regulations 2011 (NES-CS), regulates certain activities where they are proposed to take place on land which has, or is more likely than not to have had, a HAIL activity occurring. A HAIL activity is an activity which is listed on the Hazardous Activities and Industries List administered by the Ministry for the Environment. The activities regulated under the NES-CS relate to fuel storage systems, soil disturbance, subdivision or change of land use. None of these activities form part of this application.

As identified in Section 4.4, consent will be sought separately for any earthworks associated with the construction of the proposed storage facility. The earthworks may be regulated under the NES-CS as soil disturbance if they are on land which has or may have had a HAIL activity undertaken on the land. However, the proposed storage facility site has not, nor has it ever had, a HAIL Activity undertaken on it, and therefore the soil disturbance associated with the construction is not regulated under the NES-CS.

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[10] *As per the Drinking Water Register of New Zealand, March 2021 https://www.esr.cri.nz/our-services/consultancy/water-quality-and-sanitation/register-of-suppliers/*

Therefore, there is nothing in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health that precludes grant of consent, or which needs to be had regard to in determining the application.

8.2 Other Regulations

There are no other regulations relevant to this application.

8.3 National Policy Statements

There are currently four National Policy Statements under the RMA, in addition to the New Zealand Coastal Policy Statement which is assessed in Section 8.4 below. Of these four, only the National Policy Statement for Freshwater Management 2020 is relevant to this application[11].

8.3.1 National Policy Statement for Freshwater Management 2020

The National Policy Statement for Freshwater Management 2020 (NPSFM) applies to all freshwater, establishes Te Mana o Te Wai as a fundamental concept relevant to all freshwater management, and sets a clear objective for the management of freshwater as set out in Objective 1:

Objective 1:

> *"The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises:*
>
> *(a) first, the health and well-being of water bodies and freshwater ecosystems*
>
> *(b) second, the health needs of people (such as drinking water)*
>
> *(c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future."*

This objective is supported by 15 policies and an implementation framework. The following assesses the application against these policies and the relevant provisions of the NPSFM.

The proposal is considered to prioritise the health and well-being of the Manawatū River as it represents a significant reduction in the wastewater volumes and contaminants to be discharged to the River and avoids discharging at times when the River is more likely to be affected. It has been found to have a less than minor effect on the water quality and life supporting system of the Manawatū River. The discharge does not impact on the ability of the river to meet contact recreation standards, nor does it affect any drinking water supplies and therefore provides for the health needs of the people. Grant of consent will provide for ongoing operation of the Fonterra and Goodman Fielder dairy manufacturing sites at Longburn which provide a significant economic benefit to the region. The proposal is therefore considered to be consistent with the objective of the NPSFM.

Policy 1:

> *"Freshwater is managed in a way that gives effect to Te Mana o te Wai."*

Fonterra acknowledges that the way in which Te Mana o te Wai is given effect to is required to be defined via engagement with iwi and hapū. Fonterra has been engaging with the relevant iwi as discussed under Policy 2 below.

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[11] *The other three National Policy Statements relate to renewal electricity generation, electricity transmission and urban development.*

The fundamental concept of Te Mana of te Wai is described in the NPSFM as "protecting the health of freshwater protects the health and well-being of the wider environment. It protects the mauri of the wai. Te Mana o te Wai is about restoring and preserving the balance between the water, the wider environment, and the community". As discussed above and in the policies below, it is considered that the proposal protects the health and wellbeing of the wider community. Fonterra recognises that the discharge will likely have an effect on the mauri of the wai and is continuing to engage with mana whenua on this matter. The way in which Fonterra is engaging with mana whenua is consistent with the framework principles of Te Mana of te Wai as set out in the NPSFM to the extent that is possible via a consent application process.

Policy 2:

> *Tangata whenua are actively involved in freshwater management (including decision making processes), and Māori freshwater values are identified and provided for.*

Fonterra has engaged with tangata whenua throughout the consenting process and has sought feedback from iwi throughout the identification and development of the Best Practicable Option. The way Fonterra has engaged with iwi has been discussed in Section 7.1 of this AEE. Further, Fonterra identified at the outset of this project that it did not have an effective relationship with iwi and hapū of the rohe potentially impacted by the Fonterra Longburn manufacturing sites (including the larger rohe which constitutes the receiving environment, being both the Manawatū River and the wider area covered by third party farms which receive solids from the manufacturing and wastewater treatment activities). Through this project and recent consent processes for the beneficial reuse of treatment solids, Fonterra has sought to establish an effective relationship with Rangitāne o Manawatū, Ngāti Raukawa, Ngāti Kauwhata, Ngāti Apa and Muaūpoko Tribal Authority.

This has included, for example, facilitating Rangitāne o Manawatū access to Fonterra owned and third party farms for identification and assessment of cultural values and wāhi tapu; working with landowners to identify opportunities to protect, restore or mitigate impacts; and working together to improve awareness and understanding of Rangitāne values across Fonterra and its farmer shareholders. An agreed framework is in place to work with Rangitāne to achieve these outcomes and to "improve the relationship between Rangitāne and Fonterra ultimately moving towards a collaborative way of working together on matters of common interest."[12]

Fonterra is engaging with tangata whenua in a way which gives effect to this policy by seeking effective relationships with iwi and hapū and enabling active involvement in freshwater management and for freshwater values to be identified and provided for.

Policy 4:

> *Freshwater is managed as part of New Zealand's integrated response to climate change.*

This policy is to be given effect to through the implementation framework of the NPS-FW and the way in which allocation and environmental flow limits for freshwater management units are set. The setting of allocation and environmental flow limits is not within the scope of this application. This notwithstanding, development of this proposal has taken into account potential impacts of climate change, particularly through the proposed storage facility which will enhance the available wastewater for irrigation at times when there are soil moisture deficits (i.e. by storing peak production from the typically wetter months for use on the land during summer), and via the proposed November and contingency discharge conditions sought which recognise potential shifting climate patterns. The proposal is therefore considered to be consistent with Policy 4.

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[12] *Letter of Intent agreed between Rangitāne and Fonterra with respect to resource consent for the application of wastewater treatment solids to land. (January 2020)*

Policy 5:

Freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.

The National Objectives Framework is detailed in Subpart 2 of the NPSFM. It requires regional councils to engage with communities and tangata whenua to identify freshwater management units (FMUs), values for each FMU and establish environmental outcomes, objectives, attributes and baseline states for each value and FMU in Regional Plans. The NOF also requires regional councils to monitor water bodies and freshwater ecosystems and take action if degradation is detected. Horizons Regional Council has not yet implemented the NOF through its Regional Plan. It is noted that the One Plan does identify water management zones, values and numerics for those values, and an assessment against the provisions of the One Plan is provided in Sections 8.5 and 8.6.

The NOF includes national bottom lines for specific attributes as set out in Appendix 2A of the NPSFM – Attributes requiring limits on resource use. The report by Aquanet attached in Appendix D has assessed the proposal and its potential effects on freshwater against the attributes for which national bottom lines have been set in the NPSFM as follows[13]:

- Ecosystem Health (Aquatic Life)
  - Periphyton measured with respect to chlorophyll-α; The National Bottom Line attribute state requires chlorophyll-α to be less than 200 mg/ m^2. Chlorophyll-α upstream and downstream of the current discharge are less than the One Plan target of 120 mg/m^2 and therefore the National Bottom Line is met and will continue to be met with the proposed discharge.
  - Macroinvertebrates as assessed via the MCI and QMCI indices. The National Bottom Line attribute state requires QMCI to be above 4.5 and MCI to be above 90 for wadable rivers. As detailed in Aquanet's report, a formal assessment against the National Bottom Line cannot be undertaken as the attribute definition requires a five year median score to be determined based on samples collected between December and March. Aquanet notes that preliminary assessment indicates that the macroinvertebrate community indices are likely to be within Band B and Band C and, as such, would meet the National Bottom Line. The proposal will not include any discharges during December to March and therefore will not have any effect on the ability of the River to meet the National Bottom Line for Macroinvertebrates.
- Ecosystem Health (Water Quality)
  - Ammonia (toxicity); The National Bottom Line attribute state requires ammonia within Class B or better (i.e. to be less than 0.24 mg/m^3 as an annual median and less than 0.4 mg/m^3 as an annual maximum). Ammonia concentrations in the River are currently assessed as being Class C and therefore do not meet the National Bottom Line for ammonia. Aquanet has assessed that the failure to meet the National Bottom Line for ammonia is a result of upstream conditions and not an effect of the discharge. Modelling has shown that the discharge will have a less than 0.3% impact on ammonia levels in the river.
  - Nitrate (toxicity); The National Bottom Line attribute state requires ammonia to be within Class B or better (i.e. less than 2.4 mg/m^3 as an annual median and less than 3.5 mg/m^3 as an annual 95^{th} percentile). Aquanet has assessed the upstream and downstream water quality as meeting Class A under the NPSFM and therefore the National Bottom Line is met and will continue to be met with the proposed discharge.
- Human Contact
  - *E. coli.* The National Bottom Line attribute state requires *E. coli* to be less than 540 per 100 mL as a 95^{th} percentile.

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[13] *The other attribute values in Appendix 2A of the NPSFM relate to lakes and therefore are not relevant to this application; or do not have National Bottom Lines specified in the NPSFM.*

The assessment has shown that the water quality in the Manawatū River either meets the National Bottom Line attribute states specified in the NPSFM or, where these are not met it is a consequence of the upstream water quality, the discharge has a less than minor effect and the discharge does not cause the National Bottom Line to not be met. The proposal is therefore considered to be consistent with Policy 5.

Policy 6:

> *There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.*

The proposal does not affect any natural inland wetlands and therefore is not inconsistent with this policy.

Policy 7:

> *The loss of river extent and values is avoided to the extent practicable.*

The activity does not involve any loss of river extent.

The NPSFM defines loss of value in relation to a river as follows:

> *"loss of value, in relation to a … river, means the …river is less able to provide for the following existing or potential values:*
>
> *(a) Any value identified for it under the NOF process; or*
>
> *(b) Any of the following whether or not they are identified under the NOF process:*
>
> *(i) ecosystem health*
>
> *(ii) indigenous biodiversity*
>
> *(iii) hydrological functioning*
>
> *(iv) Māori freshwater values*
>
> *(v) amenity."*

There are no values identified yet for the Manawatū River under the NOF process except for the compulsory values under the NPSFM of ecosystem health, human contact, threatened species, and mahinga kai. Potential effects on ecosystem health and human contact have been assessed under NOF and discussed in relation to Policy 5 above. As set out in that assessment, the proposed activity does not result in a loss of ecosystem health or human contact values. The proposal does not have any effect on threatened species or mahinga kai as it does not adverse effect the water quality of the river, nor does it have any effect on the riparian margins or habitat.

In relation to part (b) of the definition of loss of value, the proposed activity does not have any effect on ecosystem health, amenity or the hydrological functioning of the River. It is not considered to adversely affect any indigenous biodiversity as it does not impact on water quality or habitat that would affect any indigenous freshwater species and does not involve any effects on riparian vegetation. It is recognised that the discharge may have a more than minor effect on cultural values, however Fonterra has sought to avoid those effects to the extent practicable through the proposed storage facility which results in a significant reduction in discharge volumes to the River, including avoiding discharging at more sensitive times and flows. Therefore, it is considered that the proposal is consistent with this Policy.

The NPSFM requires regional councils to include policies in its regional plan that require loss of river values to be avoided unless there is a functional need for the activity to be located in a specific location, or the effects of the activity are managed by applying the effects management hierarchy (Clause

3.24(1)). As set out above, the proposal is not considered to result in a loss of values for the river and therefore there is no restriction on grant of consent under section 3.24 of the NPSFM. This notwithstanding, it is considered that there is a functional need for the discharge location given the location of the wastewater management farms and Longburn manufacturing sites and that the proposal represents the BPO. Further, the proposal gives effect to the effects management hierarchy as defined in section 3.21 of the NPSFM as it:

a. Avoids adverse effects where practicable by removing discharges to the River at times when the River is at flows less than 56 m^3/s and during summer months.

b. Minimises potential effects through the proposed regime, including prioritising high strength waste streams to land as well as prioritising lower strength wastes to storage and to land where soil moisture conditions permit.

The proposed activity is therefore considered to be consistent with Policy 7, including the relevant implementation framework, of the NPSFM.

Policy 8:

The significant values of outstanding water bodies are protected.

Outstanding water body is defined in the NPSFM as one which "is identified in a regional policy statement, a regional plan, or a water conservation order as having one or more outstanding values". The Manawatū River is not identified in any water conservation order as having one or more outstanding values. The One Plan identifies outstanding natural features and landscapes in the region in Schedule G. That Schedule does identify some freshwater bodies within the Region as outstanding, including the Manawatū River as it flows through the Manawatū Gorge. However, Schedule G does not identify the Manawatū River at, or downstream of the discharge point as having one or more outstanding values.

In relation to the National Environmental Standard for Plantation Forestry, the One Plan (Chapter 13) equates the NES's term "outstanding freshwater bodies" with water bodies which have been identified in the One Plan as having Schedule B values of Natural State or Outstanding Trout Fishery. Neither of these values apply to the Manawatū River at, or downstream of, the discharge location.

The proposal therefore does not affect any outstanding water bodies as defined by the NPSFM and grant of consent would not be inconsistent with Policy 8.

Policy 9:

The habitats of indigenous freshwater species are protected.

The reach of the river where the discharge occurs is valued under the One Plan as a Site of Significance – Riparian and is to be protected in terms of the gravel and sand habitat provided for dotterels. The proposal does not include any disturbance of the bed or of any gravel and sand habitat and therefore will not affect the habitat for dotterels. The proposed activity does not affect riparian vegetation or disturb any habitat. It is therefore not inconsistent with Policy 9.

Policy 10:

The habitat of trout and salmon is protected, insofar as this is consistent with Policy 9.

The Aquanet report (Appendix D) has assessed potential effects on trout and salmon habitat in terms of potential effects on periphyton cover, including in relation to Ministry for the Environment Guidelines for protection of trout habitat and angling. These guidelines are also consistent with the One Plan targets for periphyton. The Aquanet assessment concluded that (s3.2.1 summary) that "overall, periphyton biomass and visual estimates of periphyton cover were generally higher upstream when compared with sties downstream, suggesting no detectable effect on periphyton proliferation can be attributed to the Fonterra Longburn discharge." It is therefore considered that the proposal does not impact on the habitat of trout or salmon and is not inconsistent with Policy 9.

Policy 12:

> *The national target (as set out in Appendix 3) for water quality improvement is achieved.*

The national target set out in Appendix 3 of the NPSFM is "to increase proportions of specified rivers and lakes that are suitable for primary contact (that is, that are in the blue, green and yellow categories) to at least 80% by 2030 and 90% no later than 2040, but also to improve water quality across all categories". The Manawatū River is a specified river in terms of Appendix 3 of the NPSFM.

As discussed in the Aquanet report, the Manawatū River is currently assessed as being in the Red (E) category for *E. coli,* and the downstream site is assessed as being in the Orange (D) category. It therefore contributes to the proportion of rivers that do not currently meet the national target and improvement to be able to meet the 2030 target is likely required. Modelling undertaken by Aquanet states that the potential maximum effect of the current discharge is to increase *E. coli* in the River by 0 - 0.51% depending on river flow. This is a very minor effect that is likely not detectable in monitoring. Notwithstanding that the effect of the existing discharge is not likely to be measurable, the proposal will remove the discharge from the Manawatū River in flows less than 56 m^3/s and will have a reduction in the effect of the discharge on *E. coli* levels in the River. There is a modelled reduction in effect in the order of 25-28% in terms of average *E. coli* levels.

It is therefore considered that grant of consent will not, in any way, impact on the ability for the national target for water quality improvement to be achieved and is therefore not inconsistent with Policy 12.

Policy 13:

> *The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends.*

The proposal does not in any way impact on the ability of the Regional Council to undertake the implementation requirements to give effect to this policy. The effects of the discharge are expected to require monitoring via consent conditions and this information will contribute information to the systematic monitoring undertaken by Regional Council to give effect to this Policy.

Policy 14:

> *Information (including monitoring data) about the state of water bodies and freshwater ecosystems, and the challenges to their health and well-being, is regularly reported on and published.*

This policy places an obligation on the regional council to make information about the state of water bodies and freshwater ecosystems available. As discussed above, the specific monitoring required by Fonterra as a consent holder, to monitor and assess the effects of the discharge, will contribute to and assist the Regional Council in its understanding of the state of the Manawatū water body and freshwater ecosystems. While it is not an obligation on any specific consent holder to report and publish on the state of water bodies and freshwater ecosystems in general, it is expected that a condition of consent will require an annual report to be provided by the consent holder on monitoring undertaken under the consent and the effects of the discharge. Therefore, there is nothing in the proposal which is inconsistent with policy 14.

Policy 15:

> *Communities are enabled to provide for their social, economic, and cultural wellbeing in a way that is consistent with this National Policy Statement.*

The Fonterra and Goodman Fielder manufacturing sites play a significant role in supporting the economic wellbeing of the community through supporting the local and regional dairy land use, and providing employment and economic benefits as has been described in Section 5.4 and Appendix E. As set out in the above assessment, the proposal is consistent with the NPSFM. Therefore, grant of consent enables the community to provide for their wellbeing, particularly in relation to economic wellbeing, and is consistent with Policy 15.

Summary of Assessment

As set out above, the proposal is considered to give effect to the objective of the NPSFM as it provides for the health and wellbeing of waterbodies and freshwater ecosystems by significantly reducing the amount of treated wastewater and contaminants discharged to the River; does not affect the health needs of people as it does not impact on any drinking water sources nor does it affect the River's ability to meet primary contact targets; and provides for community wellbeing in terms of economic wellbeing. Further, the preferred option provides for the ability to meet social and cultural wellbeing in the future by ensuring flexibility to further reduce discharge to the River in the future. It is therefore considered to meet the objective of the NPSFM.

Further, the above assessment has shown that the proposal gives effect to the policies of the NPSFM which are directly relevant to the proposal and can be given effect to by a consent holder; and is not inconsistent with, nor does it affect, regional council's ability to implement the policies of the NPSFM which are not directly relevant.

The proposal is therefore considered to be consistent with and give effect to the NPSFM.

8.4 New Zealand Coastal Policy Statement 2010

The activity is not occurring within or near the coastal environment and therefore, the New Zealand Coastal Policy Statement is not relevant to this application.

8.5 Regional Policy Statement or Proposed Regional Policy Statement

The relevant Regional Policy Statement is Part I of the Manawatū-Whanganui Regional Council's One Plan. An assessment against the relevant objectives and policies of the Regional Policy Statement is provided below.

8.5.1 Chapter 2 Te Ao Māori

Chapter 2 of the RPS identifies the resource management issues that are of significance to hapū and iwi and describes how these issues will be addressed. The relevant objectives and policies are assessed as follows.

Objective 2-1: Resource management

"a. *To have regard to the mauri of natural and physical resources to enable hapū and iwi to provide for their social, economic and cultural wellbeing.*

b. *Kaitiakitanga must be given particular regard and the relationship of hapū and iwi with their ancestral lands, water, sites, wāhi tapu and other taonga (including wāhi tūpuna) must be recognised and provided for through resource management processes."*

Fonterra has had regard to the mauri of the awa as is evident in the way it has engaged with iwi (refer Section 7.1). Fonterra is also working with Rangitāne to facilitate the exercise of Kaitiakitanga, as far as possible, with respect to the identification and management of effects on any sites, wāhi tapu and other taonga that are affected by the discharge of wastewater and DAF solids to land. This includes extending the implementation programme for identifying and assessing cultural values on third party land receiving WWTP solids from the wastewater treatment plant to the Innesmoor and Thornton Park wastewater management farms. This work has been completed, including a planting day being undertaken in early August 2021. The proposal has therefore been developed in a way which gives effect to this objective. Fonterra also endeavours to have a closer working relationship with the other iwi and hapū within the rohe.

Policy 2-1: Hapū and iwi involvement in resource management

"The Regional Council must enable and foster kaitiakitanga and the relationship between hapū and iwi and their ancestral lands, water, sites, wāhi tapu and other taonga (including wāhi tūpuna) through increased involvement of hapū and iwi in resource management processes. …

(g) the Regional Council having regard to iwi management plans lodged with the Council. …

(i) the Regional Council advising and encouraging resource consent applicants to consult directly with hapū or iwi where it is necessary to identify:

(i) the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga (including wāhi tūpuna), and

(ii) the actual and potential adverse effects of proposed activities on those relationships."

In terms of policy 2-1(g), there are no iwi management plans which have been lodged with the Council that are relevant to the discharge location or the Manawatū River downstream of the discharge.

In terms of policy 2-1(i), Fonterra has been actively engaging with iwi to understand their relationship with, and cultural values of, the Manawatū River and the actual and potential effects of the proposed activity. This has been discussed in Section 7.1 above. Fonterra has made significant effort to engage with iwi to develop ongoing relationships with mana whenua and to ensure that effects on cultural values are understood and managed in an appropriate manner. Fonterra has therefore prepared this application, acted, and has signalled an intention to continue to act, in accordance with Policy 2-1.

Policy 2-3: The Mauri of Water

Policy 2-3 specifies that mauri of water will be provided by restriction of water takes at times of minimum flow and, in exceptional circumstances and following advice of iwi and hapū, Regional Council facilitating a voluntary rahui. This application does not relate to a water take and there are no such voluntary rahui currently imposed. Therefore, this application is not contrary to Policy 2-3.

It is noted that consideration of effects on mauri of water are broader than the specific matters stated in Policy 2-3. As set out above, and in Section 7.1, Fonterra has, and will continue to, actively engage with iwi to ensure that effects on mauri are understood and are mitigated as far as possible.

Policy 2-4: Other resource management issues

Policy 2-4 sets out, via Table 2.1 of the One Plan, how specific issues raised by iwi and hapū are to be addressed. Matters in Table 2.1 of relevance to this application are:

- Resource issue of significance: "Management of water quality and quantity throughout the Region does not provide for the special qualities significant to Māori." In the context of tikanga Māori, this is described as the mauri. Wai maori (pure water) is essential to hapū and iwi to enable activities such as spiritual cleansing, baptismal rituals and food gathering. Table 2.1 notes that mauri acts as "a balancing agent to ensure the life supporting qualities within the water are maintained." It further notes that human activities including the discharge of contaminants affect the ability of mauri to perform its role effectively, therefore resulting in a standard of water not suitable for hapū and iwi to perform relevant tikanga Maori or cultural activities. Table 2.1 identifies that this issue is addressed in the One Plan via Objective 2-1, Policy 2-3, Objective 5-1, Policy 5-1 and Chapter 14 rules. These objectives and policies are all addressed within this application. As the proposed activity has been assessed as being consistent with the objectives and policies, it is considered that the activity is also consistent with the manner in which this issue is to be addressed through the One Plan.

- Resource issue of significance: “Sewage disposed to water in treated form or otherwise is culturally abhorrent. Land-based treatment is preferred”. This issue is described in Table 2.1 of the One Plan as relating specifically to human sewage. There is no human sewage within the discharge from the Fonterra wastewater treatment system. That notwithstanding, Fonterra acknowledges that any wastewater to water is considered culturally offensive to iwi and hapū. While removing the discharge from the River completely is not currently feasible and does not represent the BPO, the proposal represents a significant reduction in the times when a discharge will occur to the River compared to the status quo. Further the BPO provides flexibility for any future options which may enable further reduction of treated wastewater to the River. Table 2.1 identifies that this issue is addressed in the One Plan via Objective 5-2, Policy 5-, Policy 5-11 and Chapter 14 rules. These objectives and policies are all addressed within this application. As the proposed activity has been assessed as being consistent with the objectives and policies, and because the discharge does not include human sewage, it is considered that the activity is also consistent with the manner in which this issue is to be addressed through the One Plan.

8.5.2 Chapter 3 Infrastructure, Energy, Waste, Hazardous Substances and Contaminated Land

Chapter 3 provisions are relevant to the extent that they address how waste is to be managed, noting that waste is defined in the One Plan as including “any material, solid, liquid, or gas that is unwanted or unvalued and discarded or discharged.”. While the Fonterra manufacturing site plays a significant role in supporting the local economy, its wastewater treatment facilities are not considered to fall within the definition of “infrastructure” in terms of the definition in the RMA or the provisions of the One Plan.

Objective 3-5: Waste, hazardous substances and contaminated land

"The Regional Council and Territorial Authorities must work together in a regionally consistent way to:

i. minimise the quantity of waste generated in the Region and ensure it is disposed of appropriately,

ii. manage adverse effects from the use, storage, disposal and transportation of hazardous substances, and

iii. manage adverse effects from contaminated land."

This objective places a responsibility on the Regional Council and Territorial Authorities, and not Fonterra as the applicant. This notwithstanding, the way in which the wastewater system is managed is consistent with this policy as the overall management of the system includes a strong focus on minimising waste at source, as well as beneficial reuse of waste materials through the beneficial reuse of treatment process by-products (DAF Solids) and storage and irrigation of wastewater to land. These measures are focused on minimising the quantity of waste generated and ensuring it is disposed of appropriately. There are no hazardous substances in the wastewater stream as the waste is generated from processing of biological product (milk) and treatment processes have been selected which minimise the use of chemicals as far as possible.

Policy 3-8: Waste policy hierarchy

"Wastes, including solid, liquid, gas and sludge waste, must be managed in accordance with the following hierarchy:

a. reducing the amount of waste produced

b. reusing waste

c. *recycling waste*

d. *recovering resources from waste*

e. *appropriately disposing of residual wastes."*

The wastewater management system is consistent with the wastewater hierarchy. As described in Section 2.2, there are measures and programmes in place on both the Fonterra and Goodman Fielder sites to minimise waste at source, including water use reductions and separation of waste solids in processing for collection and use as pig feed. Process and wastewater treatment by-products are disposed of under separate consents for beneficial reuse on third party farms as substitutes for slow release synthetic fertilisers and soil conditions thereby recovering resources from the waste stream. Further, the wastewater irrigation represents a recovery of resources from the waste stream in terms of water and nutrient content. This application relates to the residual waste which remains following implementation of the waste hierarchy and, as set out in this document, the proposal is for the BPO and it is considered that the effects of the discharge are no more than minor. Therefore, this represents “appropriate” disposal of residual waste. The activity is therefore consistent with Policy 3-8.

Policy 3-9: Consent information requirements - waste policy hierarchy and hazardous substances

"Where a proposal has the potential to give rise to significant adverse effects on the receiving environment, an assessment must be required, as part of the consent information requirements for all discharges to air, land, water and the coastal marine area, of:

a. *reduction, reuse, recycle and recovery options for the discharge in accordance with Policy 3-8, and*

b. *any hazardous substances that may be present in the discharge, and alternatives to those hazardous substances."*

The discharge of treated wastewater to River does not have the potential to give rise to significant adverse effects on the Manawatū River. Therefore, this policy does not apply to this application. This notwithstanding, the proposal is in accordance with Policy 3-8 as assessed above and does not include any hazardous substances.

8.5.3 Chapter 5 Water

Chapter 5 of the RPS sets out the objectives and policies for management of freshwater in the region. The relevant objectives and policies are assessed as follows.

Objective 5-1: Water management Values

"Surface water bodies and their beds are managed in a manner which safeguards their life supporting capacity and recognises and provides for the Values in Schedule B."

The relevant Schedule B values for the Manawatū River at, and downstream of, the discharge point have been identified in section 3.2 of this report. The way in which this objective is achieved is set out in policies of Chapter 5 and provisions of Chapter 14 of the One Plan and as assessed below and in section 8.5. In summary, the current discharge and proposed discharge regimes have been assessed as having a less than minor effect on water quality. Therefore, it is considered that the proposal recognises and provides for the values in Schedule B and safeguards the life supporting capacity of the Manawatū River. It is therefore consistent with Objective 5-1.

Objective 5-2: Water quality

"a. *Surface water quality is managed to ensure that:*

i. *water quality is maintained in those rivers and lakes where the existing water quality is at a level sufficient to support the Values in Schedule B*

ii. *water quality is enhanced in those rivers and lakes where the existing water quality is not at a level sufficient to support the Values in Schedule B*

iii. *accelerated eutrophication and sedimentation of lakes in the Region is prevented or minimised*

iv. *the special values of rivers protected by water conservation orders are maintained."*

b. *Groundwater quality is managed to ensure that existing groundwater quality is maintained or where it is degraded/over allocated as a result of human activity, groundwater quality is enhanced."*

Objective 5-2(a) (i) and (ii) are relevant for the assessment of the effects of the discharge on the receiving environment. Water quality parameters which are to be maintained under (i) and those which require enhancement under (ii) have been identified by Aquanet Ltd in their assessment and have been assessed in accordance with Policies 5-3 and 5-4 below. Overall, it is found that the proposal is consistent with the management objective set out in clauses a(i) and a(ii) of Objective 5-2.

Objective 5-2a(iii) is not relevant to this application, nor is objective 5-2a(iv) as there is no water conservation order for the Manawatū River.

Objective 5-2b relates to groundwater quality and requires it to be maintained or enhanced if it is degraded / overallocated as a result of human activity. This application does not impact on groundwater, however the overall wastewater management system includes wastewater irrigation to land which is separately consented. As set out in Section 5.3 of this report, the proposed discharge regime has been assessed in terms of the ability to manage the discharge to land within existing and expected future nutrient leaching limits. As the wastewater to land discharge is able to be undertaken within acceptable nutrient leaching limits, it is considered that objective 5-2b is met.

Policy 5-1: Water Management Zones and Values
Policy 5-1 establishes water management zones and subzones as per Schedule A of the One Plan. As set out in Section 3.2 the activity is occurring in water management subzone Mana_11a and the associated values and management objectives have been identified in Table 3.1 of this report.

Policy 5-1 further states:

"The rivers and lakes and their beds must be managed in a manner which safeguards their life supporting capacity and recognises and provides for the Schedule B Values when decisions are made on avoiding, remedying or mitigating the adverse effects of activities or in relation to any other function under the Resource Management Act 1991 exercised by the Regional Council or Territorial Authorities."

The Aquanet technical assessment has identified that the current discharge is having a less than minor effect on the water quality of the River and is not affecting the life supporting capacity of Manawatū River. It is acknowledged that the Manawatū River currently does not meet the Schedule E water quality targets that have been set to recognise and provide for the Schedule B values. The proposal will achieve a significant reduction in effects of the discharge on in-river concentrations and will remove the discharge at more vulnerable times (flows below 56 m^3/s and during the summer period). The proposal therefore contributes to the overall improvement of water quality in the Manawatū River. This is further discussions in relation to policies 5-2 to 5-5 below. The proposal is considered to be consistent with Policy 5-1.

Policy 5-2: Water quality targets

"In Schedule E, water quality targets relating to the Schedule B Values (repeated in Table 5.2) are identified for each Water Management Sub-Zone. Other than where they are incorporated into permitted activity rules as conditions to be met, the water quality targets in Schedule E must be

used to inform the management of surface water quality in the manner set out in Policies 5-3, 5-4 and 5-5."

This policy establishes for targets relating to Schedule B values to be identified in Schedule E of the One Plan. The relevant targets for the Mana_11a subzone in which the discharge occurs have been identified in Aquanet Ltd's report Table 2 (Appendix D). The proposed activity is not a permitted activity and therefore, as per Policy 5-2, the targets are not to be interpreted as regulatory limits but are to be used to inform the management of surface water quality as per policies 5-3, 5-4 and 5-5. These policies are assessed below.

Policy 5-3: Ongoing compliance where water quality targets are met

"a. Where the existing water quality meets the relevant Schedule E water quality targets within a Water Management Sub-zone, water quality must be managed in a manner which ensures that the water quality targets continue to be met beyond the zone of reasonable mixing (where mixing is applicable).

b. For the avoidance of doubt:

i. in circumstances where the existing water quality of a Water Management Sub-zone meets all of the water quality targets for the Sub-zone (a) applies to every water quality target for the Sub-zone

ii. in circumstances where the existing water quality of a Water Management Sub-zone meets some of the water quality targets for the Sub-zone (a) applies only to those water quality targets that are met

iii. for the purpose of (a) reasonable mixing is only applicable to a discharge from an identifiable location."

Policy 5-3 is relevant for water quality parameters which currently meet the Schedule E water quality targets. It requires that the compliance with Schedule E water quality targets continue to be met beyond the zone of reasonable mixing.

Reasonable mixing is defined in the One Plan as follows:

Reasonable mixing, in relation to the *discharge*^ of *contaminants*^ into a *river*^ or an *artificial watercourse**, means either:

(a) a distance downstream of the *discharge*^ that is the least of:

(i) the distance that equals seven times the width of the *river*^ at the point of *discharge*^ when the flow is at half the median flow, or

(ii) 200 metres from the point of *discharge*^ or, for *discharges*^ to *artificial watercourses**, 200 metres from the point of *discharge*^ or the *property** boundary, whichever is the greater, or

(iii) the point at which mixing of the particular *contaminant*^ concerned has occurred across the full width of the body of *water*^ in the *river*^, *artificial watercourse**, or

(b) a distance for *reasonable mixing** determined as appropriate for a consent application where special circumstances apply.

The discharge is to a side stream of the Manawatū River and is not subject to the full River flow mixing effects. The existing consent specifies a reasonable mixing zone of 400 m downstream of the point of discharge which is approximately 250-300 m downstream of point where the side stream joins with the main channel. Monitoring results have determined that full mixing has not occurred by that point.

Under clause (a)(i) of the reasonable mixing definition, the reasonable mixing zone could be considered to be either 50 m (being 7 times the width of the side stream channel) or 840 m (being 7 times the width of the main river channel). The lesser of the various distances defined in clause(a) is therefore either 50 m (assuming the reasonable mixing zone is based on the side channel width) or 200 m (as per clause (a)(ii)). It is considered unreasonable to assess the mixing zone based on the side channel width as this is not considered to be representative of the discharge environment (being the Manawatū River).

It is therefore considered that the reasonable mixing zone should be determined based on special circumstances and should remain at 400 m downstream of the discharge. This will provide consistency with the approach under the existing consent is and would be consistent with clause (a) in terms of when the discharge exits the side stream and enters the main stem of the River.

Based on historic monitoring, and as documented in Table 8 of Aquanet's report, the following parameters currently meet the Schedule E water quality targets and are therefore relevant to Policy 5-3:

- Ammonia
- Change in Clarity
- Particulate Organic Matter
- pH, including change in pH
- Temperature, including change in Temperature
- $ScBOD_5$
- Dissolved Oxygen

The water quality targets are currently met for these parameters upstream and downstream of the discharge. The proposal is for a reduction in wastewater volumes, a significant reduction of in-river effects of the discharge, and for the discharge to be ceased at a higher river cut-off flow than the current situation. Therefore, and as detailed in the Aquent report, the effects of the discharge on the river water quality are reduced compared to the current situation and the above parameters will continue to be met under the proposed discharge regime. The proposal is therefore consistent with Policy 5-3.

Policy 5-4: Enhancement where water quality targets are not met

"a. Where the existing water quality does not meet the relevant Schedule E water quality targets within a Water Management Sub-zone, water quality within that sub-zone must be managed in a manner that enhances existing water quality in order to meet:

i. the water quality target for the Water Management Zone in Schedule E, and/or

ii. the relevant Schedule B Values and management objectives that the water quality target is designed to safeguard.

b. For the avoidance of doubt:

i. in circumstances where the existing water quality of a Water Management Sub-zone does not meet all of the water quality targets for the Sub-zone, (a) applies to every water quality target for the Sub-zone

ii. in circumstances where the existing water quality of a Water Management Sub-zone does not meet some of the water quality targets for the Sub-zone, (a) applies only to those water quality targets not met."

As detailed in the Aquanet report, the water quality does not meet the Schedule E Water quality targets for the following parameters. These parameters are therefore to be managed in accordance with Policy 5-4:

- SIN
- DRP

- *E. coli*
- Clarity

Policy 5-4 requires that the water management zone be managed in a way that enhances the water quality so that the water quality targets for the above parameters are met. Water quality upstream of the discharge does not meet the water quality targets for the above parameters and the effect of the existing discharge is considered to be less than minor. This notwithstanding, the policy requires water quality throughout the water management zone to be enhanced in order that the targets are met. As noted above, under Policy 5-2, the targets are not to be interpreted as regulatory limits, but are to inform management decisions.

Across the water management zone, SIN is required to be reduced by 21% in order to meet the water quality target of Schedule E. The proposed activity will result in a reduction in the effects of the Fonterra discharge on in-river SIN concentrations of 46%, which is well in excess of that required of all discharges to the water management zone. Therefore, the proposal is considered to be consistent with Policy 5-4 in relation to the management of SIN.

On a water management zone wide basis, DRP is required to be reduced by 57% for the water quality target to be achieved. The proposed discharge regime will result in a reduction in the effects of the Fonterra discharge on in-river DRP concentrations of 39% compared to the 2019 baseline discharge against which the options have been assessed. Recent decisions from the Environment Court (NZEnvC084) assist in the interpretation of Policy 5-4. It was found that, subject to the BPO being adopted, an individual discharger is not required to achieve the same percentage reduction as required on a catchment wide basis. Fonterra acknowledges that the 39% reduction in DRP that will be achieved does not reach the level of reduction that is required across the catchment. This notwithstanding, it is considered that grant of consent would not be inconsistent with Policy 5-4 considerations as far as they relate to DRP because:

- The proposal represents the Best Practicable Option
- The assessment of a 39% reduction in effects of the discharge on in-river concentrations is based on the model results, which includes conservative (low) assumptions as to volumes which may be discharged to land. An operational objective for the system to prioritise wastewater to land when it can be done within sustainable limits for the land means that there may be further marginal reductions in DRP than modelled.
- The discharge is a low DRP discharge compared to the overall loading to the river. Therefore, the proposal is a significant reduction on a very minor component of overall DRP.
- The effect of DRP discharge to the River from this discharge is within monitoring detection limits and is unlikely to be measurable.

In terms of *E. coli,* there are two relevant targets. One *E. coli* target applies only during summer months. The proposal is for there to be no discharge to the River during summer periods and therefore, by definition, the proposal is consistent with Policy 5-4 as it relates to the summer *E. coli* target. The exception to this is when the November discharge condition is to be exercised. This would result in some WMRO to the River when soil conditions are such that it cannot be managed by discharged to land or managed through storage. The discharge in November is WMRO permeate only which has very low *E. coli* levels (90th percentile <100mL) which are below the Schedule E target. Therefore, the discharge of WMRO permeate in November will not cause Schedule E targets to be exceeded and the effect of the discharge during November is less than minor.

The second *E. coli* target is a year round target and requires *E. coli* to be below 500 per 100 mL when the river is at or below the 20th FEP. The assessment undertaken by Aquanet has determined that there is currently a statistically significant decrease between the upstream and downstream monitoring sites. Further, the proposal will remove discharges from the Fonterra site from the River when the river is below 56 m^3/s. Given that the current discharge causes a statistically significant decrease in *E. coli* levels, and that the proposal will reduce the impacts of the discharge further, it is considered that grant of consent is not inconsistent with Policy 5-4 as it relates to *E. coli*.

The final parameter for which water quality target is not met is clarity. Note that this is absolute clarity (which is required to be 2.5 m horizontal clarity as measured by black disc). The water quality target for change in clarity between upstream and downstream is met. Given that change in water clarity target is met, and that the discharge will only be RO permeates which have very low concentrations of suspended solids, it is considered that grant of consent is not inconsistent with Policy 5-4 as it relates to clarity.

Policy 5-5: Management of water quality in areas where existing water quality is unknown

"a. Where there is insufficient data to enable a comparison of the existing water quality with the relevant Schedule E water quality targets, water quality within the Water Management Sub-Zone must be managed in a manner which, beyond the zone of reasonable mixing (where reasonable mixing is applicable):

i. maintains or enhances the existing water quality

ii. has regard to the likely effect of the activity on the relevant Schedule B Values that the water quality target is designed to safeguard

iii. has regard to relevant information about the existing water quality in upstream or downstream Water Management Sub-zones, where such information exists.

b. For the avoidance of doubt:

i. in circumstances where there is insufficient data to enable a comparison of the existing water quality with all of the water quality targets for a Water Management Sub-zone (a) applies to every water quality target for the Sub-zone

ii. in circumstances where there is insufficient data to enable a comparison of the existing water quality with some of the water quality targets for a Water Management Sub-zone (a) applies only to those water quality targets with insufficient data

iii. for the purpose of (a) reasonable mixing is only applicable to a discharge from an identifiable location."

Water quality is well known within this water management zone and there are no parameters for which water quality targets are not known. Therefore, assessment against Policy 5-5 is not required.

Policy 5-9: Point source discharges to water

"The management of point source discharges into surface water must have regard to the strategies for surface water quality management set out in Policies 5-3, 5-4 and 5-5, while having regard to:

a. the degree to which the activity will adversely affect the Schedule B Values for the relevant Water Management Sub-zone

b. whether the discharge, in combination with other discharges, including non-point source discharges will cause the Schedule E water quality targets to be breached

c. the extent to which the activity is consistent with contaminant treatment and discharge best management practices

d. the need to allow reasonable time to achieve any required improvements to the quality of the discharge

e. whether the discharge is of a temporary nature or is associated with necessary maintenance or upgrade work and the discharge cannot practicably be avoided *f.* *whether adverse effects resulting from the discharge can be offset by way of a financial contribution set in accordance with Chapter 19*

g. *whether it is appropriate to adopt the best practicable option."*

As has been discussed in detail in this report and the technical assessment undertaken by Aquanet, the proposal not adversely affect the Schedule B values for the relevant water management zone. The water quality targets set in Schedule E have been set in order to provide for the Schedule B values and the assessment of effects has found that the proposal does not adversely effect water quality or life supporting capacity of the river.

The discharge, by itself, or in combination with other discharges, does not cause the Schedule E water quality targets to be breached. For all parameters where the Schedule E water quality targets have not been met, these are exceeded upstream of the discharge. Where water quality targets are exceeded upstream of the discharge, the effect of the discharge has been assessed as discussed under Policy 5-3 above.

Both Fonterra and Goodman Fielder operate their sites and wastewater systems in accordance with best practices including source control of contaminants, diversion of contaminants to beneficial results and treatment and management of residual waste in an appropriate manner.

The proposal does require a capital investment in order to construct the storage facility. A three year timeframe is sought following commencement of consent to enable the storage facility and associated infrastructure to be designed, constructed and commissioned. For reasons set out in Section 2.7.1, it is considered that this timeframe is reasonable as required by Policy 5-9(d).

The discharge is not of a temporary nature, and financial offsets are not required or proposed, and therefore Policy 5-9(e) and 5-9(f) are not relevant.

As described in this report and the attached technical report, the proposal represents the Best Practicable Option and is therefore consistent with Policy 5-9(g).

Overall, it is considered that the proposal is consistent with management approach prescribed in Policy 5-9.

Policy 5-11: Human Sewage Discharges

Notwithstanding other policies in this chapter:

(a) *before entering a surface water body all new discharges of treated human sewage must:*

- *(i)* *be applied onto or into land, or*
- *(ii)* *flow overland, or*
- *(iii)* *pass through an alternative system that mitigates the adverse effects on the mauri of the receiving water body, and*

(b) *all existing direct discharges of treated human sewage into a surface water body must change to a treatment system described under (a) by the year 2020 or on renewal of an existing consent, whichever is the earlier date.*

The discharge does not contain any human sewage and therefore Policy 5-11 is not relevant. This notwithstanding, Fonterra has engaged with Rangitāne with regard to the method of discharge and potential mitigation measures that could be applied to mitigate adverse effects on the mauri of the receiving water body. The current discharge structure is via a rock outfall structure. Rangitāne has confirmed that they are satisfied with the current discharge structure and do not consider that changes to the discharge structure are necessary.

8.5.4 Summary of Assessment

In summary, the proposal is considered to be consistent with, and give effect to, all relevant objectives and policies of the Regional Policy Statement.

8.6 Regional Plan or Proposed Regional Plan

The relevant Regional Plan is Part II of the Manawatū-Whanganui Regional Council's Combined One Plan. The relevant rules have been assessed in Section 4 of this report. An assessment against the objectives and policies of the Regional Plan is provided below.

8.6.1 Chapter 12 General Objectives and Policies

The key policy in Chapter 12 is Policy 12-5 which provides guidance as to consent durations. That policy is as follows:

Policy 12-5: Consent Durations

(a) *Other than as provided for under (b), the Regional Council will generally grant resource consents for the term sought by the applicant unless reasons are identified during the consent process that make this inappropriate.*

(b) *Resource consent durations for applications required under ss13, 14 and 15 of the RMA will generally be set to the next common catchment expiry date listed in Table 12.1. The dates listed in Table 12.1 show the initial expiry or review dates for consents within the catchment. Future dates for expiry or review of consents within that catchment must occur again every 10 years thereafter. Consents granted within three years prior to the relevant common catchment expiry date may be granted with a duration to align with the second common expiry date (that is the number of years up to the next expiry date plus 10 years). Dates may also be extended in 10 year increments where a term longer than 10 years can be granted after considering the following criteria:*

(i) *the extent to which an activity is carried out in accordance with a recognised code of practice, environmental standard or good practice guideline;*

(ii) *the most appropriate balance between environmental protection and investment by the applicant;*

(iii) *the provision of s128 review opportunities to enable matters of contention to be periodically reviewed in light of monitoring and compliance information; and*

(iv) *whether the activity is infrastructure; water, sewage or stormwater treatment plants and facilities; or publicly accessible solid waste facilities including landfills, transfer stations and resource recovery facilities.*

For a consent which is granted for a duration longer than 10 years, review of the consent must occur, as a minimum, on the review date in Table 12.1 and every 10 years thereafter until consent expiry. Extra review dates may be set in accordance with Policy 12-6.

(c) *Matters to be considered in determining a shorter consent duration than that requested under (a):*

(i) *whether it is necessary for an activity to cease at a specified time;*

(ii) *whether the activity has effects that are unpredictable and potentially serious for the locality where it is undertaken and a precautionary approach is needed;*

(iii) *the risks of long-term allocation of a resource whose availability changes over time in an unpredictable manner, requiring a precautionary approach; and*

> (iv) *in the case of existing activities, whether the consent holder has a good or poor compliance history in relation to environmental effects for the same activity*

In terms of (a) Fonterra is seeking a 25-year term of consent. It is recognised that this is subject to clause (b) of Policy 12-5. This requires consents granted under s15 of the RMA to be granted to the next common catchment expiry date. For the lower Manawatū River, the next common catchment expiry date specified in Table 12.1 of the One Plan is 2023. This application is being lodged in 2021 and therefore grant of consent would be within three years of this common catchment expiry date. As per Policy 12-5(b), the relevant common catchment expiry date is therefore 2033.

Policy 12-5(b) enables Regional Council to grant a consent term to the following common catchment expiry date (i.e. 2043) after considering criteria (i) to (iv). The proposal is being carried out in accordance with industry best practice and good manufacturing practices; it is an appropriate balance between environmental protection and investment; and it is expected that any consent that this granted would include s128 review provisions. While it is not "infrastructure" as defined in the One Plan, the activity is necessary to support two dairy manufacturing sites which are critical to supporting the regional economy. **It is therefore considered that the proposal satisfies the criteria of Policy 12-5(b)(i) to (iv) and a consent is able to be granted for a term expiring 2043. This is the common catchment expiry date which is closest to the applicant's requested 25 year consent term.**

There is no requirement for the activity to be ceased for a specific time, the proposed discharge does not have any effects that are unpredictable or potentially serious such that a precautionary approach need be taken; there are no risks associated with long term allocation of resources and the consent holder has a good compliance history. Therefore, there are no reasons under Policy 12-5(c) that would warrant a shorter consent duration.

8.6.2 Chapter 14 Discharges to Land and Water

Objective 14-1: Management of discharges to land and water and land uses affecting groundwater and surface water quality

> *"The management of discharges onto or into land (including those that enter water) or directly into water and land use activities affecting groundwater and surface water quality in a manner that:*
>
> a. *safeguards the life supporting capacity of water and recognises and provides for the Values and management objectives in Schedule B,*
>
> b. *provides for the objectives and policies of Chapter 5 as they relate to surface water and groundwater quality, and*
>
> c. *where a discharge is onto or into land, avoids, remedies or mitigates adverse effects on surface water or groundwater."*

As has been detailed throughout this report, the proposed discharge does not have an adverse effect on the life supporting capacity of the Manawatū River and provides for the management objectives in Schedule B and the relevant objectives and policies of Chapter 5. The proposal discharge regime includes a discharge to land which is able to be undertaken in accordance with an existing consent and in a manner which avoids adverse effects on surface water and groundwater. The proposal therefore achieves Objective 14-1.

Policy 14-1: Consent decision-making for discharges to water

"When making decisions on resource consent applications, and setting consent conditions, for discharges of water or contaminants into water, the Regional Council must specifically consider:

a. the objectives and Policies 5-1 to 5-5 and 5-9 of Chapter 5, and have regard to:

b. avoiding discharges which contain any persistent contaminants that are likely to accumulate in a water body or its bed,

c. the appropriateness of adopting the best practicable option to prevent or minimise adverse effects in circumstances where:

i. it is difficult to establish discharge parameters for a particular discharge that give effect to the management approaches for water quality and discharges set out in Chapter 5, or

ii. the potential adverse effects are likely to be minor, and the costs associated with adopting the best practicable option are small in comparison to the costs of investigating the likely effects on land and water, and

d. the objectives and policies of Chapters 2, 3, 6, 9 and 12, extent that they are relevant to the discharge."

An assessment against the objectives and policies of chapter 5 has been provided above. It has found that the proposal is consistent with the relevant objectives and policies of the Regional Policy Statement (Chapter 5). The discharge does not include any persistent contaminants that will accumulate in the water body or bed of the river. The proposal is considered to be the Best Practicable Option and the potential effects of the discharge are considered to be less than minor. An assessment against the objectives and policies of the relevant chapters of the RPS and Regional Plan to the extent that they are relevant has been provided and it has found that the discharge is not inconsistent with any relevant provisions.

Policy 14-3: Industry-based standards

"The Regional Council will examine on an on-going basis relevant industry-based standards (including guidelines and codes of practice), recognising that such industry based standards generally represent current best practice, and may accept compliance with those standards as being adequate to avoid, remedy or mitigate adverse effects to the extent that those standards address the matters in Policies 14-1, 14-2, 14-4 and 14-5."

Fonterra operates its wastewater systems in accordance with its Leading Industry Standards, and the proposal has been developed in accordance with the Leading Industry Standards and One Plan water quality targets. Both Fonterra and Goodman Fielder adopt best practice manufacturing standards and are actively engaged in water reduction and contamination reduction initiatives. The management of wastewater from the two dairy manufacturing sites is considered to be consistent with, or exceed, relevant industry standards.

Policy 14-4: Options for discharges to surface water and land

"When applying for consents and making decisions on consent applications for discharges of contaminants into water or onto or into land, the opportunity to utilise alternative discharge options, or a mix of discharge regimes, for the purpose of mitigating adverse effects, applying the best practicable option, must be considered, including but not limited to:

a. discharging contaminants onto or into land as an alternative to discharging contaminants into water,

b. withholding from discharging contaminants into surface water at times of low flow, and

c. adopting different treatment and discharge options for different receiving environments or at different times (including different flow regimes or levels in surface water bodies)."

The proposal is entirely consistent with this policy. As per the current system, wastewater will be prioritised to discharge to land in preference to water. Where soil moisture and ground conditions permit, wastewater will be discharged to land and, further, retentate (being the waste stream which contains the majority of contaminants) is prioritised for discharge to land ahead of the low strength permeate waste streams.

The proposed discharge regime is proposed to be given effect to via construction of a nominal 95,000 m^3 storage facility, with an effective storage volume of 63,700 m^3. This will enable wastewater to be withheld from discharging to surface water at times of low flow. Further, the proposal is to increase the minimum flow in the river required for the discharge to occur from 37 m^3/s to 56 m^3/s.

Different treatment and discharge options will be adopted depending on the receiving environment. For example, when all wastewater is able to be discharged to land (i.e. during summer months), this is likely to be treated via the DAF only. This is because the RO plant essentially splits the waste into two streams being the retentate and permeate. If both the retentate and permeate are to be discharged to land, it is inefficient to split the waste stream to simply combine it again. Operating the RO in this instance is an inefficient use of power and would shorten the effective lifespan of the membranes.

The proposal is therefore consistent with Policy 14-4.

Policy 14-8: Monitoring requirements for consent holders

"Point source discharges of contaminants to water must generally be subject to the following monitoring requirements:

a. the regular monitoring of discharge volumes on discharges smaller than 100 m^3/day and making the records available to the Regional Council on request,

b. the installation of a pulse-count capable meter in order to monitor the volume discharged for discharges of 100 m^3/day or greater,

c. the installation of a Regional Council compatible telemetry system on discharges of 300 m^3/day or greater, and

d. monitoring and reporting on the quality of the discharge at the point of discharge before it enters surface water and the quality of the receiving water upstream and downstream of the point of discharge (after reasonable mixing) may also be required. This must align with the Regional Council's environmental monitoring programme where reasonably practicable to enable cumulative impacts to be measured."

Currently the discharge is monitored in a manner which is consistent with Policy 14-8. The detailed design, construction and commissioning of the new infrastructure will be undertaken in a way which ensures the required monitoring and telemetry is provided.

Policy 14-9: Consent decision making requirements from the National Policy Statement for Freshwater Management

a. This policy applies to any application for the following discharges (including a diffuse discharge by any person or animal):

i. a new discharge; or

ii. a change or increase in any discharge of any contaminant into fresh water, or onto or into land in circumstances that may result in that contaminant (or, as a result of any natural process from the discharge^ of that contaminant, any other contaminant) entering fresh water.

b. *When considering any application for a discharge the Regional Council must have regard to the following matters:*

   i. *the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water; and*

   ii. *the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided.*

   This clause of the policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2011 took effect on 1 July 2011.

c. *When considering any application for a discharge the Regional Council must have regard to the following matters:*

   i. *the extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their secondary contact with fresh water; and*

   ii. *the extent to which it is feasible and dependable that any more than minor adverse effect on the health of people and communities as affected by their secondary contact with fresh water resulting from the discharge would be avoided.*

   This clause of the policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2014 took effect on 4 July 2014.

The application is not for a new discharge, nor does it represent a change or increase in the contaminants discharged. This policy is therefore not relevant to the assessment of the application. This notwithstanding, as discussed throughout this AEE, the effect of the discharge is considered to be les than minor and will not have an adverse effect on life supporting capacity of the river or the health of people and communities.

8.6.3 Summary of Assessment

In summary, the proposal is considered to be consistent with, and give effect to, all relevant objectives and policies of the Regional Plan.

8.7 Other Matters

A relevant s104 "Other Matter" is the Manawatū River Leaders Accord. The Accord commenced in August 2019 and represents a commitment by iwi/hapū, local and central government, farming, industry leaders, Massey University, and environmental and recreational advocacy groups to work together to improve the health of the Manawatū River and its catchment. Fonterra is a signatory to the Accord and an active participant in the Accord's work programme.

The Accord document sets out the vision, and goals for the river, as follows:

OUR VISION

Kei te ora te wai, kei te ora te whenua, kei te ora te tangata.

If the water is healthy, the land and the people are nourished.

OUR MAIN GOAL

Our goal is to improve the Manawatu River, the mauri (lifeforce) of the Manawatu River Catchment, such that it sustains fish species, and is suitable for contact recreation, in balance with the social, cultural and economic activities of the catchment community.

This goal represents a community opportunity to develop leadership in catchment improvement and capture the social and economic benefits of such leadership.

ISSUES

We note that the Manawatu River flows through a developed landscape that provides important social, cultural and economic benefits.

However, we acknowledge that the community has concerns and has identified that the river is in a poor state. It has been described as dirty, lacking life and culturally compromised.

We understand that people living in and around the Manawatu River want to be able to appreciate and enjoy the river by swimming in it, taking food from it, using it as a water source and protecting its cultural values.

GOALS

1. The Manawatu River becomes a source of regional pride and mana.
2. Waterways in the Manawatu Catchment are safe, accessible, swimmable*, and provide good recreation and food resources.
3. The Manawatu Catchment and waterways are returned to a healthy condition.
4. Sustainable use of the land and water resources of the Manawatu Catchment continues to underpin the economic prosperity of the Region.

As discussed throughout this AEE, the proposed discharge regime represents a significant reduction in the volume of wastewater discharged and the in-river effects of the discharge. This is achieved by prioritising retentate to land (being the waste stream which contains the majority of the contaminants), constructing large scale storage to increase the amount of permeate discharged to land rather than the River; avoiding all discharges to the River during the summer months, and increasing the river flow cut-off below which no discharges can occur.

The Accord's 2016-2021 action plan identifies the following areas for actions to be targeted:

- **REDUCE THE NUTRIENT AND BACTERIA FROM POINT SOURCE DISCHARGES**
- **REDUCE THE IMPACT OF FLOOD CONTROL AND DRAINAGE SCHEMES**
- **PROTECT AREAS OF HABITAT FOR NATIVE FISH, BIRDS AND TROUT**
- **REDUCE SEDIMENT RUN-OFF FROM EROSION PRONE FARMLAND, THE RURAL ROAD NETWORK, AND AREAS OF MAJOR EARTHWORKS**
- **REDUCE THE RUN-OFF OF SEDIMENT, NUTRIENTS AND BACTERIA FROM INTENSIVE LAND-USE SUCH AS DAIRYING AND CROPPING**
- **INCREASE AWARENESS OF THE CHALLENGES FACED BY FRESHWATER AND ACTIONS THE COMMUNITY CAN TAKE**
- **PREVENT OVER-USE OF WATER**

The only one of these target action areas to which this application directly relates is the first action area being to "reduce the nutrient and bacteria from point source discharges". As has been discussed throughout this report and the attached Aquanet report, the proposed discharge regime is modelled to achieve a reduction in effects of the discharge on in-river annual average concentrations of 39%for DRP and 46% for SIN compared to the current discharge. The discharge is also one which does not have an adverse effect on *E. coli* levels in the River, with the current discharge resulting in a statistically significant decrease in *E. coli* between upstream and downstream monitoring results. The application is therefore consistent with, and contributes to achieving the actions set out in the Manawatū River Leaders Accord.

The River Leaders Accord Action Plan for 2016-2021 includes the following actions which are the specific responsibility of Fonterra:

TASK #	TASK DESCRIPTION	LEAD AGENCY	PARTNERS	MEASURED BY	TIMEFRAME	ACTION AREA
27.	Record nitrogen information on dairy farms in the catchment, with one on one assistance provided to at risk farmers to develop ways of reducing nitrogen leaching.	Fonterra		Percentage of farms supplying information.	100% of dairy farms supplying information by 2021	
29.	Work with farmers to increase understanding around the management and recording of water use, to increase efficiency.	Fonterra		Number of dairy farms with a water meter.	85% of farms to install a water metre by 2019	
41.	Promote riparian fencing and planting through a range of mechanisms including local farming champions and as part of existing DairyNZ and Beef and Lamb field days. This includes the promotion of the assistance and incentives available to farmers for fencing and planting.	NZ Landcare Trust, Federated Farmers, Fonterra and other industry bodies	Horizons Regional Council, DairyNZ, Fonterra, Open Country Dairy	Number of opportunities for the farmer champion to promote riparian fencing & planting (field days, media articles).	Targeting 5 opportunities to promote riparian fencing and planting each year including at least one field day per year Aim to promote the incentives to farmers in four Federated Farmers publications per year	
43.	Engage dairy farmers in developing riparian planting plans, working alongside their Sustainable Dairying Advisor.	Fonterra.	DairyNZ, Open Country Dairy	Number of farms in the catchment with a riparian planting plan.	100% of farms to have a riparian planting plan in place by 2021	

These actions relate to the work that Fonterra does to support its farmer suppliers and does not directly relate to the processing and manufacturing facility at Longburn.

8.8 Value of Investment

Section 104(2A) of the RMA requires that:

> *"When considering an application affected by section 124 or 165ZH(1)(c), the consent authority must have regard to the value of the investment of the existing consent holder."*

Section 124 applies as this application is being made for a new resource consent for the same activity associated with a consent that is expiring (resource consent APP-2003010585.02). This application is being lodged with the consent authority prior to 22 September 2021, being at least six months prior to the expiry date of consent APP-2003010585.02. Given that s124 applies, the consent authority must have regard to the value of the investment of the existing consent holder.

An assessment of the economic impact of the Longburn dairy manufacturing sites (Fonterra and Goodman Fielder) in included in Appendix E. That assessment identifies that the sites contribute approximately $25 million per annum direct to the local economy.

The value of investment in land, buildings and plant which supports this contribution to the local economy is estimated at over $349 million.

9 PART 2 RMA ASSESSMENT

Part 2 of the RMA sets out the Purpose and Principles of the Act.

Section 6 specifies Matters of National Importance that must be recognised and provided for. The proposed activity does not adversely affect any of the matters of national importance specified in Section 6 as it: does not have any adverse effect on the natural character of the Manawatū River and its margins; does not involve the subdivision, use or development of any outstanding natural features and landscapes; does not impact on indigenous vegetation or habitat of indigenous fauna; nor does it impact on public access to the River. There are no protected customary rights or historic heritages features which are affected by the proposal, and the application does have any effect on the management of significant risks from natural hazards. Fonterra does acknowledge that all discharges to the River are considered to have an effect on the mauri of the River, however, Fonterra is actively engaging with iwi to ensure that cultural effects are mitigated appropriately and is also working with iwi and hapū in relation to a range of activities associated with the Longburn site to support the relationship of Maori to ancestral lands, sites, wāhi tapu and other taonga as far as practicable. Therefore, it is considered that the proposal recognises and provides for relevant matters of national importance.

Section 7 sets out Other Matters to which particular regard must be had. These matters have been addressed through consideration of the objectives and policies in the national and regional planning instruments assessed in Section 8 of the report. Fonterra has had regard to kaitiakitanga through the way in which it has, and continues to, engage with iwi who have mana whenua and kaitiaki roles in relation to the Manawatū River. The proposed discharge does not have any effect on the amenity values of the River and has been found to have a less than minor effect on the life supporting capacity of the River and regard has been had to the intrinsic values of ecosystems. The proposal provides for the maintenance and enhancement of natural and physical resources as it represents a significant reduction in wastewater quantities to the River and a significant reduction in in-river effects, such that water quality will be enhanced while ensuring that the discharge to land is within sustainable limits. The River is recognised as an important trout fishery, and the protection of the habitat of trout is provided for through the improvements in water quality and the absence of effects of the discharge on periphyton growth. It is therefore considered particular regard has been had to the relevant other matters specified in Section 7 and the proposal has less than minor effects and / or positive effects on those matters.

Section 8 requires that the principles of the Treaty of Waitangi be taken into account. It is considered that the way in which Fonterra has engaged with iwi and will continue to engage in an ongoing relationship with iwi and hapū is consistent with the principles of the Treaty of Waitangi.

Overall, it is considered that grant of consent would be consistent with Part 2 of the Act and with the sustainable management purpose of the Act as set out in Section 5 of the Act. This is because the proposed discharge enables the ongoing operation of the Fonterra and Goodman Fielder dairy manufacturing sites thereby supporting the economic wellbeing of the community, while safeguarding the life supporting capacity of the Manawatū River and avoiding, remedying and mitigating any adverse effects on the environment.

Appendix A1

RESOURCE CONSENT APP-2003010585.02

Fonterra Limited

to discharge LSE and HSE (wastewater) via an outfall into the Manawatu River subject to the attached condition schedule

Application Reference:	APP-2003010585.02
Granted Date:	15 June 2015
Review Date:	During the month of June 2015 – 2021 or within two months of receiving a report under Conditions 8 or 9
Expiry Date:	23 March 2022

horizons
regional council

Application Summary

Application Reference	APP-2003010585.02
Purpose of Application	Vary consent APP-2003010585.01 to change condition 17 to delay the installation of the Reverse Osmosis Plant (which is equivalent to the second DAF unit and UV treatment) to 30 September 2015, and to update the table in condition 3 to require an improvement to the wastewater discharge into the Manawatu River from 1 May 2015.

Background

Fonterra Limited was granted consent on 23 March 2007 to discharge wastewater from the Fonterra processing plant to the Manawatu River subject to a number of conditions. The conditions covered matters such as the times of year the discharge could occur, the volume of wastewater discharged and the quality of the wastewater.

Over the term of the consent the consent holder is required to improve the quality of the wastewater discharged into the Manawatu River.

Specifically, condition 17 of the consent requires the consent holder to determine and implement the best practicable option for the treatment of the high strength effluent (HSE). The consent holder has determined that a reverse osmosis plant (RO) is the preferred option to meet condition 17 (ii) but delays to the construction schedule mean that the second plant will not be installed by the deadline of 31 December 2014. The applicant proposes to install the RO plant by 30 September 2015.

As an interim measure, the consent holder has proposed to divert a larger portion of wastewater to land from 1 May 2015 to when the second RO plant is installed. This will ensure a reduction in contaminants discharged to the Manawatu River will be achieved in accordance with the original dates in condition 17 ii.

In order to recognise the improved discharge standards in the conditions, the consent holder has applied to vary condition 3 to update a table that specifies the discharge quality for dissolved reactive phosphorus (DRP) and E. *coli*. This change reflects a reduction in the limits set in the consent.

Activity Summary

The following summarises the activities that are associated with this Resource Consent, please refer to the applicable section for individual activity details.

Activity Summary	Variation to Consent
Discharge to Land, variation to amend consent conditions 2 and 9	APP-2003010585.01(102909/1)

Assessment Summary

The application has been assessed against the following:

1.1 *Policies, Plans, Objectives & Rules*

The application has been assessed against the following Regional Policies, Plans, Objectives & Rules:

Policy, Plan or Rule Name

One Plan (2014) – Regional Policy Statement

Objective	Policy
5-1 5-2	5-1 5-3 5-9

One Plan (2014) – Regional Plan

Objective	Policy
14-1	14-1 14-4 14-8

The application to vary this consent has been assessed against the objectives and policies identified above. I consider that the proposed variation is consistent with the objectives and policies of the One Plan (2014).

As the application is for a variation the rules of the One Plan are not considered – rather it has been processed in accordance with Section 127 of the Resource Management Act 1991.

1.2 *Environmental Effects*

The effects of this variation have been assessed with regard to actual and potential adverse environmental effects, the following outlines the conclusions and considerations:

Potential Environmental Effects

Effects on water quality

The applicant is proposing to delay the installation of the second RO plant beyond the timeframe specified in the consent. In order to ensure that the discharge quality still improves in accordance with other conditions in the consent, the applicant will divert more of the wastewater to land and meet updated discharge standards. The diversion of more wastewater to land will result in no change or increase in effects in the Manawatu River.

Potential Environmental Effects

The application has been assessed by Maree Clark, Water Quality Scientist for Manawatu-Wanganui Regional Council. Ms Clark has assessed if the proposed variation to conditions will have any adverse effects, and whether the changes will still ensure that overall the discharge to the River improves, and that any adverse effects from the discharge into the river are reduced. The changes to the standards will improve the quality of the discharge as the applicant is reducing the consented volume of contaminants.

Ms Clark considers that the proposed variation to conditions will not cause a delay to the improvement of the quality of the discharge and that the proposed changes to condition 3 will reduce adverse effects of the discharge on the Manawatu River.

Overall, I consider that the effects of the proposed variation to conditions will be less than minor.

Other matters

The consent document has had some changes made in order to allow it to be merged into the Manawatu-Wanganui Regional Councils new electronic consenting system 'IRIS'. Changes include some of the consent conditions being renumbered, cross references within conditions being corrected and conditions being ordered under new headings. Approval was gained from the applicant for this to occur.

Recommendation

It is recommended that the resource consent variation application by **Fonterra Limited** for the activities identified in the activity summary be granted for the following reasons subject to the conditions outlined in the applicable condition schedule:

a. the variation has been assessed by Maree Clark, Water Quality Scientist, Manawatu-Wanganui Regional Council, and based on this assessment I am satisfied the proposal will have less than minor actual or potential adverse effects on the environment; and

b. the variation is consistent with relevant objectives and policies of the One Plan 2014; and

c. the variation is consistent with the purpose and principles of the Resource Management Act 1991.

G Hayes.

Gemma Hayes

CONSENTS PLANNER

Decision

The Manawatu-Wanganui Regional Council Regulatory Manager (under delegated authority), grants a variation to the resource consent for the reasons stated in the recommendation, to **Fonterra Limited** under section 127 of the Resource Management Act 1991 to:

Activity Summary
Discharge to Land, variation to amend consent conditions 2 and 9

for a term expiring on **23 March 2022** subject to the conditions outlined in the applicable condition schedule.

Greg Bevin

REGULATORY MANAGER

15 June 2015

1. Activity, Discharge (Water)

The following details the location, classifications and conditions associated with the activity.

Activity Type	**Discharge to Land**
Activity Class	Discretionary Activity
Primary Activity Purpose	Industrial, Waste Management, Liquid Waste, Condensate
Secondary Activity Purpose	Industrial, Waste Management, Liquid Waste, Wastewater
Replaces Consent	APP-2003010585.01 (102909/1)

Location

The following summarises the authorised location for the consented activity.

Activity Location Description	Walkers Road, Longburn
Valuation Number	14330/124.00
Legal Description	PT Lot 1 DP 54397, Lot 6 DP 77563, Lot 1 DP 65295, Lot 2 DP 65369, Lot 9 DP 84633, PT Lot 1 DP 54397
Map References	NZTopo50 BM34:170-249 / Easting 1817087 Northing 5524993

Classifications

The following summarises the classifications associated with the application activity.

Groundwater Management Zone	Manawatu
Water Management Zone	Manawatu Catchment, Lower Manawatu, Lower Manawatu
Estuary Management Zone	Not Affiliated with Coastal Marine Area
Associated River	MANAWATU RIVER

Condition Schedule

Environmental Standards

1. The discharge of LSE or HSE is subject to the following restrictions:

   a. During the months November to April for the term of this Discharge Permit inclusive there shall be no discharge of HSE commencing **November 2006**.
   b. During the months November to April inclusive for the term of this Discharge Permit the volume of LSE discharged shall not exceed 2,500 cubic metres per day commencing **November 2006**.
   c. During the months May to October inclusive for the term of this Discharge Permit the total combined volume of LSE and HSE discharged shall not exceed 6,000 cubic metres per day commencing **August 2006**.
   d. During the months May to October inclusive for the term of this Discharge Permit there shall be no discharge of HSE when Q is less than 37 cubic metres per second commencing **August 2006**.
   e. At all times the discharge of LSE and HSE shall be to land on the Permit Holder's irrigation farms whenever the soil moisture conditions on those farms are suitable for that purpose.

2. The wastewater discharged shall comply with the daily mass load discharge standards in Table 1 (all kg/day except for *E.coli*) based on 24 hour chilled (4^{o} Celsius) composite samples of wastewater with a running 95 percentile calculated for each sample using 20 consecutive samples:

Table 1: Discharge Restrictions

Parameter	**November to April**		**May to October**	
	95 Percentile	**Maximum**	**95 Percentile**	**Maximum**
Total $CBOD_5$	15 Q	30 Q	50 Q	60 Q
Dissolved $CBOD_5$	9 Q	18 Q	30 Q	40 Q
NH_4-N	2 Q	4 Q	2 Q	4 Q
TSS	6 Q	12 Q	25 Q	35 Q
DRP	0.1 Q	0.3 Q	0.15 Q	0.2 Q
E.Coli (CFU)	0.86 trillion *Q	8.6 trillion *Q	0.1 trillion *Q	0.17 trillion *Q

Advice Note: If the Teachers College recording site ceases to be used by the Manawatu-Wanganui Regional Council then the Council will identify a new flow recording site and will recalibrate the Q values in Table 1 accordingly.

[Condition 2 amended as per variation APP-2003010585.02 dated 15 June 2015]

3. The discharge of LSE or HSE shall not:

i. cause the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials at any time; or
ii. cause any emission of objectionable odour at any time; or
iii. cause any conspicuous change in colour or clarity when Q is greater than 13.7 cubic metres per second; or
iv. cause a change in horizontal visibility, defined as the horizontal sighting range of a 200 millimetre-diameter black disc, by more than 30% when Q is greater than 13.7 cubic metres per second; or
v. cause horizontal visibility, defined as the horizontal sighting range of a 200 millimetre-diameter black disc, to be less than 1.6 metres, when upstream visibility is greater than 2.0 metres when Q is less than 30 cubic metres per second

at any point in the Manawatu River more than 400 metres downstream of the Permit Holder's discharge outfall.

Operational Restrictions

4. The Permit Holder shall install a diversion system in the LSE collection system prior to either recommissoning the Special Powders Unit (SPU) or operating any other milk processing plant which has the potential to contribute contaminants to the LSE system. The diversion system shall ensure that contaminated LSE is not discharged to the Manawatu River. The Permit Holder shall inform the Manawatu-Wanganui Regional Council's Team Leader Compliance of the diversion system's installation within 10 working days following its installation.

5. Should the Permit Holder recommission the SPU prior to complying with Condition 4 then any condensate from the SPU shall be discharged to the HSE system and shall not be allowed to enter the LSE system.

6. By **31 October 2006** the Permit Holder shall install signage advising the general public of the area affected by the discharge and the area where contact recreation is inappropriate. The signage shall be maintained in good order by the Permit Holder throughout the duration of this Permit.

7. The Permit Holder shall ensure that riverbed sediment or general detritus does not accumulate at the head of the channel in which the discharge outfall is located to such an extent that the mixing of the effluent with the river flow would be adversely affected.

Post-Development Assurance

8. By **30 June 2008** the Permit Holder shall undertake a comprehensive review of all the effluent generation sources and water use activities in the Longburn facilities (including to the extent permissible those not owned or operated by the Permit Holder) which contribute to the LSE and HSE effluent streams. The review shall:

   i. characterise individual effluent sources and evaluate effluent minimisation opportunities;
   ii. evaluate options for water use reduction and water reuse;
   iii. recommend best practicable options for maximising water use efficiency and minimising effluent volumes.

   The results of the review shall be compiled into a report which shall be provided to Manawatu-Wanganui Regional Council's Team Leader Compliance by **31 August 2008**.

9. By **30 September 2008** the Permit Holder shall undertake a review of the Fonterra Longburn effluent treatment system for the purpose of determining the Best Practicable Option for the treatment of the HSE. The review shall include the current state of technical knowledge, and the financial implications and effects on the environment of each treatment option compared to other options (including the option of no additional treatment). The Permit Holder shall forward a copy of the review report to Manawatu-Wanganui Regional Council's Team Leader Compliance by **31 October 2008**. The report shall include a programme of implementation for the selected Best Practicable Option for the treatment of the HSE. That programme shall include:

   i. the installation of a dissolved air flotation (DAF) unit by 30 November 2009 and the commissioning of that unit by 30 April 2010 (or other treatment of equivalent effect or outcome); and
   ii. the installation and commissioning of a second DAF unit and UV treatment (or other treatment of equivalent effect or outcome) by 31 September 2015.

   Advice Note: For the avoidance of doubt, compliance with Condition 9 (including the installation of treatment required under (i) and (ii) above), shall not in and of itself affect the application of review Condition 21(v) below.

   [Condition 9 amended as per variation 102909/1 dated 17 August 2009]

   [Condition 9 amended as per variation APP-2003010585.02 dated 15 June 2015]

Monitoring Provision

Effluent Monitoring

10. The Permit Holder shall separately measure and record the daily volume of LSE and HSE discharged to the Manawatu River. Those records shall be made available to Horizons Regional Council's Compliance Monitoring staff on request.

11. The Permit Holder shall take 24 hour flow proportioned combined samples of LSE and HSE discharged and the samples shall be analysed for the constituents and at the frequency listed in Table 2. If no discharge occurs in any one week then no sampling of the weekly parameters is required.

River Monitoring

12. The Permit Holder shall take samples from the Manawatu River at a point located 400 metres downstream of the Permit Holder's discharge outfall and the samples shall be analysed for the constituents and at the frequency listed in Table 2. The samples shall be taken at a time when the Permit Holder is discharging effluent to the Manawatu River. If no discharge of effluent occurs during any one calendar month then no sampling of river water quality shall be required in that month.

Table 2: Effluent and River Monitoring

Analyte	Effluent Daily	Effluent Weekly	River Monthly
Total COD	X		
Filtered COD	X		
Total $CBOD_5$		X	X
Dissolved $CBOD_5$		X	X
NH_4-N		X	X
TSS		X	X
DRP		X	X
E.Coli (CFU)		X	X
NO_3-N		X	X
NO_2-N		X	X
TKN		X	X
pH		X	X
Conductivity		X	X
Total Phosphorus		X	X

Advice Note: Weekly means the seven day period Monday to Sunday.

13. All quality analysis shall be undertaken by an appropriate accredited laboratory. All methodologies adopted shall be appropriate for either wastewater or receiving water analyses respectively and the dissolved $CBOD_5$ shall be GF/C filtered.

14. The Permit Holder shall have an accredited laboratory undertake an annual audit of the effluent and river water quality sampling and analysis. A copy of the audit results shall be provided to Manawatu-Wanganui Regional Council's Team Leader Compliance by **30 June** each year for the term of this Discharge Permit commencing **30 June 2007**.

15. In the period **October to November** in the years **2006, 2009, 2012, 2015, 2018 and 2021** the Permit Holder shall carry out surveys of macroinvertebrate (MCI, QMCI, %ETP taxa and %ETP individuals) and periphyton (chlorophyll *a* and total periphyton cover) communities from riffles at two sites located in the reach 200 metres upstream of the Permit Holder's discharge outfall and at two sites in the reach 400 metres to 800 metres downstream of the Permit Holder's discharge outfall. The surveys shall generally be carried out following a period when Q has been less than 111 cubic metres per second for more than 14 consecutive days. The methodology and precise locations for monitoring shall be determined in consultation with Manawatu-Wanganui Regional Council's Team Leader Compliance. The Permit Holder shall forward a comprehensive report on these surveys to Manawatu-Wanganui Regional Council's Team Leader Compliance by 31 March of the year following each survey. The reports shall include an assessment of the effects of the Permit Holder's discharge on the benthic biota of the Manawatu River.

Annual Reporting

16. The Permit Holder shall make results of monitoring undertaken required by Conditions 10, 11 and 12 of this Permit available to the Manawatu-Wanganui Regional Council's Team Leader Compliance on request, and data records for each three month period ending March, June, September and December shall be forwarded to Manawatu-Wanganui Regional Council's Team Leader Compliance in a suitable electronic format, within 14 days after the end of each three monthly period.

17. By **31 July** each year commencing **31 July 2007** the Permit Holder shall prepare a report that summarises and assesses all of the monitoring information required under the conditions of this Permit. In particular the Permit Holder shall critically assess the effects of the discharges over the preceding 12 months on the receiving environment and identify whether or not any adverse effects on the environment are evident as a result of the discharges.

18. No later than **15 August** each year commencing **15 August 2007**, a copy of the annual report required under Condition 17 shall be provided by the Permit Holder to Tanenuiarangi Manawatu Incorporated, Fish and Game New Zealand (Wellington Region), the Department of Conservation (Wanganui Conservancy), the Waitarere Environmental Care Association Inc, Caleb Royal, Pataka Moore, Royal Forest and Bird Protection Society of NZ Inc, the Manawatu Estuary Trust, the Foxton Waterfowl and Wetlands Club, and Christina and George Paton. The Permit Holder shall provide copies of the annual report required under Condition 17 upon request to parties who submitted to the 2006 resource consent application for this Permit.

19. Charges, set in accordance with Section 36(1)(c) of the Resource Management Act 1991 and Section 150 of the Local Government Act 2002, shall be paid to the Manawatu-Wanganui Regional Council for the carrying out of its functions in relation to the administration, monitoring and supervision of this resource consent, and for the carrying out of its functions under Section 35 (duty to gather information, monitor, and keep records) of the Act.

    Advice Note: Section 36(1)(c) of the Act provides that Council may from time to time fix charges payable by holders of resource consents. The procedure for setting administrative charges is governed by Section 36(2) of the Act and is currently carried out as part of the formulation of the Council's Long Term Council Community Plan.

20. A liaison group shall be established by the Permit Holder made up of representatives of the Permit Holder, Horizons Regional Council, the Waitarere Environmental Association Inc, the Manawatu Estuary Trust, the Foxton Waterfowl & Wetlands Club, Christina & George Paton, Caleb Royal, Pataka Moore, and the Royal Forest & Bird Protection Society of NZ Inc. The liaison group shall be established by 1 April 2007 and shall meet at least annually and otherwise when major events under this Permit occur to discuss matters related to this Permit.

    Advice Note: Costs related to attending the liaison group meetings shall be met by each attendee.

Review

21. Manawatu-Wanganui Regional Council, under Section 128 of the Act, may initiate a review of the conditions of this Permit annually in the month of June commencing **June 2007** or within two months of receiving a report under Conditions 8 or 9 i.e. between 31 August 2008 and 31 December 2008. The review of conditions shall be for the purposes of:

    i. To deal with any adverse effect on the environment which may arise from the exercise of the Permit and which it is appropriate to deal with at a later stage; or
    ii. To require the adoption the best practicable option to remove or reduce any adverse effect on the environment; or
    iii. To amend the monitoring or reporting required under conditions of this Permit.
    iv. To amend the macroinvertebrate and periphyton monitoring required under conditions of this Permit if necessary to accommodate a coordinated monitoring programme undertaken in conjunction with other discharge Permit Holders;
    v. When a regional plan has been made operative which sets rules relating to minimum standards of water quality, and in Manawatu-Wanganui Regional Council’s opinion it is appropriate to review the conditions of the Permit in order to enable the standards set by the rule to be met.

The review of conditions shall allow for:

i. The deletion or amendment of any of the conditions of this Permit;
ii. The addition of new conditions as necessary to avoid, remedy or mitigate any adverse effects on the environment;
iii. The amendment of the daily mass load discharge standards in Table 1;
iv. The implementation of the best practicable treatment option derived under Condition 9.

Advice Note: It is anticipated that the daily mass load discharge standards in Table 1 of Condition 2 will be reviewed and amended after the new treatments referred to in Condition 9(i) and (ii) have been installed and commissioned.

Duration

22. This Permit shall be for a term of 15 years from the date of commencement.

Appendix A2

HORIZONS LETTER APRIL 2014 RE WMRO DEFINITION AS LSE

28 April 2014

horizons
regional council

Private Bag 11025
Manawatu Mail Centre
Palmerston North 4442

P 06 952 2800
F 06 952 2929

www.horizons.govt.nz

Fonterra Cooperative Group Ltd
P O Box 14063
LONGBURN 4866

File ref:2/1/FCG
LMS:KJH

Attention: Campbell Dodds

Dear Campbell

RESOURCE CONSENT 102909/1 – INCLUSION OF REVERSE OSMOSIS PERMEATE IN WASTEWATER

Thank you for your letter dated 24 February 2014. As discussed at our meeting on 28 February, I believe the permeate generated as part of the proposed reverse osmosis process fits within the definition of Low Strength Effluent (as defined in consent 102909/1). Therefore, a change to consent conditions will not be required provided the discharge volumes specified in both the water discharge consent (102909/1) and the land discharge consent (105070) can still be complied with.

I have reached this conclusion on the understanding that the permeate produced from the reverse osmosis plant will effectively be the same composition as condensate but at a lower strength. If possible, I would recommend that testing of the permeate occurs to ensure this is the case.

Yours sincerely

Leana Shirley
SENIOR CONSENTS PLANNER

Appendix B

RECORD OF TITLES

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN53C/912**
Land Registration District **Wellington**
Date Issued 12 October 1998

Prior References
WNE3/898

Estate Fee Simple
Area 6.9076 hectares more or less
Legal Description Lot 1-2 Deposited Plan 85957
Registered Owners
Fonterra Limited

Interests

Subject to Section 241(2) Resource Management Act 1991

Subject to Section 59 Land Act 1948

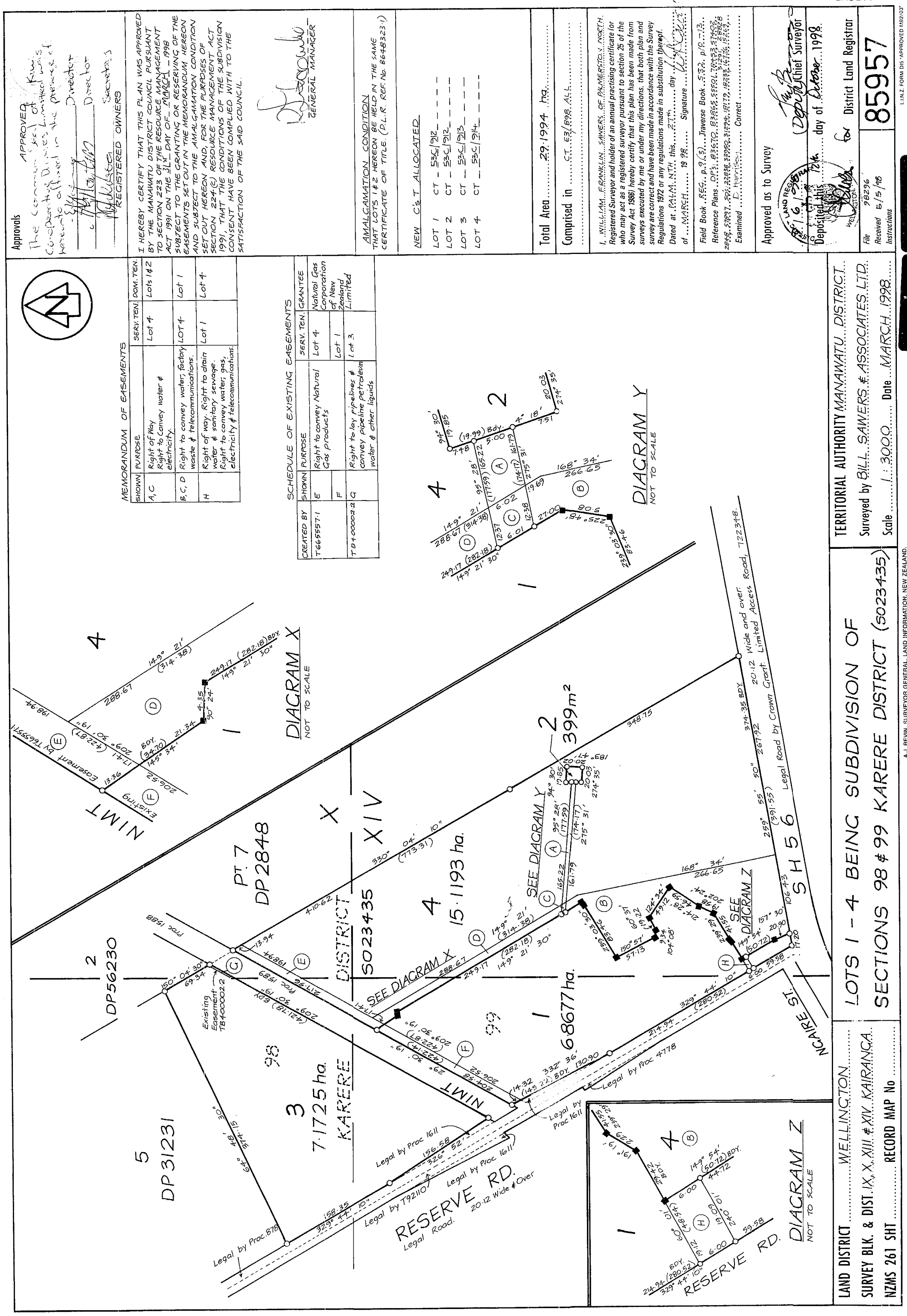
722348 Gazette Notice declaring State Highway 56 to be a limited access road - 25.9.1967 at 11.17 am

Subject to gas rights (in gross) over part marked F on DP 85957 in favour of Natural Gas Corporation of New Zealand Limited created by Transfer 665557.1 - 15.1.1985 at 10.38 am

Appurtenant hereto is a right of way and rights to convey water and electricity (affects Lots 1 and 2 herein) and rights to convey water, factory waste and telephone (affects Lot 1 herein) specified in Easement Certificate B688535.5 - 12.10.1998 at 9.01 am

Subject to a right of way and rights to water and sewage drainage, convey water, gas, electricity and telephone over part marked H on DP 85957 specified in Easement Certificate B688535.5 - 12.10.1998 at 9.01 am (affects Lot 1 DP 85957)

The easements specified in Easement Certificate B688535.5 are subject to Section 243 (a) Resource Management Act 1991


LOTS 1 - 4 BEING SUBDIVISION OF
SECTIONS 98 & 99 KARERE DISTRICT (SO23435)
LAND DISTRICT WELLINGTON
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by BILL SAWERS & ASSOCIATES LTD.
Scale 1:3000
Date MARCH 1998
Total Area 29.1994 ha.
DIAGRAM X
NOT TO SCALE
DIAGRAM Y
NOT TO SCALE
DIAGRAM Z
NOT TO SCALE
MEMORANDUM OF EASEMENTS
SCHEDULE OF EXISTING EASEMENTS
RESERVE RD.
NIMT
DP 31231
DP 56230
PT 7 DP 2848
SH 56
McCAIRE ST.
15.1193 ha.
6.8677 ha.
7.1725 ha.
399m²
Approved as to Survey
District Land Registrar
85957

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**WN27C/590**
Land Registration District	**Wellington**
Date Issued	11 October 1985

Prior References
WN394/168

Estate	Fee Simple
Area	31.0411 hectares more or less
Legal Description	Part Lot 7 Deposited Plan 2848

Registered Owners
Fonterra Limited

Interests

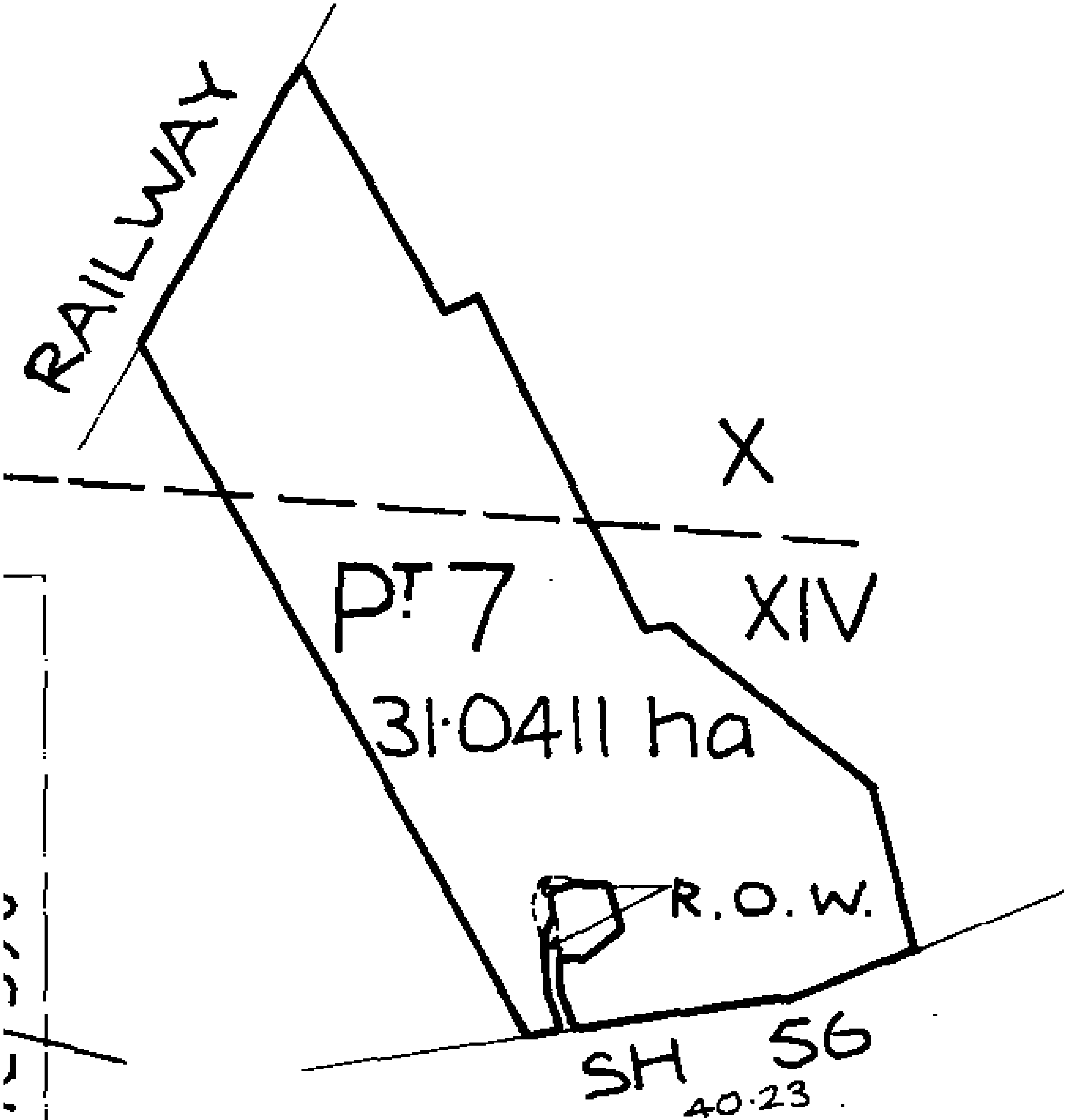
722348 Gazette Notice declaring portion of State Highway No 56 to be a limited access road

Appurtenant hereto is a right of way and right to convey water as specified in Easement Certificate 721372.2 - 11.10.1985 at 2.40 pm

Some of the easements specified in Easement Certificate 721372.2 are subject to Section 309 (1) (a) Local Government Act 1974 (see DP 57402)

Subject to a right of way over part marked B on DP 57402 created by Transfer 721372.3 - 11.10.1985 at 2.40 pm

The easements created by Transfer 721372.3 are subject to Section 309 (1) (a) Local Government Act 1974



Measurements are Metric

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN53C/913**
Land Registration District **Wellington**
Date Issued 12 October 1998

Prior References
WNE3/898

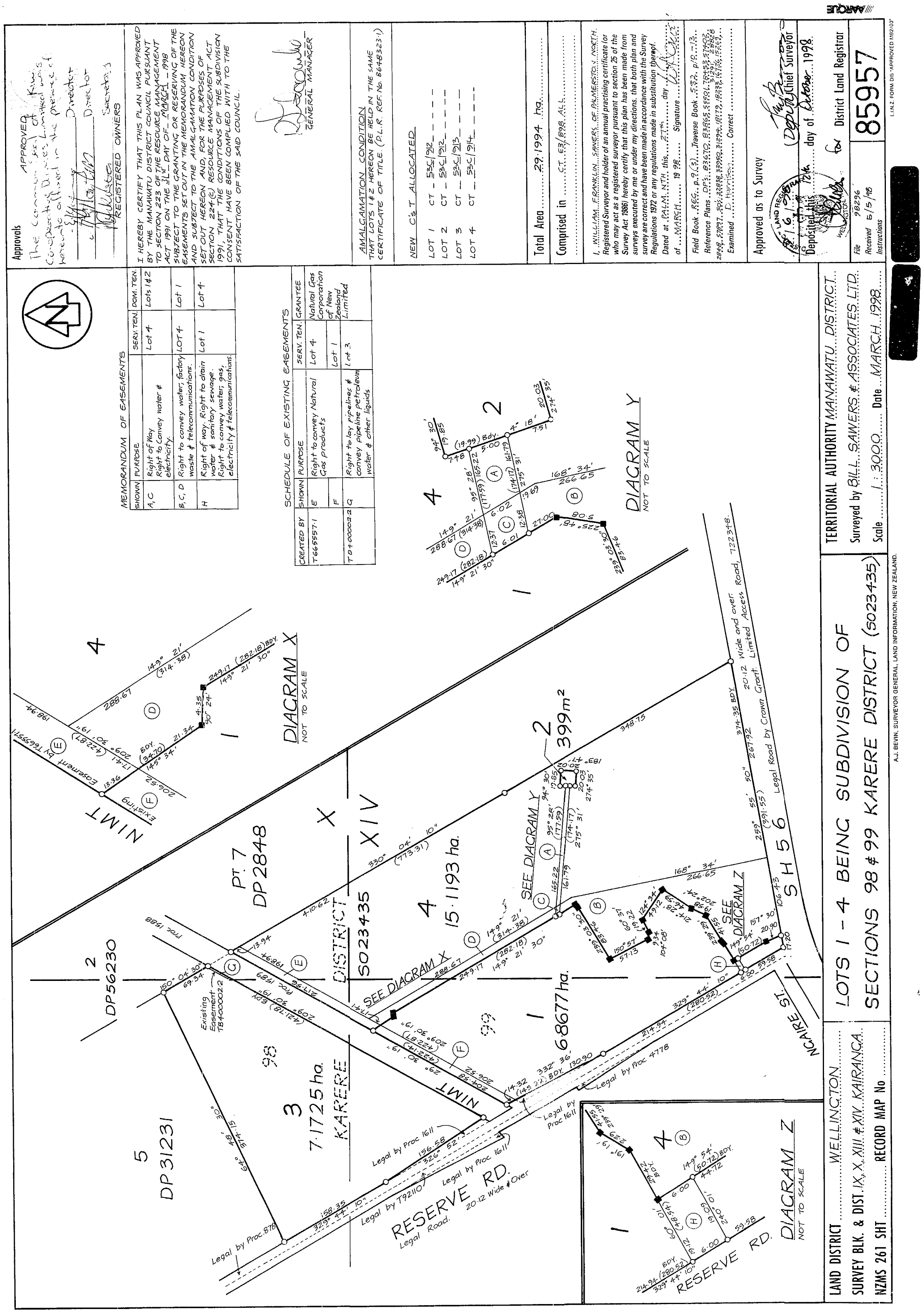
Estate	Fee Simple
Area	7.1725 hectares more or less
Legal Description	Lot 3 Deposited Plan 85957

Registered Owners
Fonterra Limited

Interests

Subject to Section 59 Land Act 1948

Subject to a petroleum right (in gross) over part marked G on DP 85957 in favour of Natural Gas Corporation of New Zealand Limited created by Transfer B400002.2 - 18.10.1994 at 2.10 pm


LOTS 1 - 4 BEING SUBDIVISION OF
SECTIONS 98 & 99 KARERE DISTRICT (SO23435)
LAND DISTRICT WELLINGTON
SURVEY BLK. & DIST. IX, X, XIII & XIV, KAIRANGA
NZMS 261 SHT RECORD MAP No
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by BILL SAWERS & ASSOCIATES LTD.
Scale 1:3000 Date MARCH 1998
MEMORANDUM OF EASEMENTS
SCHEDULE OF EXISTING EASEMENTS
AMALGAMATION CONDITION
NEW C&T ALLOCATED
LOT 1 CT - 53C/912
LOT 2 CT - 53C/912
LOT 3 CT - 53C/913
LOT 4 CT - 53C/914
Total Area 29.1994 ha.
Approved as to Survey
District Land Registrar
85957
4 15.1193 ha.
1 6.8677 ha.
3 7.1725 ha.
2 399 m²
DIAGRAM X NOT TO SCALE
DIAGRAM Y NOT TO SCALE
DIAGRAM Z NOT TO SCALE
RESERVE RD.
DP 31231
DP 56230
PT 7 DP 2848

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN53C/914**
Land Registration District **Wellington**
Date Issued 12 October 1998

Prior References
WNE3/898

Estate Fee Simple
Area 15.1193 hectares more or less
Legal Description Lot 4 Deposited Plan 85957
Registered Owners
Fonterra Limited

Interests

Subject to Section 59 Land Act 1948

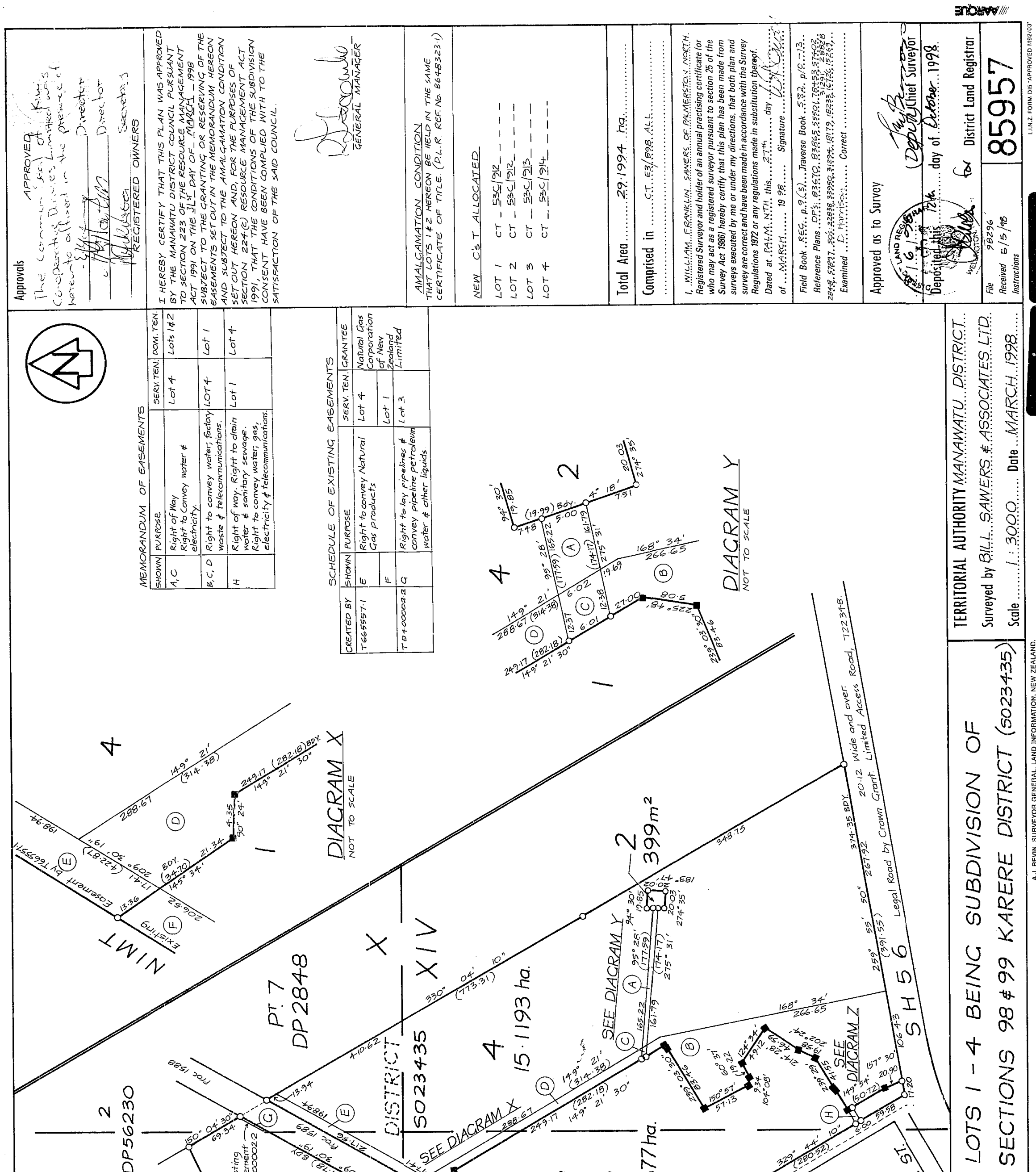
722348 Gazette Notice declaring State Highway 56 a limited access road - 25.9.1967 at 11.17 am

Subject to a gas right (in gross) over part marked E on DP 85957 in favour of Natural Gas Corporation of New Zealand Limited created by Transfer 665557.1 - 15.1.1985 at 10.38 am

Subject to a right of way and a right to convey water and electricity over parts marked A C and a right to convey water, factory waste and telephone over parts marked B C D on DP 85957 specified in Easement Certificate B688535.5 - 12.10.1998 at 9.01 am

Appurtenant hereto is a right of way, a right to convey water, gas, electricity and telephone and water and sewage drainage rights as specified in Easement Certificate B688535.5 - 12.10.1998 at 9.01 am

The easements specified in Easement Certificate B688535.5 are subject to Section 243 (a) Resource Management Act 1991


LOTS 1 - 4 BEING SUBDIVISION OF
SECTIONS 98 & 99 KARERE DISTRICT (SO23435)
DIAGRAM X
DIAGRAM Y
DIAGRAM Z
NOT TO SCALE
MEMORANDUM OF EASEMENTS
SCHEDULE OF EXISTING EASEMENTS
RESERVE RD.
S H 56
DP 2848
DP 31231
DP 56230
7.1725 ha.
6.8677 ha.
15.1193 ha.
399 m²
85957

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **505988**
Land Registration District **Wellington**
Date Issued 25 March 2011

Prior References

WN16C/749 WN30B/32 WN50D/471
WN50D/474

Estate Fee Simple
Area 4.5609 hectares more or less
Legal Description Lot 2 Deposited Plan 426930
Registered Owners
Fonterra Limited

Interests

Subject to the water rights over the within land created by Transfer 122558 - 21.10.1910 at 12:00 am

Subject to a right (in gross) to drain sanitary sewer over part marked B3, B4, B13, B6 and B8 on DP 426930 in favour of Manawatu District Council created by Transfer B612861.2 - 15.8.1997 at 9.18 am

The easements created by Transfer B612861.2 are subject to Section 243 (a) Resource Management Act 1991

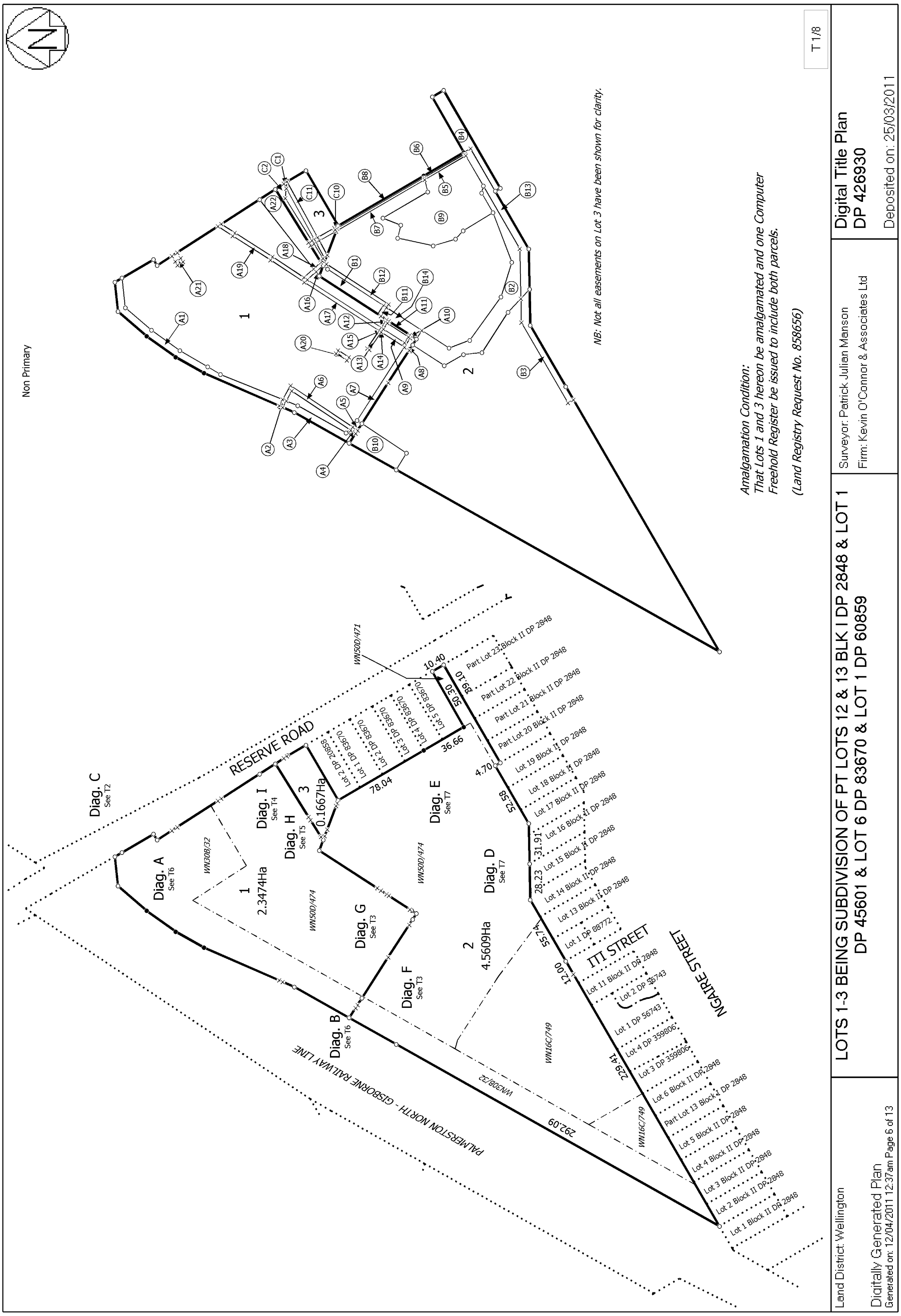
Subject to a right of way over part marked B10, B1, B11, B2, B4, B13 and B14, a right to convey electricity over part marked B1, B11 and B14, a right to convey telecommunications and computer media over part marked B11 and B12, and a parking easement over part marked B5, B6 and B9, all on DP 426930 created by Easement Instrument 8725056.2 - 25.3.2011 at 3:15 pm

Appurtenant hereto is a right of way, a right to drain water, a right to convey electricity, water, telecommunications and computer media created by Easement Instrument 8725056.2 - 25.3.2011 at 3:15 pm

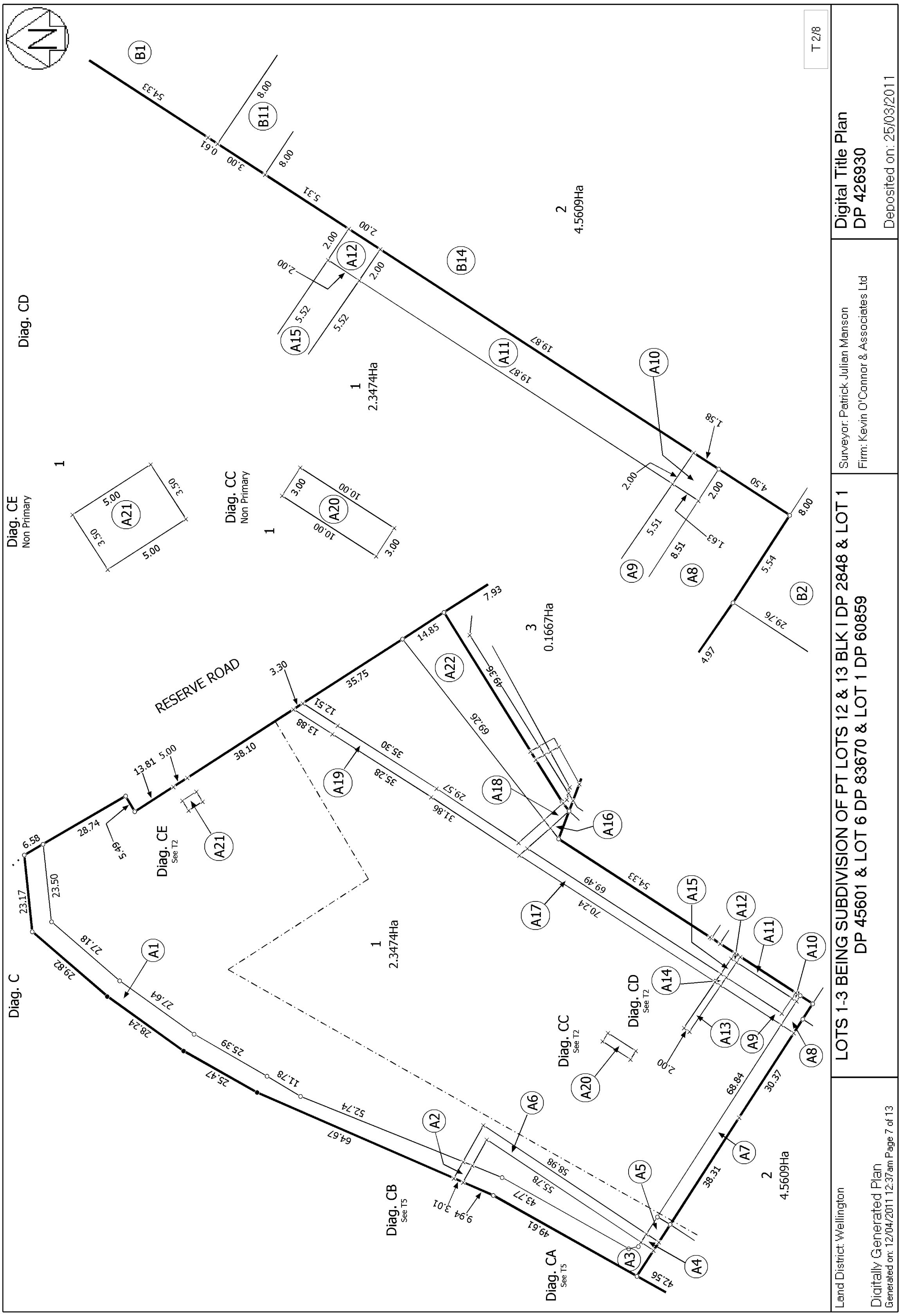
The easements created by Easement Instrument 8725056.2 are subject to Section 243 (a) Resource Management Act 1991

Subject to a right (in gross) to drain sewage over part marked B5, B7 and B4 on DP 426930 in favour of Manawatu District Council created by Easement Instrument 8725056.3 - 25.3.2011 at 3:15 pm

8953801.1 Partial Surrender of the right of way over part Lot 1 DP 426930 CT 505987 marked A7 on DP 426930 appurtenant hereto specified in Easement Instrument 8725056.2 - 22.12.2011 at 1:12 pm



LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1 DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 6 of 13
T 1/8
Non Primary
Amalgamation Condition:
That Lots 1 and 3 hereon be amalgamated and one Computer Freehold Register be issued to include both parcels.
(Land Registry Request No. 858656)
NB: Not all easements on Lot 3 have been shown for clarity.
RESERVE ROAD
ITI STREET
NGAIRE STREET
PALMERSTON NORTH - GISBORNE RAILWAY LINE
2.3474Ha
4.5609Ha
0.1667Ha
Diag. A
Diag. B
Diag. C
Diag. D
Diag. E
Diag. F
Diag. G
Diag. H
Diag. I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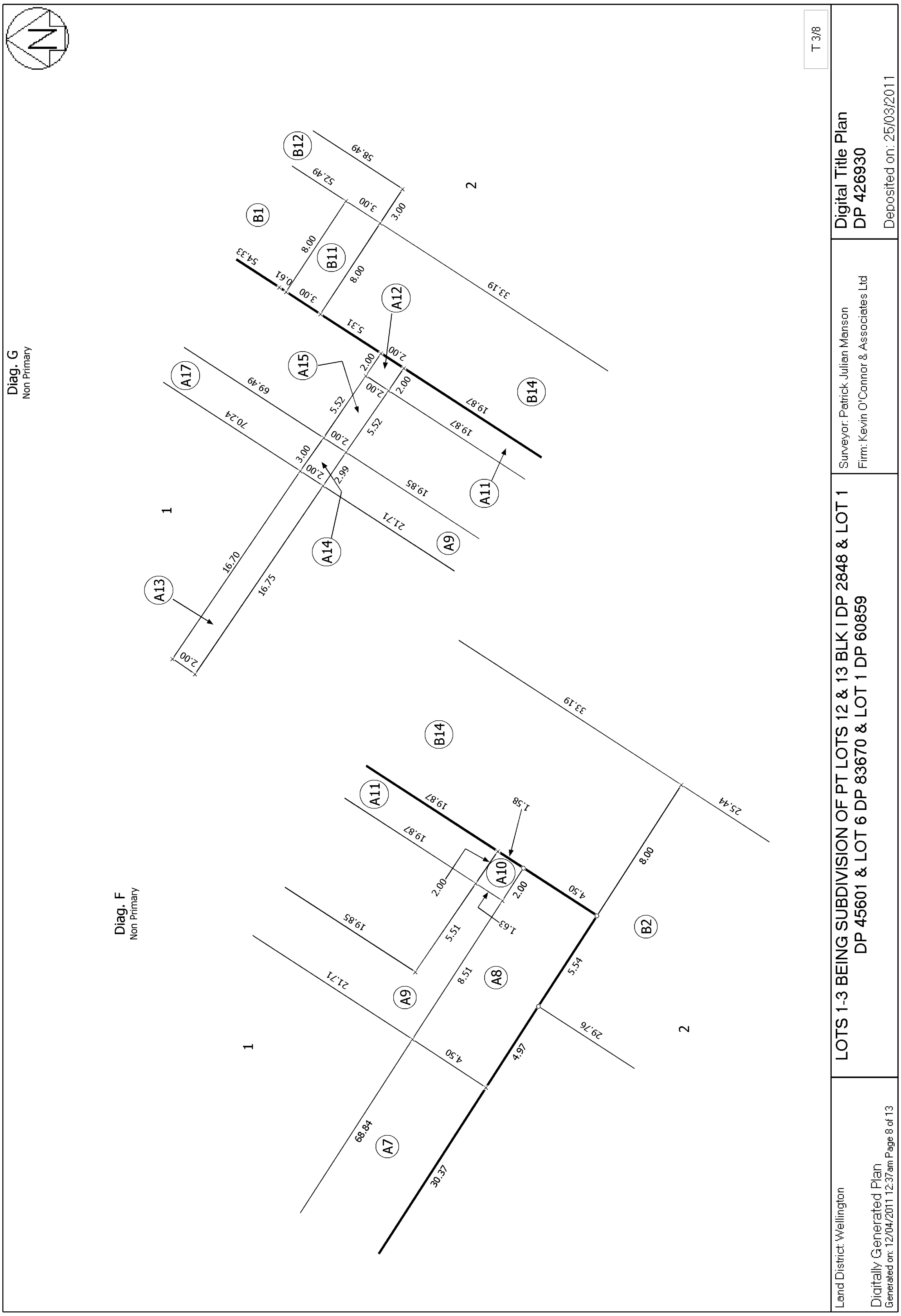
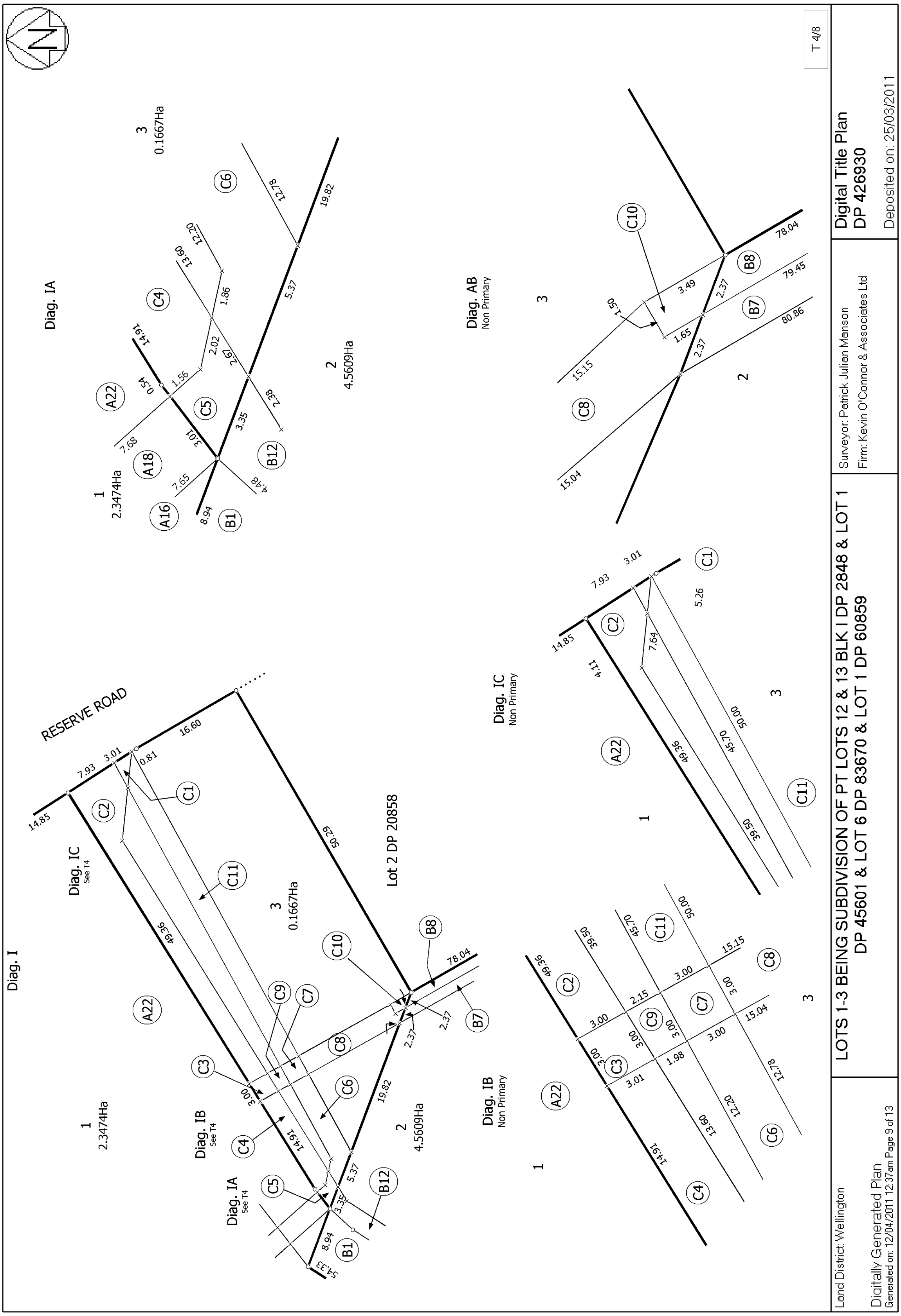
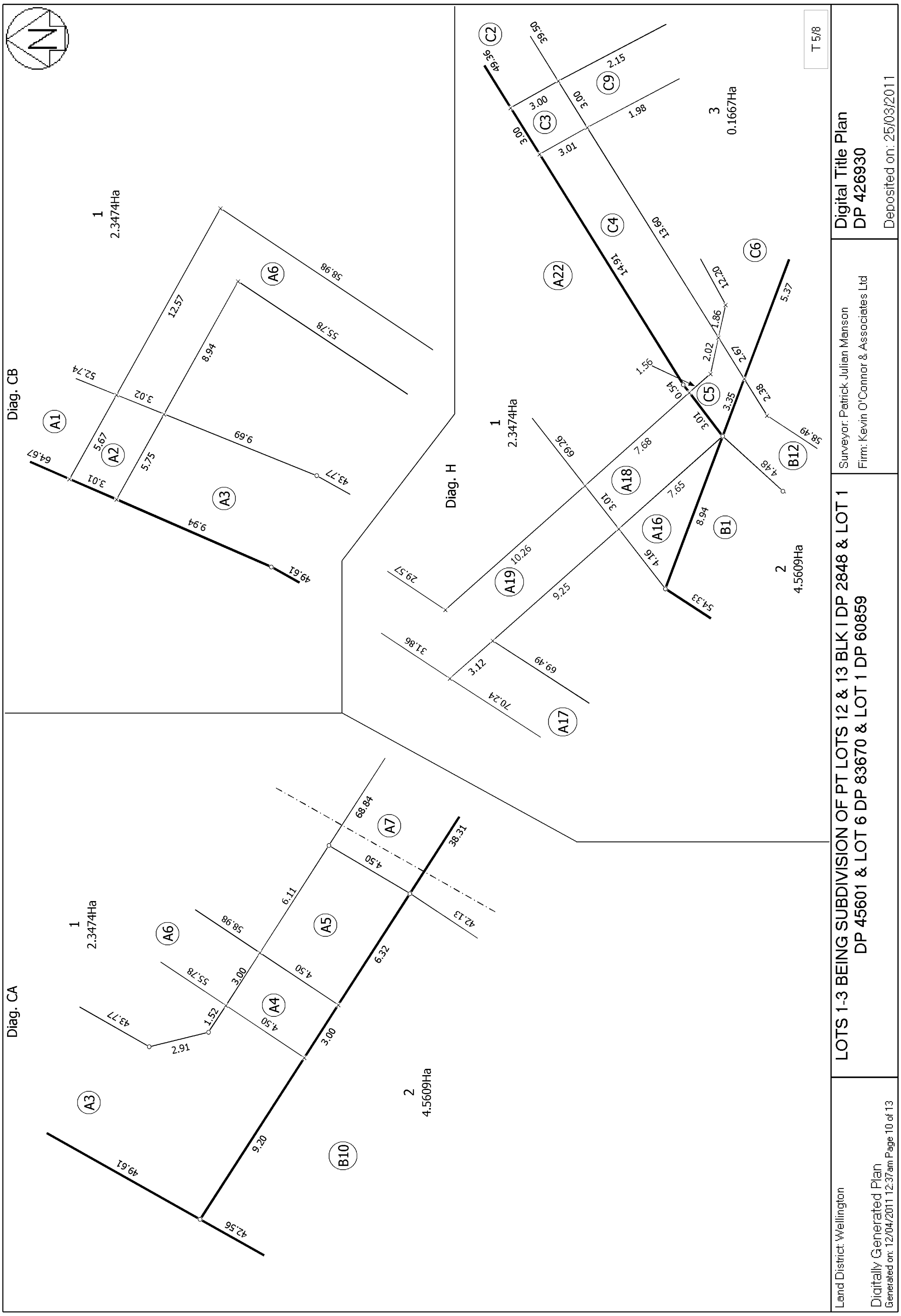
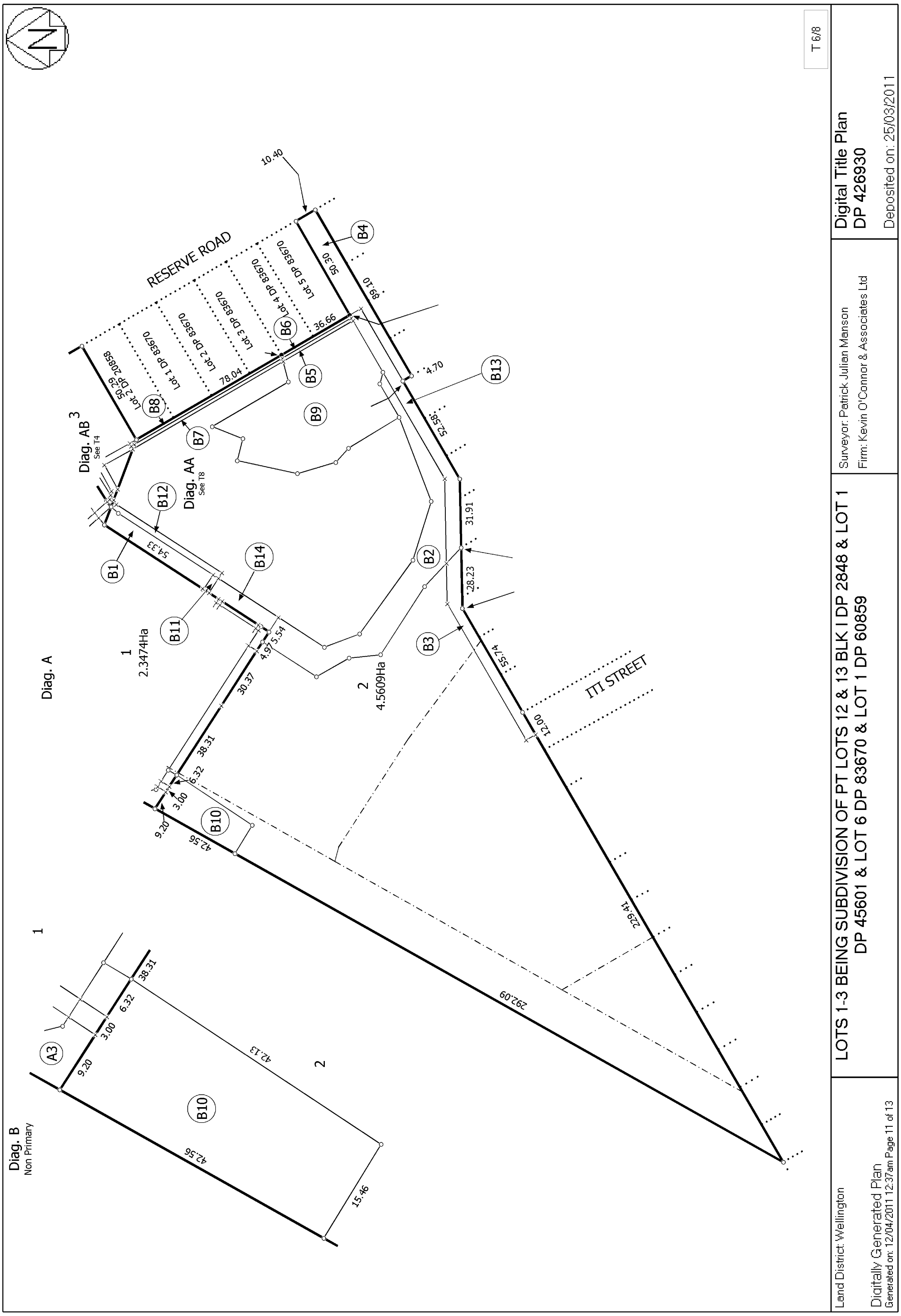
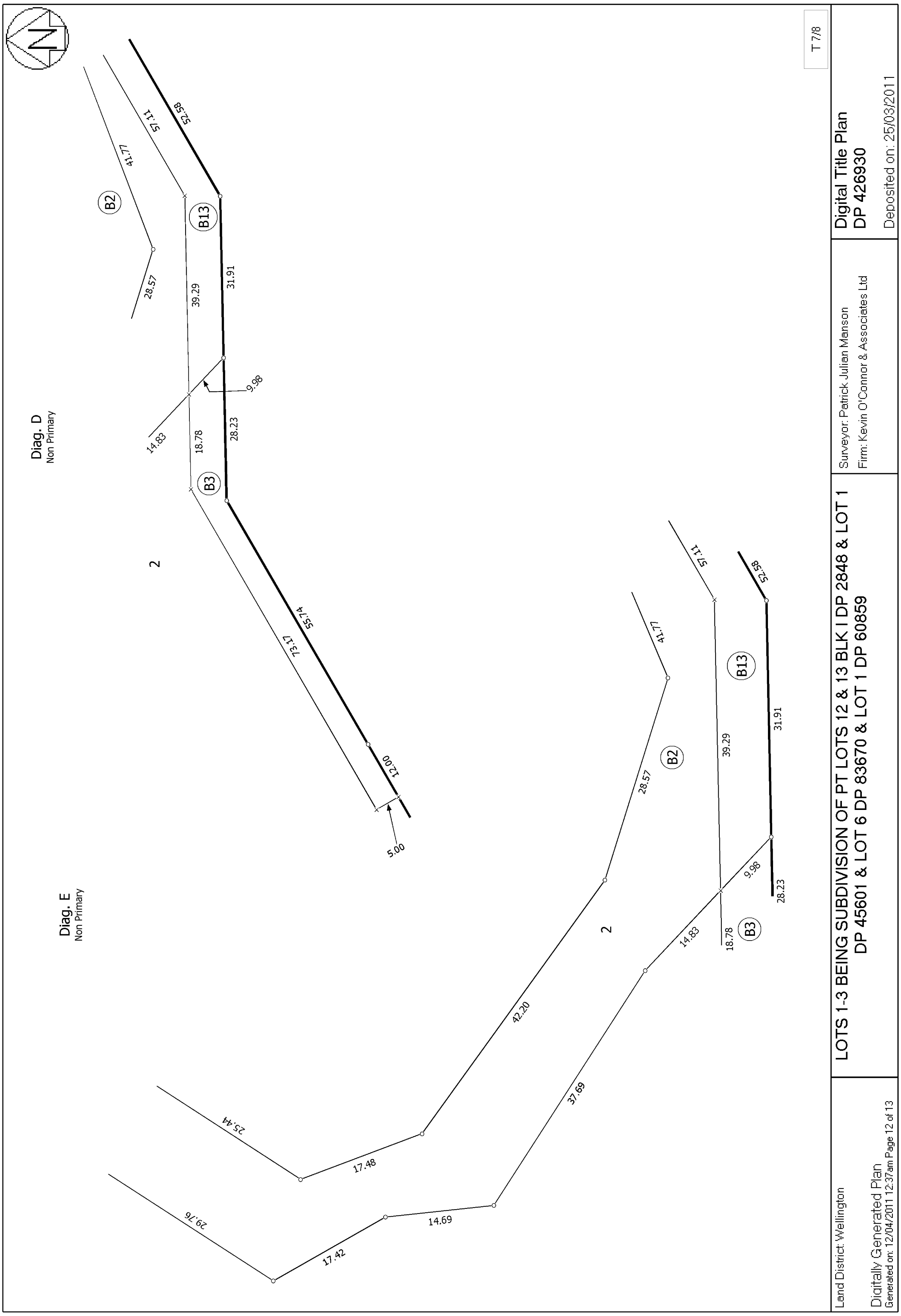
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 7 of 13
T 2/8
RESERVE ROAD
1
2.3474Ha
2
4.5609Ha
3
0.1667Ha
Diag. C
Diag. CD
Diag. CE
Non Primary
Diag. CC
Non Primary
Diag. CB
See T5
Diag. CA
See T5

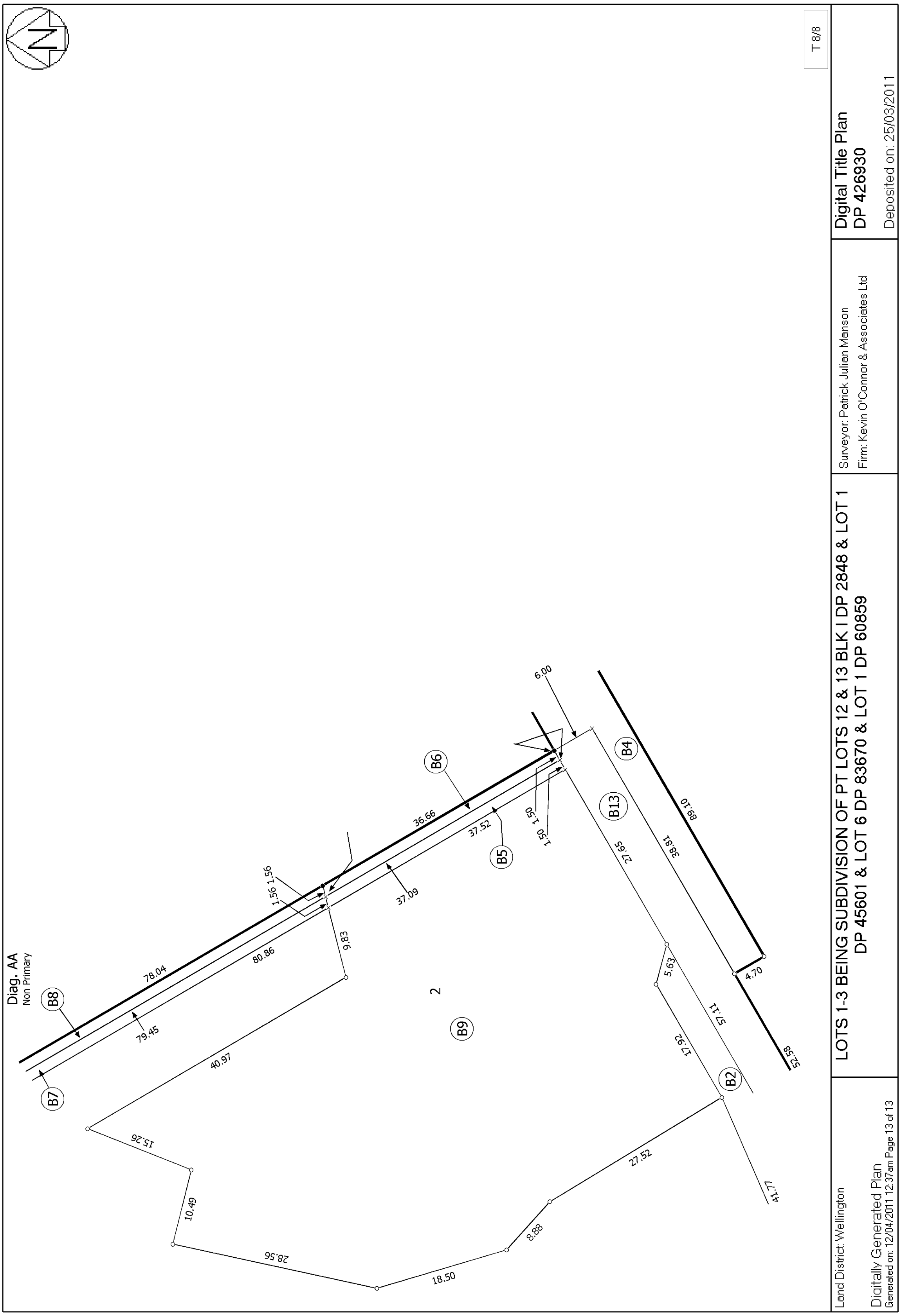

T 3/8
Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 8 of 13
Diag. G
Non Primary
Diag. F
Non Primary


Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 9 of 13
T 4/8
Diag. I
Diag. IA
Diag. IB
Diag. IC
Diag. AB
Non Primary
See T4
RESERVE ROAD
Lot 2 DP 20858
1
2.3474Ha
2
4.5609Ha
3
0.1667Ha


LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 10 of 13
T 5/8
Diag. CB
Diag. H
Diag. CA
1
2.3474Ha
2
4.5609Ha
3
0.1667Ha


Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 11 of 13
T 6/8
RESERVE ROAD
ITI STREET
Lot 2 DP 20858
Lot 1 DP 83670
Lot 2 DP 83670
Lot 3 DP 83670
Lot 4 DP 83670
Lot 5 DP 83670
Diag. AB
See T4
Diag. AA
See T8
Diag. A
Diag. B
Non Primary
1
2.3474Ha
2
4.5609Ha


Diag. D
Non Primary
Diag. E
Non Primary
B2
B13
B3
2
41.77
57.11
52.58
28.57
39.29
31.91
9.98
14.83
18.78
28.23
73.17
55.74
12.00
5.00
42.20
25.44
17.48
29.76
17.42
14.69
37.69
T 7/8
Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 12 of 13


Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 13 of 13
T 8/8
Diag. AA
Non Primary
B2
B4
B5
B6
B7
B8
B9
B13
2
6.00
36.66
37.52
37.09
78.04
80.86
79.45
40.97
15.26
10.49
28.56
18.50
8.88
27.52
41.77
17.92
5.63
57.11
27.65
38.81
89.10
4.70
52.58
9.83
1.56 1.56
1.50 1.50

Goodman Fielder

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **505987**
Land Registration District **Wellington**
Date Issued 25 March 2011

Prior References
WN30B/32 WN50D/474

Estate Fee Simple
Area 2.5141 hectares more or less
Legal Description Lot 1, 3 Deposited Plan 426930
Registered Owners
Goodman Fielder New Zealand Limited

Interests

Subject to a right to drain sanitary sewer (in gross) over part Lot 3 DP 426930 marked C10 on DP 426930 in favour of Manawatu District Council created by Transfer B612861.2 - 15.8.1997 at 9.18 am

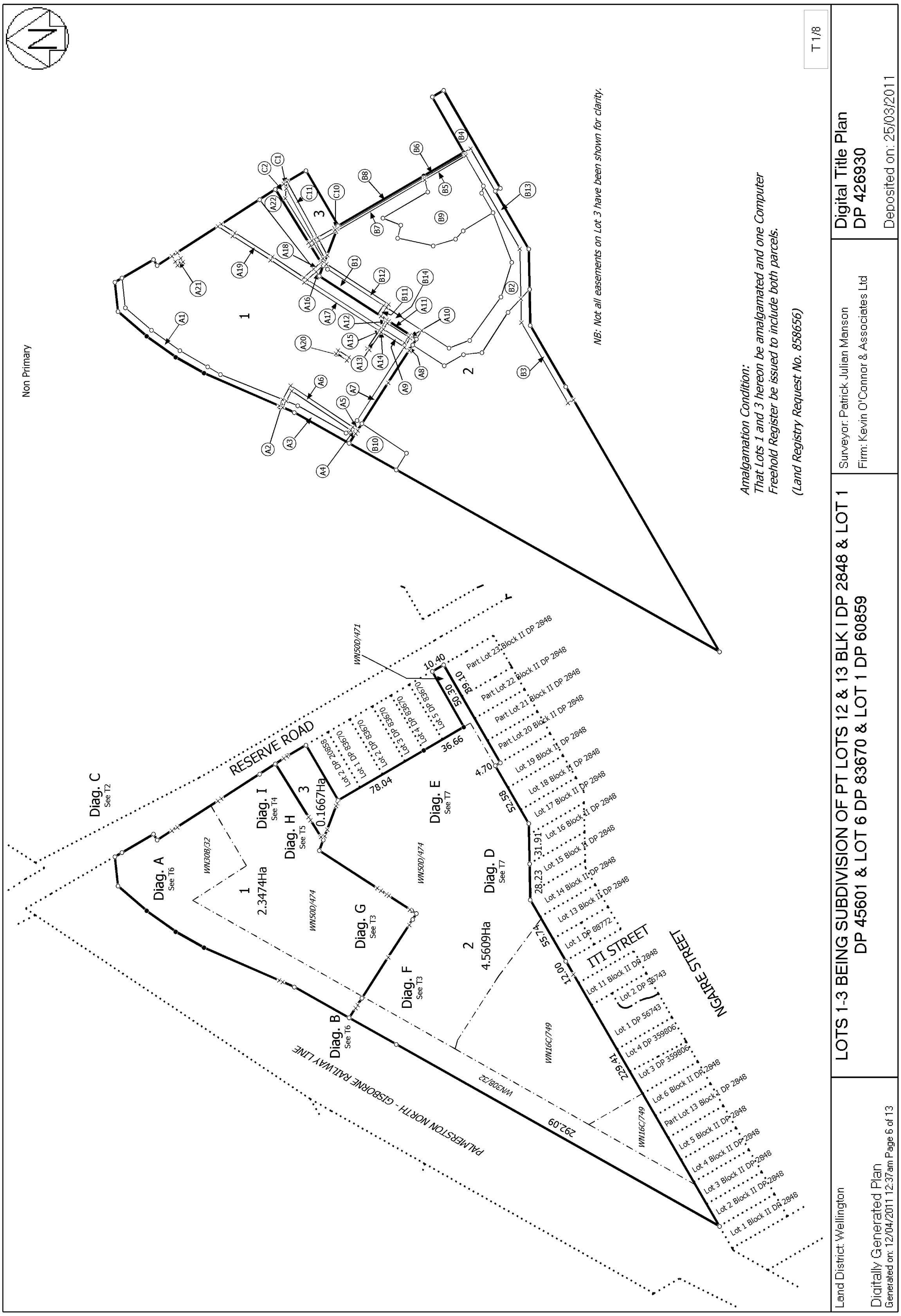
The easements created by Transfer B612861.2 are subject to Section 243 (a) Resource Management Act 1991

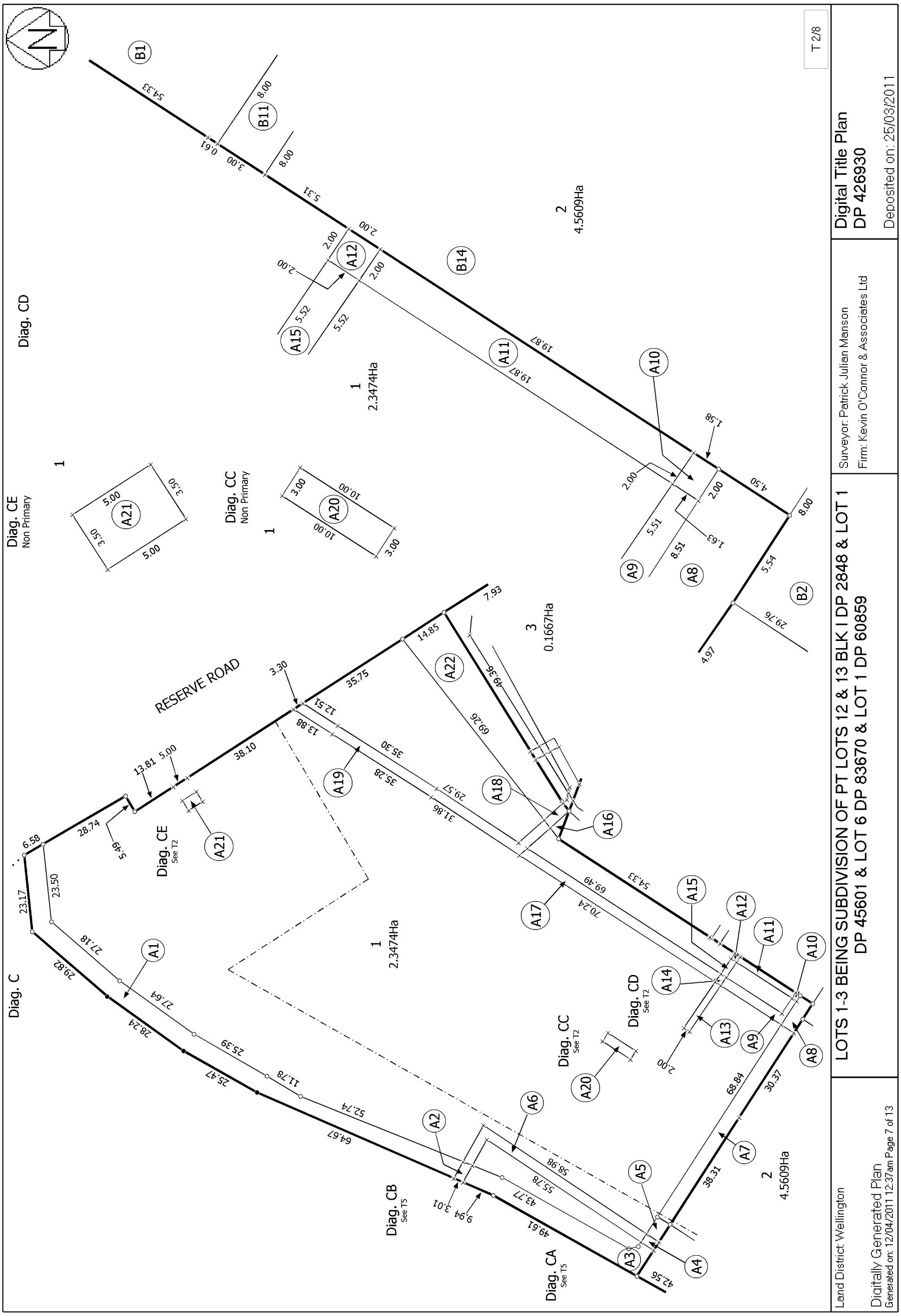
Subject to Section 241(2) Resource Management Act 1991 (affects DP 426930)

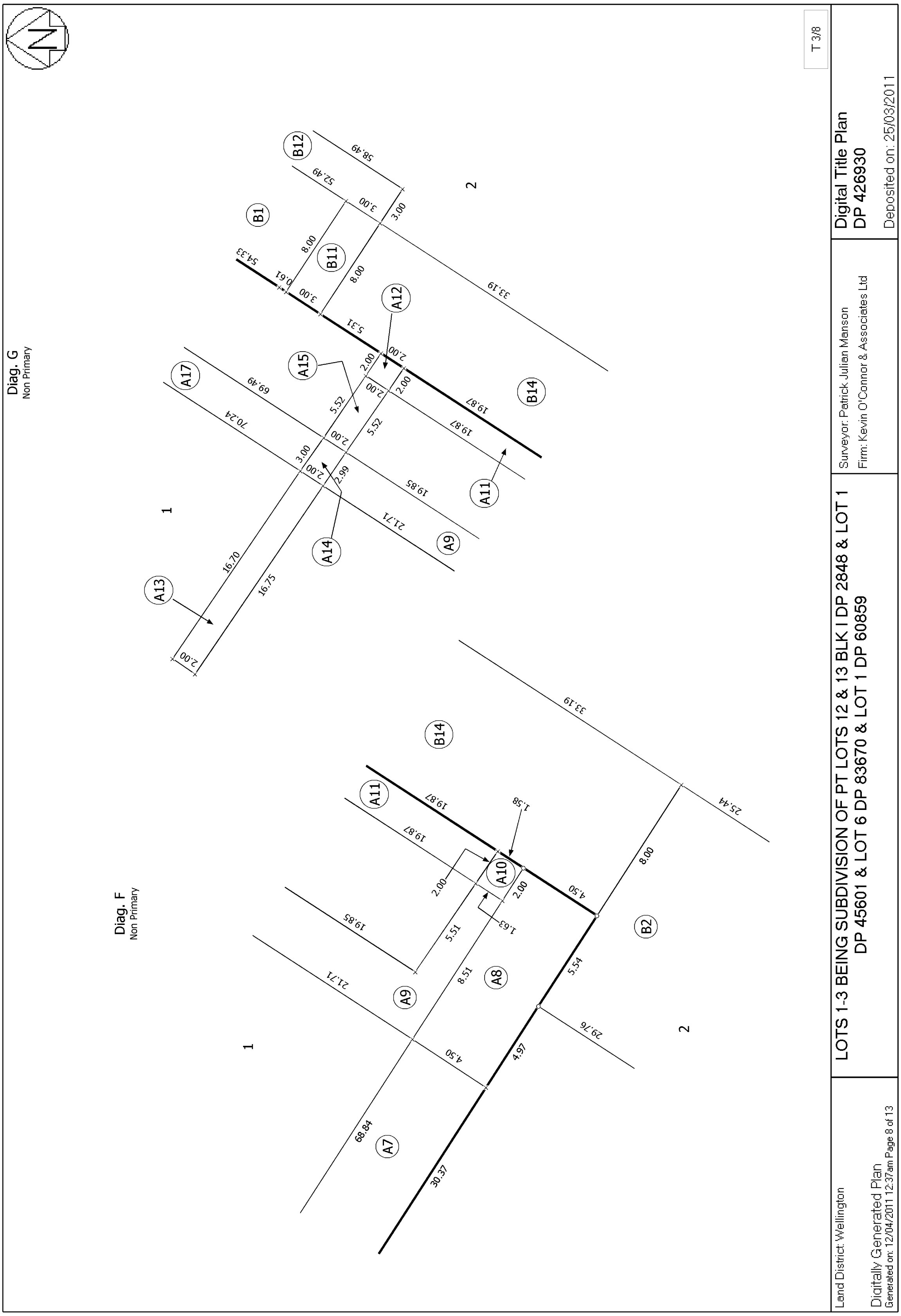
Subject to a right of way over part Lot 1 DP 426930 marked A1, A2, A3, A4, A5, A8, A16, A18 and A22, a right to drain water over part Lot 1 DP 426930 marked A8, A9, A10, A14, A17, A19, A18, A4, A6 and A2, a right to convey electricity over part Lot 1 DP 426390 marked A12, A11, A10, A8, A7, A5, A16, A18 and A22, a right to convey water over part marked A13, A14, A15, A12, A22, A18 and A16, a right to convey telecommunications and computer media over part Lot 3 DP 426930 marked C1, C2, C3, C4 and C5, a right to convey sewage over part Lot 3 DP 426930 marked C3, C9, C7 and C8, and a right to drain water over part Lot 3 DP 426930 marked C5, C6, C7, C11 and C1, all on DP 426930 created by Easement Instrument 8725056.2 - 25.3.2011 at 3:15 pm

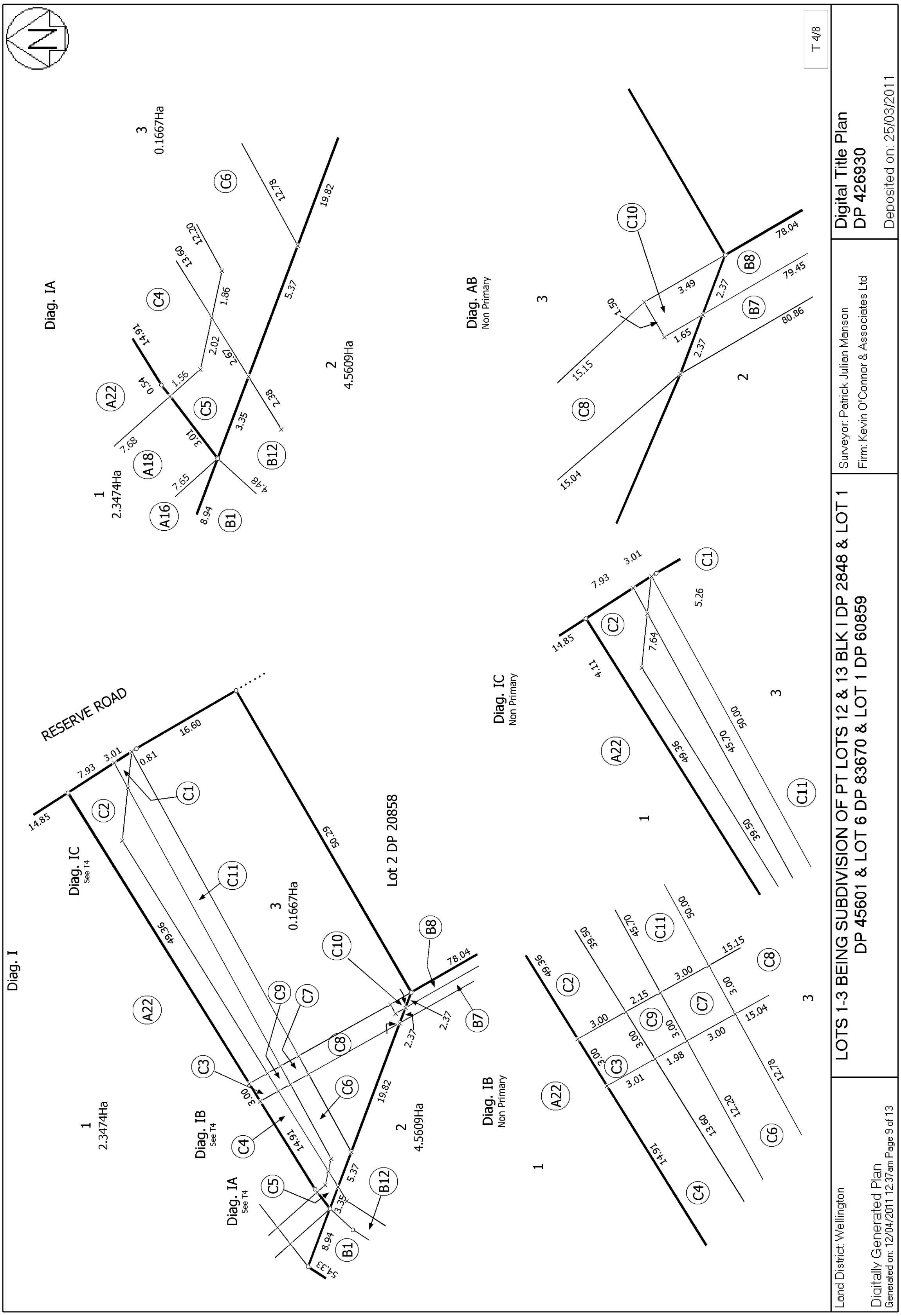
Appurtenant hereto is a right of way and a parking easement, and appurtenant to Lot 1 DP 426930 is a right to convey electricity, a right to convey telecommunications, computer media and sewage, and appurtenant to Lot 3 DP 426930 is a right to drain water created by Easement Instrument 8725056.2 - 25.3.2011 at 3:15 pm

The easements created by Easement Instrument 8725056.2 are subject to Section 243 (a) Resource Management Act 1991

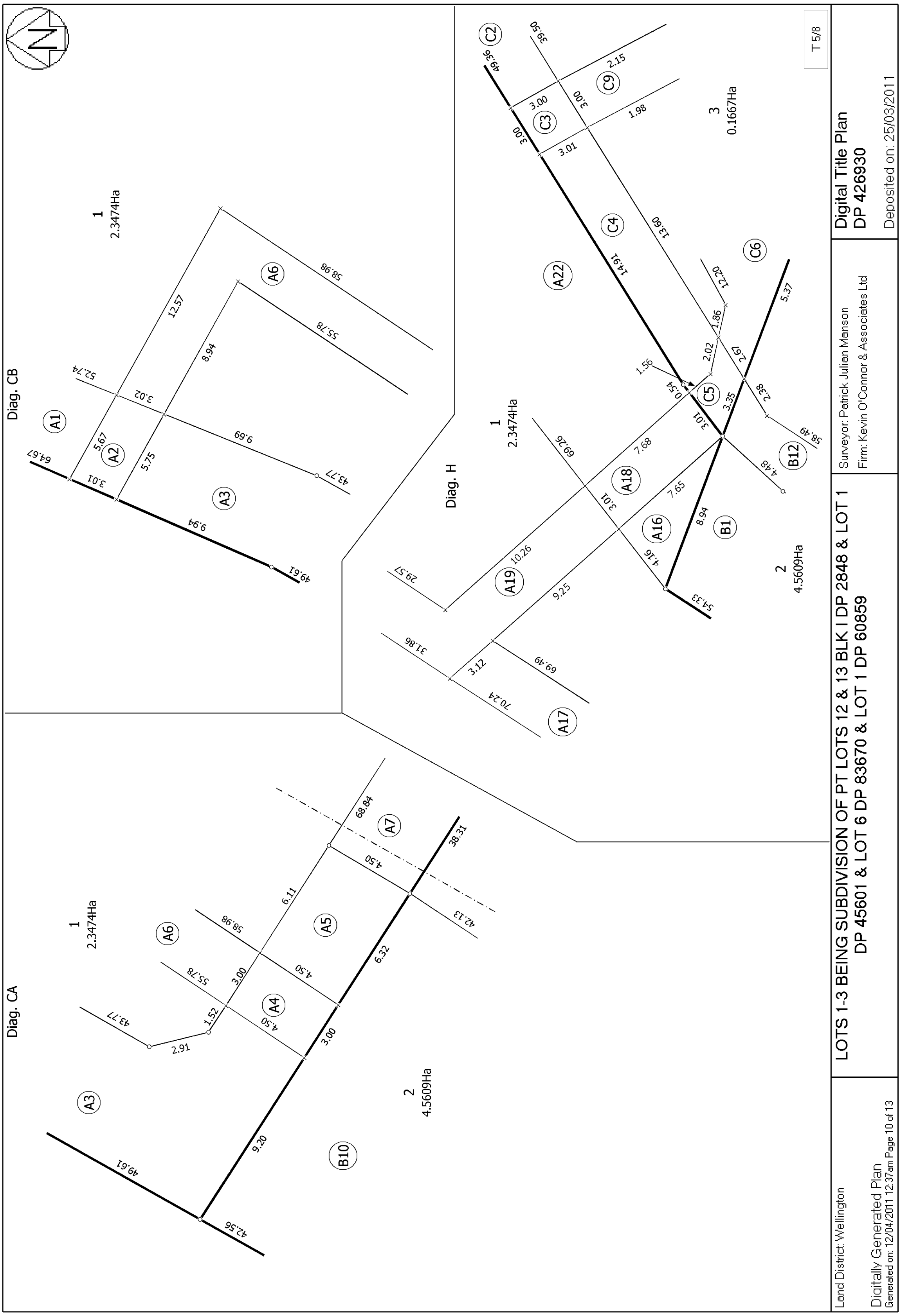

T1/8
Non Primary
NB: Not all easements on Lot 3 have been shown for clarity.
Amalgamation Condition:
That Lots 1 and 3 hereon be amalgamated and one Computer Freehold Register be issued to include both parcels.
(Land Registry Request No. 858656)
RESERVE ROAD
ITI STREET
NGAIRE STREET
PALMERSTON NORTH - GISBORNE RAILWAY LINE
1
2.3474Ha
2
4.5609Ha
3
0.1667Ha
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 6 of 13
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1 DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
Digital Title Plan
DP 426930
Deposited on: 25/03/2011

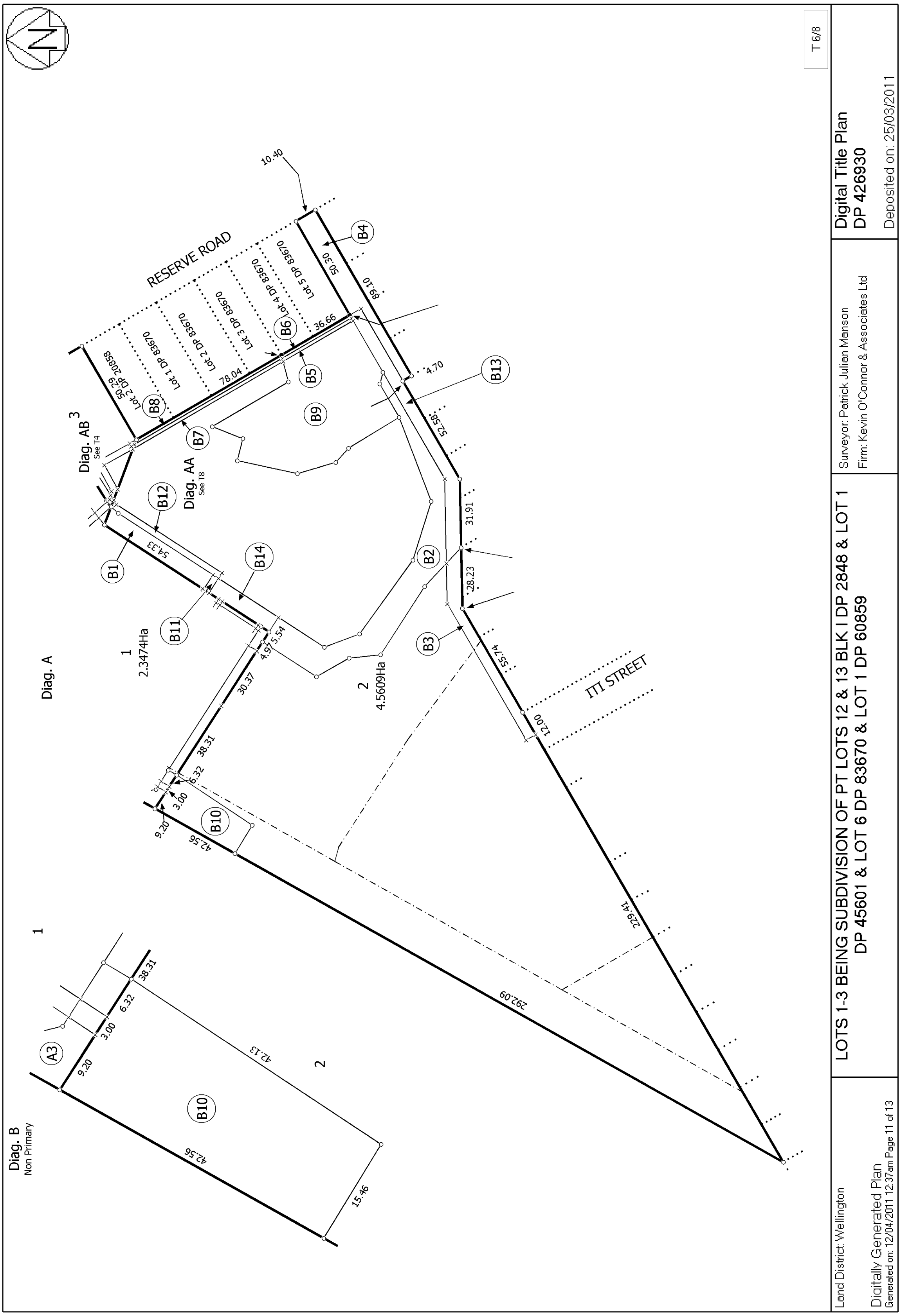

Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 7 of 13
T 2/8
RESERVE ROAD
1
2.3474Ha
2
4.5609Ha
3
0.1667Ha
Diag. C
Diag. CA
Diag. CB
Diag. CC
Diag. CD
Diag. CE
Non Primary


Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 8 of 13
T 3/8
Diag. G
Non Primary
Diag. F
Non Primary

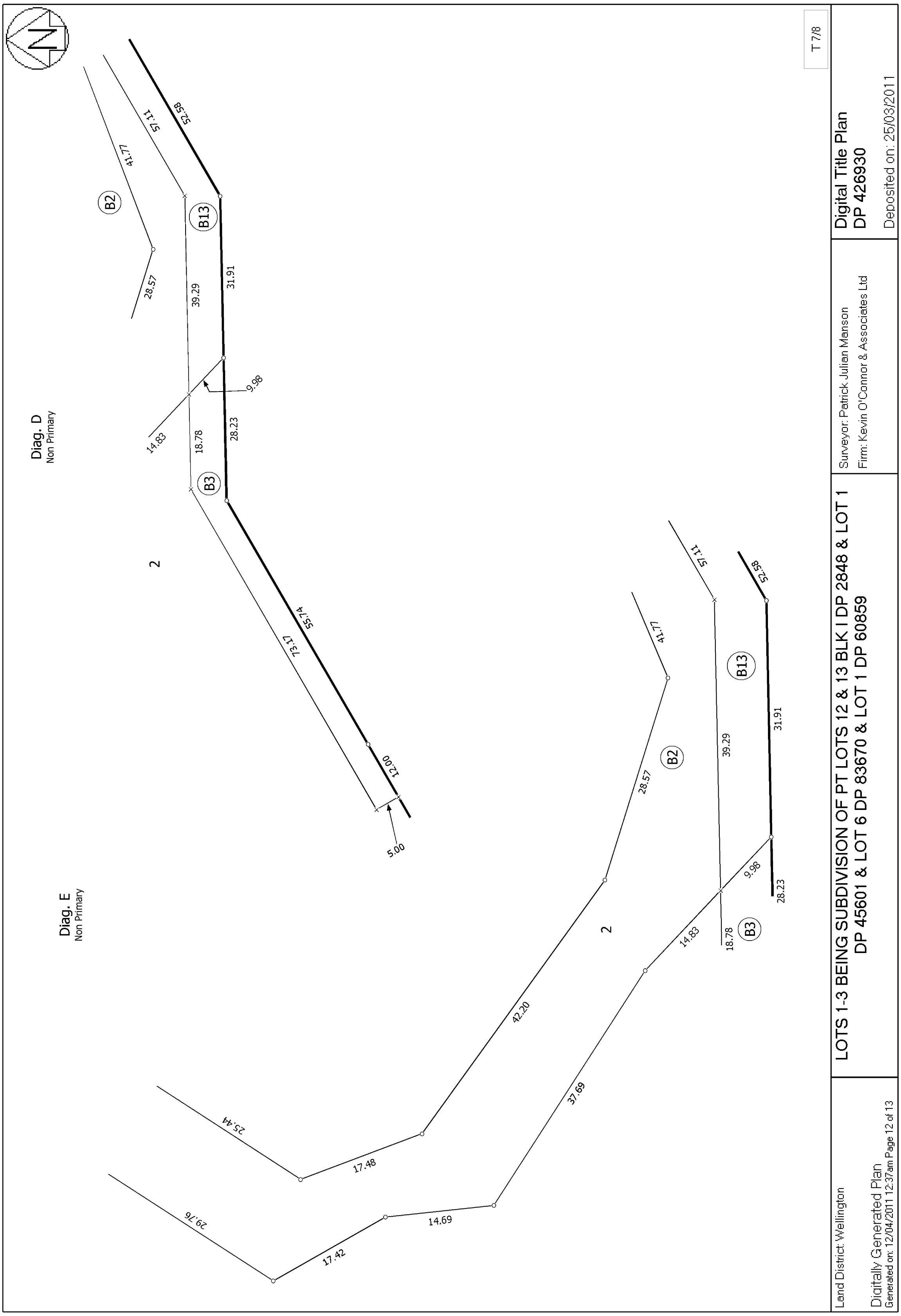


LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 9 of 13
T 4/8
Diag. I
Diag. IA
Diag. IB
Diag. IC
Diag. AB
Non Primary
RESERVE ROAD
Lot 2 DP 20858
1
2.3474Ha
2
4.5609Ha
3
0.1667Ha

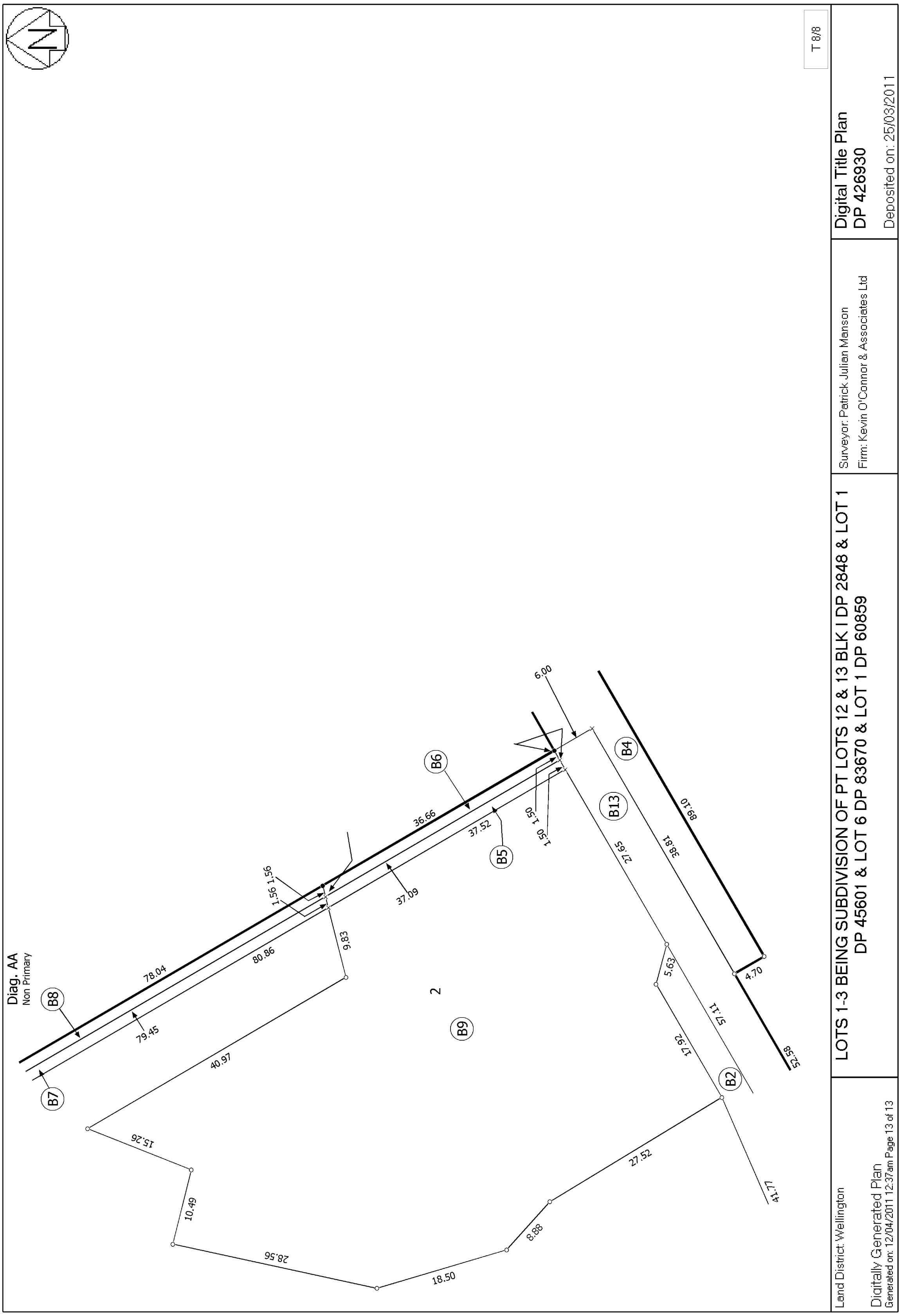

LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 10 of 13
T 5/8
Diag. CB
Diag. H
Diag. CA
1
2.3474Ha
2
4.5609Ha
3
0.1667Ha



T 6/8
Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 11 of 13
RESERVE ROAD
ITI STREET
Diag. A
Diag. AA
See T8
Diag. AB 3
See T4
Diag. B
Non Primary
1
2.3474Ha
2
4.5609Ha
Lot 2 DP 20858
Lot 1 DP 83670
Lot 2 DP 83670
Lot 3 DP 83670
Lot 4 DP 83670
Lot 5 DP 83670



T 7/8
Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 12 of 13
Diag. D
Non Primary
Diag. E
Non Primary
B2
B13
B3
2
41.77
57.11
52.58
28.57
39.29
31.91
9.98
14.83
18.78
28.23
73.17
55.74
12.00
5.00
42.20
37.69
25.44
17.48
29.76
17.42
14.69


T 8/8
Digital Title Plan
DP 426930
Deposited on: 25/03/2011
Surveyor: Patrick Julian Manson
Firm: Kevin O'Connor & Associates Ltd
LOTS 1-3 BEING SUBDIVISION OF PT LOTS 12 & 13 BLK I DP 2848 & LOT 1
DP 45601 & LOT 6 DP 83670 & LOT 1 DP 60859
Land District: Wellington
Digitally Generated Plan
Generated on: 12/04/2011 12:37am Page 13 of 13
Diag. AA
Non Primary
B2
B4
B5
B6
B7
B8
B9
B13
2
6.00
36.66
37.52
37.09
1.56 1.56
1.50
1.50
78.04
80.86
79.45
9.83
40.97
15.26
10.49
28.56
18.50
8.88
27.52
41.77
17.92
5.63
57.11
27.65
38.81
89.10
4.70
52.58

River Discharge Site

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**678568**
Land Registration District	**Wellington**
Date Issued	26 January 2016

Prior References

10316595.1	DI 33/328	DI 33/879
GN 432199	WN34/161	

Estate	Fee Simple
Area	38.5392 hectares more or less
Legal Description	Lot 1 Deposited Plan 482384

Registered Owners

Longburn Holding Co Limited

Interests

Subject to a right of way over parts formerly Part Section 20 & 21 Karere Block contained in DI 33/879 created by Deed of Easement 74486 (123/277) - 18.5.1898

428772 Proclamation defining the middle line of pathway - 18.4.1959 at 11.00 am (affects part formerly Part Section 22 Karere Block contained in WN34/161)

Appurtenant to parts formerly Part Section 20 & 21 Karere Block contained in DI 33/879 is a right of way created by Transfer 695481.2 - 13.6.1985 at 10:22 am

Subject to a right (in gross) to communications over part formerly Part Section 22 Karere Block contained in WN34/161 in favour of Clear Communications Limited created by Transfer B144443.1 - 15.2.1991 at 11.35 am

10316595.2 Consent Notice pursuant to Section 221 Resource Management Act 1991 - 26.1.2016 at 7:00 am

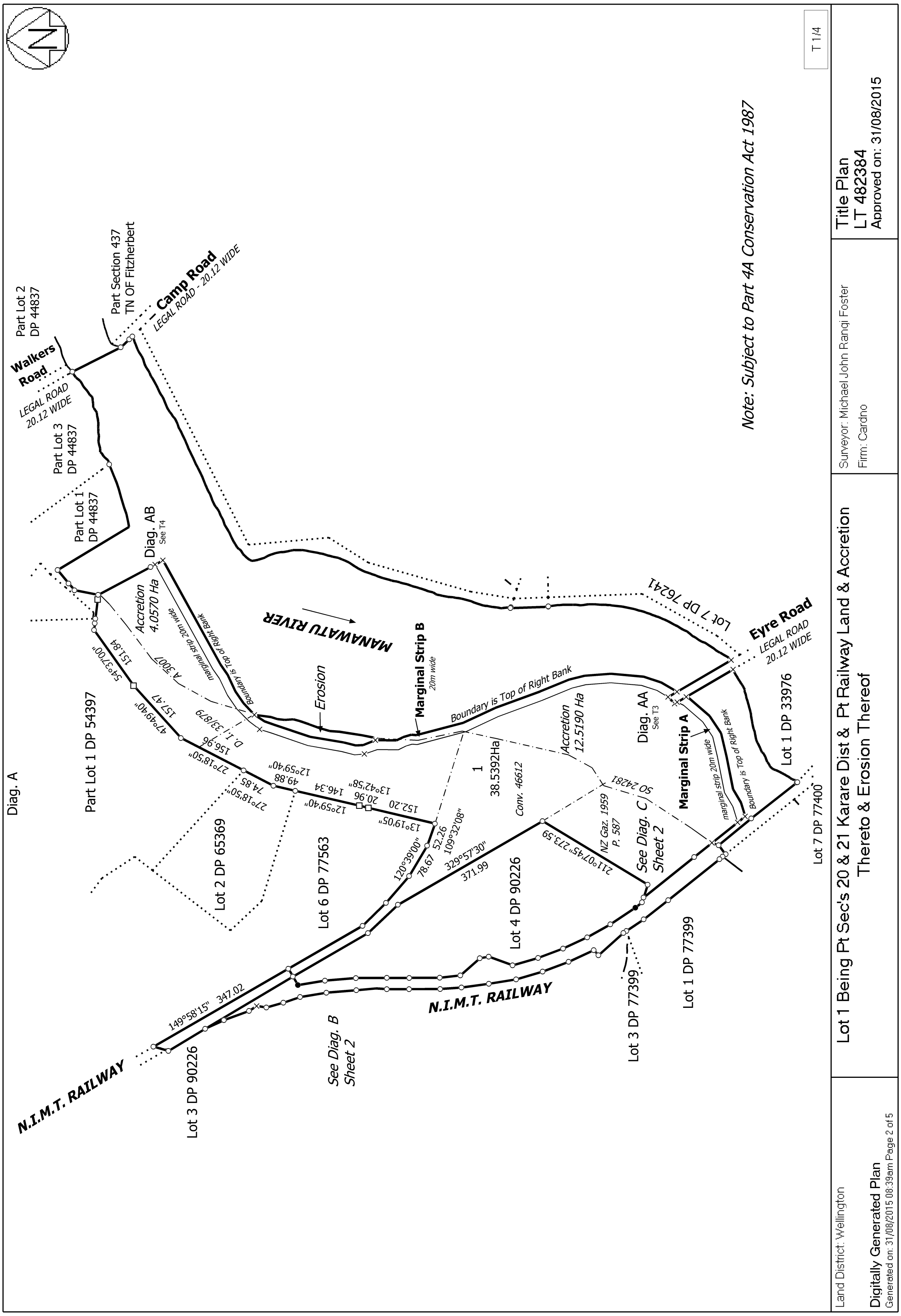
Subject to Part IVA Conservation Act 1987

Subject to Section 11 Crown Minerals Act 1991

Fencing Covenant in Transfer 11044439.1 - 26.3.2018 at 4:34 pm

11044439.2 Encumbrance to Her Majesty the Queen - 26.3.2018 at 4:34 pm

11044439.3 Mortgage to Bank of New Zealand - 26.3.2018 at 4:34 pm


T 1/4
Title Plan
LT 482384
Approved on: 31/08/2015
Surveyor: Michael John Rangi Foster
Firm: Cardno
Lot 1 Being Pt Sec's 20 & 21 Karare Dist & Pt Railway Land & Accretion Thereto & Erosion Thereof
Land District: Wellington
Digitally Generated Plan
Generated on: 31/08/2015 08:39am Page 2 of 5
Note: Subject to Part 4A Conservation Act 1987
Part Lot 2 DP 44837
Part Section 437 TN OF Fitzherbert
Camp Road
LEGAL ROAD - 20.12 WIDE
Walkers Road
LEGAL ROAD 20.12 WIDE
Part Lot 3 DP 44837
Part Lot 1 DP 44837
Diag. AB
See T4
Accretion 4.0570 Ha
MANAWATU RIVER
Marginal Strip B
20m wide
Erosion
Boundary is Top of Right Bank
Lot 7 DP 76241
Eyre Road
LEGAL ROAD 20.12 WIDE
Lot 1 DP 33976
Lot 7 DP 77400
Diag. AA
See T3
Marginal Strip A
Accretion 12.5190 Ha
1
38.5392Ha
Conv. 46612
SO 24281
NZ Gaz. 1959 P. 587
See Diag. C Sheet 2
Diag. A
Part Lot 1 DP 54397
Lot 2 DP 65369
Lot 6 DP 77563
Lot 4 DP 90226
Lot 3 DP 77399
Lot 1 DP 77399
N.I.M.T. RAILWAY
See Diag. B Sheet 2
Lot 3 DP 90226
149°58'15" 347.02
329°57'30" 371.99
211°07'45" 273.59
120°39'00" 78.67
109°32'08" 52.26
13°19'05" 152.20
13°42'58" 146.34
12°59'40" 20.96
12°59'40" 49.88
27°18'50" 74.85
27°18'50" 156.96
47°49'40" 157.47
54°37'00" 151.84
D. I. 33/879
A 3007

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Limited as to Parcels
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **680478**
Land Registration District **Wellington**
Date Issued 23 December 2015

Prior References
WN43B/534

Estate Fee Simple
Area 57.1695 hectares more or less
Legal Description Lot 2 Deposited Plan 483031
Registered Owners
Fonterra Limited

Interests

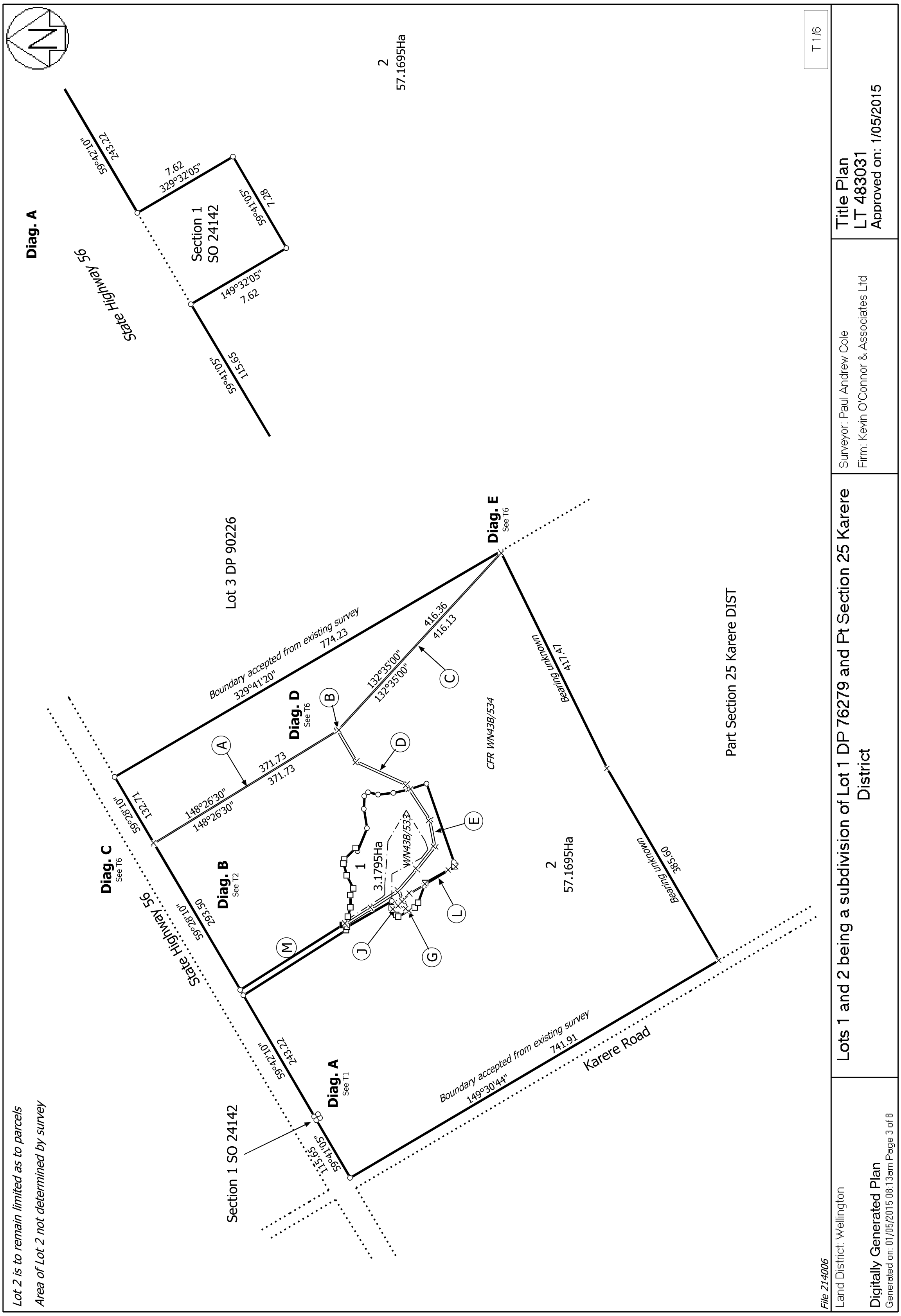
732549 Gazette Notice declaring the adjoining State Highway No. 56 to be a limited access road - 9.1.1968 at 10:05 am

Subject to a right (in gross) to convey electricity over part marked A, B, C on DP 483031 and a right to spray waste water in favour of Kiwi Co-operative Dairies Limited created by Transfer B676065.2 - 17.7.1998 at 3.19 pm

Subject to a right to convey electricity over part marked B, D and a right to convey water over part marked L both on DP 483031 created by Easement Instrument 10228868.6 - 23.12.2015 at 11:50 am

Appurtenant hereto is a right of way, right to convey electricity, telecommunications, computer media and water created by Easement Instrument 10228868.6 - 23.12.2015 at 11:50 am

The easements created by Easement Instrument 10228868.6 are subject to Section 243 (a) Resource Management Act 1991


Lot 2 is to remain limited as to parcels
Area of Lot 2 not determined by survey
Diag. A
State Highway 56
Section 1
SO 24142
2
57.1695Ha
Lot 3 DP 90226
Part Section 25 Karere DIST
Diag. E
See T6
Diag. D
See T6
Diag. C
See T6
Diag. B
See T2
Diag. A
See T1
Boundary accepted from existing survey
329°41'20"
774.23
Boundary accepted from existing survey
149°30'44"
741.91
Karere Road
Section 1 SO 24142
CFR WN43B/534
WN43B/533
1
3.1795Ha
2
57.1695Ha
Bearing unknown
417.47
Bearing unknown
385.60
148°26'30"
371.73
132°35'00"
416.36
416.13
59°28'10"
132.71
293.50
59°42'10"
243.22
59°41'05"
115.65
7.62
329°32'05"
149°32'05"
7.28
T 1/6
Title Plan
LT 483031
Approved on: 1/05/2015
Surveyor: Paul Andrew Cole
Firm: Kevin O'Connor & Associates Ltd
Lots 1 and 2 being a subdivision of Lot 1 DP 76279 and Pt Section 25 Karere District
File 214006
Land District: Wellington
Digitally Generated Plan
Generated on: 01/05/2015 08:13am Page 3 of 8

Thornton Park

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN550/186**

Land Registration District **Wellington**

Date Issued 03 October 1949

Prior References
WN359/128

Estate Fee Simple

Area 8.5110 hectares more or less

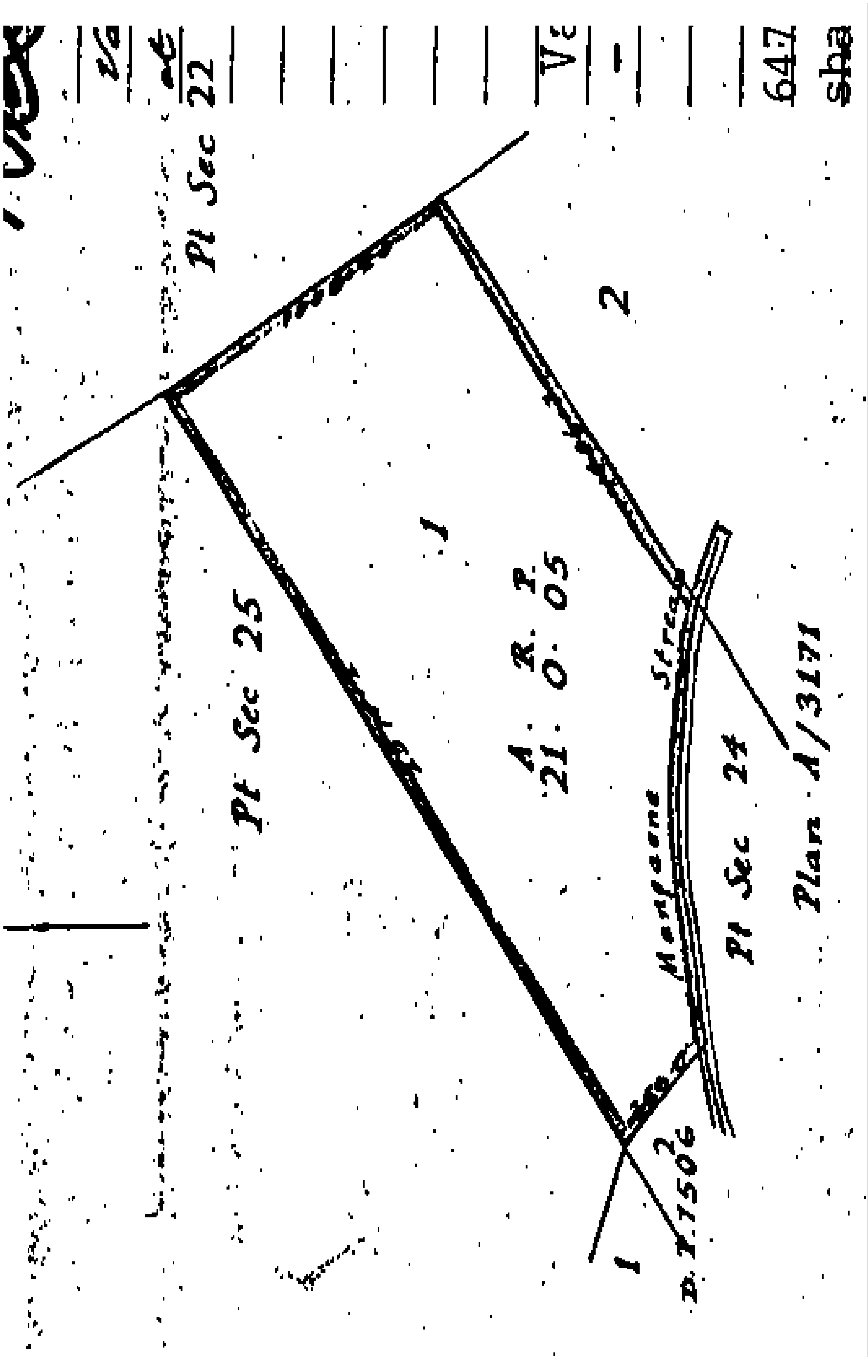
Legal Description Lot 1 Deposited Plan 14496

Registered Owners
Fonterra Limited

Interests

For frontage to a public road see Certificate of Title WN353/177

Subject to a right (in gross) to spray waste water over all of the within land in favour of Kiwi Co-operative Dairies Limited created by Transfer B676065.2 - 17.7.1998 at 3.19 pm


Pt Sec 22
Pt Sec 25
1
2
A. R. P.
21. 0. 05
Mangaone Stream
Pt Sec 24
Plan A/3171
D.P. 7506
647

Thornton Park

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN596/268**

Land Registration District **Wellington**

Date Issued 28 April 1953

Prior References

WN552/64

Estate Fee Simple

Area 6.5104 hectares more or less

Legal Description Lot 2 Deposited Plan 14496

Registered Owners

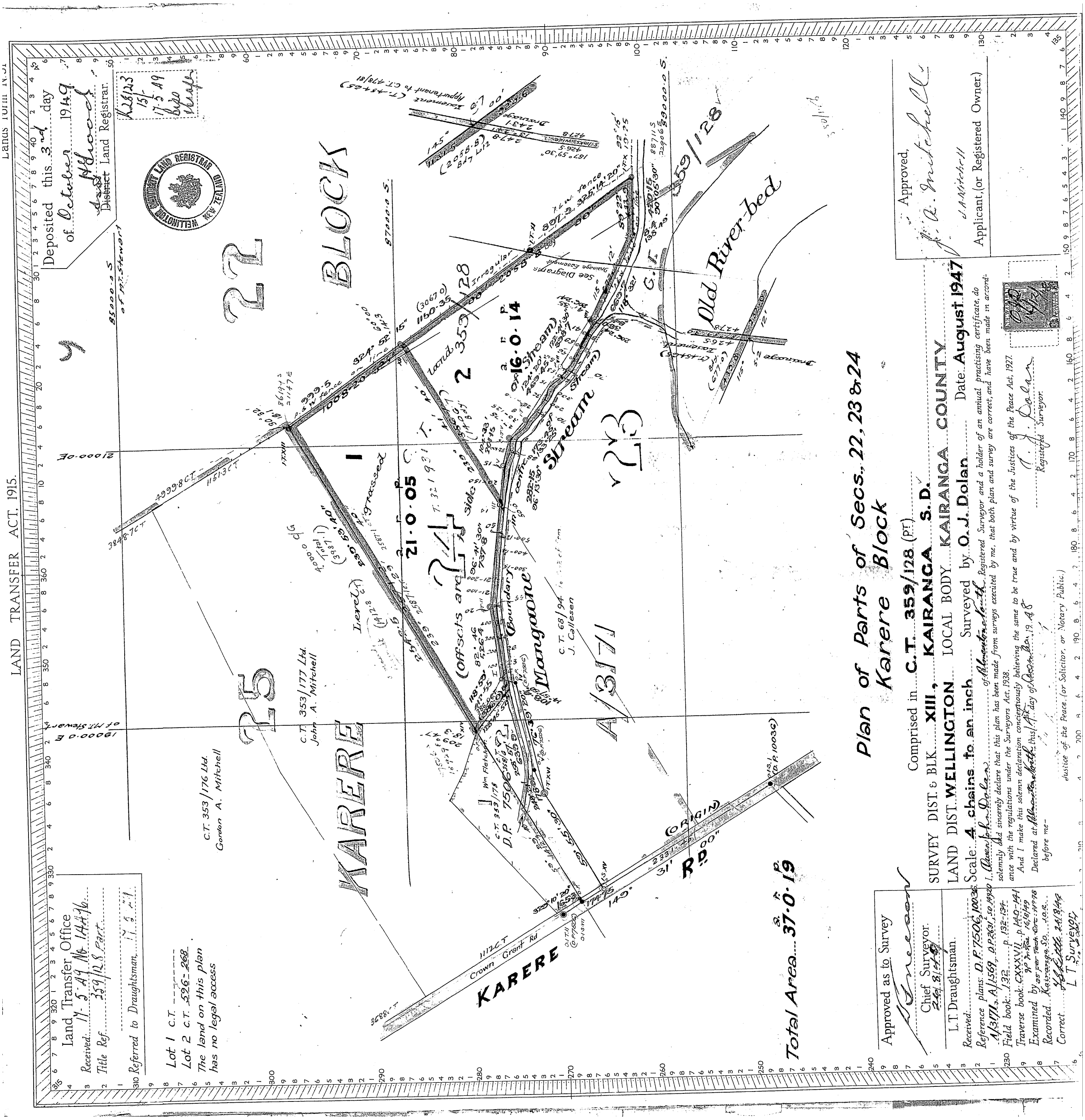
Fonterra Limited

Interests

Subject to drainage rights over part created by Transfer 45465

For access to a public road see CT WN550/186

Subject to a right (in gross) to spray waste water over all of the within land in favour of Kiwi Co-operative Dairies Limited created by Transfer B676065.2 - 17.7.1998 at 3.19 pm


LAND TRANSFER ACT, 1915.
Deposited this 3rd day of October 1949
District Land Registrar.
Plan of Parts of Secs. 22, 23 & 24 Karere Block
Comprised in C.T. 359/128 (pt)
SURVEY DIST. & BLK. XIII, KAIRANGA S.D.
LAND DIST. WELLINGTON LOCAL BODY KAIRANGA COUNTY
Scale: 4 chains to an inch
Surveyed by O.J. Dolan
Date: August 1947
Total Area 37.0.19
KARERE BLOCK
Mangaone Stream
Old River-bed
Karere Rd.
Crown Grant Rd
C.T. 353/177 Ltd. John A. Mitchell
C.T. 353/176 Ltd. Gordon A. Mitchell
C.T. 68/94 J. Callesen
A/3171
21.0.05
16.0.14
Lot 1 C.T. ....
Lot 2 C.T. 596-268
The land on this plan has no legal access
Approved as to Survey
Chief Surveyor
L.T. Draughtsman.
Land Transfer Office
Approved,
Applicant, (or Registered Owner.)
Registered Surveyor.

Thornton Park

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN44D/921**

Land Registration District **Wellington**

Date Issued 21 July 1995

Prior References

WN44D/914

Estate	Fee Simple
Area	2.2900 hectares more or less
Legal Description	Lot 3 Deposited Plan 77399

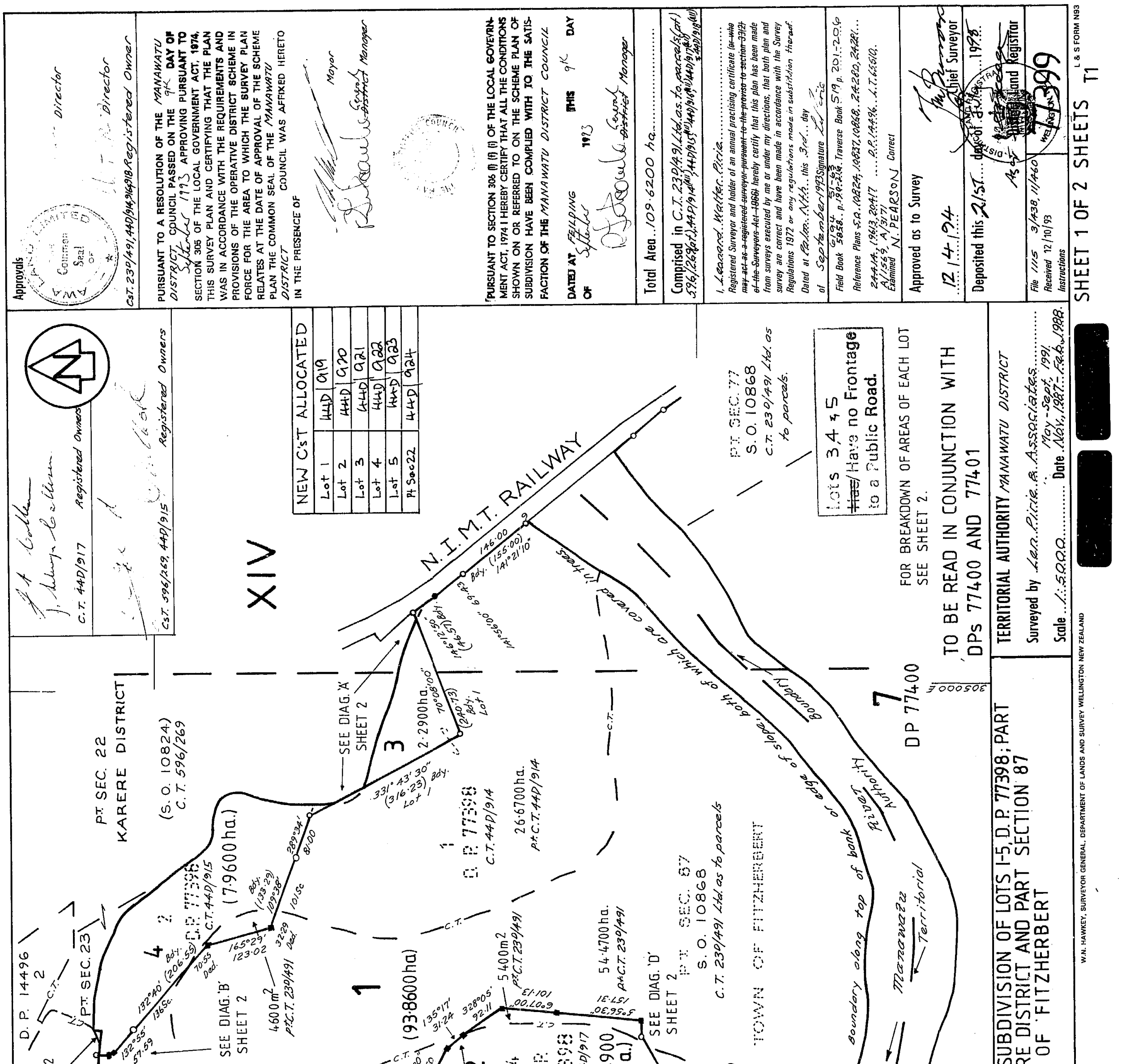
Registered Owners

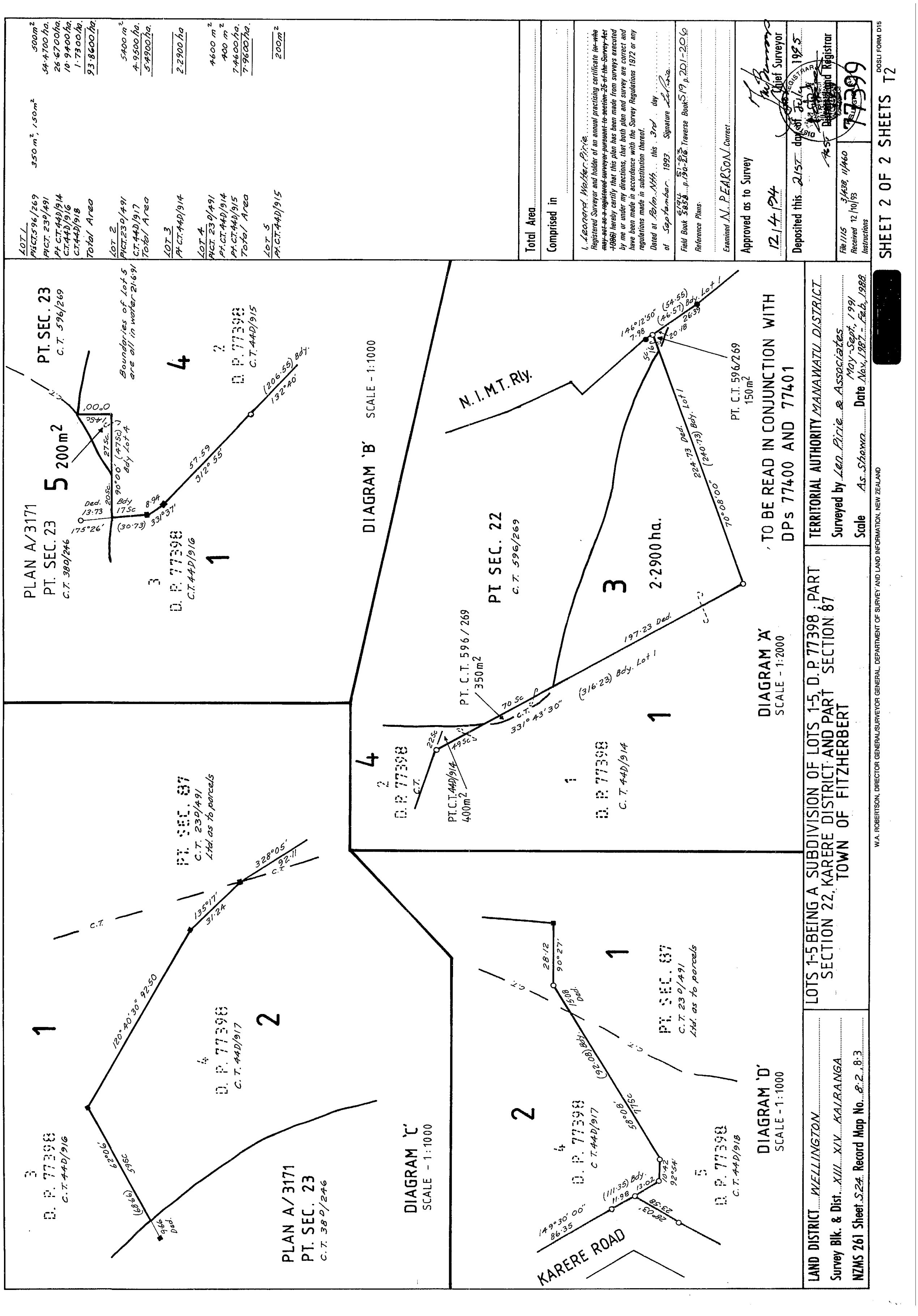
Fonterra Limited

Interests

The within land has no frontage to a legal road - see No. B445237.1

Subject to a right to spray waste water (in gross) over all of the within land in favour of Kiwi Co-operative Dairies Limited created by Transfer B676065.2 - 17.7.1998 at 3.19 pm


Approvals
Common Seal
Director
Director
C.T. 23⁰/491, 44D/914, 916 & 918 Registered Owner
C.T. 44D/917 Registered Owners
C.T. 596/269, 44D/915 Registered Owners
PURSUANT TO A RESOLUTION OF THE MANAWATU DISTRICT COUNCIL PASSED ON THE 9th DAY OF September 1993 APPROVING PURSUANT TO SECTION 305 OF THE LOCAL GOVERNMENT ACT, 1974, THIS SURVEY PLAN AND CERTIFYING THAT THE PLAN WAS IN ACCORDANCE WITH THE REQUIREMENTS AND PROVISIONS OF THE OPERATIVE DISTRICT SCHEME IN FORCE FOR THE AREA TO WHICH THE SURVEY PLAN RELATES AT THE DATE OF APPROVAL OF THE SCHEME PLAN THE COMMON SEAL OF THE MANAWATU DISTRICT COUNCIL WAS AFFIXED HERETO IN THE PRESENCE OF
Mayor
General Manager
PURSUANT TO SECTION 306 (1) (f) (i) OF THE LOCAL GOVERNMENT ACT, 1974 I HEREBY CERTIFY THAT ALL THE CONDITIONS SHOWN ON OR REFERRED TO ON THE SCHEME PLAN OF SUBDIVISION HAVE BEEN COMPLIED WITH TO THE SATISFACTION OF THE MANAWATU DISTRICT COUNCIL
DATED AT FEILDING THIS 9th DAY OF September 1993
General Manager
Total Area 109·6200 ha
Comprised in C.T. 23⁰/491 Ltd. as to parcels (pt) 596/269 (pt) 44D/914 44D/915 44D/916 44D/917 44D/918
I, Leonard Walter Pirie Registered Surveyor and holder of an annual practising certificate ~~(or who may act as a registered surveyor pursuant to the proviso to section 33(2) of the Surveyors Act 1986)~~ hereby certify that this plan has been made from surveys executed by me or under my directions, that both plan and survey are correct and have been made in accordance with the Survey Regulations 1972 or any regulations made in substitution thereof.
Dated at Palm. Nth. this 3rd day of September 1993 Signature
Field Book 5858 p. 190-214 Traverse Book 519 p. 201-206
Reference Plans S.O. 10824, 10837, 10868, 24280, 24281, 24414, 19613, 20417, A/1569, A/3171, D.P. 14496, L.T. 62610
Examined N. PEARSON Correct
Approved as to Survey 12.4.94 Chief Surveyor
Deposited this 21st day of April 1995 Asst District Land Registrar
File 1115 3/438, 11/460
Received 12/10/93
Instructions
77399
SHEET 1 OF 2 SHEETS T1
L & S FORM N93
NEW C'sT ALLOCATED
Lot 1 44D/919
Lot 2 44D/920
Lot 3 44D/921
Lot 4 44D/922
Lot 5 44D/923
Pt Sec 22 44D/924
XIV
XIII
Pt SEC. 22 KARERE DISTRICT (S.O. 10824) C.T. 596/269
Pt SEC. 23 KARERE DISTRICT (SO 10824)
PLAN A/3171 CT 38D/246
D.P. 14496 2
Pt SEC. 23
5 200 m²
4 (7·9600 ha.)
2 D.P. 77398 C.T. 44D/915
3 D.P. 77398 C.T. 44D/916 10·9400 ha.
1 (93·8600 ha)
1 D.P. 77398 C.T. 44D/914 26·6700 ha. Pt C.T. 44D/914
2 (5·4900 ha.)
4 D.P. 77398 CT 44D/917
54·4700 ha. Pt C.T. 23⁰/491
5400 m² Pt C.T. 23⁰/491
4600 m² Pt C.T. 23⁰/491
3 2·2900 ha.
SEE DIAG. 'A' SHEET 2
SEE DIAG. 'B' SHEET 2
SEE DIAG. 'C' SHEET 2
SEE DIAG. 'D' SHEET 2
N.I.M.T. RAILWAY
KARERE ROAD 20·12 Legal Road
Crown Grant
AKERS ROAD 20·12 Legal Road
Legal Road by Sec 315(4) Local Government Act 1974
2 D.P. 9952
Present Bank of River
Pt SEC. 87 S.O. 10868 C.T. 23⁰/491 Ltd. as to parcels
TOWN OF FITZHERBERT
Pt SEC. 77 S.O. 10868 C.T. 23⁰/491 Ltd. as to parcels
D.P. 77398 CT 44D/918
Boundary along top of bank or edge of slope, both of which are covered in trees
Manawatu
Territorial Authority Boundary
River
7 DP 77400
8 DP 77401
Lots 3, 4 & 5 ~~Has~~/Have no Frontage to a Public Road.
FOR BREAKDOWN OF AREAS OF EACH LOT SEE SHEET 2.
TO BE READ IN CONJUNCTION WITH DPs 77400 AND 77401
682 000 N
681 000 N
304000 E
305000 E
LAND DISTRICT WELLINGTON
SURVEY BLK. & DIST. XIII XIV KAIRANGA
NZMS 261 SHT S24 RECORD MAP No 8.2, 8.3
LOTS 1-5 BEING A SUBDIVISION OF LOTS 1-5, D.P. 77398; PART SECTION 22, KARERE DISTRICT AND PART SECTION 87 TOWN OF FITZHERBERT
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by Len Pirie & Associates May-Sept. 1991
Scale 1:5000 Date Nov. 1987 - Feb. 1988
[redacted]
W.N. HAWKEY, SURVEYOR GENERAL, DEPARTMENT OF LANDS AND SURVEY WELLINGTON NEW ZEALAND
Printed by Littlejohns Wellington, New Zealand


LOTS 1-5 BEING A SUBDIVISION OF LOTS 1-5, D.P. 77398, PART SECTION 22, KARERE DISTRICT AND PART SECTION 87 TOWN OF FITZHERBERT
TO BE READ IN CONJUNCTION WITH DPs 77400 AND 77401
DIAGRAM 'A' SCALE - 1:2000
DIAGRAM 'B' SCALE - 1:1000
DIAGRAM 'C' SCALE - 1:1000
DIAGRAM 'D' SCALE - 1:1000
PT. SEC. 22 C.T. 596/269
PT. SEC. 23 C.T. 596/269
PLAN A/3171 PT. SEC. 23 C.T. 380/246
PT. SEC. 87 C.T. 230/491 Ltd. as to parcels
N. I. M. T. Rly.
KARERE ROAD
2·2900 ha.
5 200m²
Boundaries of Lot 5 are all in water 21:691
LAND DISTRICT WELLINGTON
Survey Blk. & Dist. XIII XIV KAIRANGA
NZMS 261 Sheet S24 Record Map No. 8:2 8:3
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by Len Pirie & Associates
Scale As Shown
Date Nov., 1987 - Feb., 1988
Total Area
Comprised in
Approved as to Survey
Deposited this 21st day of July 1995
SHEET 2 OF 2 SHEETS T2
77399
DOSLI FORM D15
W.A. ROBERTSON, DIRECTOR GENERAL/SURVEYOR GENERAL, DEPARTMENT OF SURVEY AND LAND INFORMATION, NEW ZEALAND

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN44D/922**
Land Registration District **Wellington**
Date Issued 21 July 1995

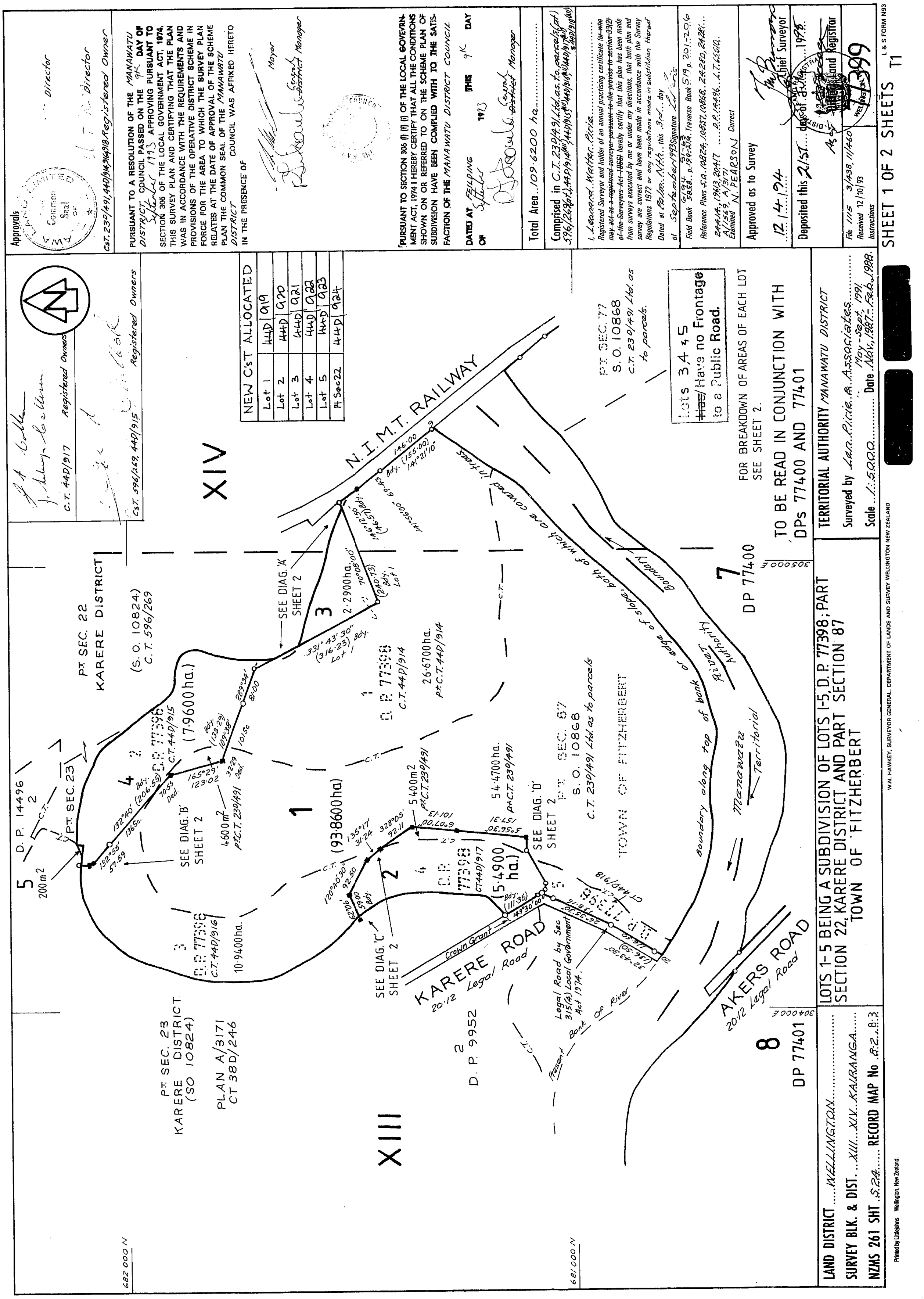
Prior References
WN23D/491 WN44D/914 WN44D/915

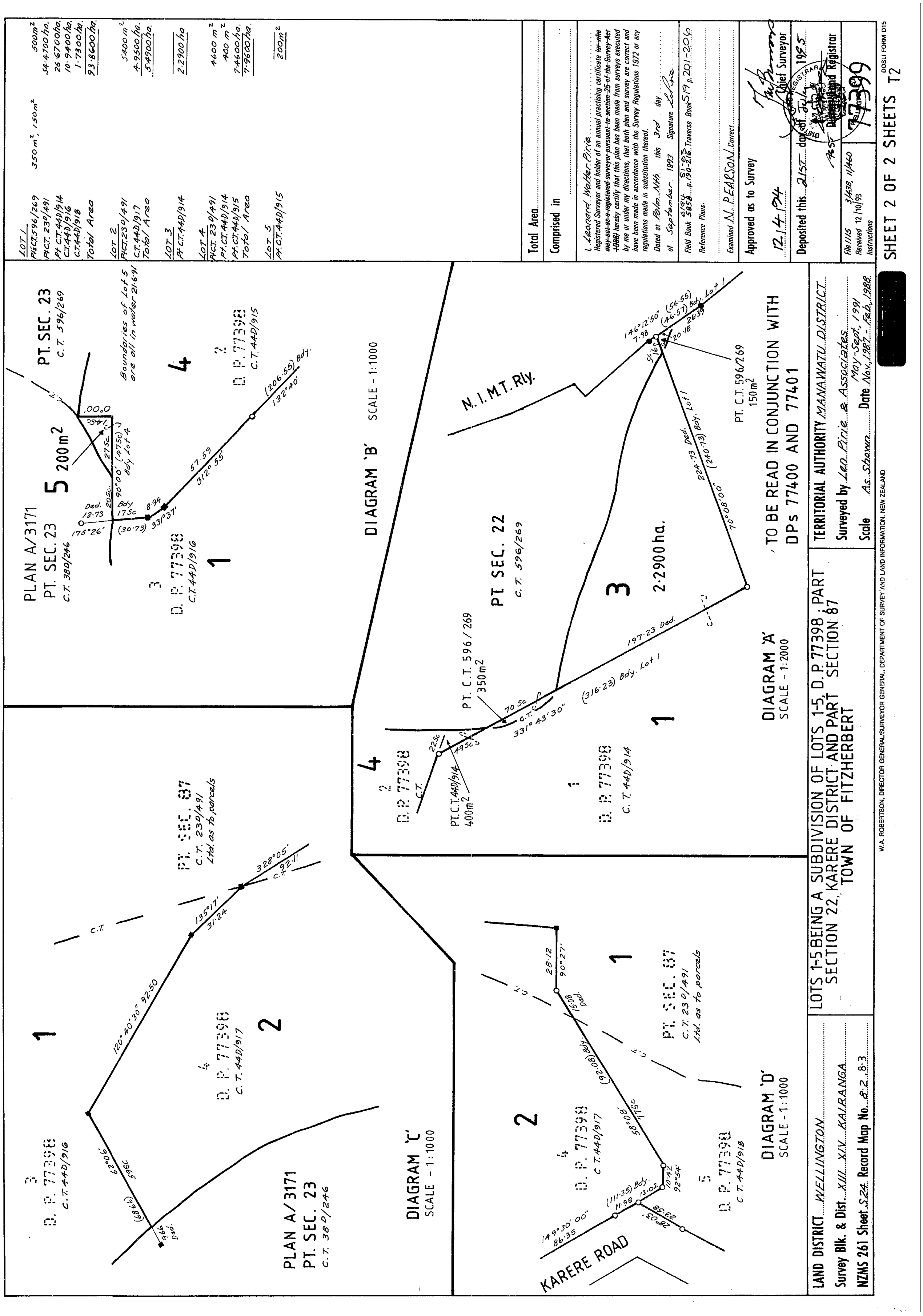
Estate Fee Simple
Area 7.9600 hectares more or less
Legal Description Lot 4 Deposited Plan 77399
Registered Owners
Fonterra Limited

Interests

The within land has no frontage to a legal road - See No. B445237.1

Subject to a right to spray waste water (in gross) over all of the within land in favour of Kiwi Co-operative Dairies Limited created by Transfer B676065.2 - 17.7.1998 at 3.19 pm


Approvals
Director
Director
C.T. 230/491, 44D/914, 916, 918 Registered Owner
C.T. 44D/917 Registered Owners
C.T. 596/269, 44D/915 Registered Owners
PURSUANT TO A RESOLUTION OF THE MANAWATU DISTRICT COUNCIL PASSED ON THE 9th DAY OF September 1993 APPROVING PURSUANT TO SECTION 305 OF THE LOCAL GOVERNMENT ACT, 1974, THIS SURVEY PLAN AND CERTIFYING THAT THE PLAN WAS IN ACCORDANCE WITH THE REQUIREMENTS AND PROVISIONS OF THE OPERATIVE DISTRICT SCHEME IN FORCE FOR THE AREA TO WHICH THE SURVEY PLAN RELATES AT THE DATE OF APPROVAL OF THE SCHEME PLAN THE COMMON SEAL OF THE MANAWATU DISTRICT COUNCIL WAS AFFIXED HERETO IN THE PRESENCE OF
Mayor
General Manager
PURSUANT TO SECTION 306 (f) (f) (i) OF THE LOCAL GOVERNMENT ACT, 1974 I HEREBY CERTIFY THAT ALL THE CONDITIONS SHOWN ON OR REFERRED TO ON THE SCHEME PLAN OF SUBDIVISION HAVE BEEN COMPLIED WITH TO THE SATISFACTION OF THE MANAWATU DISTRICT COUNCIL
DATED AT FEILDING THIS 9th DAY OF September 1993
General Manager
Total Area ..109·6200 ha..
Comprised in C.T. 230/491 Ltd. as to parcels (pt) 596/269 (pt) 44D/914 44D/915 44D/916 44D/917 44D/918
I, Leonard Walter Pirie, Registered Surveyor and holder of an annual practising certificate ~~(or who may act as a registered surveyor pursuant to the proviso to section 33(2) of the Surveyors Act 1986)~~ hereby certify that this plan has been made from surveys executed by me or under my directions, that both plan and survey are correct and have been made in accordance with the Survey Regulations 1972 or any regulations made in substitution thereof.
Dated at Palm. Nth. this 3rd day of September 1993 Signature
Field Book 5858 p. 190-214 Traverse Book 519 p. 201-206
Reference Plans S.O. 10824, 10837, 10868, 24280, 24281, 24414, 19613, 20417, A/1569, A/3171 D.P. 14496 L.T. 65610
Examined N. PEARSON Correct
Approved as to Survey
12.4.94
Chief Surveyor
Deposited this 21st day of 1995
Land Registrar
File 1115 3/438, 11/460
Received 12/10/93
Instructions
77399
SHEET 1 OF 2 SHEETS
L & S FORM N93
T1
NEW C's T ALLOCATED
Lot 1 44D/919
Lot 2 44D/920
Lot 3 44D/921
Lot 4 44D/922
Lot 5 44D/923
Pt Sec 22 44D/924
5
200 m2
D.P. 14496
2
PT. SEC. 23
PT. SEC. 22
KARERE DISTRICT
(S.O. 10824)
C.T. 596/269
XIV
4
2
D.P. 77398
C.T. 44D/915
(7·9600 ha.)
SEE DIAG. 'B' SHEET 2
4600 m2
Pt C.T. 230/491
3
D.P. 77398
C.T. 44D/916
10·9400 ha.
PT. SEC. 23
KARERE DISTRICT
(SO 10824)
PLAN A/3171
CT 38D/246
XIII
1
(93·8600 ha)
SEE DIAG. 'A' SHEET 2
3
2·2900 ha.
1
D.P. 77398
C.T. 44D/914
26·6700 ha.
Pt C.T. 44D/914
N.I.M.T. RAILWAY
SEE DIAG. 'C' SHEET 2
2
5400 m2
Pt C.T. 230/491
4
D.P. 77398
CT 44D/917
(5·4900 ha.)
54·4700 ha.
Pt C.T. 230/491
SEE DIAG. 'D' SHEET 2
5
2
D.P. 9952
KARERE ROAD
20·12 Legal Road
Crown Grant
Legal Road by Sec 315(4) Local Government Act 1974.
D.P. 77398
CT 44D/918
PT. SEC. 87
S.O. 10868
C.T. 230/491 Ltd. as to parcels
TOWN OF FITZHERBERT
Present Bank of River
Boundary along top of bank or edge of slope, both of which are covered in trees
Boundary
River Authority
Manawatu
Territorial
PT. SEC. 77
S.O. 10868
C.T. 230/491 Ltd. as to parcels.
Lots 3,4 & 5 ~~Has~~/Have no Frontage to a Public Road.
7
DP 77400
FOR BREAKDOWN OF AREAS OF EACH LOT SEE SHEET 2.
TO BE READ IN CONJUNCTION WITH DPs 77400 AND 77401
8
DP 77401
AKERS ROAD
20·12 Legal Road
682 000 N
681 000 N
304000 E
305000 E
LAND DISTRICT ..WELLINGTON..
SURVEY BLK. & DIST. ..XIII XIV KAIRANGA..
NZMS 261 SHT ..S24.. RECORD MAP No ..8.2..8.3
LOTS 1-5 BEING A SUBDIVISION OF LOTS 1-5, D.P. 77398; PART SECTION 22, KARERE DISTRICT AND PART SECTION 87 TOWN OF FITZHERBERT
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by Len Pirie & Associates May-Sept. 1991
Scale 1:5000 Date Nov. 1987 - Feb. 1988
Printed by Littlejohns Wellington, New Zealand.
W.N. HAWKEY, SURVEYOR GENERAL, DEPARTMENT OF LANDS AND SURVEY WELLINGTON NEW ZEALAND
[redacted]


LOTS 1-5 BEING A SUBDIVISION OF LOTS 1-5, D.P. 77398, PART SECTION 22, KARERE DISTRICT AND PART SECTION 87 TOWN OF FITZHERBERT
TO BE READ IN CONJUNCTION WITH DPs 77400 AND 77401
LAND DISTRICT WELLINGTON
Survey Blk. & Dist. XIII XIV KAIRANGA
NZMS 261 Sheet S24 Record Map No. 8.2 8.3
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by Len Pirie & Associates
Scale As Shown
SHEET 2 OF 2 SHEETS
DIAGRAM 'A' SCALE - 1:2000
DIAGRAM 'B' SCALE - 1:1000
DIAGRAM 'C' SCALE - 1:1000
DIAGRAM 'D' SCALE - 1:1000
PT. SEC. 22 C.T. 596/269
PT. SEC. 23 C.T. 596/269
PT. SEC. 87 C.T. 230/491
PLAN A/3171 PT. SEC. 23 C.T. 380/246
N.I.M.T. Rly.
KARERE ROAD
2·2900 ha.
5 200m²
Total Area
Comprised in
Approved as to Survey
Deposited this 21st day of July 1995
DOSLI FORM D15
T2

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier WN57C/965
Land Registration District Wellington
Date Issued 29 April 2002

Prior References
WN44D/924

Estate	Fee Simple
Area	109.5581 hectares more or less
Legal Description	Lot 2-4 Deposited Plan 90226

Registered Owners
Fonterra Limited

Interests

Subject to drainage rights over part Lot 3 marked D on DP 90226 created by Transfer 45465 - 23.6.1903 at 2:40 pm

428772 Proclamation defining middle line of Railway - 18.4.1959 at 11:00 am

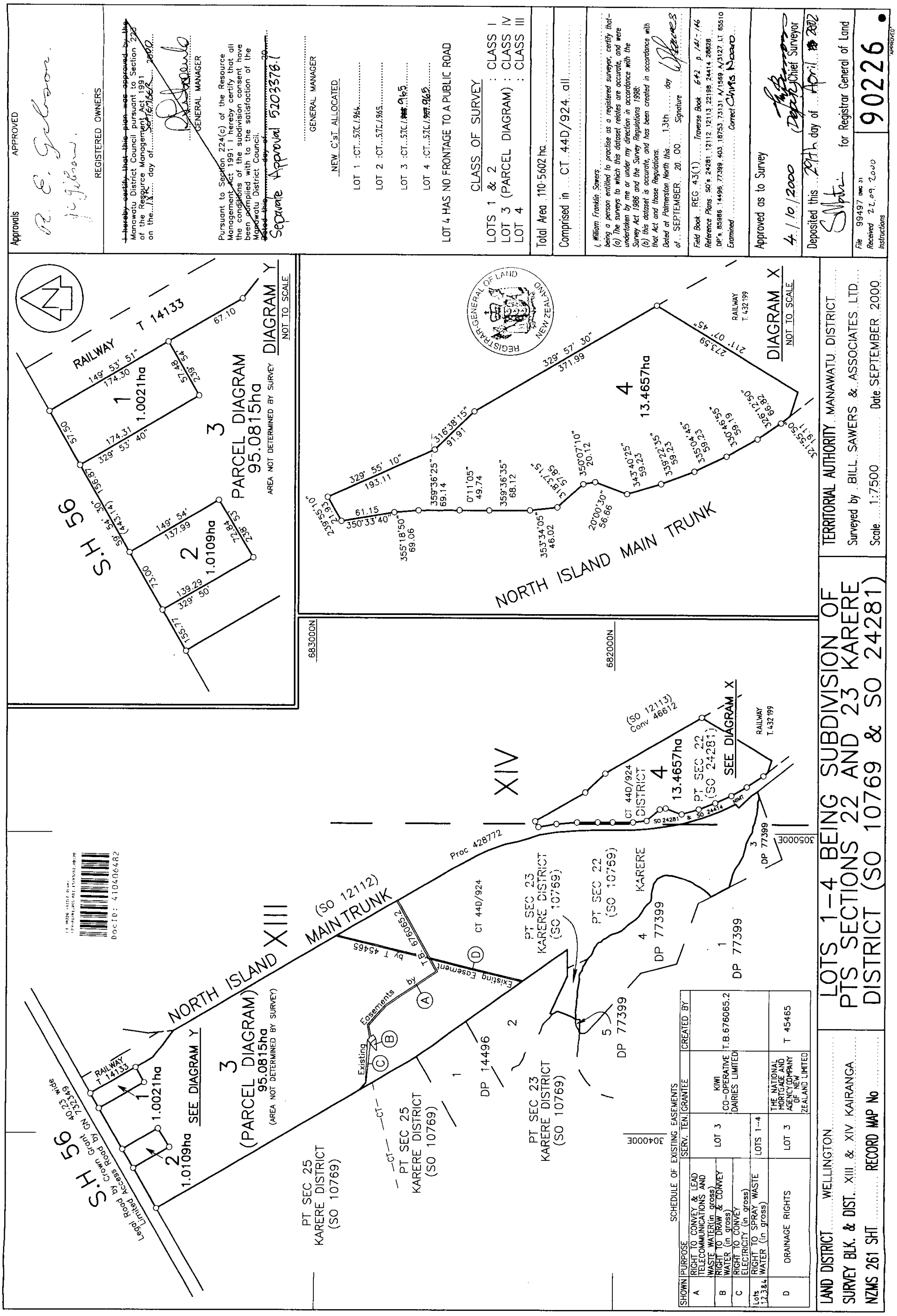
732549 Gazette Notice declaring the adjoining State Highway No. 56 to be a limited access road - 9.1.1968 at 10:05 am (affects Lots 2-3 DP 90226)

Subject to a right (in gross) to convey and lead telecommunications and waste water over part Lot 3 marked A, a right (in gross) to draw and convey water over part Lot 3 marked B, a right (in gross) to convey electricity over part Lot 3 marked C on DP 90226 and a right (in gross) to spray waste water over the within land in favour of Kiwi Co-operative Dairies Limited created by Transfer B676065.2 - 17.7.1998 at 3.19 pm

5203378.3 Certificate pursuant to Section 321(3)(b) Local Government Act 1974 (affects Lot 4 DP 90226) - 29.4.2002 at 9:00 am

Subject to Section 241(2) Resource Management Act 1991 (affects Lots 2-3 DP 90226)

Subject to a right (in gross) to convey electricity over part Lot 3 marked C on DP 465230 favour of Powerco Limited created by Easement Instrument 9448893.1 - 4.10.2013 at 9:41 am


LOTS 1-4 BEING SUBDIVISION OF
PTS SECTIONS 22 AND 23 KARERE
DISTRICT (SO 10769 & SO 24281)
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by BILL SAWERS & ASSOCIATES LTD
Scale 1:7500
Date SEPTEMBER 2000
LAND DISTRICT WELLINGTON
SURVEY BLK. & DIST. XIII & XIV KAIRANGA
NZMS 261 SHT
RECORD MAP No
Approved as to Survey
4/10/2000
for Registrar General of Land
90226
CLASS OF SURVEY
LOTS 1 & 2 : CLASS I
LOT 3 (PARCEL DIAGRAM) : CLASS IV
LOT 4 : CLASS III
LOT 4 HAS NO FRONTAGE TO A PUBLIC ROAD
Total Area 110·5602 ha
Comprised in CT 44D/924 all
NEW C's T ALLOCATED
LOT 1 : CT 57C/964
LOT 2 : CT 57C/965
LOT 3 : CT 57C/965
LOT 4 : CT 57C/965
APPROVED
REGISTERED OWNERS
GENERAL MANAGER
Separate Approval 5203378.1
SCHEDULE OF EXISTING EASEMENTS
SHOWN | PURPOSE | SERV. TEN. | GRANTEE | CREATED BY
A | RIGHT TO CONVEY & LEAD TELECOMMUNICATIONS AND WASTE WATER (in gross) | LOT 3 | KIWI CO-OPERATIVE DAIRIES LIMITED | T.B.676065.2
B | RIGHT TO DRAW & CONVEY WATER (in gross)
C | RIGHT TO CONVEY ELECTRICITY (in gross)
Lots 1,2,3&4 | RIGHT TO SPRAY WASTE WATER (in gross) | LOTS 1-4
D | DRAINAGE RIGHTS | LOT 3 | THE NATIONAL MORTGAGE AND AGENCY COMPANY OF NEW ZEALAND LIMITED | T 45465
S.H. 56
NORTH ISLAND MAIN TRUNK
RAILWAY T 14133
1 1.0021ha
2 1.0109ha
3 (PARCEL DIAGRAM) 95.0815ha (AREA NOT DETERMINED BY SURVEY)
4 13.4657ha
DIAGRAM Y NOT TO SCALE
DIAGRAM X NOT TO SCALE
SEE DIAGRAM X
SEE DIAGRAM Y
XIII
XIV
PT SEC 25 KARERE DISTRICT (SO 10769)
PT SEC 23 KARERE DISTRICT (SO 10769)
PT SEC 22 (SO 10769) KARERE
DP 14496
DP 77399
Proc 428772
683000N
682000N
3040000E
3050000E

Thornton Park

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Limited as to Parcels
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier WN353/177

Land Registration District Wellington

Date Issued 09 May 1930

Prior References
DI 26/640

Estate Fee Simple

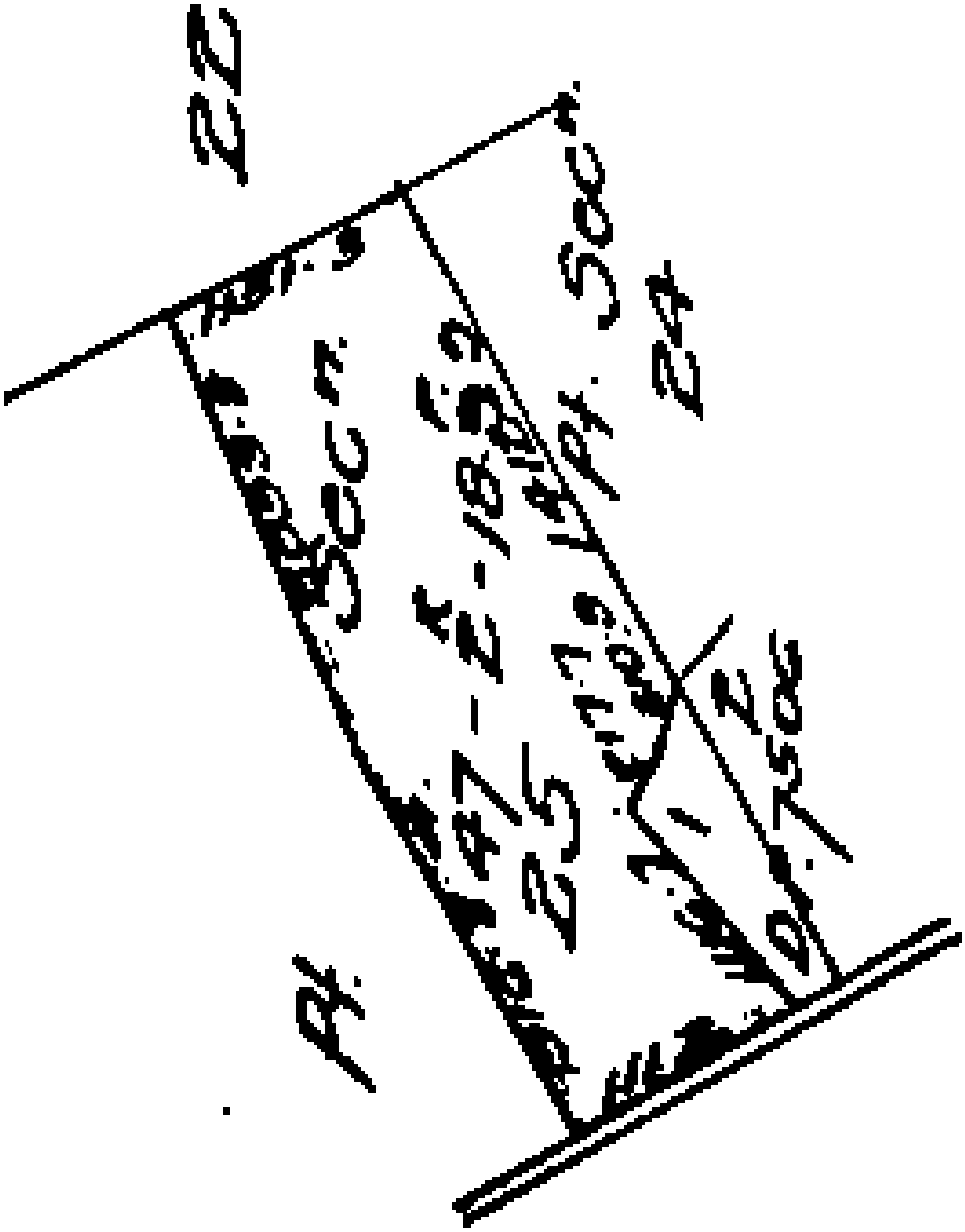
Area 19.2704 hectares more or less

Legal Description Part Rural Section 25 Karere District

Registered Owners
Fonterra Limited

Interests

Subject to a right (in gross) to spray waste water in favour of Kiwi Co-operative Dairies Limited created by Transfer B676065.2 - 17.7.1998 at 3.19 pm



Innesmoor

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**WN37D/995**
Land Registration District	**Wellington**
Date Issued	24 August 1990

Prior References
WN34D/267

Estate	Fee Simple
Area	34.7642 hectares more or less
Legal Description	Part Lot 1 Deposited Plan 54397

Registered Owners
Fonterra Limited

Interests

Appurtenant hereto is a right of way created by Conveyance 74486 (123/277)

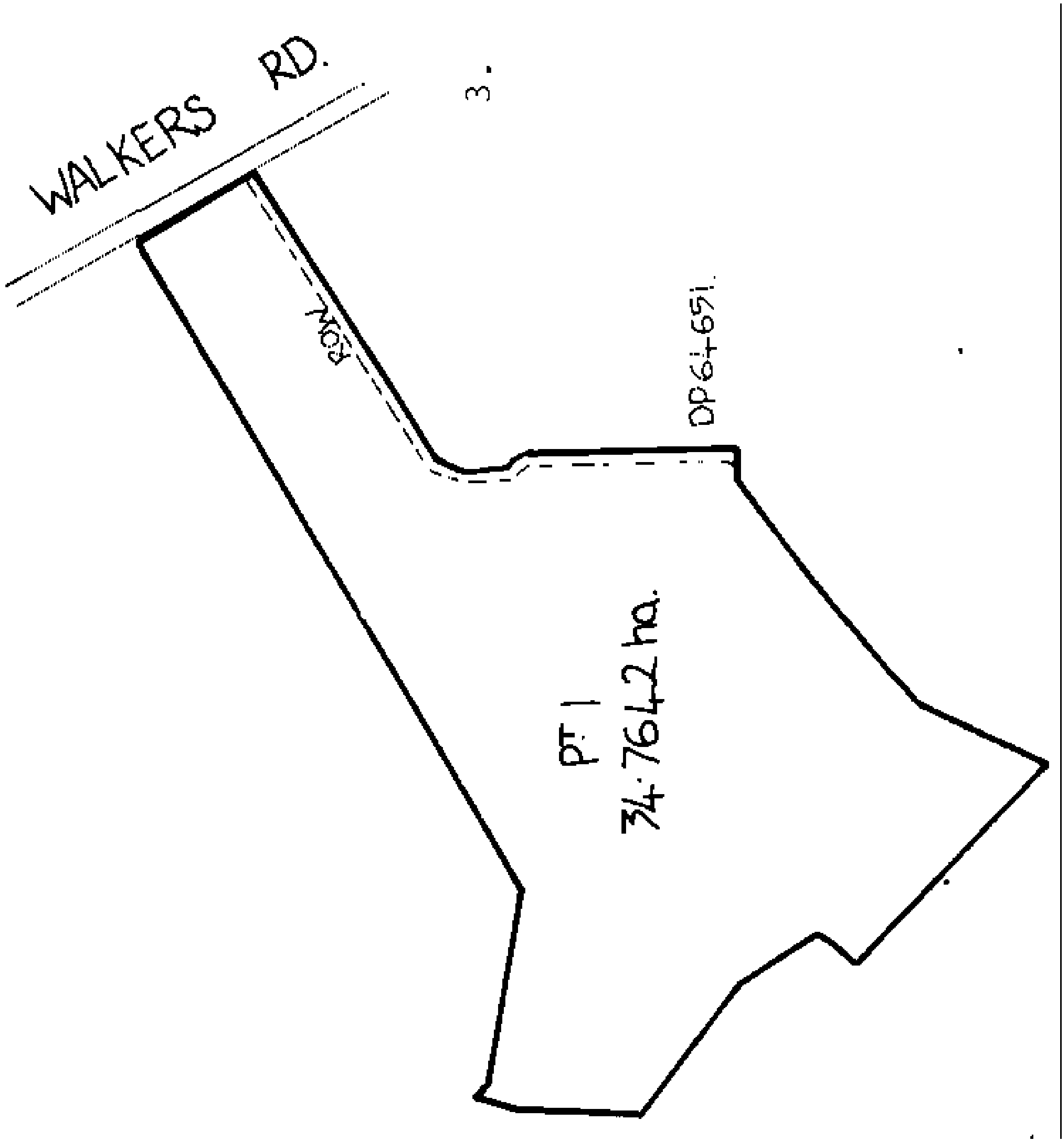
Subject to drainage rights over part marked G on DP 54397 created by Transfer 177653

Subject to drainage rights over part marked D on DP 54397 created by Transfer 218768

Subject to a right of way over part marked A, B, C and D on DP 64651 created by Transfer 695481.2 (D.R. 123/180)

Subject to a right of way (in gross) over part marked B, C & D on DP 64651 for sewage disposal works in favour of The Manawatu District Council acquired by Gazette Notice 784619.1

Subject to a right of way over part marked A, B, C and D on DP 64651 created by Transfer B151024.2 - 25.3.1991 at 10.22 am


WALKERS RD.
3.
ROW
DP 64651.
PT 1
34.7642 ha.

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN43D/361**
Land Registration District **Wellington**
Date Issued 17 December 1993

Prior References
WN34A/977

Estate	Fee Simple
Area	46.4600 hectares more or less
Legal Description	Lot 6 Deposited Plan 77563

Registered Owners
Fonterra Limited

Interests

Appurtenant hereto is a right of way created by Transfer 14013 (affects part formerly in CT WN478/81)

Appurtenant hereto is a right of way created by Conveyance 74486 (DR 123/277) (affects part formerly in CT WN461/214)

The within land has no frontage to a legal road

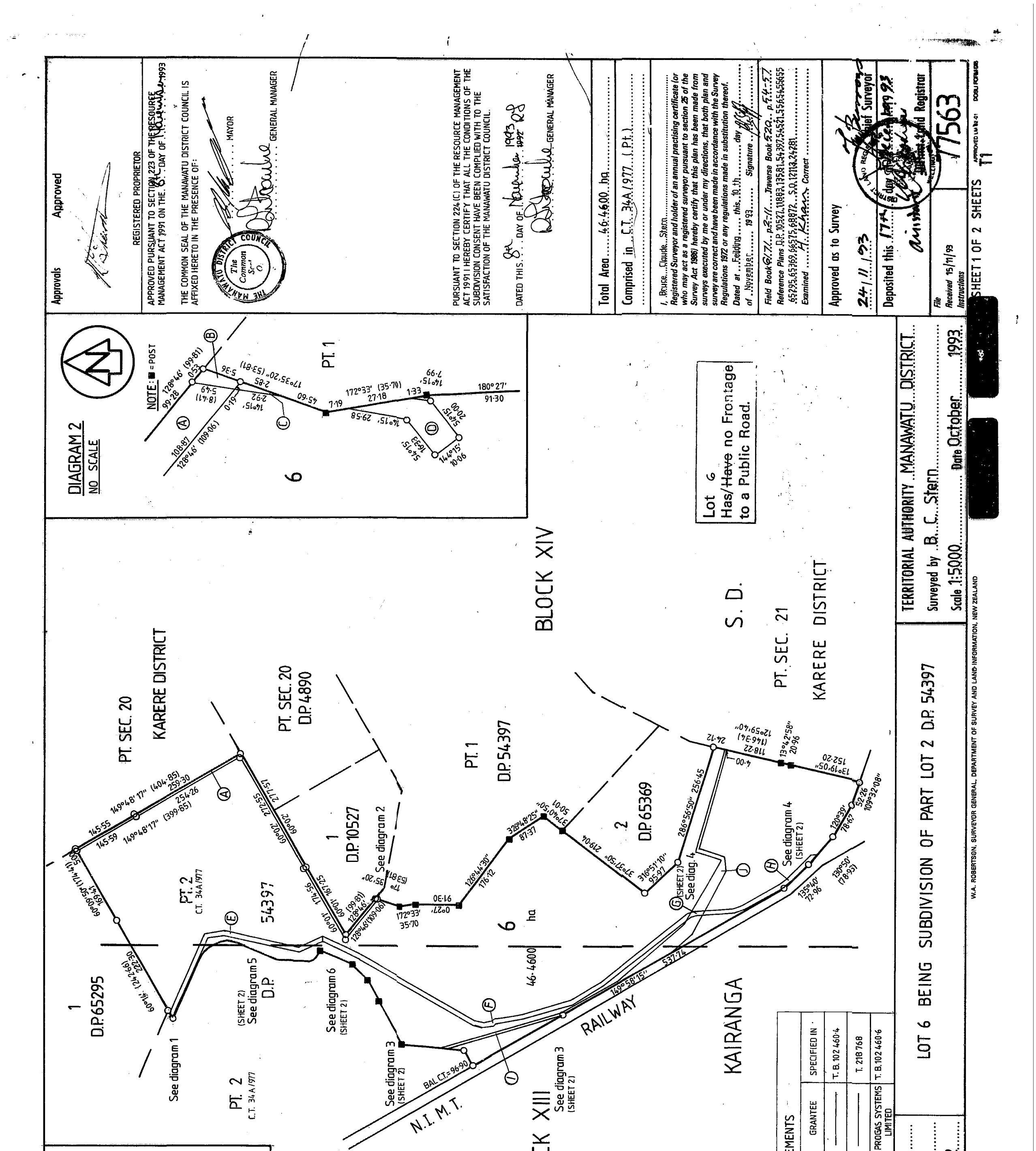
Subject to a right to drain sewage over parts marked B, C and D on DP 77563 created by Transfer 218768

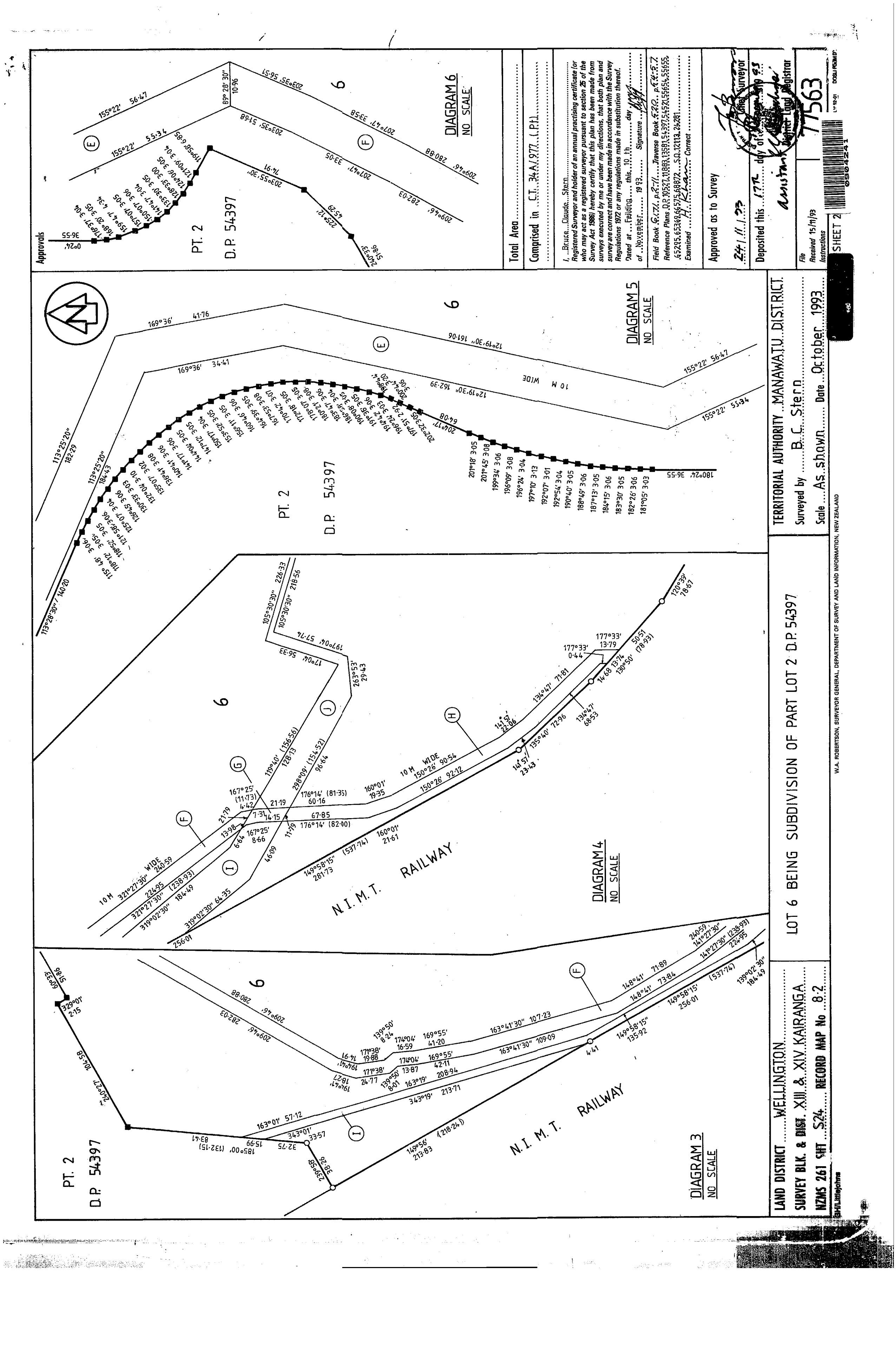
Subject to a right of way over parts marked A and B on DP 77563 created by Transfer B102460.4

Subject to gas reticulation rights (in gross) over parts marked E, F, G and H on DP 77563 in favour of (now) Powerco Limited created by Transfer B102460.6

Subject to a right to convey effluent over parts marked G, I and J on DP 77563 specified in Easement Certificate B324725.3 - 17.12.1993 at 12.08 pm

Identifier **WN43D/361**




LOT 6 BEING SUBDIVISION OF PART LOT 2 D.P. 54397
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by B. C. Stern
Scale As shown Date October 1993
LAND DISTRICT WELLINGTON
SURVEY BLK. & DIST. XIII & XIV KAIRANGA
NZMS 261 SHT S24 RECORD MAP No 8:2
DIAGRAM 3 NO SCALE
DIAGRAM 4 NO SCALE
DIAGRAM 5 NO SCALE
DIAGRAM 6 NO SCALE
PT. 2 D.P. 54397
N.I.M.T. RAILWAY
10 M WIDE
Approved as to Survey
SHEET 2
77563

Innesmoor

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN34A/976**
Land Registration District **Wellington**
Date Issued 26 June 1989

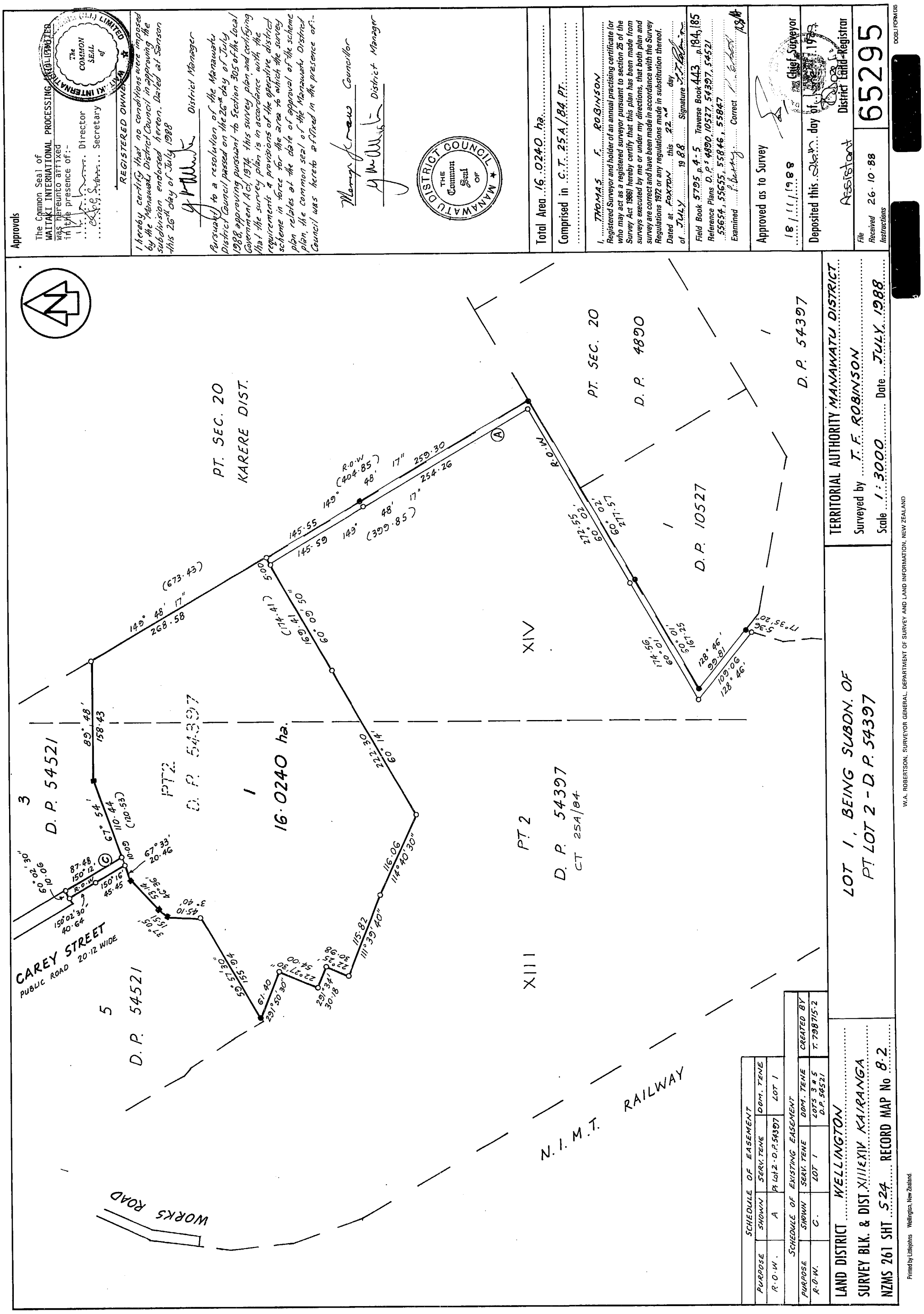
Prior References
WN25A/84

Estate Fee Simple
Area 16.0240 hectares more or less
Legal Description Lot 1 Deposited Plan 65295
Registered Owners
Fonterra Limited

Interests

Subject to a right of way over part marked C on DP 65295 created by Transfer 798715.2

Appurtenant hereto is a right of way created by Transfer B102460.4 - 16.8.1990 at 10.19 am


Approvals
REGISTERED OWNER
DISTRICT COUNCIL MANAWATU
Total Area 16.0240 ha.
Comprised in C.T. 25A/84 PT.
Approved as to Survey
District Land Registrar
65295
PT. SEC. 20 KARERE DIST.
PT. SEC. 20 D.P. 4890
D.P. 54397
D.P. 10527
D.P. 54521
16.0240 ha.
PT 2 D.P. 54397 CT 25A/84
XIII
XIV
CAREY STREET PUBLIC ROAD 20.12 WIDE
N.I.M.T. RAILWAY
WORKS ROAD
LOT 1, BEING SUBDN. OF PT LOT 2 - D.P. 54397
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by T.F. ROBINSON
Scale 1:3000 Date JULY 1988
SCHEDULE OF EASEMENT
SCHEDULE OF EXISTING EASEMENT
LAND DISTRICT WELLINGTON
SURVEY BLK. & DIST XIII & XIV KAIRANGA
NZMS 261 SHT. S24 RECORD MAP No 8.2

Innesmoor

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

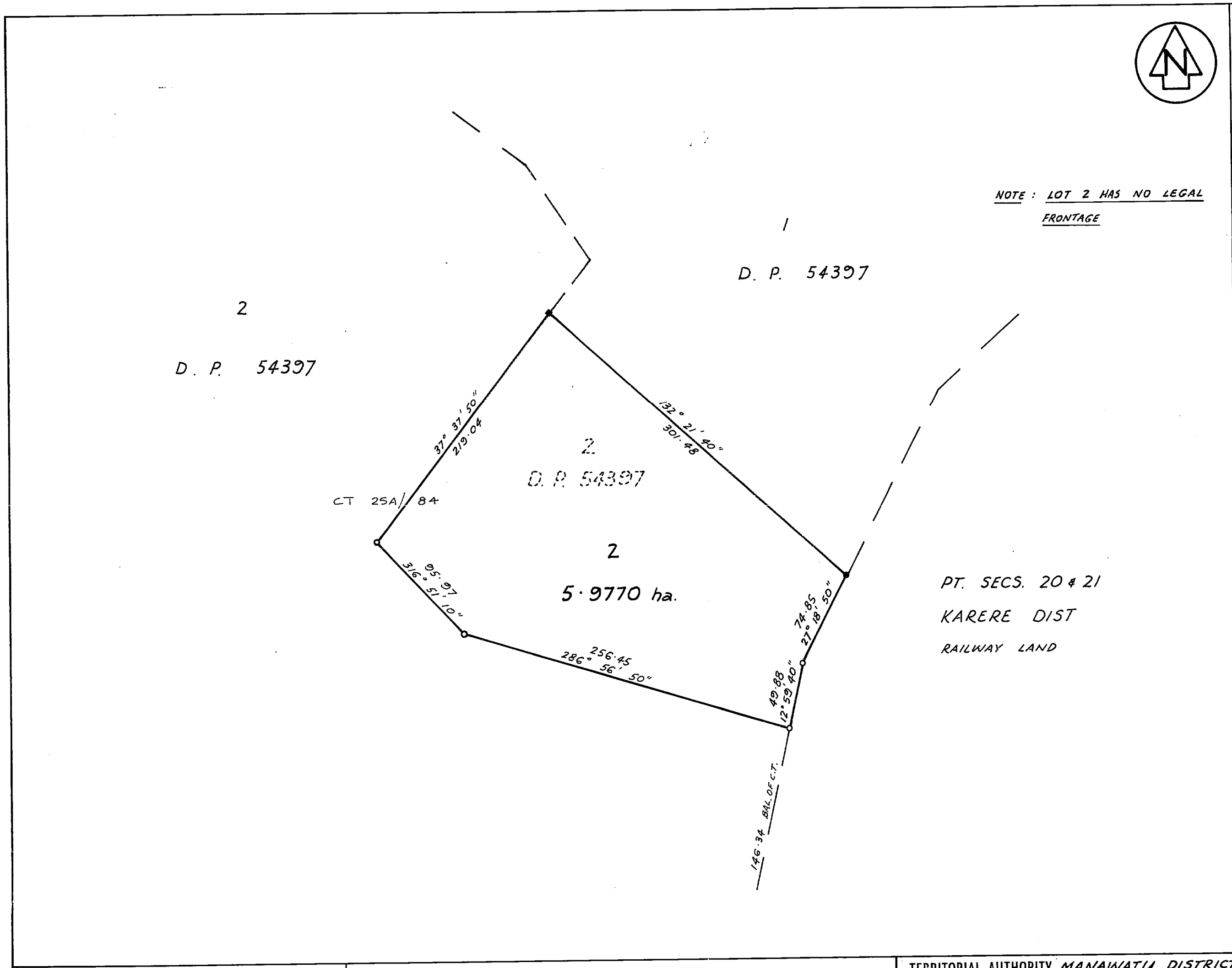
Identifier **WN34A/975**
Land Registration District **Wellington**
Date Issued 26 June 1989

Prior References
WN25A/84

Estate Fee Simple
Area 5.9770 hectares more or less
Legal Description Lot 2 Deposited Plan 65369
Registered Owners
Fonterra Limited

Interests

Appurtenant hereto is a right of way over part created by Conveyance 74486 (DR 123/277)



Approvals

The Common Seal of WAITAKI INTERNATIONAL PROCESSING (N.I.) LIMITED was hereunto affixed in the presence of:-
.... Director
.... Secretary

REGISTERED OWNER

The COMMON SEAL of WAITAKI INTERNATIONAL PROCESSING (N.I.) LIMITED

I hereby certify that no conditions were imposed by the Manawatu District Council in approving the subdivision endorsed hereon. Dated at Sanson this 26th day of July 1988

District Manager

Pursuant to a resolution of the Manawatu District Council passed on the 26th day of July 1988 approving pursuant to Section 305 of the Local Government Act 1974 this survey plan and certifying that the survey plan is in accordance with the requirements & provisions of the operative district scheme in force for the area to which the survey plan relates at the date of approval of the scheme plan, the common seal of the Manawatu District Council was hereto affixed in the presence of:-

Councillor

District Manager

MANAWATU DISTRICT COUNCIL THE Common Seal OF

Total Area 5·9770 ha.

Comprised in C.T. 25A/84 PT.

I, THOMAS F. ROBINSON
Registered Surveyor and holder of an annual practising certificate (or who may act as a registered surveyor pursuant to section 25 of the Survey Act 1986) hereby certify that this plan has been made from surveys executed by me or under my directions, that both plan and survey are correct and have been made in accordance with the Survey Regulations 1972 or any regulations made in substitution thereof.
Dated at FOXTON this 22nd day of JULY 1988 Signature T.F.Robinson

Field Book 5795 p. 3 Traverse Book 443 p. 186
Reference Plans D.P. 54397 A/3007
S.O. 24281
Examined P. Berry Correct

Approved as to Survey
18/11/1988 Chief Surveyor

Deposited this 2nd day of ... 1989
Assistant District Land Registrar

File
Received 3-11-88
Instructions

65369

[redacted] [redacted]

DOSLI FORM D5

LAND DISTRICT WELLINGTON SURVEY BLK. & DIST. XIV - KAIRANGA NZMS 261 SHT S24 RECORD MAP No 8-2	LOT 2, BEING SUBDN. OF LOT 2 - D.P. 54397	TERRITORIAL AUTHORITY MANAWATU DISTRICT Surveyed by T.F. ROBINSON Scale 1 : 2000 Date JULY 1988

Printed by Littlejohns Wellington, New Zealand.

W.A. ROBERTSON, SURVEYOR GENERAL, DEPARTMENT OF SURVEY AND LAND INFORMATION, NEW ZEALAND

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **WN52B/72**
Land Registration District **Wellington**
Date Issued 08 January 1998

Prior References
WN436/260

Estate Fee Simple
Area 17.7876 hectares more or less
Legal Description Lot 9 Deposited Plan 84633
Registered Owners
Fonterra Limited

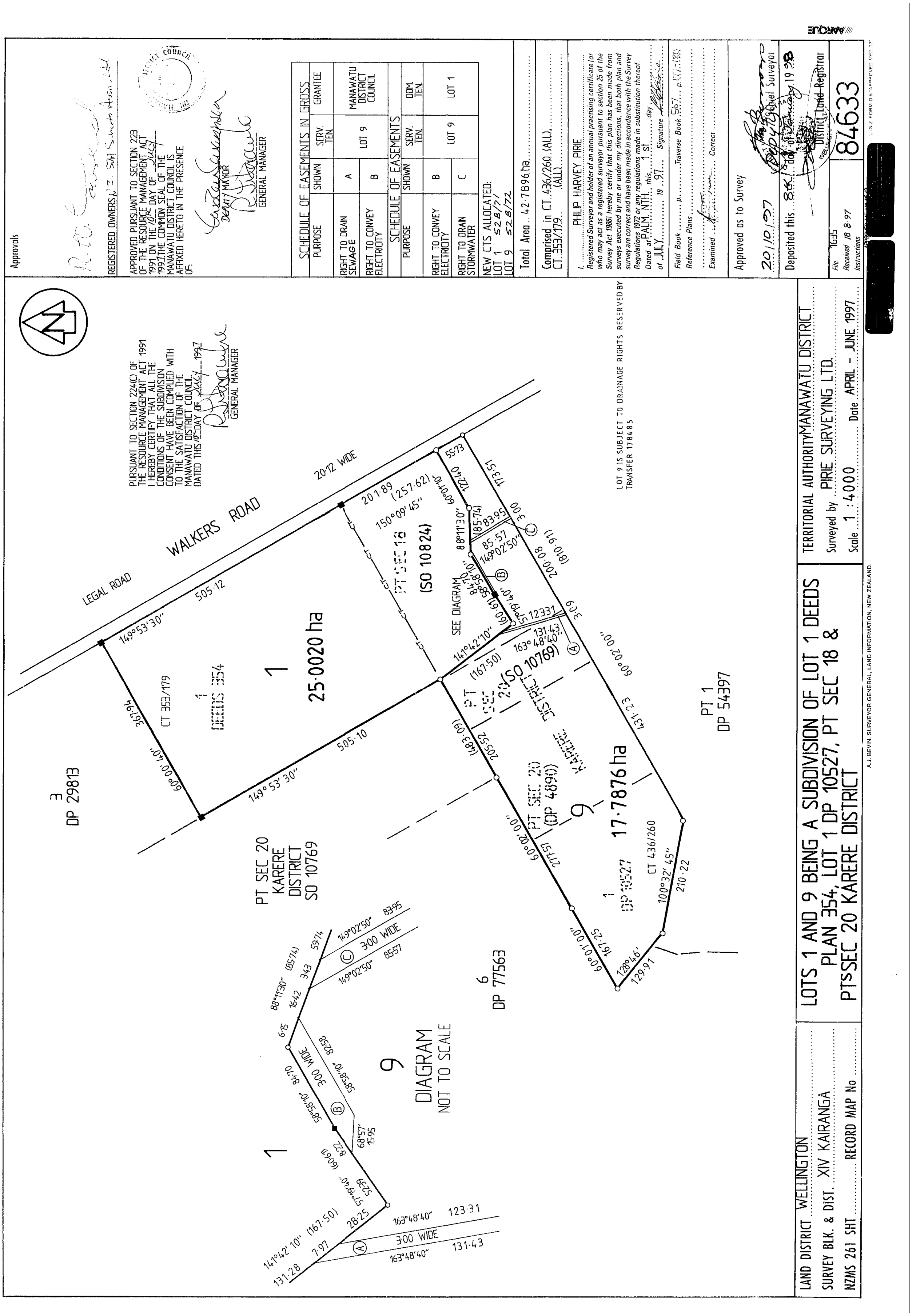
Interests

Subject to drainage rights for the passage and conveyance of sewerage whey and other dairy produce waste matters over part created by Transfer 178485 - 30.9.1926 at 11.30 am

Appurtenant hereto are drainage rights created by Transfer 218768 - 6.7.1933 at 11.47 am

Subject to rights to convey electricity and drain sewage (in gross) to over parts marked A and B on DP 84633 in favour of the Manawatu District Council created by Transfer B645260.2 - 8.1.1998 at 12.20 pm

Subject to a right to convey electricity over part marked B and to drain water over part marked C on DP 84633 specified in Easement Certificate B645260.3 - 8.1.1998 at 12.20 pm


LOTS 1 AND 9 BEING A SUBDIVISION OF LOT 1 DEEDS PLAN 354, LOT 1 DP 10527, PT SEC 18 & PTS SEC 20 KARERE DISTRICT
LAND DISTRICT WELLINGTON
SURVEY BLK. & DIST. XIV KAIRANGA
NZMS 261 SHT RECORD MAP No
TERRITORIAL AUTHORITY MANAWATU DISTRICT
Surveyed by PIRIE SURVEYING LTD.
Scale 1 : 4000 Date APRIL - JUNE 1997
WALKERS ROAD
LEGAL ROAD
20·12 WIDE
1
25·0020 ha
9
17·7876 ha
PT SEC 18 (SO 10824)
PT SEC 20 KARERE DISTRICT SO 10769
3 DP 29813
6 DP 77563
PT 1 DP 54397
CT 353/179
CT 436/260
9 DIAGRAM NOT TO SCALE
SEE DIAGRAM
3·00 WIDE
LOT 9 IS SUBJECT TO DRAINAGE RIGHTS RESERVED BY TRANSFER 178485
PURSUANT TO SECTION 224(C) OF THE RESOURCE MANAGEMENT ACT 1991 I HEREBY CERTIFY THAT ALL THE CONDITIONS OF THE SUBDIVISION WITH CONSENT HAVE BEEN COMPLIED WITH TO THE SATISFACTION OF THE MANAWATU DISTRICT COUNCIL
GENERAL MANAGER
Approvals
REGISTERED OWNERS
APPROVED PURSUANT TO SECTION 223 OF THE RESOURCE MANAGEMENT ACT 1991 ON THE 10th DAY OF JULY 1997 THE COMMON SEAL OF THE MANAWATU DISTRICT COUNCIL IS AFFIXED HERETO IN THE PRESENCE OF:
DEPUTY MAYOR
GENERAL MANAGER
SCHEDULE OF EASEMENTS IN GROSS
PURPOSE SHOWN SERV. TEN. GRANTEE
RIGHT TO DRAIN SEWAGE A LOT 9 MANAWATU DISTRICT COUNCIL
RIGHT TO CONVEY ELECTRICITY B
SCHEDULE OF EASEMENTS
PURPOSE SHOWN SERV. TEN. DOM. TEN.
RIGHT TO CONVEY ELECTRICITY B LOT 9 LOT 1
RIGHT TO DRAIN STORMWATER C
NEW CTS ALLOCATED:
LOT 1 52B/71
LOT 9 52B/72
Total Area 42·7896 ha
Comprised in CT 436/260 (ALL) CT 353/179 (ALL)
PHILIP HARVEY PIRIE
Approved as to Survey
Deposited this 8th day of January 1998
District Land Registrar
84633

Appendix C1

TECHNICAL OPTIONS DEVELOPMENT
ASSESSMENT DISCHARGE TO THE MANAWATŪ RIVER
FROM THE FONTERRA LONGBURN SITE

Technical Options Development Assessment: Discharge to the Manawatū River from the Fonterra Longburn site

Technical Report:
Fonterra Environment Technical Group

Prepared by Bram Beuger
Date: 17 September 2021

Executive Summary

The Longburn site's resource consent to discharge treated wastewater to the Manawatū River expires on 22 March 2022. The site cannot continue to operate without the consent given its current infrastructure and operations.

Over the course of the current consent, the Longburn wastewater system has received several upgrades to reduce the volumes of wastewater and the contaminant loads to the Manawatū River. These include the installation of a Dissolved Air Floatation ("**DAF**") unit in 2010, and a Wastewater Reverse Osmosis ("**WWRO**") plant in 2015.

To further reduce the contaminant loads and wastewater volumes being discharged to the Manawatū River through this next resource consent, a number of technical options are considered. The options fit into three main categories:

- No Manawatū River discharge, with all wastewater discharged to land (Macro-option "A");
- Combined landriver discharges (Macro-option "C"); and
- Discharge into a municipal system (Macro-option "D").

The preferred option involves a combined land / Manawatū River discharge and uses the current wastewater treatment system but adds long-term storage for the WWRO and whole-milk reverse osmosis ("**WMRO**") permeates. The WWRO retentate and any DAF wastewater that is not subject to further treatment throught the WWRO will only be discharged to land. This option seeks to maximise Fonterra's discharge to land, acknowledging that particularly in spring, soil moisture conditions can restrict the volume and timing of irrigation.

The preferred option also allows for better management of Fonterra's Manawatū River discharge to reduce the adverse environmental effects on the River, particularly in relation to soluable inorganic nitrogen ("**SIN**") and dissolved reactive phosphorus ("**DRP**"). The environmental effects on the Manawatū River will be reduced as the discharge can be managed more effectively due to using the facility as a buffer for both flows and also the quality of the discharge. The facility can also be used in summer during periods of very wet weather to store permeate which can be irrigated to land when soil moisture conditions allow.

The volume of storage required is estimated to be 95,000 m^3. However, the final volume is dependent on the minimum flow at which wastewater can be discharged to water, and it will require some further optimisation. The facility volume includes an allowance for rainfall and to store permeates during November when the Manawatū River discharge becomes unavailable, but soil moisture on the farms is still high.

This results in nearly 64,000 m^3 effective storage for permeates, to be mainly used during September to October.

The preferred option also includes upgrades to the existing irrigation network including a new pump station on the Innesmoor property and irrigation network upgrades.

1 Introduction

The Longburn site's consent to discharge treated wastewater to the Manawatū River expires on 22 March 2022. The site cannot continue to operate without the consent, due to constraints from current infrastructure and operational requirements. This report details the background of the Longburn sites's operations and the wastewater system and performance. Further, it will explore a number of technical options considered and further detail of the preferred option selected.

2 Fonterra Longburn

2.1 Background

Fonterra's Longburn site is located at 1 Reserve Road Longburn (Figure 1), and it was established in 1966. Originally established as a milk powder plant, today the site has a WMRO and casein plants[1]. 27 milk tankers are based at the site, and approximately 90 people are employed at the Longburn site.

An agreement between Goodman Fielder and Fonterra requires Fonterra to treat and discharge Goodman Fielder's wastewater from their site (adjacent to the Fonterra site) on their behalf.

Resource consents to discharge contaminants associated with the operations at the Longburn site to land, water and air are held by Fonterra.

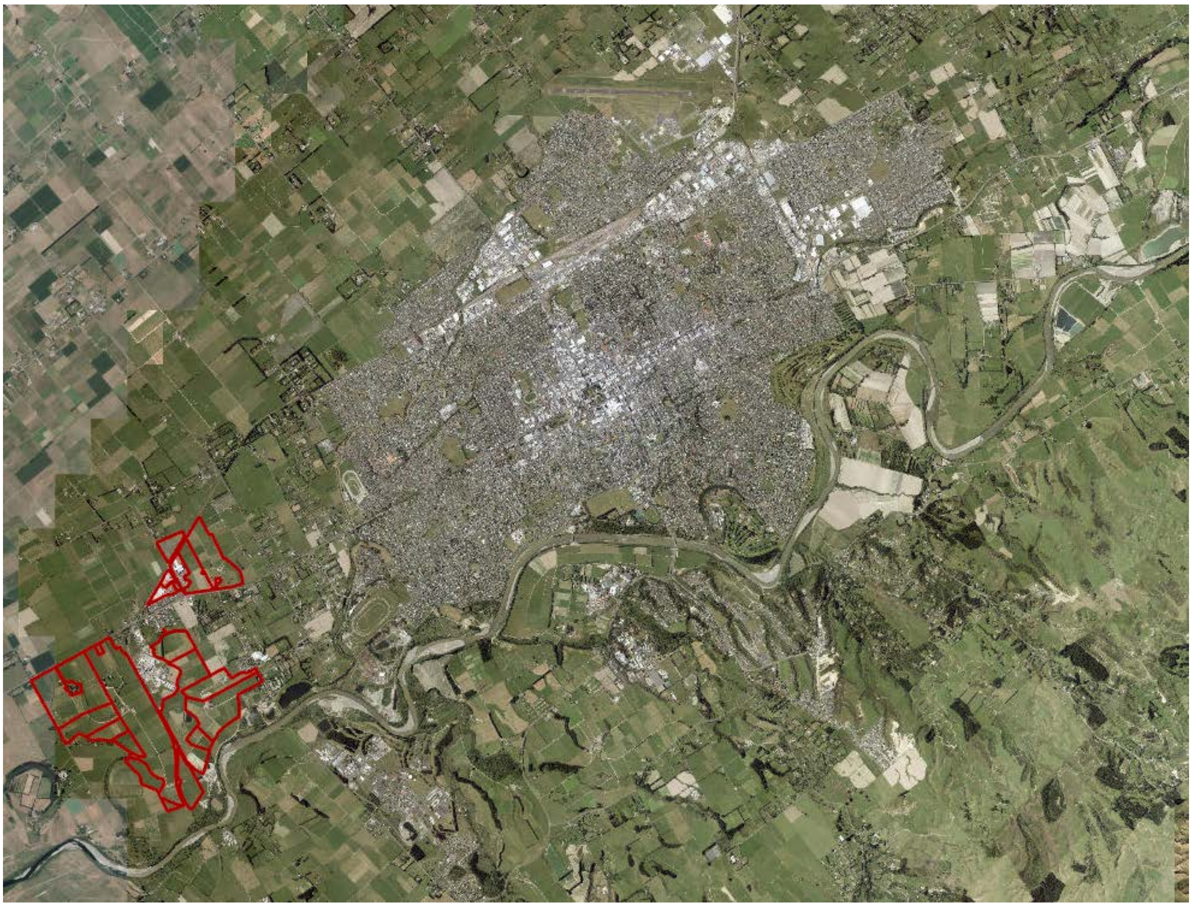


Figure 1: Location of the Fonterra Longburn site and associated farmland

[1] The site has two casein plants. However, only one casein plant is currently available for use.

3 Current resource consent (APP-2003010585.02)

3.1 Overview of the resource consent

Fonterra's Longburn site was granted a resource consent (Discharge Permit APP-2003010585.02, formerly 102909) in March 2007 to discharge treated wastewater into the Manawatū River. This consent expires on 22 March 2022.

This consent differentiates between high-strength ("**HSE**") and low-strength ("**LSE**") wastewater streams.

- The LSE stream consists of WMRO permeate
- The HSE stream consists of all other wastewater from the Longburn site

The consent applies different "management" parameters to each:

- Limits the discharge of HSE to the months of May to October (inclusive) (**Condition 1(a)**).
- The volume of LSE being discharged to the Manawatū River cannot exceed 2,500 m^3 per day (**Condition 1(b)**).
- Between the months of May to October (inclusive), the total combined volume of LSE and HSE discharged to the Manawatū River cannot exceed 6,000 m^3 per day (**Condition 1(c)**).
- There shall be no discharge of HSE between May and October (inclusive) when River flow (Q) is less than 37 cumecs (**Condition 1(d)**).
- At all times the discharge of HSE and LSE shall be to land, unless soil moisture conditions are not suitable (**Condition 1(e)**).

This consent also required Fonterra to install and commission a DAF unit (refer to **Condition 9(i)**) by April 2010. A second DAF unit and UV treatment was to be installed and commissioned by September 2015. Combined, this was considered to be the best practicable option ("**BPO**") for the treatment of HSE at the time that consent was granted.

The discharge was also required to comply with daily mass load limits (kg/d) stated in **Condition 2.** The current mass loading limits (following a variation to the consent in 2015) areas follows:

Table 1: Daily mass load limits as per Condition 2

	November to April		May to October	
	95 Percentile	**Maximum**	**95 Percentile**	**Maximum**
Total $cBOD_5$	15 Q	30 Q	50 Q	60 Q
Dissolved $cBOD_5$	9 Q	18 Q	30 Q	40 Q
NH_4-N	2 Q	4 Q	2 Q	4 Q
TSS	6 Q	12 Q	25 Q	35 Q
DRP	0.1 Q	0.3 Q	0.15 Q	0.2 Q
E. coli (cfu)	0.86 trillion Q	8.6 trillion Q	0.1 trillion Q	0.17 trillion Q

Two variations to this resource consent have been granted. In 2009 the variation allowed a delay in the installation of the DAF unit. In 2015 a variation was granted to allow the delayed installation of the WWRO plant as an alternative to the second DAF unit and UV treatment, and an update to the table in Condition 2 to decrease the *E. coli* and dissolved reactive phosporus ("**DRP**") winter loadings.

3.2 Installation of the first DAF unit (2010)

Condition 9(i) of the resource consent required Fonterra to install and commission a DAF unit (or other treatment of equivalent effect or outcome) by 30 April 2010.

A DAF unit is used to mainly remove protein, fat and suspended solids from dairy wastewater. It uses pH adjustment to create flocs. A portion of the wastewater is saturated with air under pressure. When combining the pH adjusted wastewater with the saturated air, small bubbles are formed that attach to the particles and flocs and float them to the top of the DAF tank. These solids are removed using a scraper and either injected into farmland[2] or sent to composting.

The installation of the 2010 DAF unit improved the wastewater quality in terms of chemical oxygen demand (**"COD"**), total Kjeldahl nitrogen (**"TKN"**) and total suspended solids (**"TSS"**) (Table 2). Other discharge parameters are not changed significantly by the installation of the first DAF unit.

Table 2: Change in COD, TKN and Suspended Solids concentration of the river discharge due to the installation of the DAF in 2010.

		June 2007 to Oct 2010		June 2011 to Oct 2013		Reduction
		Average	90%ile	Average	90%ile	%
COD	gO_2/m^3	2,730	3972	1,910	2,600	32%
TKN	g/m^3	71	98	50	74	30%
TSS	g/m^3	547	870	187	338	66%

3.3 Installation of the wastewater reverse osmosis unit (2015)

At the time the resource consent was granted, the BPO for the treatment of HSE included the installation and commissioning of a second DAF along with UV treatment. The commitment was made to achieve 5 g/m^3 for DRP and < 5 cfu/100ml for *E. coli*, which was the expected performance of that system. It was initially proposed that the second DAF would be similar in size to the one installed and commissioned in 2010.

The 2010 DAF would continue to operate under the same acid-dosing operating conditions. However, to aid in the reduction of phosphorus in the HSE, it was proposed that both lime and polymer would be dosed before the HSE reached the second DAF. The addition of lime would increase the pH of the HSE to at least 9. This would create an environment in which excess calcium ions from the lime could react with the phosphate in the HSE to produce an insoluble precipitate which would be removed by the second DAF. Polymer would be added to aid flocculation so that the precipitate could be readily removed as sludge.

Fonterra reviewed the Longburn site's wastewater treatment system in 2014, and found that the installation and commissioning of a second DAF would not constitute the best option for the treatment of HSE. Instead, it was found that the use of a WWRO plant would be better suited to removing additional phosphorus (in particular) from the HSE prior to its discharge to the Manawatū River. In addtion to better performance the capital and operational costs were more favourable.

A reverse osmosis (**"RO"**) plant is a technology that uses a partially permeable membrane to separate ions, particles and other molecules from a liquid stream. The water and contaminants are put under pressure using pumps and the water is 'pushed' through the membrane, while holding back the majority of contaminants.

[2] Fonterra holds a separate resource consent to discharge wastewater treatment plant solids (including those from the DAF unit) to land across the Manawatū.

Fonterra sought a variation to the resource consent to reflect the improvements in the quality of the wastewater and commissioned the WWRO plant in 2015. As a result of the WWRO, the wastewater now being discharged to the Manawatū River has about 80 percent lower contaminant concentrations than what a second DAF unit (as originally proposed) would have produced. This represented a significant improvement in discharge quality over what was originally proposed, and approved via grant of consent, in 2007.

The additional benefit to the use of a WWRO plant compared to a second DAF unit (Table 4) is that it reduced the overal volume discharged to the Manawatū River by about 30%. The WWRO concentrates the contaminants into the retentate which is about one-third of the total wastewater volume. This retentate is then irrigated onto the Fonterra-owned irrigation farms.

Table 3: Comparison of the effluent quality of the originally proposed DAF versus the Wastewater RO quality.

		Expected wastewater after second DAF with lime treatment	Actual WWRO Quality June 2016 -June 2021		Reduction
			Average	90%ile	%
COD	gO_2/m^3	2,010	350	560	83%
TKN	g/m^3	60	7	13	88%
TP	g/m^3	6	1.3	1.9	78%
DRP	g/m^3	5	0.5	1.2	90%
Suspended Solids	g/m^3	80	15	25	81%

4 Longburn site's current wastewater treatment system

A schematic of the Longburn site's current wastewater treatment system is provided in Figure 2.

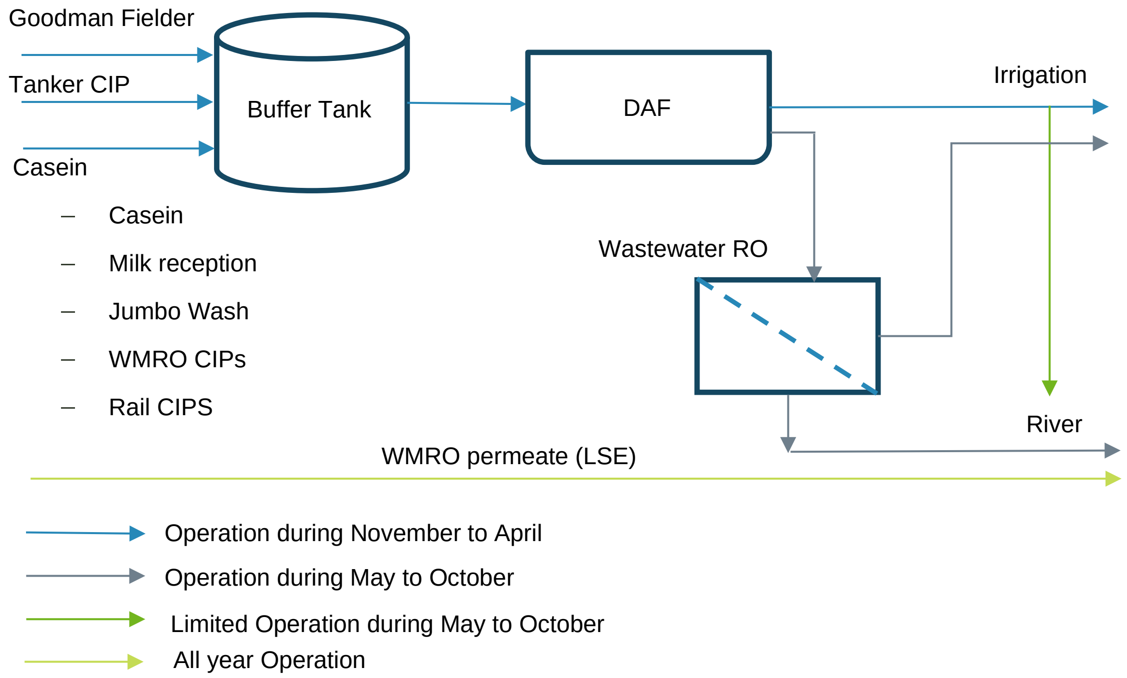


Figure 2: Schematic of the current Longburn wastewater treatment system.

The Longburn site's current treatment system involves a combination of discharges to land (via irrigation) and a discharge to the Manawatū River.

Wastewater at Fonterra's Longburn site is generated from:

- The cleaning (known as clean-in-process or CIP) of Fonterra's plant which includes milk treatment, casein and WMRO plants;
- Boiler blow-down;
- The cleaning of milk tankers and rail tankers;
- The permeate from the WMRO plant[3]; and
- Dairy wastewaters produced by Goodman Fielder, noting that Fonterra treats and discharges Goodman Fielder's wastewater on their behalf.

All sources of wastewater, except the WMRO permeate, are collected in a buffer tank prior to its primary treatment by the 2010 DAF unit. Sludges resulting from the DAF treatment process are collected and trucked off-site to be injected into land at various locations across the Lower Manawatū (authorised by way of consent ATH-2019202710).

Further treatment of the DAF-treated wastewater depends on the time of year as follows:

- From May to October (inclusive), the DAF-treated wastewater is then further treated by the WWRO plant, and permeate resulting from this process is discharged to the river and the retentate is irrigated to the Fonterra-owned farms.
- From November to April (inclusive), all wastewater (DAF treated) is irrigated onto the two Fonterra-owned farms.

The existing Manawatū River discharge resource consent differentiates between two different wastewater streams, being LSE and HSE as described in **section 3** above.

Under the current resource consent, LSE can be discharged to the Manawatū River year-round, and its discharge is not subject to a minimum flow[4].

Table 1 contains the mass loadings that the discharge cannot exceed (linked to river flow) of carbonaceous Biological Oxygen Demand ("**cBOD$_5$**"), ammonia, TSS, DRP and *E. coli* (refer to **Condition 2**).

The composition of the wastewater post-DAF, the WWRO retentate and permeate and the WMRO permeate are shown in Table 6. The averages and 90%iles are based on measurements from the F19 (Financial Year ending July 2019) to F21 season.

[3] This is noting that the WMRO retentate (the component of milk that is "retained") is the solids component from milk, and is transported to Whareroa for further processing.
[4] Noting that the discharge is subject to volume limits, and the consent states a preference for discharges to land over water unless soil moisture conditions are not suitable for irrigation (**Condition 1(e)**).

Table 4: Wastewater composition post-DAF, post-WWRO and WWRO permeate based on data from F19 to F21. WMRO permeate data based on F17 to F21

	Unit	Post-DAF		WWRO				WMRO Permeate (LSE)	
				Retentate		Permeate (HSE)			
		Average	90%ile	Average	90%ile	Average	90%ile	Average	90%ile
Total $cBOD_5$	g/m^3	791	1159	1433	2750	236	366	26	73
Dissolved $cBOD_5$	g/m^3					229	356	15	52
COD	g/m^3	1242	1793	2186	4260	344	592	54	166
Total Nitrogen	g/m^3	54	77	98	184	13	23	61	88
NH_4-N	g/m^3	11	25	14	26	2.6	5.9	3.0	6.7
SIN	g/m3	16	29	23	45	8	13	3	7
TSS	g/m^3	118	179	268	490	18	29	7.2	29.5
Total Phosphorus	g/m^3	15	22	33	71	1.4	2.3	1.4	3.6
DRP	g/m^3	10	14	22	44	0.8	1.4	0.15	0.5
E. coli	cfu	7,070	12,700	38,616	61,300	2,729	20,535 (95%ile)	62	99

The LSE discharge had not been used until the installation of the WMRO plant in September 2014 but it is in general of better quality than reported in the original AEE for the current consent. Only the ammonium-N is higher at 3 g/m^3 compared to a median of 0.4 g/m^3. One thing to note is that although total nitrogen is currently not a reportable consent condition, it is relatively high at around 60 g/m^3. This is mainly the non-protein nitrogen (NPN) with the main component being urea.

The WWRO permeate quality has deteriorated in the past few seasons which is particularly evident in the DRP values. This increase could point to a loss of integrity of one or more membranes. Most membranes have been replaced in May 2021.

The casein plant operated two casein lines up to 2015. The casein plant was not operational in the 2016/2017 and 2017/2018 seasons. One casein line has been decommissioned, while the other remains operational as a stand-by plant during the peak of the dairy season (generally August to October). This plant is used for “contingency” and will operate when the other milk processing sites in the Lower North Island are at capacity or as a result of a plant failure at another site.

The wastewater volumes contributed by each wastewater stream to the overall total wastewater volume “basis of design” for the options assessed is shown in Table 7. These are based on:

- Goodman Fielder operating at 365 days per year;
- Operation of one casein line for 90 days per year during the peak period (August to October); and
- Operating the WMRO for five months from September until January.

All options are assessed using these volumes.

Table 5: Design wastewater volumes by month for the Longburn site.

		August	September	October	November	December	January	February	March	April	May	June	July
Goodman Fielder	m^3/d	1,153	1,153	1,153	1,153	1,153	1,153	1,153	1,153	1,153	1,153	1,153	1,153
Casein 1	m^3/d		700	700	700								
WMRO CIP	m^3/d		400	400	400	400	400						
WWRO CIP	m^3/d	67	67	67							67	67	67
Milk Reception	m^3/d	75	75	75	75	75	75	75	75	75	75	75	
Tanker/Rail CIP/Jumbo	m^3/d	285	285	285	285	285	285	235	235	235	235	235	
Boiler	m^3/d	50	150	150	150	50	50	50	50	50	50	50	
Total WW	**m^3/d**	**1,630**	**2,830**	**2,830**	**2,763**	**1,963**	**1,963**	**1,513**	**1,513**	**1,513**	**1,580**	**1,580**	**1,220**
WMRO Permeate	**m^3/d**		**800**	**800**	**800**	**800**	**800**						
Total WW	**m^3/d**	**1,630**	**3,630**	**3,630**	**3,563**	**2,763**	**2,763**	**1,513**	**1,513**	**1,513**	**1,580**	**1,580**	**1,220**

Both the Manawatū River discharge and the land discharge are critical for the operation of the wastewater system at Longburn. Fonterra owns two farms at Longburn, being Innesmoor and Thornton Park (Figure 3). The primary purpose of these two farms is for the land-based treatment (via irrigation) of the Longburn site's wastewater. The two farms are also utilised as lower-intensity dairy farms.

Figure 3: Location of Fonterra farms: Innesmoor and Thornton Park

This wastewater irrigation activity is authorised by resource consent (ATH-2011013049.01, formerly 105070) which expires on 1 July 2033.

The wastewater irrigation resource consent does not have any specific hydraulic limitations, except for a requirement to avoid run-off and facilitying. However, irrigation has to be managed to appropriate levels relative to the soil's moisture. A minimum 12-day rotation is required.

The key condition of the consent is around nitrogen loading (kg N per hectare per year) and leaching (kg N leached per hectare per year). Although consent condition 11 stipulates a maximum average nitrogen loading of 300 kgN/ha/y, the whole farm leaching is restricted to a maximum of 37 kgN/ha/y on Thornton Park and 42 kgN/ha/y on Innesmoor.

Prior to the installation of the WWRO plant, during the months of May to October, little or no irrigation was applied when the Manawatū River discharge was operating. The installation of the WWRO plant meant that irrigation of the retentate is required during this period.

From 2016 Thornton Park (under third party ownership) limited irrigation of WWRO retentate from year round to the period 1 November to 30 April. This meant that during winter and spring months the amount of wastewater that could be irrigated was limited to Innesmoor farm only. Some of the remainder of the wastewater had to be trucked off-site – this was up to 1,000 m^3/day. It also meant that at times (2018), wastewater directly off the DAF plant had to be discharged to the Manawatū River (within consented limits) to reduce the hydraulic loadings on Innesmoor Farm.

Thornton Park farm was privately-owned and has received Fonterra Longburn irrigation wastewater for over 20 years. In 2019 Fonterra purchased the property and took over full operations. As part of this, Fonterra reduced cow numbers from (see Dr. Jeff Brown's technical report) to approximately 430, and removed the replacement dairy cows. The farm is now available again for irrigation over the winter months, therefore reducing the hydraulic loading on Innesmoor farm as the wastewater volumes can be better shared between the two properties.

5 Options development

5.1 Process for identifying the best practicable option

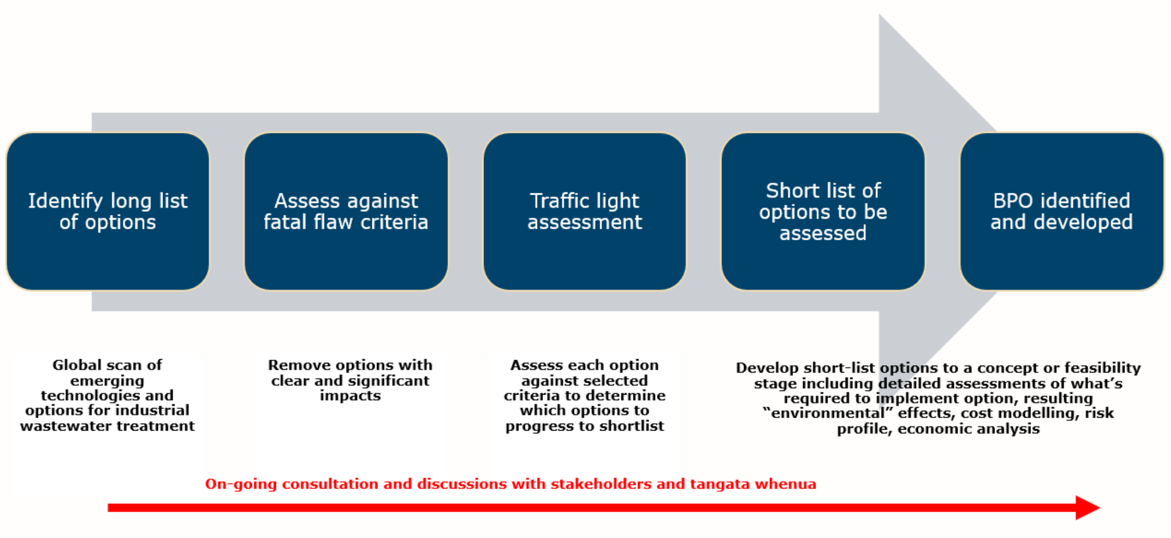


Figure 4: BPO process diagram

My role in the process was to provide technical advice regarding the options during the BPO process.

5.2 Identification of the long-list of options

The first step was to undertake a global scan of all emerging technologies and options that could be reasonably (without further assessment of appropriateness or consentability) implemented at the Fonterra Longburn site to develop a long-list of options.

To do this, a series of workshops were held with Fonterra staff and external technical specialists on 8 August 2019, 10 September 2019 and 20 September 2019. The purpose of the workshops was:

- To identify a wide range of options that could reasonably meet the key goals and address the specific effects identified with the current system.
- To conduct a screening assessment of the options identified to narrow the number of options to be considered further to less than 10.

A wide range of options were considered at the workshop that incorporated some or all of the following elements:

- Water re-use and loss minimisation (opportunities under ISO accreditation) – continuous improvement ethos;
- Storage of wastewater;
- Expansion of the existing irrigation system; and
- Secondary biological treatment.

The wide range of options developed at this workshop were then assessed against the key environmental performance criteria. Any option that did not satisfy the key performance criteria and therefore did not address key environmental effects was not considered for further assessment. Refer to **Appendix 1** for a summary of the wider options considered at the workshop and the reasons for/against further assessment.

Following the screening assessment, ten options were considered the most feasible and warranting further assessment in this stage (Table 9):

A.2 No river discharge with all wastewater discharged to land, increase land area, short-term storage

A.3 No river discharge with all wastewater discharged to land, increase land area, WWTP, long-term storage

A.4 No river discharge with all wastewater discharged to land, increase land area, long-term storage of RO permeate

C.2 Combined land/river discharges, long-term storage of RO permeate, storage to land

C.3 Combined land/river discharges, long-term storage of RO permeates, storage to land or river

C.5 Combined land/riverdischarges, WWTP, long-term storage to land or river

D.1 Discharge of RO permeate to Municipal system

E.1 Current system

Options in the following categories have been rejected:

B. All wastewater discharged to the Manawatū River, no land discharge

F. Managed aquifer recharge

G. Discharge to ocean

Each of these options (minus the three rejected) are described below.

5.3 Option A.2: No river discharge with all wastewater discharged to land, increase land area, short-term storage

This option is to only use land for the discharge of all wastewater generated from the Longburn site. This will require expansion of the land area due to the high hydraulic loadings in September and October, meaning that the irrigation capacity is low. Also note that the WMRO permeate will need to be irrigated in this option. The additional land requirement is based on the shortfall in September of 1,500 m^3/d. At a dose of 15mm at 20 days rotation, the “effective” irrigable land area is estimated at 200 ha additonal to the current areas[5]. The rest of the year, the irrigation capacity exceeds the wastewater volumes.

Soils in the wider Longburn area are hydraulically-limited and do not provide a sustainable option with regards to wet weather. Short-term storage will allow for deferring irrigation during extreme weather events only. The assumption is that two days of storage would be 2 x 3,500 m^3. Wastewater held in the storage tanks is aerated to prevent odours from developing.

Odour remains a risk as the wastewater is only treated by a DAF unit. The irrigation system will be designed to include mainline and network flushes to manage odour. The existing irrigation system will require some modifications for adequately flushing the irrigation network.

[5] This is noting that the actual land area required would be larger to account for setbacks (ie. houses, waterways and property boundaries).

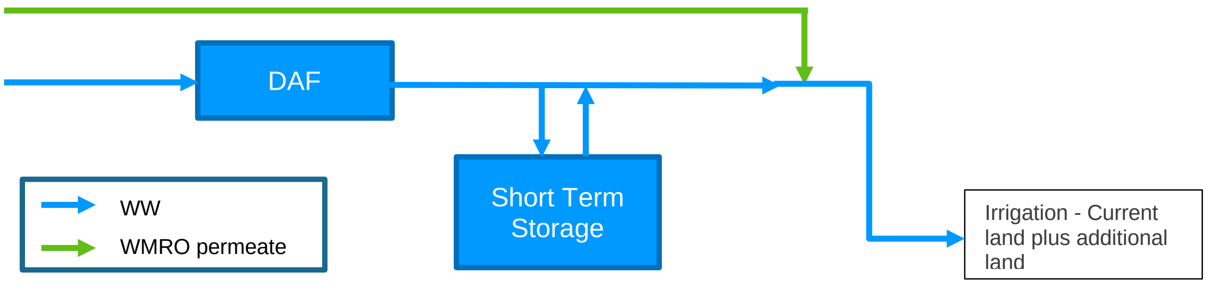


Figure 5: Option A.2 - No Manawatū River discharge with all wastewater discharged to land, increase land area, short-term storage

The extra land will reduce the nutrient loading to the farms. This option does not enable the discharge of wastewater to the Manawatū River, so only a short-term consent for the Manawatū River dicharge is required[6]. However, a new consent will be required for the new irrigation land. The area of "effective" irrigable land plus the "buffer" required is very large for the Lower Manawatū region and it is unlikely to be found within a reasonable distance of the Longburn site. For details see the AEE.

5.3.1 Option A.3 - No river discharge with all wastewater discharged to land, increase land area, WWTP, long-term storage

Under this option, all wastewater will be biologically treated and the excess that cannot be irrigated in spring is stored for irrigation in summer. The increase in land area will be less than previous "A" options (above) as the hydraulics can be better managed through spring. The nutrient loading on the farm is reduced as the treated wastewater has low nitrogen and phosphorus. The main nutrients are in the waste activated sludge ("**WAS**"), which can be either co-irrigated or exported. This is similar to the treatment concept at Fonterra Pahiatua.

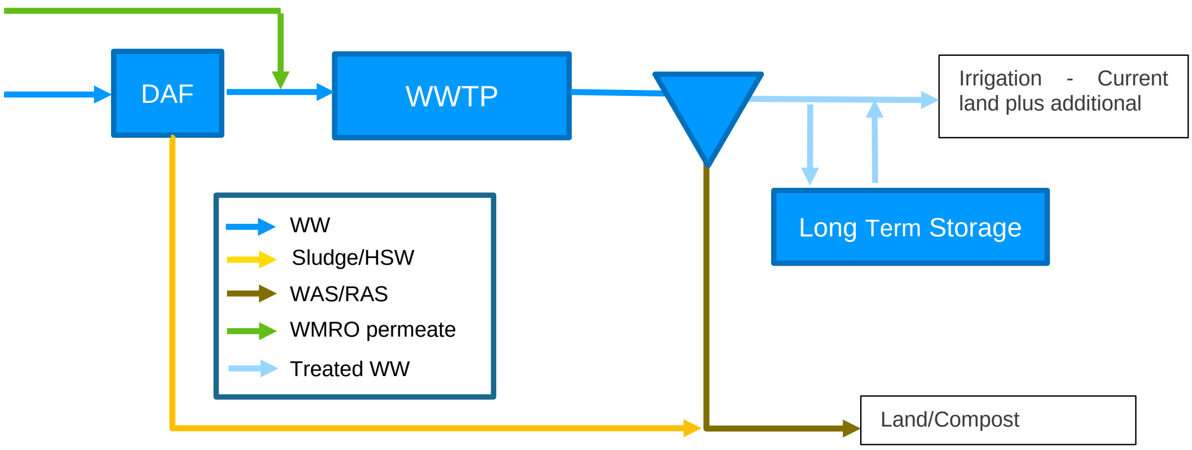


Figure 6: Option A.3 - Increase land area, add long-term storage with biological treatment

The land requirements will be less due to the ability to store the treated wastewater in spring when the wastewater volumes are high, but the farms hydraulic capacity is low. The additional irrigation area is directly related to the size of the storage facility. Additional irrigation land will be required to allow for some irrigation during winter and spring and to enable emptying of an increased storage volume to reduce the storage volumes. For 125,000 m^3 storage an additional "effective" irrigation area of around 100 ha is required. A consent will be required for the new irrigation farms. The land

[6] Noting a short-term consent may be required until discharge (irrigation) consents are obtained for the additional irrigation land, and the required infrastructure is operational.

area required is very large and it is unlikely to be found near the Longburn site. For details see the AEE.

This option has a very high capital and operational cost as a wastewater treatment plant, storage and additional land are required.

5.3.2 Option A.4 - No river discharge with all wastewater discharged to land, increase land area, long-term storage of RO permeate

Under this option, the wastewater is treated by the WWRO and the permeate is stored when the farms are hydraulically limited. The stored permeates are from a combination of the WMRO and the WWRO plants. The required storage exceeds 145,000 m³ and will be emptied during December to March. As discussed earlier, it will be difficult to empty the storage facility during a wetter than average year.

Additional "effective" irrigable area (approximately 200ha) land is needed to empty the facility. Further land will reduce the size of the storage facility. A consent will be required for the new irrigation farms. The land area required is very large and it is unlikely to be found near the Longburn site For details see the AEE.

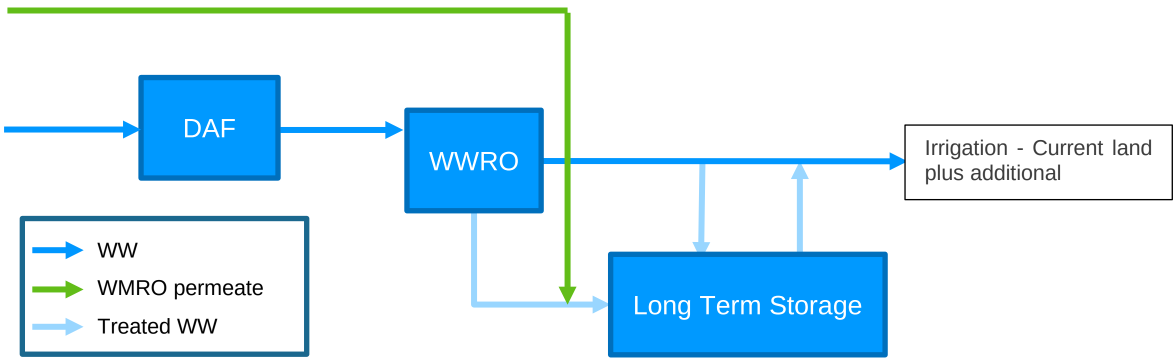


Figure 7: Option A.4 - Increase land area, add long-term storage of WWRO permeate, irrigate retentate

5.3.3 Option C.2 - Combined land/river discharges, long-term storage of RO permeate, storage to land only

This option uses the current wastewater treatment system and adds long term storage for the WWRO and WMRO permeates. The Manawatū River is still being used to discharge the WWRO and WMRO permeates (only), and this is limited to the period between May to October (inclusive)

Currently, the minimum flow required for HSE to be discharged is 37 m³/s. This option not only ceases the discharge of WWRO retentate in its entirety, but also only allows for discharges into the Manawatū River at a higher flow rate in the Manawatū River. The permeate during low flow in May to October is stored and irrigated in summer.

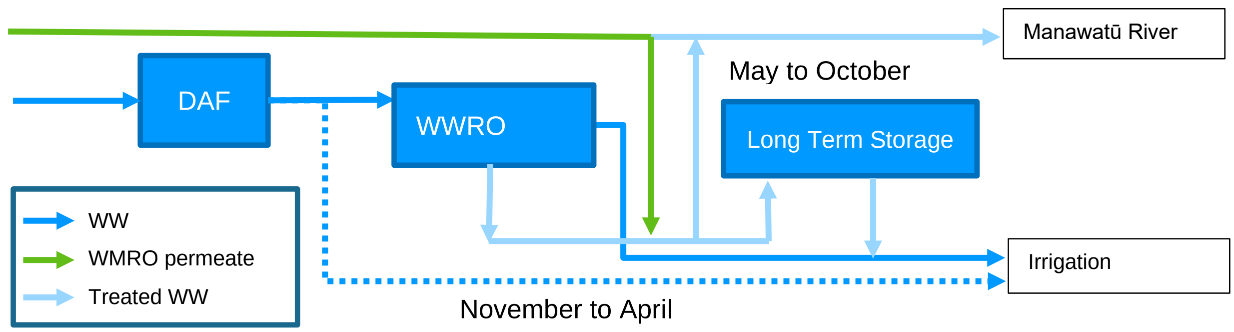


Figure 8: Option C.2 - Current system and operation but add long-term storage of RO permeate to be discharged to land

The size of the storage facility will be smaller than those options that only enable wastewater to be discharged to land. The size is also dependent on the “final” minimum river flow required before the discharge can occur, and will require some further optimisation.

Operationally discharging to the Manawatū River directly is similar to the current operation and does not take advantage of the buffer capacity of the storage facility.

5.3.4 Option C.3 - Combined land/river discharges, long-term storage of RO permeate, storage to land or river

This option builds on the current wastewater treatment system and adds long term storage for the WWRO and WMRO permeates. The Manawatū River is still used to discharge the permeates when available during May to October.

Currently the minimum river flow for discharging HSE to the Manawatū River is 37 m^3/s. This option would require a higher flow rate in the Manawatū River to enable improvements towards the Horizons One Plan in-stream targets for dissolved reactive phosphorous (“**DRP”**) and soluble inorganic nitrogen (“**SIN”**).

The main difference of this option compared to Option C.2 is that thestored permeate can be discharged to the Manawatū River during periods of higher flows. This would require a similar storage volume to Option C.2. The intent is to have a full facility of stored permeate by the end of October that will be irrigated in summer.

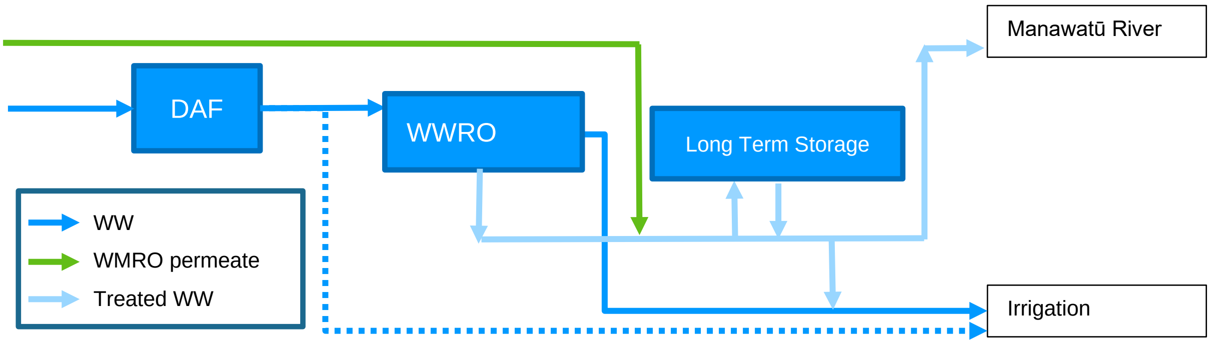


Figure 9: Option C.3 - Current system and operation but add long term storage of RO permeate to be discharged to land or river

The size of the storage facility will be smaller than those options which only allow for subsequent discharges to land (Options “A”). It is dependent on the minimum flow for the discharge and will require some further optimisation.

The environmental effects on the Manawatū River will be reduced as the discharge can be managed better than option C.2 due to using the facility as a buffer for both flows and the quality of the discharge is better. The facility can also be used in summer during periods of very wet weather to store permeate.

5.3.5 Option C.5 - Combined land/river discharges, biological WWTP, long-term storage to land or river

This option involves the biological treatment of the wastewater during May to October, and then this treated wastewater is discharged into the Manawatū River. When the Manawatū River’s flow is low (threshold to be set) it can be stored for discharge to either the Manawatū River during higher flows or to irrigation. In summer the wastewater is irrigated to land directly without biological treatment.

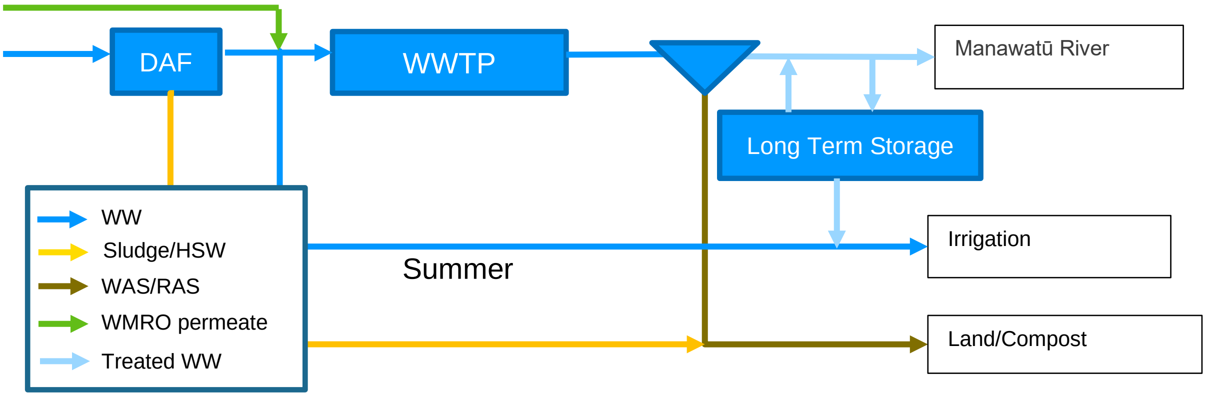


Figure 10: C.5 Biological treatment of wastewater in winter/spring and discharge to river. All wastewater to land in summer. Long term storage to manage river flows and wet weather

This option has no requirement for the WWRO plant as it does not provide any additional benefits for the wastewater treatment plant. The storage facility is mainly used for as part of the management of the Manawatū River discharge and can therefore be smaller. The size is estimated at 35,000 m^3 or about 10 days' storage during the spring period.

The volume discharged into the Manawatū River will also increase as there is no retentate to be irrigated during May to October. If no wastewater will be stored for irrigation during summer then the overall volume discharge to the Manawatū River will increase by around 30% (this is the amount of retentate currently generated by the WWRO). To maintain the current nutrient load, the treated wastewater quality will have to contain 30% less nutrients than the current permeate(s) quality.

Typical quality values from a biological treatment plant is shown in Table 8. Further improvements on this quality can be achieved with further tertiary treatment like phosphorous removal by chemical dosing. This type of removal will generate a sludge stream that is very hard to further treat and deal with, often ending up in landfill.

Biological plants do produce excess bacteria (waste activated sludge or WAS) that has to be dealt with. If irrigation is operational then the WAS can be added to irrigation, but during winter and spring when the treated wastewater is discharged to the Manawatū River the WAS has to be exported off site to, for example, a composing facility.

The use of the storage facility will allow for discharge at higher river flows therefore reducing the environmental effects (particulalry DRP and SIN).

The wastewater treatment plant costs, including those associated with discharge of by-products (ie WAS), will be high in capital and operational cost. Volumes discharged to the Manawatū River will increase but the nutrient loads can be decreased through careful design of the plant which might require tertiary treatment.

Table 6: Typical effluent quality values from a biological treatment plant.

Parameter		Quality Values (all values annual median unless stated otherwise)
cBOD5	g/m^3	< 6
Total Suspended Solids	g/m^3	< 5
pH	-	6-9
Dissolved Inorganic Nitrogen	g/m^3	< 6
Total Nitrogen	g/m^3	< 10
Nitrate – Nitrogen	g/m^3	< 5
Ammonium – Nitrogen	g/m^3	< 1
Total Phosphorus	g/m^3	< 1
Dissolved Reactive Phosphorus	g/m^3	< 1
E. coli	cfu/100ml	< 126 as 95%ile

5.3.6 Option D - Discharge of RO permeate to municipal system (assumed PNCC)

This involves the discharge of the WWRO and WMRO permeates (into the Palmerston North City Council (**PNCC**) tradewaste system. This would remove the requirement for Fonterra's discharge into the Manawatū River without losing the hydraulic benefits on the irrigation farms.

Initial discussions between Fonterra and PNCC to send a portion of the permeate (~1000 m^3/d) to PNCC as trade waste were held in 2018. At that time only the Innnesmoor farm was available for irrigation. Thornton Park was owned by a third-party and was not available for irrigation. This reduced (almost by half) the land available for irrigation. After discussions with PNCC, a decision was made not to pursue this option due to the time required to install the connection and there was an improvement in the weather which freed-up irrigation capacity on both Innesmoor and Thornton Park farms.

A key limitation with this option is that the peak volumes (up to 2,800 m^3/d) occur during September and October, and might exceed the tradewaste capacity. However, a key benefit is that a volume in November could be sent to PNCC that currently cannot be discharged to the Manawatū River. At this time however the farms can be hydraulically limited and operating the WWRO and discharge this volume to PNCC would be an advantage.

This option would remove the direct Manawatū River discharge. However, the "same" volumes would be discharged to the Manawatū River via the PNCC system, the permeates would be further biologically treated and the overall contaminant load to the Manawatū River will be reduced.

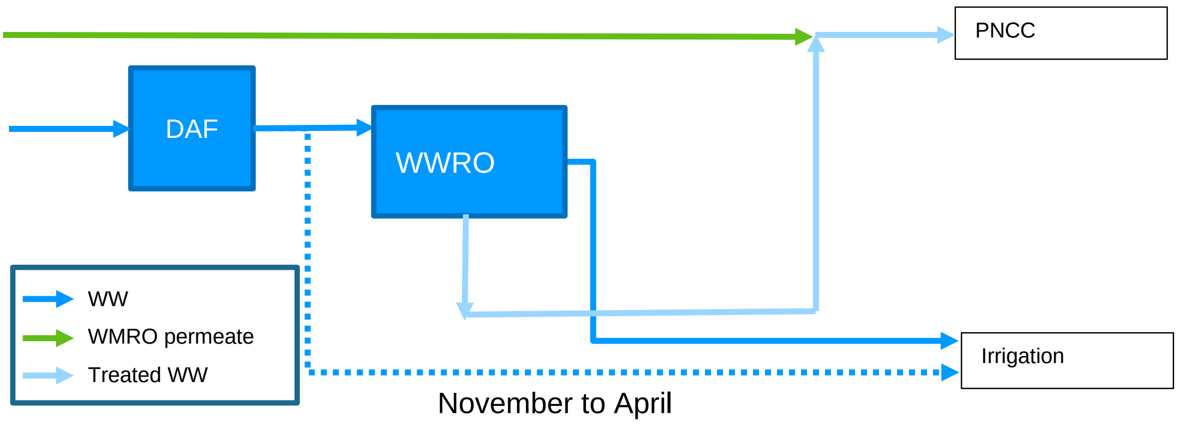


Figure 11: Option D.1 - Discharge to PNCC

This option will rely on achieving a "workable" agreement with PNCC. The volumes are significant, and it would require a further investigation into whether or not the sewer capacity can handle these volumes. It is likely a dedicated pipeline will be required. PNCC are currently in the process of assessing the different options for their disharge to the Manawatū River. A consent, proposing a new "BPO" is expected to be lodged with Horizons Regional Council in mid-2022. It is Fonterra's preference to wait until PNCC have selected, and consented, their "new" system before further undertaking further assessment as to the feasibility of this option for the Longburn site.

5.3.7 Option E - Maintain current system

The current system is described in Section 4.

The quality of the HSE that is discharged into the Manawatū River has improved significantly since the consent was granted in 2007 due to both the installation of the DAF in 2010, and the WWRO in 2015. The total HSE volume (retentate and permeate) is similar, but the quality has improved significantly.

The annual contaminant load for all river discharge, including LSE $cBOD_5$ has been reduced by around 90%, TSS by 98%, DRP by 90% and *E. coli* by >99% from 2007-2009 to now (Figure 11).

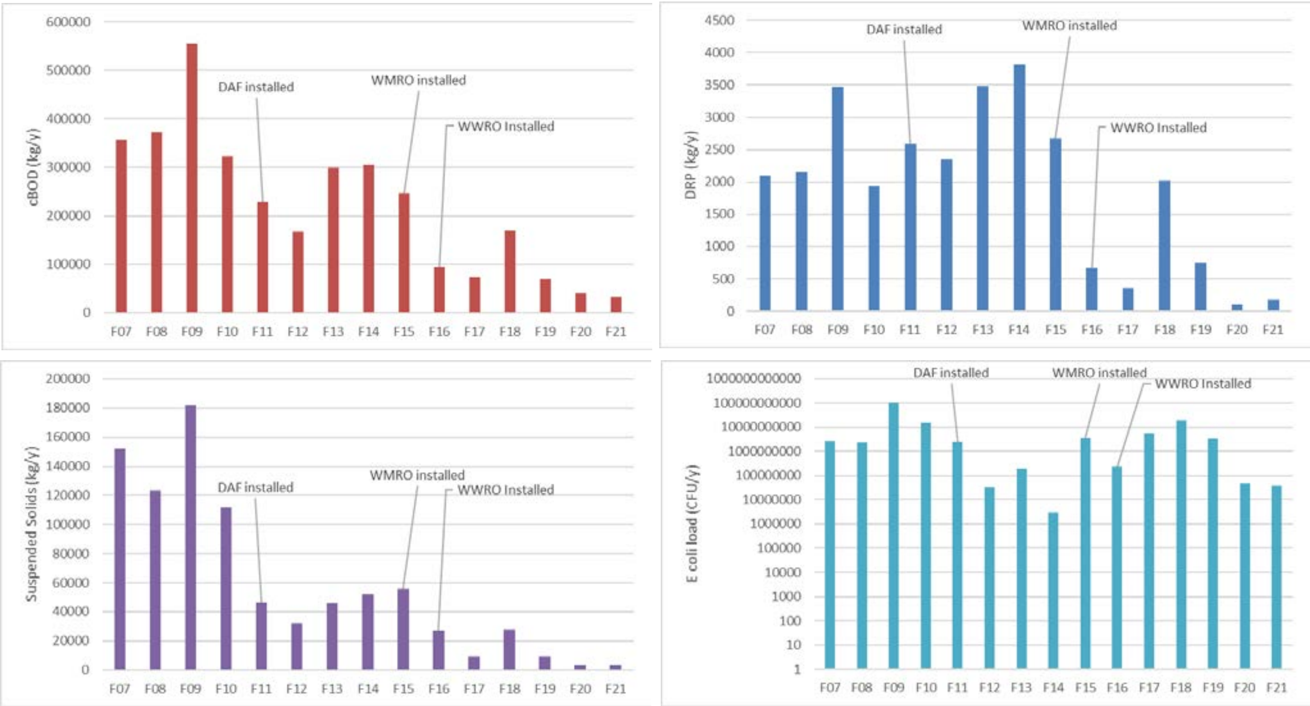


Figure 12: Annual loads of cBOD, DRP, Suspended Solids and E. coli for seasons F07 to F21.

The SIN, ammonia and nitrate/nitrite have not changed as much over this period. The nitrate and nitrite were not measured consistently until the F14 season and thus comparisons are difficult to make.

The increases in loads in the F18 season are explained due to the direct discharge to the Manawatū River after DAF treatment. Although this complies with the discharge consent limits, this was only done when there were technical issues with the WWRO plant or when the irrigation farms were hydraulically limited so that there was no, or less, retentate to irrigate.

Although the improvements over the past period are significant in a number of areas, maintaining the current system will not reduce the overall contaminant load to the Manawatū River inline with the Horizons One Plan targets for DRP and SIN (particularly) over the next consenting period.

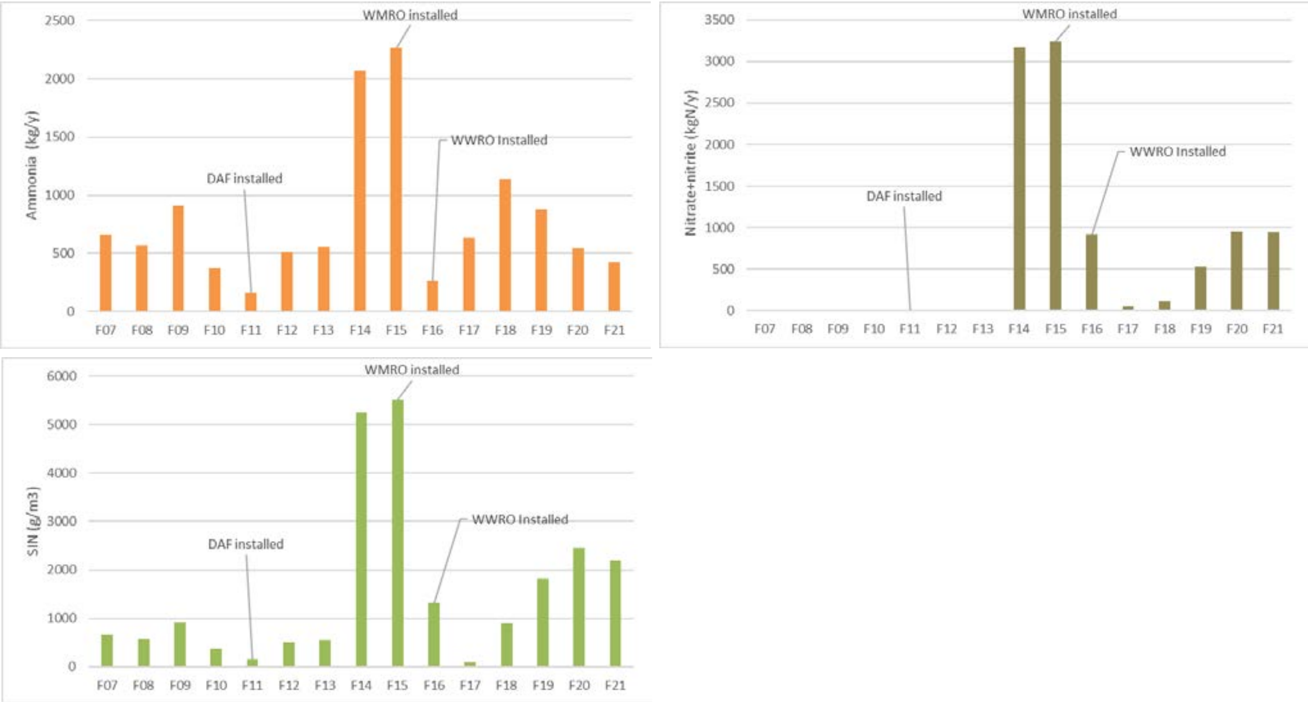


Figure 13: Annual loads of ammonia, nitrate + nitrite and SIN for seasons F07 to F21. Note that nitrate and nitrite were not monitored until F14.

Table 7: Shortlist of options selection table.

Option			Notes	Do we need to discharge below 20th FEP (flow exceedance percentile) (Red = Yes, Green = no) if Red consider Water Quality Parameters	SIN reduction	P Reduction	*E. coli* reduction	Volume to river reduction	Wet weather	Land	Risk and Operations	Operational cost	Capital Cost
All Wastewater to land	A	2		N/A	N/A	N/A	N/A	N/A	Short term storage	More land to spread nutrients	Only land carries a significant risk. Additional land area is large and difficult to obtain.	Irrigation only. Relatively low cost. No WWRO reducing cost	High due to large land are and irrigation system required.
All Wastewater to land	A	3		N/A	N/A	N/A	N/A	N/A	WWTP and long term storage	Nutrient management through WWTP	Similar operation at Pahiatua.	WWTP opex is high but can be stopped in summer. WAS management required	The WWTP cost is high
All Wastewater to land	A	4		N/A	N/A	N/A	N/A	N/A	RO means volume reduction but still irrigate.	Nitrogen leaching unknown	Some challenges managing all to land due to unknowns in system. Giving up river reduces flexibility.	Irrigation only. Relatively low cost. WWRO required.	RO improvements and large storage.
Combined river/land discharge	C	2	Stored WW only to land	Has flexibility to manage the river discharge	Improvements in load not concentrations	Improvements in load not concentrations	Improvements in load not concentrations	Using storage.	RO means volume reduction but still irrigate.	Nitrogen leaching unknown	Storage only to land means less operational flexibility during wet weather/low river	Irrigation only. Relatively low cost. WWRO required.	RO improvements and medium storage.
Combined river/land discharge	C	3	Stored WW to river or land	The storage can be used to manage the discharge better at higher river flows reducing the effect.	Improvements in load not concentrations	Improvements in load not concentrations	Improvements in load not concentrations	Using storage. River discharge can be timed better than C2.	RO means volume reduction but still irrigate.	Nitrogen leaching unknown	Storage can be maximised when discharge to the river at high flows from storage	Irrigation only. Relatively low cost. WWRO required.	RO improvements and medium storage.
Combined river/land discharge	C	5		Has flexibility but quality of discharge will be high to meet requirements of lower flows				Storage available but likely to maintain volumes	WWTP and long term storage and river discharge	Nutrient management through WWTP	High quality WWTP. Likely tertiary treatment resulting in WAS and chemical sludges.	WWTP opex is high due to high quality needed for river. WAS management required	The WWTP cost is high
Municipal	D	1		Unknown due to PNCC BPO process	Unknown due to PNCC BPO process	Unknown due to PNCC BPO process	Unknown due to PNCC BPO process						
BAU / No	E	1		No improvement	No improvement	No improvement	No improvement	No improvement	No improvement	No improvement			

6 Preferred option

6.1 Option C.3 - Combined land/river discharges, long-term storage of RO permeate, storage to land or river

The preferred Option C.3 utilises the existing wastewater treatment system, but adds long-term storage for the WWRO and WMRO permeates, and requires improvements for the WWRO and WMRO plants, and the irrigation system. These improvements include:

- A new 95,000 m^3 wastewater storage facility on Innesmoor Farm to hold permeate from the WWRO and WMRO plants prior to irrigation or discharge to River;
- Upgrades to the existing irrigation network include:
  - Removing current irrigation tanks from the Farm Source site;
  - Construction and installation of new irrigation feed tanks and pumps at the Innesmoor irrigation pump shed;
  - Addition of a water flush system to the irrigation network on Innesmoor Farm (only) using the stored permeate; and
  - Modification and additions to piping to connect the new storage facility to the Thornton Park and Innesmoor Farm irrigation network.

This option seeks to maximise Fonterra's discharge to land acknowledging that, particularly in spring, soil moisture conditions restrict the volume and timing of irrigation. It also allows for better management of the River discharge to reduce the effect on the Manawatū River.

The wastewater volumes (Table 7 above) generated at the Longburn site are highest during the peak of the season, being September to November. This coincides with high soil moisture levels on the irrigation farms, reducing the ability to irrigate higher volumes. The wastewater volumes decrease from December onwards over summer. The storage allows for a deferment of irrigation of permeates from spring to summer when the hydraulic capacity is greater and the need for additional water on the farms exists.

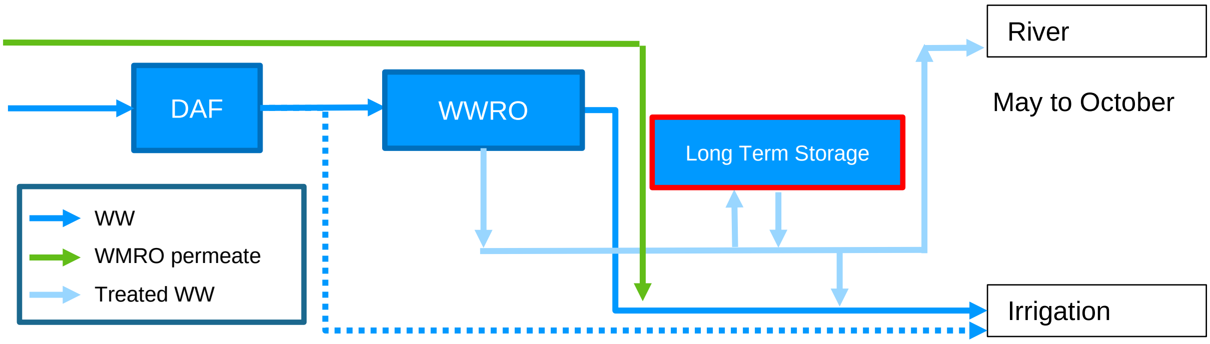


Figure 14: Schematic of preferred option – Permeate storage and combination river and land discharge. New items in red outline.

The stored permeate could be discharged to the Manawatū River during periods of higher flows (ie at a flow above the current 37 m^3/s). The stored permeate collected after October will be irrigated onto the Fonterra farms when soil moisture levels allow.

Currently the minimum river flow for WWRO permeate discharged is 37 m^3/s. Current consent decisions and policy direction indicates that the flow rate would be increased. Discharging at a higher minimum flow rate would enable greater assimilation of the discharge, and therefore reduce environmental effects.

6.2 Storage

6.2.1 Sizing

The volume of storage required is estimated to be about 95,000 m^3. The final storage volume is dependent on the minimum flow at which wastewater can be discharged into the Manawatū River, and it will require some further optimisation (to be undertaken during the detailed design phase). At this stage, the minimum flow is 56 cumecs, and this is the basis upon which the 95,000 m^3 storage volume has been determined.

The wastewater volumes (Table 7) are used in combination with the irrigation capacity to model the average volume of permeate that would need to be stored. The model assumes that during August to October all WWRO retentate is irrigated to land, and the permeate is stored. From here, the permeate could be irrigated to land or discharged to the Manawatū River at consented flow rates or stored for irrigation during summer months. This is noting that Fonterra intends to discharge to land when soil moisture conditions allow.

The preliminary estimate of the storage facility is 95,000 m^3. This includes an assumed dead volume that cannot be effectively used of 5% or nearly 5,000 m^3. The breakdown of the sizing in shown in Table 10.

Table 8: Storage facility volume allowances.

Storage facility			Current Assumption (m^3)
Total		m^3	95,000
Dead volume	5 %	m^3	4,750
Rainfall allowance	700	mm	16,531
November Allowance		m^3	10,000
Available for permeate		m^3	63,719

The storage facility has an area of about 2.5 ha and will resultantly also collect rainwater. An allowance in the total volume is made for rainfall which isassumed at 100mm per month for the 7-month period of May to October. Rainfall outside this time is stored but does not exceed the maximum volume required for the facility.

Allowance is made in the facility’s sizing to enable the storage of permeates during the month of November when the River discharge is generally unavailable. This allowance can be used to store WMRO permeate or to operate the WWRO and store the resulting permeate. A November allowance of 10,000 m^3 is provided.

This results in nearly 64,000 m^3 effective storage for the permeates to be primarily used during September to October.

A model of the storage, irrigation and river discharge is shown in Figure 14. This model is based on an average year. The wastewater volumes are based on design volumes in Table 7. The wastewater volumes at Longburn are highest during the peak of the season which occurs between September to November. This coincides with higher soil moisture levels on the irrigation farms meaning the volumes of wastewater that can be discharged to land are lower than what could occur during the summer months.

The irrigation volumes in the model are based on the following parameters:

May to October:

- Irrigation of all WWRO retentate
- Supplemented with stored permeate when soil moisture allows (up to 300 m³/d)

November (no River discharge)

- If soils are wet: Irrigation of all retentate, storage of permeate
- If soils are dry: Irrigation of DAF (no further treatment via the WWRO plant), supplemented with stored permeate (up to 200 m³/d)

December to April

- If soils are wet (extreme weather contingency): Irrigation of all retentate, storage of permeate
- If soils are dry: Irrigation of DAF no further treatment via the WWRO plant),, supplemented with stored permeate (up to 1,500 m³/d)

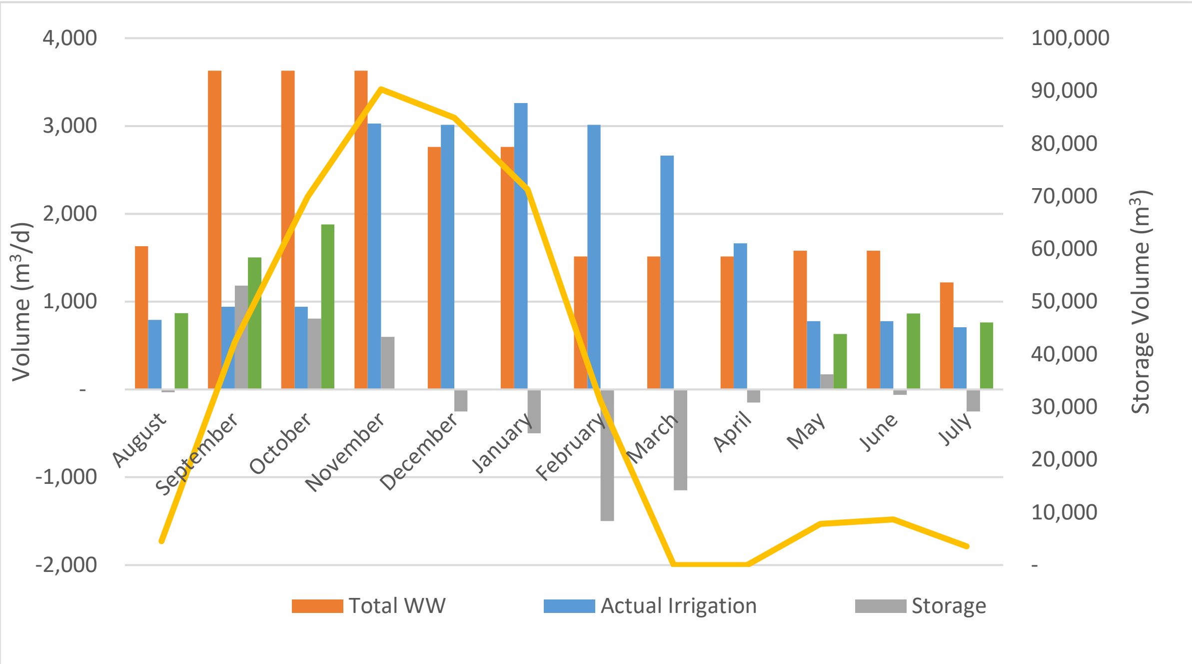


Figure 15: Model of storage, river and land discharge.

The yellow line of the model shows the cumulative volume stored in the facility. The orange bars show the total wastewater produced on the site (wastewater plus WMRO permeate). The blue bars represent the irrigation volumes, the green bars the River discharge volume and the grey bars the net monthly storage volume. Note a negative value shows emptying of the facility.

This model clearly shows the increase of permeates in the storage facility that otherwise would have been discharged to the River. Over summer, when wastewater volumes generated from the site reduce, the irrigation is supplemented with the stored permeates.

The maximum storage volume is limited as the facility has to be emptied over the summer period (by 30 April) to allow for storage for the next season. If the facility size is increased further, there is a signficant risk that it will not be emptied by 30 April and therefore will not have the full capacity available for the next season. Additionally, increasing the facility size increases the amount of rain water caught in it, which increases the volume that needs to be stored and discharged over the summer months.

With no storage and assuming all WWRO and WMRO permeates are discharged to the Manawatū Rver, a total annual volume of 359,000 m^3 would be discharged to the Manawatū River. Using storage (as per this model), the permeates discharged to the River is reduced to 200,000 m^3 which is an annualvolume reduction of almost 45%.

The above model provided a starting point for Aquanet to undertake more detailed modelling of the in-stream environmental and cumulative effects on the on-going discharge of treated wastewater to the Manawatū River, and to determine the actual volumes and contaminant loads.

6.2.2 Operation

The current River discharge is directly linked to the production of the permeates, and the discharge's flow is not constant during the course of a day. In this preferred option, the storage facility acts as a "buffer" and the enables the discharge to be done at a constant rate during the whole day.

The large amount of buffering also provides a more consistent discharge quality. This gives a better understanding of compliance as the quality is not as variable as the current operation (whereby the discharge operates when the WWRO and/or WMRO plants are operating). The large buffering will only allow slow changes in quality.

Currently there is a delay between the discharge and the return of the lab results which can, and has in the past, lead to a non-compliance being discovered several days after the discharge event. The buffering capacity will provide far more gradual changes and therefore increase confidence that the discharge will occur within the compliance limits.

6.2.3 Facility location

The location of the storage facility will be on one of either of the two Fonterra-owned farms. The exact location is to be determined as it is dependent on distance from sensitive receptors, detailed design, pipeline routes and geotechnical investigations. However, and at this stage, Innesmoor Farm is the preferred location.

A standard facility-size calculation has been completed. The bottom of the facility is approximately 140 x 120m, with a depth of 4.8m when full. This will give a water surface dimension of 164 by 144m. Exact dimensions will have to be determined, including the depth and RL, during the detailed design phase.

6.3 Irrigation

The irrigation system is installed on two separate farms: Innesmoor and Thornton Park. Thornton Park has its own pump station, including storage.

Innesmoor is irrigated from pumps and silos located behind the Farmsource building on SH56. The pump station is not in a suitable location to allow for irrigation of the stored permeates and therefore has to be relocated. This also enables the implementation of irrigation flushes. This flushing system, which is not available currently on Innesmoor and has resulted in occasional odour issues on the farm.

The preferred location is at the Innesmoor irrigation control station. This location has been originally designed for the pump station but was never been constructed. This location allows for good access to power, access to the main lines and good proximity to irrigate from the storage facility. The pump station will include storage silos, irrigation pumps and manifold, and solenoid bank for control of the paddock valves.

Some irrigation paddocks have no hydraulic paddock valves fitted, which are needed to allow for automated flushes for odour control. This proposal allows for the installation of Bermad valves and control tube to the pump station.

The irrigation scope includes:

- A new pump station next to the Innesmoor control room. Including new silos, pumps, instrumentation and pipework.
- Connections of the current irrigation system to the pump station.
- Installation of control valves to enable stored permeate (with freshwater backup) flushes for odour control in paddocks that don't have individual control valves.
- Modifications needed in the transfer of the wastewater (RO retentate in winter and DAF effluent in summer) from site to the pump stations at Innesmoor and Thornton Park.
- The connection from the storage facility into the Innesmoor pump station silos.
- Connection from storage facility pump into the Thornton Park transfer line.
- Automated sampling.
- Automation of the new pump station operation.
- Data to be collected into the new data management system (Infrastructure Data).
- Removal of the old pump station at the Farm Source site.

7 Irrigation – constraints

7.1 Hydraulic capacity of the irrigation area

The two Fonterra-owned farms are Innesmoor and Thornton Park. Thornton Park farm was purchased in 2019 and has increased the operational flexibility compared to the years prior when the irrigation of WWRO retentate during May to October was restricted to the Innesmoor farm. This led to significant hydraulic challenges during the spring of 2017.

Fonterra's irrigation consent does not have any specific hydraulic limitations, but it has to be managed to maintain appropriate soil moisture levels. The irrigation operators inspect the paddocks prior to irrigation for their soil moisture status and potential facilitying from rainfall.

The farms are located close to the Manawatū River and therefore have been prone to flooding during wet weather.

The installation of the WWRO resulted in having to irrigate the retentate during the times it is operational. As this is from May to October, these are normally the periods with higher soil moisture levels. Prior to the WWRO being installed, the irrigation would have been minimal during these months.

Depending on the time of year, the retentate volume is between 600 to 1,500 m^3/d.

A high-level assessment has been completed with the irrigation operators on the ability to irrigate any permeate above the retentate during May to October and above the full DAF treated wastewater from November to April (Table 11). The summer irrigation volumes of permeate can increase as the normal wastewater volumes start to drop off.

Table 9: Irrigation capacity assessment of additional irrigation volumes additional to the minimum depending on the weekly rainfall.

Weekly rainfall (mm)	Summer	Spring	Winter	Autumn
	m^3/d	m^3/d	m^3/d	m^3/d
0 -10	1500	250	350	450
10 – 25	1500	250	350	450
25 – 40	1000	250	175	300
40 – 60	750	0	175	300
60 – 100	500	0	0	150
100	0	0	0	0

The irrigation volumes as per the earlier model are shown in Table 12. In August the retentate is irrigated, supplemented with a small volume from storage if soil moisture allows. From September the wastewater volumes will increase due to the increased production on the Longburn site. The retentate volume will increase and only minimal additional capacity for the permeate to be irrigated is expected. In November the WWRO is turned-off and all wastewater from the DAF is irrigated onto the farms. This is supplemented with a small volume of permeate. The WMRO permeate is mostly stored in the facility during this time.

From December (summer) onwards the land is "drying-out" and the wastewater volumes start to reduce. This increases irrigation capacity to start drawing from the storage facility to irrigate to land. This increases further over January, February and March, with the facility mostly empty by the start of April. From April onwards, the remaining volume and additional rain water is managed by irrigation so Fonterra has the maximum storage available for the coming spring period. The irrigation volumes are an average daily volume over the month. This means that one day a smaller volume more can be irrigated and some days a larger volume.

Table 10: Projected irrigation volumes as per model in Figure 14.

		August	September	October	November	December	January	February	March	April	May	June	July
Total WW	m^3/d	1,630	3,630	3,630	3,630	2,763	2,763	1,513	1,513	1,513	1,580	1,505	1,220
WW DAF to Irrigation	m^3/d				2,830	1,963	1,963	1,513	1,513	1,513			
WW Retentate to Irrigation	m^3/d	543	943	943							527	502	407
Storage to Irrigation	m^3/d	250	-	-	200	1,050	1,300	1,500	1,150	150	250	250	300
Total Irrigation	m^3/d	793	943	943	3,030	3,013	3,263	3,013	2,663	1,663	777	752	707

7.2 Nutrients

The WWRO system is only a separation system, and the majority of the nutrients will end up in the retentate. It does reduce the hydraulic loadings on the farms as it removes the “permeate” but almost all nitrogen and phosphorus will be irrigated onto the farms.

The additional stored permeate has a low nutrient content and the nutrient loadings will only marginally increase. The increase in irrigation during spring and winter for facility management will increase the leaching potential. This is assessed in Dr Jeff Brown’s technical report covering the wastewater irrigation farms.

Appendix 1: Options Longlist

Option group	Option	No.	Treatment: DAF	Treatment: WWRO	Treatment: Biological All	Treatment: Biological WWRO retentate	Treatment: Biological WMRO permeate	Treatment: More land	Treatment: Short term storage	Treatment: Long term storage	Treatment: Evaporator / concentration	Wastewater reduction	Discharge: Land	Discharge: River	Discharge: PNCC	Discharge: MDC	Discharge: Aquifer	Discharge: Ocean	Notes
All wastewater to land	A	1	Yes					yes					yes						
All wastewater to land	A	2	Yes					yes	yes				yes						
All wastewater to land	A	3	Yes		yes			yes		yes			yes						
All wastewater to land	A	4	Yes	yes				yes		yes (WWRO permeate)			yes						
All wastewater to land	A	5	Yes	yes		yes		yes		yes (WWRO permeate + bio treated retentate)			yes						
All wastewater to land	A	6	Yes	yes				yes		yes (WWRO permeate)	yes		yes						
All wastewater to river	B	1	yes		yes									yes					
All wastewater to river	B	2	yes		yes					yes				yes					
All wastewater to river	B	3	yes	yes		yes								yes					
All wastewater to river	B	4	yes	yes		yes				yes				yes					
Combined river/land discharge	C	1	yes	yes									yes	yes					Expand river discharge time for wet weather
Combined river/land discharge	C	2	Yes	yes						yes			yes	yes					Stored WW only to land
Combined river/land discharge	C	3	Yes	yes						yes			yes	yes					Stored WW to river or land
Combined river/land discharge	C	4	yes		yes								yes	yes					
Combined river/land discharge	C	5	yes		yes					yes			yes	yes					
Combined river/land discharge	C	6	yes		yes								yes	yes					Contingency discharge in summer
Combined river/land discharge	C	7	yes	yes			yes						yes	yes					
Combined river/land discharge													yes	yes					
Municipal	D	1	yes												yes				
Municipal	D	2	yes	yes									yes		yes				
Municipal	D	3	yes												yes	yes			
Municipal	D	4	yes	yes											yes	yes			
BAU / No change	E	1	yes	yes									yes	yes					
Managed Aquifer Recharge	F	1	yes	yes													yes		
Managed Aquifer Recharge	F	2	yes		yes												yes		
Discharge to ocean	G	1	yes															yes	
Discharge to ocean	G	2	yes		yes													yes	

Option	Fatal flaw/Discard/Further work	Consistent with Manawatu River Accord? BPO re N, P, SS & E. coli reduction to river? (esp. N)	Supports One Plan (restores/ protects Manawatu River)	Cultural	Consent-ability: 25 year consent likelihood?	Practical; proven technology; consistent performance can be achieved?	Whole of life cost?	Risks: Wet Weather	Risks: Odour	Risks: Operational complexity	Risks: River Low flow conditions	Sustainability targets	Other consents required?	3rd party reliance	Further notes
A 1	Have to show the land area required.	No river discharge			n/a - No river consent required			No allowance	Only DAF treated wastewater		n/a	Less energy than current	Irrigation consent for increase in land	purchasing from 3rd party	Finding and securing land will be difficult in the Longburn region
A 2	this option could be considered further but	No river discharge			n/a - No river consent required				Only DAF treated wastewater		n/a	Less energy than current	Irrigation consent for increase in land	purchasing from 3rd party	Finding and securing land will be difficult in the Longburn region
A 3	Equivalent to Pahiatua	No river discharge			n/a - No river consent required		WWTP and extra land -> high cost				n/a	Increase in enery due to WWTP	Irrigation consent for increase in land	purchasing from 3rd party	Finding and securing land will be difficult in the Longburn region
A 4	Also consider the WMRO permeate reuse in this	No river discharge			n/a - No river consent required						n/a	Similar to current	Irrigation consent for increase in land	purchasing from 3rd party	Finding and securing land will be difficult in the Longburn region
A 5	WWRO will have no benefit	No river discharge			n/a - No river consent required		WWTP and extra land -> high cost				n/a	Increase in enery due to WWTP	Irrigation consent for increase in land	purchasing from 3rd party	Finding and securing land will be difficult in the Longburn region
A 6	Concentration plant is expensive and does not solve hydraulics	No river discharge			n/a - No river consent required		Concentration plant and extra land -> high cost				n/a	Concentration plant will require increase of energy	Irrigation consent for increase in land	purchasing from 3rd party	Finding and securing land will be difficult in the Longburn region
B 1	River only. Not a feasible option.						WWTP expensive, but could divest current land. High opex.				Always have to discharge regardless of river flow				
B 2	River only. Not a feasible option.		Treatment and storage dependent		Storage and thus ability for river flow/dicharge management		WWTP expensive, but could divest current land. High opex.								
B 3	River only. Not a feasible option.						WWTP expensive, but could divest current land. High opex.				Always have to discharge regardless of river flow				
B 4	River only. Not a feasible option.		treatment and storage dependent		Storage and thus ability for river flow/dicharge management		WWTP expensive, but could divest current land. High opex.								
C 1	More wastewater to river.														
C 2	Also include the WMRO reuse				2033 (common catchment								Storage pond location?		
C 3	Also include the WMRO reuse				2033 (common catchment								Storage pond location?		
C 4	More volume to river.				2034 (common catchment										
C 5					2035 (common catchment										
C 6	Similar to C5 but summer discharge not an option														
C 7	Use as reuse example to integrate in other options.											Energy required. Good			
D 1	Show how this could work as an option.														
D 2	Uncertainty around future PNCC solution. Discard														
D 3	Uncertainty around future PNCC solution. Discard														
D 4	Uncertainty around future PNCC solution. Discard														
E 1	Baseline case.				0 years										
F 1	Technology required expensive. Uncertainty around the process. Discard														
F 2	Technology required expensive. Uncertainty around the process. Discard														
G 1	Distance to ocean. No current discharge. Stakeholders unacceptable. Discard.														
G 2	Distance to ocean. No current discharge. Stakeholders unacceptable. Discard.														

Appendix C2

TECHNICAL REPORT – WASTEWATER IRRIGATION FARMS

Technical Report - Wastewater Irrigation Farms

17 September 2021 / Dr Jeff Brown / ETG Report 2021-004

1 Purpose of technical report

1.1 This technical report is provided in relation to Fonterra Limited’s (Fonterra) application to renew its discharge of treated wastewater to the Manawatū River.

1.2 The report provides an outline of:

- Fonterra’s existing consented operations to discharge treated wastewater to land on two Fonterra owned-farms; and
- The operational contraints and capabilties associated with options to increase or optimise the irrigation of wastewater to land.

2 Introduction

2.1 Fonterra is applying for a new resource consent to enable the continuation of its discharge of treated wastewater into the Manawatū River from its Longburn dairy manufacturing site (Longburn site).

2.2 As part of this application, Fonterra is proposing to make a number of improvements to the Longburn site’s existing wastewater treatment system which will reduce the overall volume and contaminant loads being discharged into the Manawatū River. This will include the use of a 95,000 m^3 storage facility. The storage facility will enable Fonterra to store permeate produced from the wastewater treatment processes for irrigation, therefore reducing the volumes that will be discharged to the Manawatū River. The stored volumes of permeate will then be irrigated to Fonterra-owned farms (Innesmoor and Thornton Park) when soil moisture conditions allow.

2.3 Key to the success of these proposed changes is ensuring that the two farms can:

1. Still operate within the parameters of the discharge to land resource consent (APP-2011013049.01, formerly 105070);
2. maintain pasture and soil quality on both farms; and
3. still operate as viable dairy units.

2.4 The first part of this report provides an overview of both the Innesmoor and Thornton Park farms including their management and the wastewater irrigation system that is operated over both, and it summarises the nutrient losses (as modelled using Overseer®) for the past 2017-2020 seasons.

2.5 The second part of this report assesses the nutrient losses under the proposed system, and then reviews a number of mitigation options that could be implemented to ensure that the nitrate leaching loss limits can still be met. In assessing the proposed changes, we have looked beyond the current limits in the resource consent ATH-2011013049.01 to also consider those in the One Plan. This ensures that any increases in wastewater volumes being applied to both farms will still be "consentable" when ATH-2011013049.01 expires on 1 July 2033.

3 Fonterra Longburn's Wastewater Irrigation Farms

3.1 Fonterra's wastewater treatment system at Longburn comprises both a discharge to the Manawatū River and discharges to land via irrigation (refer to **Figure 1** below). A key reason for the dual system (and the proposal to retain it, albeit with changes) is that the limiting factor for the Fonterra irrigation land is its hydraulic capacity to absorb water.

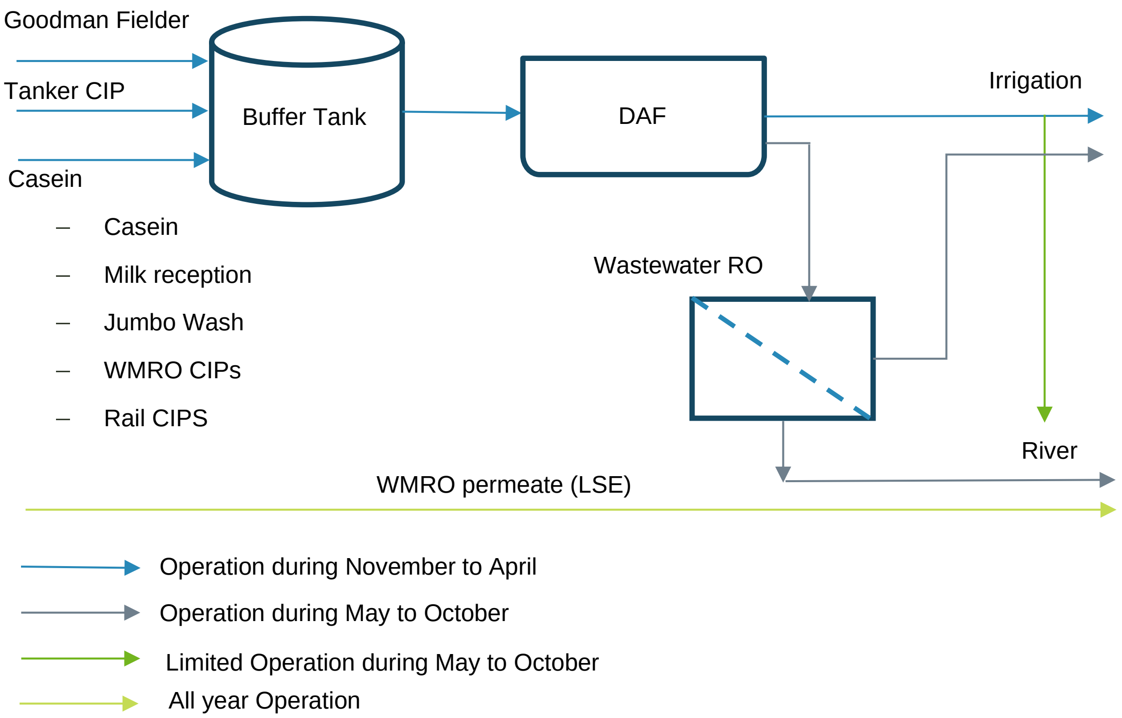


Figure 1: An overview of Fonterra Longburn's wastewater treatment system

3.2 The two irrigation farms that support the Longburn site's wastewater treatment system are Innesmoor and Thornton Park Farms. The location of these two farms in relation to the Longburn site are shown in **Figure 2** below.

Figure 2: Location of the Longburn site's Innesmoor and Thornton Park Farms

3.3 This section provides an overview of the two Fonterra-owned irrigation farms, being Innesmoor and Thornton Park.

Innesmoor Farm

3.4 Fonterra's Innesmoor Farm comprises a 135 hectare (ha) dairying platform which includes the Adventist lease block (13.6 ha) (refer to **Figure 3** below).

3.5 The dairy herd includes 320 Fresian x Jersey cross cows (at peak) which produce around 120,000 kg milk solids (MS) per annum, and supplies A2 milk. All replacement stock are grazed off-site.

3.6 In the 2019/20 dairy season, around 370 tonnes (T) dry matter (DM) of feed was imported and fed largely on the farm's covered feed pad. The feed pad was constructed in 2018 and has enabled Fonterra to reduce the risk of pasture damage due to pugging in wet periods. Average nitrogen loads from all sources (wastewater, dairy shed effluent and fertiliser) have remained in the range of 180-210 kgN/ha/yr.

3.7 100 T DM of silage was fed from on-farm storage in the 2019/20 season. Chicory is a common fodder crop (grazed in-situ) used on the farm. In the 2019/20 dairy season, this comprised 14 ha.

3.8 Effluent from the feed pad, yards and dairy milking shed is collected and stored in two large ponds. For 2019/20 season, the effluent was irrigated onto a 6 ha dairy shed effluent-only (DSE) block as well as one other 4 ha block which also received the dairy process wastewater (as shown in **Figure 3**).

3.9 Treated process wastewater from the Longburn site is irrigated over a total of 103.5 ha using, predominantely, fixed in-ground sprinklers. **Appendix 1** shows the layout of the irrigation system on the Innesmoor Farm. Wastewater irrigation occurs for most months of the year and the rate of irrigation depends on the Longburn site's production.

Figure 3: Innesmoor Farm OverseerFM blocks. Wastewater (WW), dairy shed effluent (DSE)

3.10 Recent farm scale soil mapping is shown in **Appendix 3**.

3.11 In the 2019/20 seaons, wastewater irrigation on Innesmoor Farm contributed 116 kgN/ha/yr and synthetic N-fertiliser a further 54 kgN/ha/yr (2019/20 season figures). The total nitrogen from these sources in the 2019/20 season was 170 kgs/ha/year. This is outlined further in **Table 1**.

Thornton Park

3.12 The dairy herd comprised 428 Friesian cows producing 181,000 kgMS in the 2019/20 season. Replacement stock are grazed on the Callensen run-off (refer to **Figure 4**). Around 360 T DM of supplements were imported and fed largely on the feed pad.

3.13 Fonterra has irrigated wastewater onto the Thornton Park Farm for over 20 years. However, up until 2019 the farm was held by a third-party. The purchase of the Thornton Park farm enabled Fonterra to reduce cow numbers from 730 milking cows at peak to 428. Additionally, the majority of replacement stock are now grazed off-site.

3.14 As shown in **Figure 4**, Thornton Park adjoins the Innesmoor Farm to the southwest. **Appendix 2** shows the layout of the irrigation system on the Thornton Park Farm.

3.15 Thornton Park is comprised of a 202 ha productive dairying platform which is managed as a 147 ha wastewater irrigated block (fixed in-ground sprinklers) and a 26 ha joint wastewater plus dairy shed effluent (DSE) irrigated block (refer to **Figure 4**). Of the remaining 29 ha of non-irrigated land, some this area has irrigation infrastructure, but is not typically used. The Callensen Block, which adjoins Thornton Park to the south, is the run-off block whereby maize and other crops are grown to support the main dairying platform.

3.16 Recent farm scale soil mapping is shown in **Appendix 3**.

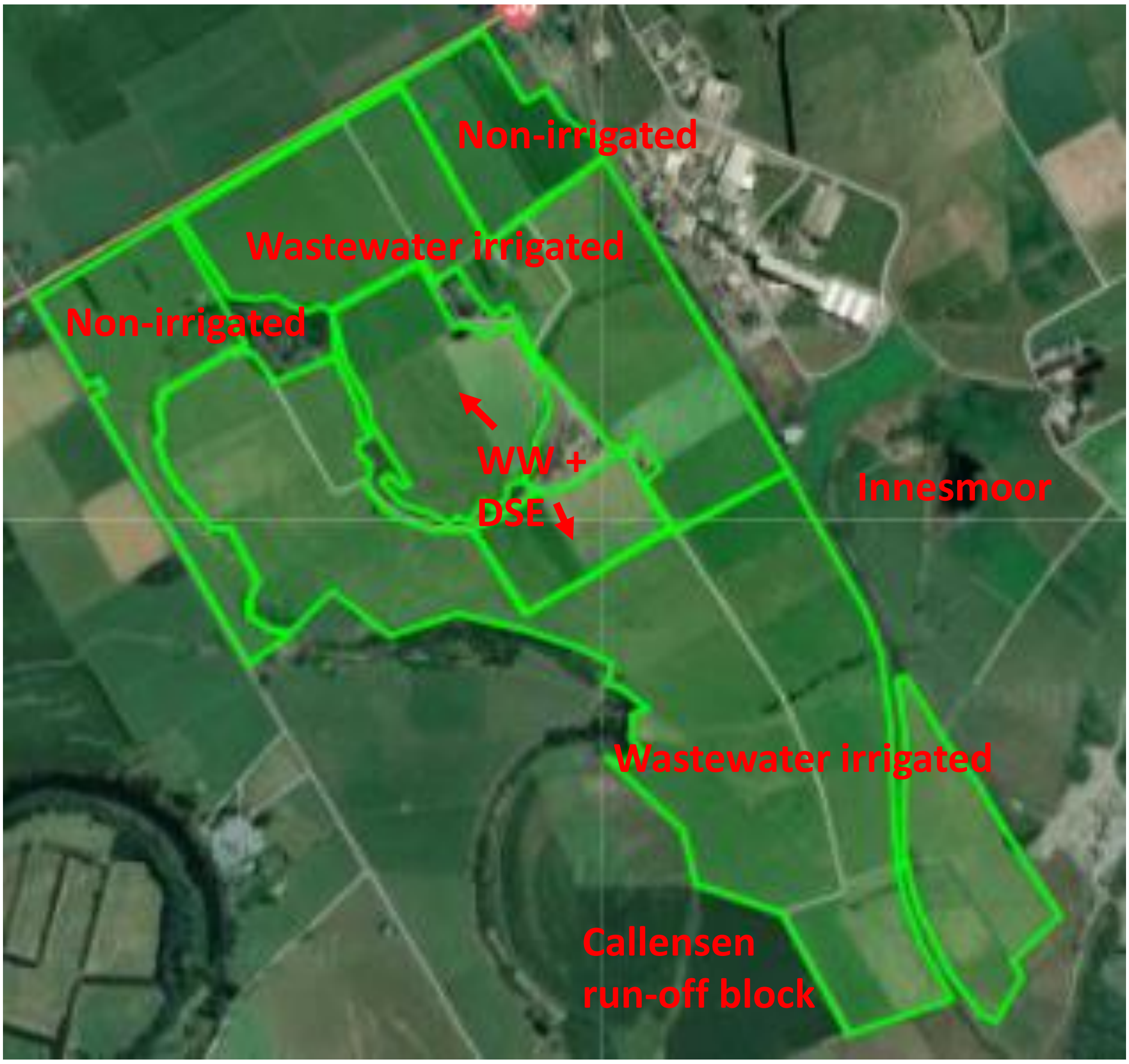


Figure 4. Thornton Park farm OverseerFM blocks. Wastewater (WW), dairy shed effluent (DSE)

3.17 Similar to the Innesmoor Farm, the wastewater irrigation occurs during most months of the year. Process wastewater irrigation supplies around 168 kgN/ha/yr and synthetic N-fertiliser a further 30 kgN/ha/yr (2019/20 season figures). The total nitrogen from these sources in the 2019/20 season was 198 kgs/ha/year. This is outlined further in **Table 1**.

4 Annual Overseer modelling

4.1 Condition 17 of Fonterra's wastewater irrigation consent (APP-2009013720.01) requires that Overseer FM nutrient loss modelling is undertaken annually and reported to Horizons. The Overseer FM modelled losses for the 2017/18, 2018/19 and 2019/20 are provided in **Table 1** (year 2020/21 estimates are currently being compiled).

Table 1 Past season's nutrient loads and Overseer FM (version 6.4.0) modelled loss rates based on actual wastewater and farm system data

Farm	Year	Nutrient load (kg/ha/yr)[@] as per condition 7		Nutrient loss rates (kg/ha/yr)	
		Nitrogen	Phosphorus	Nitrogen	Phosphorus
Innesmoor	*** 2.3 cow/ha, 142 ha, 103 ha irrigated**			**N-limit = 42**	**-**
Year	2019/20	170	31	36	2.1
	2018/19	198	46	31	1.8
	2017/18	177	38	36	1.9
Thornton	*** 2.0 cow/ha, 211 ha, 172 ha irrigated**			**N-limit = 37**	-
Year	2019/20	209	43	39^	1.3
	2018/19	133	28	38^	1.1
	2017/18	95	22	38^	1.6

[@] Wastewater & fertiliser to main irrigated block (prior to removal of fodder crop area)
* 2019/20 figures for stocking rate and irrigated area
^ Modelled numbers have increased above limit due to recent revisions to account for soil mapping

4.2 Overall, both Thornton Park and Innesmoor Farms have been compliant with both the N loading (Condition 7) and nitrate leaching limits (Condition 15) for the past three seasons. The values for Thornton Park have increased slightly above 37 kgN/ha/yr due to the recent incorporation of the results of the farm scale soil mapping.

4.3 Soil testing is conducted annually as part of the consent's monitoring conditions. On the wastewater irrigated areas, the mean soil Olsen P values are 72 mg/l for Thornton Park and 167 mg/l for Innesmoor. These higher soil values contribute to higher than average P loss predictions for these farms.

5 Future Overseer FM Nutrient Loss Results

5.1 Predictive scenario modelling has been undertaken to confirm that any modifications to the wastewater irrigation regime still comply with the consented limits in Fonterra's wastewater irrigation consent (APP-2009013720.01) - namely those for nitrogen loading and predicted nutrient loss rates.

5.2 The storage facility will enable Fonterra to store some of the permeate volumes (rather than discharge them to the Manawatū River) and then irrigate them to the Fonterra farms when soil moisture conditions allow (ie summer months). This will consequently result in higher volumes and marginally more nutrients being irrigated on to the farms.

5.3 The modelling was conducted using the existing farm year end 2020 Overseer FM file for the 2019/20 season as the “existing baseline”. The additional wastewater (and its nutrient loads) were then added to the file to asses further changes.

5.4 Mitigation options, known to be reasonable for this location and underlying farming system, such as altered fodder crop regimes, were then assessed. These are provided in **Table 2** and discussed in turn below.

Table 2. Predictive modelling of future nutrient loads and Overseer FM nutrient loss rates

Farm	Scenario	WW Nutrient load (kg/ha/yr)@		Nutrient loss rates (kg/ha/yr)	
		Nitrogen	Phosphorus	Nitrogen	Phosphorus
Innesmoor	*** 2.3 cow/ha, 142 ha, 103 ha irrigated**			**N-limit = 42**	**-**
S1 - WW Storage Facility# (14 ha irrigated chicory crop)		188	67	42	2.4
S2 - WW Storage Facility# + altered fodder crops (7.6 ha irrigated & 6.4 ha non-irrig. chicory crop)		188	67	40	2.4
S2b - WW Storage Facility# + altered fodder crops (6.4 ha non-irrig. chicory crop + increased imported feed)		188	67	35	2.6
Thornton	*** 2.0 cow/ha, 211 ha, 172 ha irrigated**			**N-limit = 37**	**-**
S1 - WW Storage Facility# *(22 ha irrigated chicory, 16 ha maize)		197	43	43	1.6
S2 - WW Storage Facility# + altered fodder crops (22 ha chicory crop removed + increased imported feed, 16 ha maize remains)		197	43	36	1.6

@ All nutrient sources = WW + fertiliser. Applies to main wastewater irrigation block
* 2019/20 figures for stocking rate and irrigated area
\# Wastewater storage facility of 95,000 m^3 total, 64,000 m^3 effective working storage volume.

Scenario 1: Increased wastewater volumes to land, no further mitigations

5.5 For both the Thornton Park and Innesmoor farms, the increased hydraulic and nutrient loads associated with emptying the storage facility with no additional changes or mitigation measures, increase the nutrient losses to levels above that permitted by the resource consent.

Scenario 2: Increased wastewater volumes to land, remove chicory crops

5.6 A significant contributor to the N-leaching comes from the chicory crops that are grown on both farms, and which are also irrigated with wastewater.

5.7 Fonterra could grow the chicory crops on non-irrigated farm areas only, reduce the area within which they are grown or remove this crop entirely (and increase supplementary feed brought in). Through these options the modelled leaching can be reduced to below the current consent limits.

5.8 Predicted phosphorus losses climb slightly as the increased wastewater irrigation results in a greater phosphorus surplus on to soils which are already above agronomic optimums.

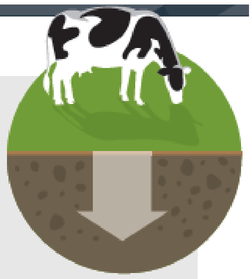
Other options – not modelled

5.9 Further reductions in the volume of treated wastewater discharged to the Manawatū River would require an even larger storage facility, coupled with further increases in hydraulic and nutrient loads to the farms.

5.10 Additional mitigations such as the co-irrigation of the dairy shed effluent (successfully conducted at Fonterra's Pahiatua site), complete reliance on imported feed over fodder crops or reductions in stocking rate would be required. Such mitigations have not been modelled at this stage.

6 Comparison to Horizon's One Plan Targets

6.1 Horizon's One Plan targets for nitrogen leaching losses are shown in **Figure 3**. It must be noted that these apply within 'targeted' sensitive catchments. The Lower Manawatu River at Longburn is not within one of these catchments, however it is useful to compare the past and predicted future results for the Innesmoor and Thornton farms against.



WHAT DOES THE PLAN CHANGE SAY?

PROPOSED PLAN CHANGE 2

Cross reference Operative One Plan, Chapter 5, Table 14.2, page 14-8. [2018 additions in blue and 2007 deletions in ~~red~~].
Table 14.2 sets out the *cumulative nitrogen leaching maximum** for the land used for intensive farming land use activities within each specified *land use capability class**.

Table 14.2 *Cumulative nitrogen leaching maximum** by *Land Use Capability Class**
Kgs of N per hectare per year

Period (from the year that the rule has legal effect)	LUC* I	LUC* II	LUC* III	LUC* IV	LUC* V	LUC* VI	LUC* VII	LUC* VIII
Year 1	51 ~~30~~	45 ~~27~~	40 ~~24~~	29 ~~18~~	25 ~~16~~	24 ~~15~~	11 ~~8~~	3 ~~2~~
Year 5	46 ~~27~~	40 ~~25~~	35 ~~21~~	25 ~~16~~	22 ~~13~~	19 ~~10~~	8 ~~6~~	3 ~~2~~
Year 10	44 ~~26~~	37 ~~22~~	32 ~~19~~	23 ~~14~~	20 ~~13~~	17 ~~10~~	8 ~~6~~	3 ~~2~~
Year 20	43 ~~25~~	35 ~~21~~	30 ~~18~~	21 ~~13~~	19 ~~12~~	16 ~~10~~	8 ~~6~~	3 ~~2~~

Figure 3. Horizon's One Plan RevisedTable 14.2 under Plan Change 2 - Nitrogen Leaching Limits

6.2 Both farms are comprised mainly of Manawatu and Kairanga series soils and are flat. As a result the farms will be predominately LUC II and LUC III and sit approximately part way between these categories. Assuming a Year 10 value, both farms could likely comply with 32-37 kgN/ha/yr if the mitigation options above were implemented.

6.3 At Year 20 of the One Plan, further reductions in nitrogen leaching are likely to be required. Options that could be evaluated to achieve this could include further modification of fodder crops, co-irrigation of the dairy shed effluent with the wastewater and slight reductions in stock density.

7 Conclusion

7.1 The Innesmoor and Thornton Park farms are used for the land treatment of the wastewater produced by the Longburn site. Both farms are dairying units with the lower than average number of cows reflecting the constraints placed on these farms by the wastewater irrigation.

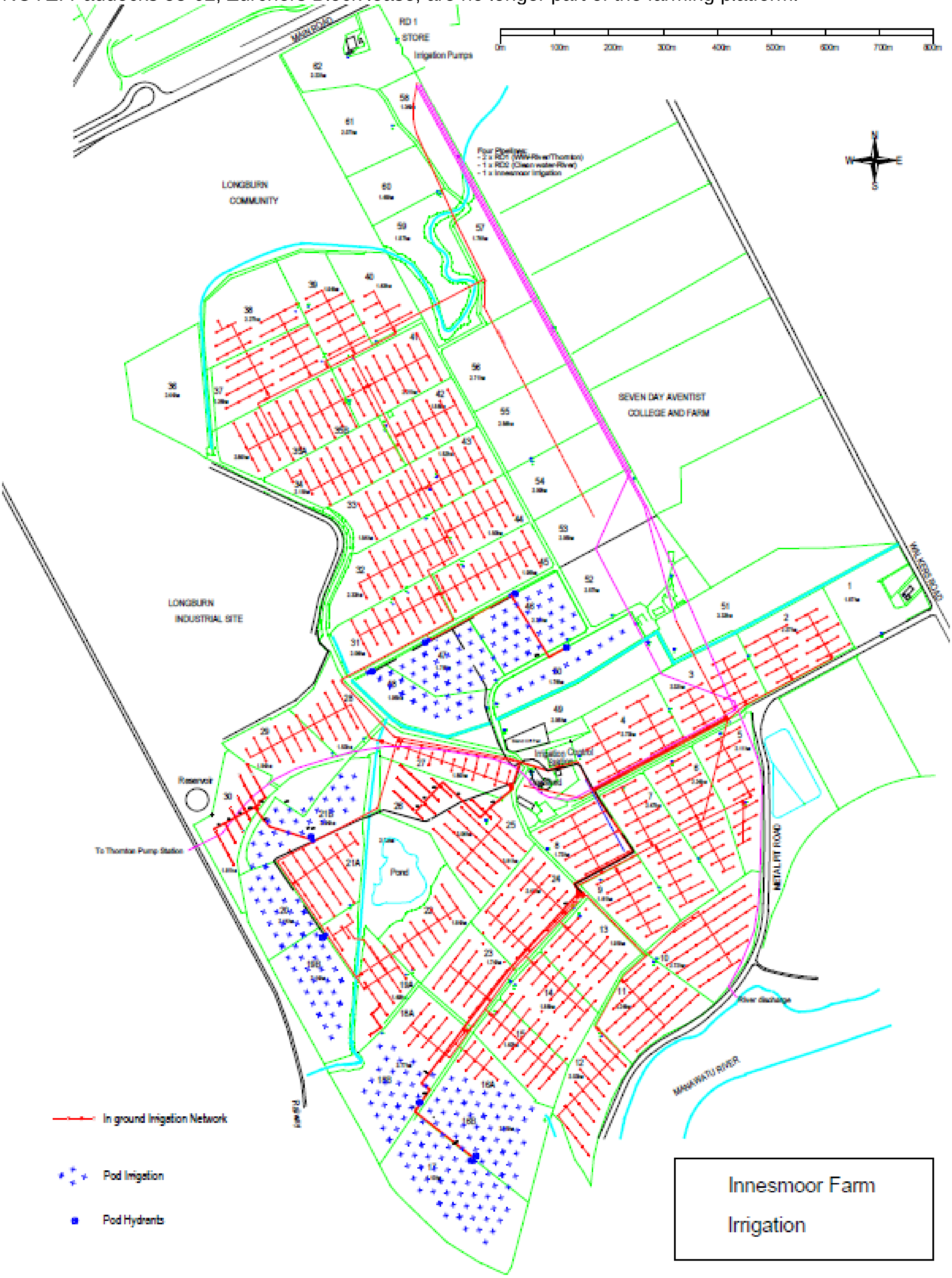
7.2 The wastewater irrigation and farm operations are required to meet nitrogen leaching limits of 42 kgN/ha/yr for Innesmoor and 37 kgN/ha/yr for Thornton by way of resource consent. Good compliance with these resource consent limits has been achieved.

7.3 A decrease in the volume of treated wastewater being discharged to the Manawatū River would mean increases in the volume of wastewater being irrigated onto the two farms. However, storage of this volume in a large storage facility, such as a pond, would allow the extra volume to be irrigated in the summer period when soil moisture deficits are greater.

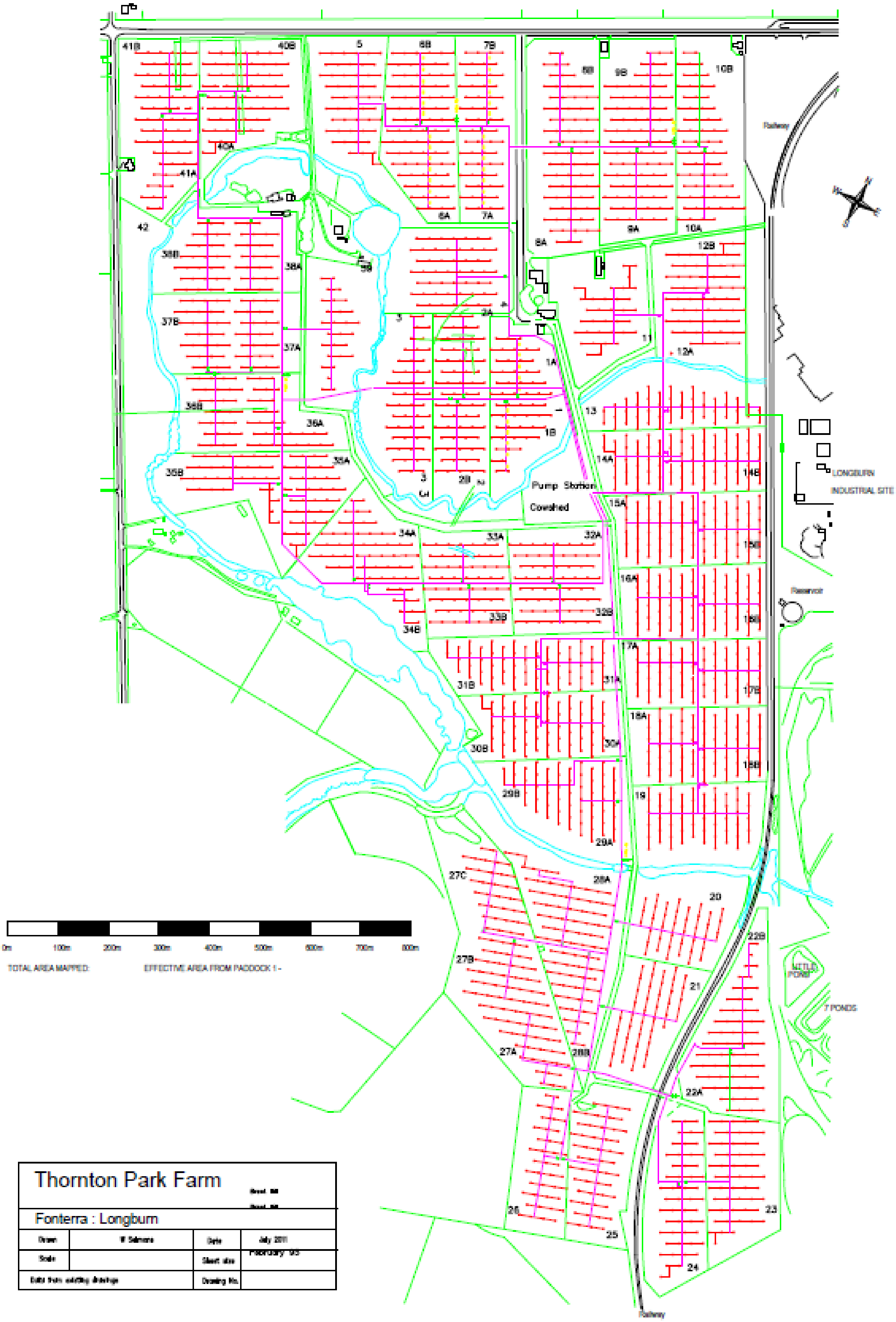
7.4 Nitrogen leaching predictions using the OverseerFM model show that the additional irrigation would cause slight increases to levels marginally beyond the consented limits for each farm. This could be mitigated by minor on-farm changes such as the location and size of fodder crops, such that the existing consent limits could be complied with. Comparison to the revised Table 14.2 of Horizon’s One Plan shows the farms in the future would also likely comply, but in fact they don’t sit within a ‘targeted’ catchment.

Appendix I Innesmoor Wastewater Irrigation Network

NOTE: Paddocks 53-62, Zurchers Block lease, are no longer part of the farming platform.



Appendix II Thornton Wastewater Irrigation Network



Appendix III Farm Scale Soil Maps (LandVision report)

Soil Resources

Fonterra discharge farms

Innesmore & Thornton Dairy Units

Longburn

June 2021

LandVision Ltd
PO Box 7191
Whanganui

1 SUMMARY

A soil survey was undertaken on the waste water irrigation areas of Innessmore and Thornton dairy units at Longburn for Fonterra. Eleven soil types were identified as part of the soil survey (1;8,000) and the dominant soil series included Manawatu and karapoti soils on the imperfectly to freer draining soils and the Kairanga series on the imperfectly to poorly draining soils.

2 TABLE OF CONTENTS

3 PURPOSE

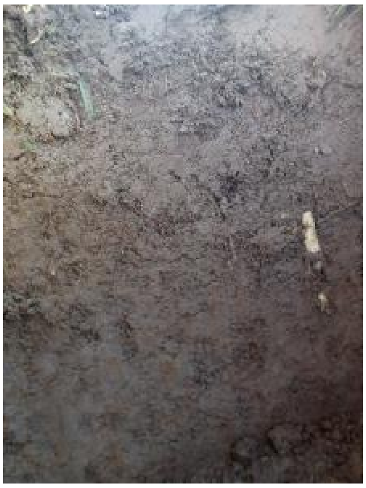
The purpose of this report is to obtain the soils information for the Fonterra discharge farms, Thornton and Innesmore, at Longburn.

4 SOIL RESOURCES TABLE

The following table describes the soils present on the two properties currently under waste irrigation.

	**Name: Manawatu sandy loam** **LUC map symbol:** M1 **Parent material:** Alluvium derived from sedimentary rock. **Drainage status:** Well drained. **Soil consistence:** Friable when moist, slightly plastic when wet. **Degree of topsoil development:** Weakly developed. **Profile description:** 20 cm brown (10YR 4/3) weakly developed nutty sandy loam; on 80 cm dark greyish brown (2.5YR 4/2) weakly developed blocky to structureless sandy loam and becoming a loamy sand with depth; on yellowish brown (10YR 5/4) loose single grain sand. **Comments:** recent soil still prone to infrequent flooding. On flat to undulating river levees. Generally no erosion.
	**Name: Manawatu fine sandy loam** **LUC map symbol**: M2 **Parent material**: Alluvium. **Drainage status**: Moderately well drained. **Soil consistence**: Friable when moist, slightly plastic when wet. **Degree of topsoil development**: Weakly developed. **Profile description**: 25 cm dark brown (10YR 3/3) weakly developed nutty fine sandy loam; on 60 cm yellowish brown (10YR 4/3) weakly developed blocky fine sandy loam; on yellowish brown (10YR5/4) massive fine sandy loam. **Comments**: Found on flat to gently undulating river levees.
	**Name: Manawatu silt loam.** **LUC map symbol: M3** **Parent material:** Alluvium. **Drainage status:** Moderately well drained. **Soil consistence:** Friable when moist, plastic when wet. **Degree of topsoil development:** Moderately to weakly developed. **Pugging susceptibility:** Moderate. **Effluent application risk:** Low. **Profile description:** 30 cm moderately to weakly developed, medium nut and crumb, friable when moist, plastic when wet, 10YR 4/1 silt loam. On: moderately to weakly developed, medium nut and crumb, friable when moist, plastic when wet, 10YR 6/3 silt loam. On alluvium.

	**Name: Manawatu mottled silt loam.** **Soil map symbol: M4** **Parent material:** Alluvium. **Drainage status:** Moderately well drained. **Soil consistence:** Friable when moist, plastic when wet. **Degree of topsoil development:** Weakly developed. **Pugging susceptibility:** Moderate. **Effluent application risk:** Low. **Profile description:** 35 cm weakly developed, fine crumb and nut, friable when moist, plastic when wet, 10 YR 5/2 silt loam. On: 30 cm weakly developed, fine to medium crumb and nut, friable when moist, plastic when wet, 10 YR 6/2 silt loam with few low chroma mottles. On: weakly developed, fine to medium crumb and nut, friable when moist, plastic when wet, 10 YR 6/3 silt loam with few low chroma mottles. On alluvium.
	**Name:** Kairanga sandy loam **LUC map symbol: K1** **Parent material:** Alluvium. **Drainage status:** Poorly drained. **Soil consistence:** Friable when moist, plastic when wet. **Degree of topsoil development:** Weakly developed. **Profile description:** 18 cm dark greyish brown (10YR 4/2) sandy loam to fine sandy loam, friable, weakly developed medium nut structure, some indistinct fine mottling along root channels, many roots, distinct irregular boundary; on 10 cm dark greyish brown (10YR 4/2) sandy loam, friable, weakly developed coarse blocky structure, abundant fine and medium reddish brown (5YR 4/4) and indistinct yellowish brown (10YR 5/6) mottles, distinct boundary; on 18 cm olive (5Y 4/3) fine loamy sand, soft, massive, abundant distinct coarse iron coated grey (10YR 5/1) mottles, few roots, indistinct boundary; on olive (5Y 5/3) very fine sandy loam, slightly sticky, slightly plastic, massive, abundant fine to medium strong brown (7.5YR 5/8) mottles.
	**Name: Kairanga silt loam.** **Soil map symbol:** K2 **Parent material:** Alluvium. **Drainage status:** Imperfectly to poorly drained. **Soil consistence:** Friable when moist, plastic when wet. **Degree of topsoil development:** Weakly developed. **Pugging susceptibility:** High. **Effluent application risk:** High. **Profile description:** 30 cm weakly developed, fine to medium crumb and nut, friable when moist, very plastic when wet, 10 YR 5/3 silt loam with few brown and orange mottles. On: 25 cm weakly developed, fine to medium crumb and nut, friable when moist, sticky when wet, 10 YR 6/3 silty clay loam with many orange and gley mottles. On: weakly developed, fine to medium crumb and nut, friable when moist, sticky when wet, 10 YR 7/3 silty clay loam with many orange and gley mottles. On alluvium.

	**Name: Kairanga silt loam on sand** **Soil map symbol:** K3 **Parent material:** Alluvium. **Drainage status:** Poorly drained. **Soil consistence:** Friable when moist, slightly plastic when wet. **Degree of topsoil development:** Moderately developed. **Pugging susceptibility:** High **Effluent application risk:** High **Profile description:** 20 cm weakly to moderately developed, medium nut structure, friable when moist, plastic when wet, 10YR 4/4 silt loam. On: weakly developed, medium block structure, friable when moist, plastic when wet, 10YR 6/2 silty clay loam with few to many yellow brown mottles. On: structureless, firm, N6/ sand with abundant yellow brown mottles.
	**Name: Kairanga silty clay loam.** **Soil map symbol:** K4 **Parent material:** Alluvium. **Drainage status:** Poorly drained. **Effluent application risk**: High. **Soil consistence:** Friable when moist, slightly sticky when wet. **Degree of topsoil development:** Moderately to weakly developed. **Profile description:** 25 cm moderately to weakly developed, medium to fine nut and crumb, friable when moist, slightly sticky when wet, greyish yellow brown (WO 2c) silty clay loam with few low chroma mottles. On: moderately to weakly developed, medium nut and block, friable when moist, sticky when wet, orange grey (WO 1d) silty clay loam with many orange and gley mottles. On alluvium.
	**Name: Kairanga clay loam.** **LUC map symbol:K6** **Parent material:** Alluvium. **Drainage status:** Poorly drained. **Soil consistence:** Friable when moist, very plastic when wet. **Degree of topsoil development:** Weakly developed. **Pugging susceptibility:** High. **Effluent application risk:** High. **Profile description:** 30 cm weakly developed, medium nut and crumb, friable when moist, very plastic when wet, 10 YR 6/1 silt loam with few low chroma mottles. On: 20 cm weakly developed, medium nut and block, friable when moist, very plastic when wet, 10 YR 6/2 silty clay loam with few orange and gley mottles. On: weakly developed, medium nut and block, friable when moist, sticky when wet, 10 YR 7/3 clay loam with many orange and gley mottles. On alluvium.

	**Name: Karapoti sandy silt loam** **Soil map symbol**: **Kt1** **Parent material:** Alluvium **Drainage status:** Well drained. **Effluent application risk**: Low. **Soil consistence:** Friable when moist, slightly plastic when wet. **Degree of topsoil development:** Weakly to moderately developed. **Profile description:** 20 cm weakly to moderately developed, fine to medium crumb and nut, friable when moist, slightly plastic when wet, dark yellow brown (WO 4b) sandy silt loam. On: 15 cm weakly developed, fine crumb and nut, friable to loose when moist, slightly plastic when wet, yellowish brown (WO 4c) sandy loam. On: weakly developed to structureless, fine granular crumb, loose when moist, non-plastic when wet, dusky pale-weak orange (WO 3f) silty sand with few indistinct low chroma mottles. On unconsolidated sands.
	**Name: Karapoti fine sandy loam.** **LUC map symbol: Kt2** **Parent material:** Alluvium over gravels. **Drainage status:** Well drained. **Soil consistence:** Friable when moist, slightly plastic when wet. **Degree of topsoil development:** Weakly to moderately developed. **Pugging susceptibility:** Low. **Profile description:** 20 cm weakly to moderately developed, medium to fine crumb and nut, friable when moist, slightly plastic when wet, 10YR 5/2 fine sandy loam. On: 25 cm weakly to moderately developed, medium to fine crumb and nut, very friable when moist, slightly plastic when wet, 10YR 6/2 fine sandy loam with few small gravels. On: weakly to moderately developed, medium to fine crumb and nut, very friable when moist, slightly plastic when wet, 10YR 6/3 fine sandy loam with few to many small to medium gravels. On alluvium over gravels.
	**Name: Halcombe silt loam, hill soil.** **Soil map symbol:** HhS **Parent material:** Loess. **Drainage status:** Poorly drained. **Soil consistence:** Friable when moist, very plastic when wet. **Degree of topsoil development:** Moderately developed. **Pugging susceptibility:** High. **Effluent application risk:** High. **Profile description:** 18 cm moderately developed, medium nut and crumb, friable when moist, very plastic when wet, 10YR 4/1 silty clay loam with few brown mottles. On: moderately developed, medium nut and block, friable when moist, very plastic when wet, 10YR 4/1 silty clay loam with many gley mottles and iron concretions. On loess.

5 SOIL RESOURCES MAP

Appendix C3

LAND AVAILABILITY ASSESSMENT

LON Manawatū River Discharge - Land Assessment

An initial assessment of land suitability and availability within a 10km proximity of the Longburn Site has been undertaken by Group Property to identify landholdings or groupings of land holdings >200ha.

Of 269 properties identified within the 5,600ha search area, only 24 parcels are of a significant size, enough to achieve the >200ha footprint requirement required.

To achieve >200ha, 77% of opportunities would require negotiations with 2 or more land owners. The reluctance/willingness of land owners to sell is unknown, with premium of at least 20% above market needed to secure (unaware of any land owners who have previously expressed an interest in selling). In being made aware of a requirement for Fonterra to secure land there is the very real risk land owners would hold out for greater premiums.

Market advice indicates land ownership of this type/size of property is tightly held, only 10 transactions occurring in the search area over the previous 10 years (1 of which was Fonterra). Where multiple acquisitions are needed to achieve >200ha, there is the risk that only one land owner is a willing seller and while acquiring one, there is the risk we would be unsuccessful in acquiring both (preventing >200ha being secured). There is potential for reputational risk (community) through the loss of productive dairy land and conversion to irrigation land.

Due to the location of the properties identified, there is a high probability of needing to secure easements through Council, road corridors, river and privately owned land to achieve.

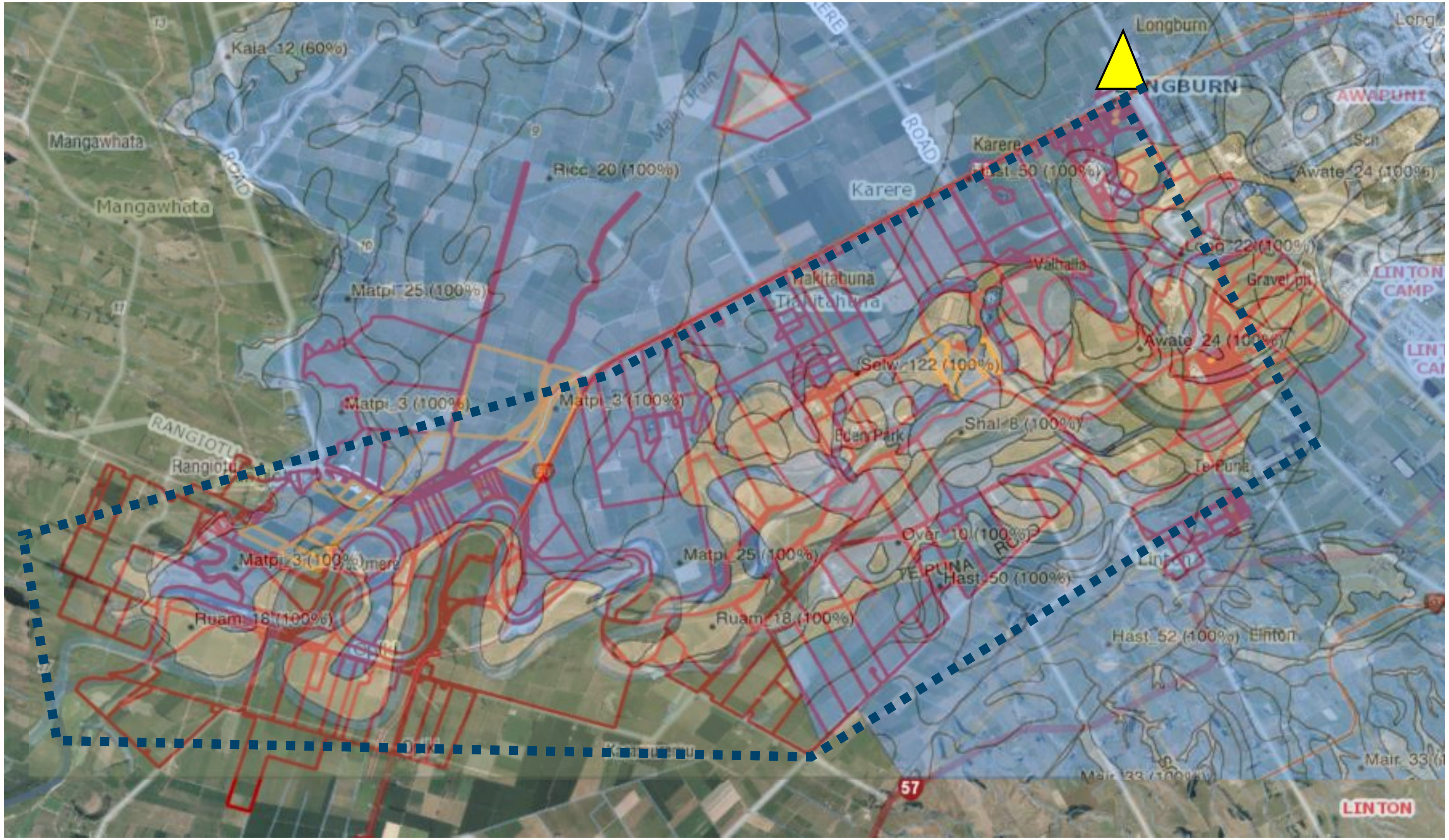
As below, the indicative cost range of $16M - $24M is needed to secure >200ha of land, with an indicative $8M - $11M needed for supporting infrastructure.

Location	Land Area (ha)	Territorial Authority	# Acquisitions Required	Indicative Land Acquisition Cost	Indicative Infrastructure/ Set-Up Cost	Indicative Total Cost
1	315	PALMERSTON NORTH CITY	1	$23,697,103	$ 10,872,368	$34,569,470
2	300	HOROWHENUA DISTRICT	5	$22,930,623	$ 10,510,208	$33,440,830
3	255	HOROWHENUA DISTRICT	1	$19,182,118	$ 9,367,373	$28,549,490
4	250	MANAWATU DISTRICT	2	$18,893,283	$ 9,244,428	$28,137,710
5	212	PALMERSTON NORTH CITY	1	$15,954,943	$ 8,291,648	$24,246,590
6	209	MANAWATU DISTRICT	3	$15,949,305	$ 8,236,435	$24,185,740
7	206	HOROWHENUA DISTRICT	5	$15,848,418	$ 8,149,473	$23,997,890
8	206	MANAWATU DISTRICT	3	$15,678,923	$ 8,146,308	$23,825,230
9	201	MANAWATU DISTRICT	3	$15,334,590	$ 8,031,530	$23,366,120

Assumptions:

1. 269 properties identified within approx. 5,600ha, 10km search extent.
2. Search extent included preferred soil types as identified by Environmental Team
3. Search extent excluded land areas <10ha and residential properties
4. Grouped land holdings total >200ha
5. Additional infrastructure costs to be validated by project team (based on previous projects), consists of $500K consenting and allowance for 10km mainline/pumping
6. Allowance for legal
7. No allowance for costs to secure easements

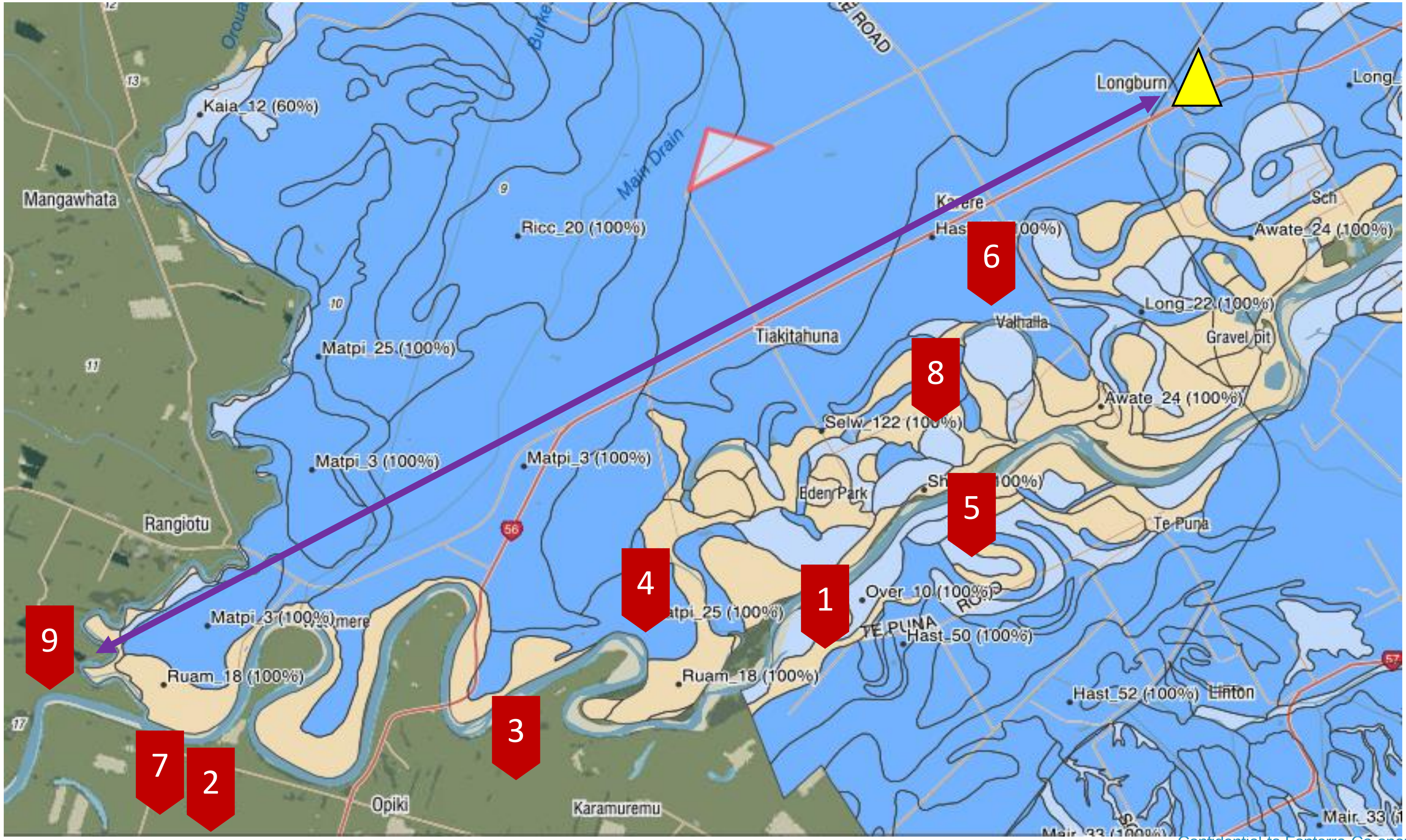
Longburn Irrigation Land Search



Longburn Factory

Search Area

Longburn Irrigation Land Search – Groupings >200ha



Longburn Factory

10km search radius

Property Grouping Location

Appendix D

AQUANET REPORT: ASSESSMENT OF CURRENT AND FUTURE EFFECTS ON FRESHWATER QUALITY AND ECOLOGY

Fonterra Longburn manufacturing site discharge to the Manawatū River: Assessment of effects on freshwater quality and ecology

10th September 2021

Report Prepared for Fonterra Limited

Aquanet Consulting Ltd
441 Church Street
Palmerston North

14 Lombard Street
Level 1, Wellington

06 358 6581

Fonterra Longburn manufacturing site discharge to the Manawatū River: Assessment of effects on freshwater quality and ecology

10th September 2021

Report prepared for Fonterra Limited by:

Dr Michael Greer
Fiona Death
Dr Olivier Ausseil

Aquanet Consulting Limited

Quality Assurance			
Role	**Responsibility**	**Date**	**Signature**
Prepared by	Michael Greer		
Approved for issue by:	Olivier Ausseil	10/09/2021	
Status	Final		

EXECUTIVE SUMMARY

Context

Fonterra Limited (Fonterra) owns and operates the Longburn manufacturing site (the Longburn site). Resource Consent APP-2003010585.02 currently allows the discharge of process wastewater from the Longburn site to the Manawatū River subject to a suite of conditions. The key wastewater streams from the site are from:

- A Whole Milk Reverse Osmosis Plant (WMRO);
- Casein manufacture;
- Raw milk collection; and
- The Goodman Fielder dairy processing operation (which shares wastewater treatment facilities with Fonterra).

The Longburn site processes milk from the region and also collects milk to be transported to other Fonterra processing facilities throughout the country. The Goodman Fielder processing site manufactures a variety of dairy products for the New Zealand market.

As part of the renewal process for the discharge permits, Fonterra has explored a range of options to reduce the in-river effects of its operations. Understanding how these options affect water quality and periphyton growth in the Manawatū River and determining the best way to manage the discharge is complex. To help inform the consent renewal process Fonterra have engaged Aquanet Consulting Ltd (Aquanet) to assess the current effects of the discharge, test the potential water quality and ecology effects of five different options using their Point Source Impact Model (PointSIM), and describe the future effects of the discharge under the preferred option.

Current effects assessment approach

The current discharge from the Longburn site consists of the following components:

- Higher strength effluent from either a Wastewater Reverse Osmosis (WWRO) plant or a Dissolved Air Flotation plant (prior to 2015 only) between May and October (inclusive) when river flows are above 37 m^3/s; and
- Discharge of a lower strength effluent from a WMRO plant year round.

The assessment of the current effects of the Longburn site's discharge is primarily based on monitoring data collected by Horizons Regional Council (HRC), Fonterra and Aquanet Staff for the period July 2011 to June 2021. The analysis of water quality and ecological data presented in this report includes an assessment against the provisions of:

- The Horizons One Plan Schedule E water quality targets; and
- The National Policy Statement for Freshwater Management (NPS-FM) 2020 relevant numeric attribute states.

Options assessment approach

In preparing the application to renew the Resource Consent for the discharge, Fonterra undertook a process to determine the Best Practicable Option for treatment and discharge of wastewater from the Longburn site. The first step was to undertake a global scan of all emerging technologies and options that could be reasonably implemented at the Fonterra Longburn site to develop a long-list of options. The wide range of options developed were then assessed against key environmental performance criteria. Any option that did not satisfy the key performance criteria and therefore did not address key environmental effects was not considered for further assessment.

Following the screening assessment, ten options were considered to be the most feasible and warranting further assessment. Then, having identified storage and deferred irrigation as the preferred option for reducing the wastewater discharge to the River (Option C.3), five sub-options were developed in order to refine and optimise the proposal.

The potential future effects under the five options were assessed using Aquanet's Point Source Impact Model (PointSIM)for the period July 2000 to June 2020. The options all include:

- A river discharge component that operates above a given river flow cut-off and ceases between November and April (inclusive);
- A land discharge component that varies based on rainfall; and
- An effluent storage component. *Note - the model assumes that storage is empty at the end of April each year, meaning that all effluent in storage at the end of October has to be irrigated on to land before the 30th of April.*

Each option is defined by a desired outcome for one or more of the metrics listed below; PointSIM was used to predict the likely outcome for the other metrics under each option (see Table 1):

- Storage volume;
- River cut-off flow (the flow below which the discharge must cease);
- The reduction in the effects of the discharge on in-river concentrations compared with the baseline discharge; and/or
- Maximum daily discharge volume.

Table 1: Assumptions for each of the five options modelled. "?" indicate the variables explored through modelling. For example, for Option 1: "if we assume a total storage volume of 63,719 m^3, and constrain the daily discharge volume to the river to be no more than the previous day's effluent production, what is the river flow cut-off?"

<table>
<tr><th>Option</th><th>Available storage needed</th><th>River cut-off flow (no discharge below)</th><th>Daily discharge volume</th><th>Reduction in DRP below 20th FEP</th><th>Reduction in SIN below 20th FEP</th></tr>
<tr><td>1</td><td>63,719</td><td rowspan="2">?</td><td rowspan="3">Prior days production</td><td>?</td><td rowspan="5">?</td></tr>
<tr><td>2</td><td rowspan="4">?</td><td>57%</td></tr>
<tr><td>3</td><td>80m³/s</td><td rowspan="3">?</td></tr>
<tr><td>4</td><td rowspan="2">73.4m³/s</td><td>Flow proportional up to 2,670 m³/day</td></tr>
<tr><td>5</td><td>Flow proportional up to 4,000 m³/day</td></tr>
</table>

For this assessment, the reductions under each option are measured against a status quo "design baseline" which assumes full site operation, current effluent concentrations, year-round river discharge from the WMRO plant and no discharge from the WWRO plant between November and April.

Future effects assessment approach

Fonterra are looking to reduce the effects of their discharge by upgrading the wastewater system at the Longburn site. The option Fonterra has identified as the Best Practicable Option from the five modelled is Option 1 (Table 1). The potential effects of the Option 1 were assessed in more detail than in the initial Options Assessment and incorporated an updated effluent quality data series. Specifically, PointSIM was used to predict how the distribution of the following parameters will be changed downstream of the discharge under the selected option:

- SIN;
- DRP;
- Ammoniacal nitrogen (NH_4-N);
- *E. coli*; and
- Periphyton biomass (useful as a qualitative assessment of risk only).

The modelled downstream distributions have been compared to a baseline modelled data set, a modelled upstream dataset and the relevant One Plan targets to provide some context on the nature and magnitude of the future effects of the discharge.

Assessment of current effects

From the available monitoring data (July 2011 to June 2021) the following conclusions were made about the current effects of the Longburn discharge on water quality and ecology in the Manawatū River:

- The available data indicates that in the past, statistically detectable degradations in nitrate nitrogen (NO_3-N), SIN and visual clarity occurred in the Manawatū River downstream of the Longburn discharge. However, there is limited potential for this to have resulted in adverse effects due the prevailing water quality conditions upstream exceeding relevant guideline levels, or downstream concentrations/levels not being degraded beyond guideline levels by the discharge.
- Across all available data, statistically detectable degradations in NH_4-N, DRP, particulate organic matter (POM), 5-day biochemical oxygen demand ($ScBOD_5$), pH and temperature were not identified in the Manawatū River downstream of the discharge. However, under certain flow conditions the effects of the discharge on pH and temperature were detectable.
- The One Plan water quality targets were complied with as follows:
  - NH_4-N, $ScBOD_5$, pH, and temperature in the Manawatū River generally met the One Plan targets upstream and downstream of the Longburn discharge;
  - Visual clarity and *E. coli*, SIN, DRP and POM concentrations did not meet the One Plan targets upstream or downstream of the discharge; and
  - The change in pH, temperature and visual clarity between the upstream and downstream sites generally met the relevant One Plan targets.
- Sampling of the Manawatū River at Longburn since 2010 has found poor to fair ecological health at all sites, but there is no indication that the Longburn discharge is having adverse effects on aquatic communities in this stretch of the river.
  - Macroinvertebrate communities observed at the downstream sites were similar to those seen upstream of the discharge, with biotic indices showing either no statistically significant differences between the upstream and downstream sites or an improvement at the downstream sites.
  - The Macroinvertebrate Community Index (MCI) was generally below the One Plan "State of the Environment" target of 100 at all sites upstream and downstream of the discharge. However, the percent change in the Quantitative Macroinvertebrate Community Index (QMCI) between upstream and downstream sites consistently met the One Plan target of no more than a 20% reduction, and in most years this metric was found to improve downstream of the discharge.
  - Periphyton biomass and cover were generally higher upstream of the discharge when compared with sites downstream, suggesting no detectable effect on periphyton.
  - Sites downstream of the discharge met the One Plan periphyton cover and biomass targets in all years, despite the biomass and long filamentous algae target being occasionally exceeded at the upstream sites.
- The NPS-FM 2020 assigns sites as follows:

- NH_4-N concentrations were assigned to attribute state C at the upstream and downstream monitoring sites;
- NO_3-N concentrations at both the upstream site and downstream site were assigned to attribute state A; and
- Concentrations of *E. coli* fell within attribute state E upstream of the discharge (which represents the highest risk of effects) and attribute state D downstream of the discharge.

In summary water quality data indicates that while the discharge may have increased nitrogen concentrations in the past, there appears to be limited potential for this to have resulted in adverse ecological effects due the prevailing water quality conditions upstream exceeding relevant guideline levels, or downstream concentrations/ levels not being degraded beyond guideline levels by the discharge. This is supported by the results of ecological monitoring data which shows no evidence of the Longburn discharge having adverse effects on aquatic life (plant or macroinvertebrate) in this stretch of the river. Nevertheless, it is worth noting that the available water quality data record may not provide a full idea of the past effects of the discharge due to:

- Some downstream samples being collected when the discharge was not operating;
- The discharge potentially not being fully mixed at the downstream site under some flow conditions, leading to cumulative effects being over estimated; and
- The pulse nature of the discharge, meaning that the instantaneous effects of the discharge measured through water quality sampling may be greater than the effects on daily average concentrations, which may be more important in understanding the effects on factors such as periphyton growth.

Options testing results

Based on our modelling, all of five options tested are likely to reduce the effects of the discharge on SIN and DRP (when assessed against the assumed status quo 2019 'design' baseline) to the point that they are unlikely to be detectable (Table 2)

Table 2: Assumptions for each of the five options modelled (red) and the results of the options testing process (black).

Option	Total storage needed	River cut-off flow (no discharge below)	Daily discharge volume	Reduction in DRP below 20th FEP	Reduction in SIN below 20th FEP
1	63,719 m^3	56.5 m^3/s	Prior days production	39%	48%
2	103,803 m^3	72 m^3/s		57%	64%
3	121,983 m^3	80 m^3/s		66%	71%
4	113,412 m^3	73.4 m^3/s	Flow proportional up to 2,670 m^3/day	64%	70%
5	99,307 m^3		Flow proportional up to 4,000 m3/day	56%	63%

Option 1

PointSIM indicates that to ensure that the available storage volume is not exceeded under Option 1, a river cut-off flow of 56.5 m^3/s would be required. Ceasing the discharge at this point is predicted to achieve a 39% reduction in the effects of the discharge on average DRP concentrations in the Manawatū River, and a 48% reduction for SIN. While this reduction does not meet the DRP reduction target set for Option 2, it still represents a significant improvement when assessed against the assumed status quo 2019 'design' baseline, and the effects of the discharge on both DRP and SIN concentrations are unlikely to be detectable under this option. Furthermore, this option significantly reduces the potential for adverse ecological effects caused by nutrients in the discharge by eliminating the discharge at times when the risk of periphyton growth is highest (no discharge to the river during November to April inclusive and the river cut-off flow increased from 37 m^3/s to 56.5 m^3/s the rest of the time).

Option 2

Modelling suggests that a river cut-off flow of 72 m^3/s (approximately median flow) would be required to reach the desired 57% reduction in effects on DRP concentrations under this option and indicates that 103,803 m^3 of available storage would be needed to achieve this.

Option 3

Modelling suggests that implementing an 80 m^3/s river cut-off flow under this option would result in greater reductions in the effects on DRP (66%) and SIN (71%) concentrations than those expected under Option 1 or Option 2. However, it would also require significantly more available storage (121,983 m^3).

Option 4

Option 4 is predicted to achieve greater reductions in effects on SIN (71%) and DRP (64%) concentrations than Option 2, despite having a similar river cut-off flow. However, the storage requirements are also expected to be significantly greater (113,412 m^3 available storage needed).

Option 5

The flow proportional river discharge regime assumed under Option 5 is expected to require significantly less storage than Option 4 (99,307 m^3), while still achieving significantly greater reductions in effects on SIN (63%) and DRP (56%) than Option 1. On the other hand, storage requirements are also still significantly greater than under Option 1.

Future effects

Modelling results suggest that the proposed upgrades to the Longburn site will result in a significant proportional reduction in effects across the distribution of NH_4-N, SIN, DRP and *E. coli* concentrations in the Manawatū River when assessed against the assumed status quo 'design' baseline. The increases in contaminant concentrations observed historically in the river are expected to be vastly reduced by the upgrades due to:

- The removal of the discharge during the summer months (November to April inclusive) and at flows below 56.5 m^3/s;
- Improved treatment performance (not all of the effluent in the current effects assessment period was treated with the reverse osmosis plant); and
- The change from a pulse discharge to a continuous discharge will mean that the instantaneous effects of the discharge will no longer be greater than the effect on daily average concentrations, reducing the risk of potential adverse effects being overstated by monitoring data.

In the future it is expected that the effects of the discharge on both DRP and SIN concentrations will be generally not be detectable and that the potential for adverse ecological effects caused by nutrients in the discharge will be significantly reduced by eliminating the discharge at times where the risk of periphyton growth is highest (low flows and late spring to early autumn). Furthermore, the discharge’s negligible current effect on ammonia toxicity risk is expected to be further reduced, as will its effects on human health as it is not predicted to cause an increase in median and 95th percentile *E. coli* concentrations going forward.

The discharge is not currently having an effect on periphyton or macroinvertebrate community health, and this is expected to remain the case in the future.

Contingency river discharges in November

In high rainfall years, it may be necessary to discharge some of the effluent produced in November to the Manawatū River to avoid exceeding storage capacity. The option considered for this contingency discharge involves discharging effluent to the River at a strength and volume that is consistent with what is allowed by the conditions of the existing consent. PointSIM results suggest that a November discharge regime designed in this way will adequately deal with the effluent produced in that month without adversely effecting water quality and aquatic ecology beyond the already negligible effects expected under Option 1. Nevertheless, it is expected that these November discharges will be rare and subject to specific consent conditions.

Contents

Tables

Figures

1. Introduction

1.1. Background

Fonterra Limited (Fonterra) owns and operates the Longburn manufacturing site (the Longburn site). The Longburn site processes milk from the region and also collects milk to be transported to other Fonterra processing facilities throughout the country. The Goodman Fielder processing site manufactures a variety of dairy products for the New Zealand market.

Resource Consent APP-2003010585.02 currently allows the discharge of process wastewater from the Longburn site to the Manawatū River subject to a suite of conditions. The key wastewater streams from the site are from:

- A Whole Milk Reverse Osmosis Plant (WMRO);
- Casein manufacture;
- Raw milk collection; and
- The Goodman Fielder dairy processing operation (which shares wastewater treatment facilities with Fonterra).

The Manawatū River arises in the Ruahine Ranges, runs through the Manawatū Gorge and flows into the sea at Foxton Beach / Manawatū Estuary. The Longburn site discharge flows into a reach that is currently impacted by cumulative effects, and nutrient concentrations do not meet the relevant Horizons One Plan targets upstream of the discharge. Of particular note is the contribution of the Palmerston North City Council (PNCC) Totara Road Wastewater Treatment Plant (WWTP) discharge to degraded water quality. This discharge enters the Manawatū River approximately 3.5 kilometres upstream of the Longburn site, and significantly increases both nitrogen and phosphorus concentrations in the Manawatū River.

While the Manawatū River is impacted by both diffuse and point source discharges, it is highly valued. The reach into which the Longburn discharge enters provides nesting habitat for dotterels, is an important trout fishery and is a site of cultural significance for Rangitāne O Manawatū, as well as other iwi and hapū.

1.2. Aim and Scope

As part of the renewal process for their discharge permits Fonterra have explored a range of options to reduce the in-river effects of their operation. Understanding how these options will affect water quality and periphyton growth in the Manawatū River and determining the best way to manage the discharge is complex. To help inform the consent renewal process Fonterra engaged Aquanet Consulting Ltd (Aquanet) to assess the current effects of the discharge, test the potential water quality and ecology benefits of five different options using their Point Source Impact Model (PointSIM), and describe the future effects of the discharge under the preferred option.

1.3. Structure of the Report

This report is comprised of six sections:

- In Section 2, the data available for the current effects assessment are described, maps of the relevant monitoring sites are presented, the approaches used in data analysis are detailed and the relevant water quality targets, against which data were assessed, are outlined;
- In Section 3, the current state of water quality, periphyton cover and macroinvertebrate health in the Manawatū River upstream and downstream of the discharge is assessed, and the contribution of the discharge to any degradation is discussed;
- In Section 4, the methodology and results of the option testing process carried out to inform the plant upgrade selection process are presented;
- In Section 5, the improvements planned for the Longburn site are presented, and the future effects assessment methodology and results are described; and
- In Section 6, the main findings of Sections 2 through 5 are summarised.

2. Current effects assessment methods

2.1. Available data and preparation

This report primarily considers data collected in the ten-year period between July 2011 and June 2021 (inclusive)[1]. All data available at the time of writing have been included in the analyses presented in this report, except obvious outliers. The data used for the assessment presented in this report are summarised in Table 3.

[1] Ecological data collecting in 2010 has also been considered due to the low sampling frequency within the assessment period.

Table 3: Summary of data used in this assessment.

Site	Type	Parameters	Frequency	Period	Source
Upstream of Longburn discharge	River water quality	NH4-N, SIN, NO3-N, NO2-N, DRP, E. coli, Black Disc, POM, pH, Temperature, ScBOD5, DO	Monthly	July 2011 to July 2021	Horizons
Downstream of Longburn discharge					
Upstream of Longburn discharge		NH4-N, SIN, NO3-N, NO2-N, DRP, E. coli, pH, Temperature, ScBOD5, DO	Monthly when the discharge is operating	July - Oct 2012, May - Oct 2013, June - Dec 2014, May - Oct 2015, June – Aug, Nov - Dec 2016, Jan, Mar – May, Aug – Oct 2017 May – Sep, Nov 2018 Jan, May – Nov 2019 May – Nov 2020 May 2021	Fonterra
Downstream of Longburn discharge					
Manawatū River at Teachers College	Flow Data	Daily averages		July 2011 to July 2021	Horizons
Upstream of Longburn discharge	Macroinvertebrates	MCI, QMCI, ASPM, %EPT taxa, %EPT individuals, No. of taxa, No. of individuals;	Biannually One off	Oct 2010 – Oct 2018 July 2019	River Lake & Aquanet (2 u/s & 2 d/s)
Downstream of Longburn discharge					
Upstream of Longburn discharge	Periphyton	Periphyton biomass (Chl-a), %Periphyton cover	Biannually One off	Oct 2010 – Oct 2018 July 2019	River Lake & Aquanet (2 u/s & 2 d/s)
Downstream of Longburn discharge					

2.1.1. Water quality

Water quality data used in this assessment to describe the state of the Manawatū River were sourced from:

- Monthly water quality monitoring at sites on the Manawatū River upstream and downstream of the Longburn discharge (conducted by Horizons Regional Council (HRC)); and
- Additional monthly water quality compliance monitoring conducted when the discharge was operating[2] at sites on the Manawatū River upstream and downstream of the Longburn discharge (conducted by Fonterra since 2012).

The Longburn discharge is not continuous (i.e., it does not run 24 hours a day), and prior to 2019 Fonterra were not targeting their water quality monitoring to when the discharge was operating (rectified in 2019). Likewise, at least some of the HRC monitoring data would have been collected when there was no discharge. As such, some of the downstream data record may not capture the effects of the discharge. However, it was considered preferable to use all of the data available, rather than to base this assessment on just 16 samples collected by Fonterra since 2019. Any potential bias resulting from this method is considered in the narrative (see Section 3.1.9).

2.1.2. Ecology

Ecological data were sourced from:

- Three-yearly compliance monitoring of periphyton cover, periphyton biomass and macroinvertebrate community indices at two sites upstream of the Longburn discharge and two sites downstream (undertaken in 2010, 2012 and 2016 by River Lake Ltd and in 2018 by Aquanet).
- Additional surveys of periphyton cover in January and April 2019 at two upstream sites and two downstream sites (conducted by Aquanet). *Note – These surveys included sites in a side stream upstream and downstream of the Fonterra Longburn discharge point. However, the purpose of this monitoring was to assess for the presence sewage fungus. As none was found, these monitoring results have not been included in body of this report although they are alluded to in the S107 assessment provided in Section 3.3.3.*
- A further ecological survey (periphyton cover, periphyton biomass and macroinvertebrates) undertaken at the same four sites in July 2019 (conducted by Aquanet).

Periphyton sampling methodologies were consistent through the assessment period. Periphyton biomass (chlorophyll-*a* and Ash Free Dry Weight) was measured following the protocols of Biggs and Kilroy (2000) (Method QM-1b) and periphyton cover was also visually assessed following the protocols of Kilroy *et al.* (2008). In contrast macroinvertebrate sampling

[2] Monitoring not required in months when the there was no discharge to the river.

methodologies differed slightly depending on the agency collecting the data. While both River Lake and Aquanet collected samples following the quantitative method for hard bottomed streams – Protocol C3 of (Stark *et al*. 2001), River Lake collected five replicates, each consisting of three pooled Surber samples, while Aquanet collected seven replicate samples, each consisting of a single Surber sample. Processing in both cases followed Protocol P3 (Full count with subsampling option) and QC3 (Quality control for full count with subsampling option) from the Ministry for the Environment "Protocols for sampling macroinvertebrates in wadeable streams" (Stark *et al*., 2001).

2.1.3. Flow

Flow data from the HRC flow recorder site on the Manawatū River at Teachers College were used to 'bin' water quality data based on (Table 4):

- Mean flow;
- Median flow;
- Half median flow; and
- The 20th flow exceedance percentile (FEP).

Table 4: Summary of flow statistics used in this assessment. Values were calculated from flow statistics for Teachers College recorder site presented in *Statistical analysis of river flow data in the Horizons Region*, NIWA 2011. All flows in L/s.

Site	Mean flow	Median flow	Half median flow	20th flow exceedance %ile
Manawatū River at Teachers College	116,604	73,402	36,702	164,281

2.2. Monitoring sites

2.2.1. Water quality

Water quality data were collected from sites on the Manawatū River upstream and downstream of where the discharge from the Longburn site enters the river (Figure 1).

2.2.2. Aquatic ecology

The current Resource Consent (APP-2003010585.02) requires that surveys of macroinvertebrate and periphyton communities be carried out at two sites within 200 metres upstream of the discharge and at two sites within 400-800 metres downstream of the discharge and during a period when flows in the Manawatū River have been less than 111 m^3/s for at least two weeks.

Data from the above samplings have been used in our assessment of the current ecological effects of the discharge from the Fonterra Longburn site. Coordinates for sites monitored are listed below in Table 5 and their positions shown in Figure 1.

Table 5: Sites on the Manawatū River sampled for macroinvertebrates and periphyton, 2010 - 2019.

Location	Latitude	Longitude
Upstream 1	40 23 55.33 S	175 33 24.49 E
Upstream 2	40 23 56.61 S	175 33 22.33 E
Downstream 400 m (sampled 2018 only)	40 24 06.73 S	175 33 16.31 E
Downstream 1	40 24 16.27 S	175 33 20.74 E
Downstream 2	40 24 25.20 S	175 33 23.16 E

It should be noted that field investigations carried out by Aquanet staff prior to the Spring 2018 sampling indicated that the first downstream site required by the Resource Consent (400 metres downstream) was not wadable (i.e., physically could not be sampled for macroinvertebrates or periphyton) from the true right bank (the side where the discharge is located). Wadable access was only possible from the true left bank. Given the channel characteristics of the Manawatū River between the discharge point and 400 metres downstream, it was considered that the discharge plume would not have reached the true left bank by 400 metres downstream of the discharge. This first downstream site was therefore not considered representative of conditions potentially affected by the Fonterra Longburn discharge and although sampled in 2018 (only), has been excluded from our analysis when comparing ecological data between upstream and downstream sites. The first sites physically accessible and wadable from the true right bank were located at 650 - 700 metres and 950 - 1000 metres downstream of the discharge (named Downstream 1 and Downstream 2 in this report). Locations for sampling at upstream and downstream sites have been kept consistent across monitoring undertaken by both River Lake Ltd and Aquanet Consulting.

Figure 1: Map showing location of sites sampled for discharge quality, surface water quality and sediment quality.

2.3. Data analysis

2.3.1. Water quality

Water quality data from sites on the Manawatū River upstream and downstream of the Longburn discharge were matched for each sampling date; if a parameter was absent for one site then the parameter for the other site was removed from the dataset for the purposes of statistical comparisons. Data were then categorised into one of six distinct flow "bins" according to river flow at the Teachers College HRC recorder site (i.e., data collected above the 20th FEP, below the 20th FEP, between the 20th FEP and median flow, below median flow, between median and half median flow and below half median flow). Clear outliers were removed from the dataset.

Water quality parameters in the Manawatū were compared upstream and downstream of the discharge across all flows and in each flow bin using Wilcoxon Signed Rank Tests (Real statistics). Detailed descriptive statistics, such as mean, median, distribution percentiles, standard error and confidence intervals were also calculated for each parameter at each site (Appendix A).

To help describe the effects of any observed changes in water quality in the Manawatū River downstream of the Longburn discharge, water quality data were assessed against the targets in the Horizons One Plan[3] and the attribute states in the National Policy Statement for Freshwater Management (NPS-FM) 2020. Specifically:

- pH, temperature, dissolved oxygen (DO), soluble carbonaceous five-day biochemical oxygen demand ($ScBOD_5$), particulate organic matter (POM), dissolved reactive phosphorus (DRP), soluble inorganic nitrogen (SIN) and ammoniacal nitrogen (NH_4-N) were assessed against the One Plan targets; and
- NH_4-N, nitrate nitrogen (NO_3-N), DRP and *E. coli* were assessed against the NPS-FM 2020 attribute states (One Plan targets set out in Table 6; NPS-FM attribute states are described in Appendix B).

The NPS-FM 2020 numeric attribute states for NH_4-N are based on pH 8 and temperature of 20°C; concentrations need to be adjusted for these parameters to assess compliance. Accordingly, NH_4-N concentrations recorded in the Manawatū River were converted to un-ionised ammonia (NH_3-N) concentrations[4] and assessed against NH_3-N thresholds that correspond to the NPS-FM 2020 NH_4-N attribute states[5].

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[3] All references to the One Plan in this report are to the web-based Operative version available on the Horizon's Regional Council (Horizons) website, accessed on 29th of June 2021, for water quality targets relevant to the Lower Manawatū management sub-zone (Mana_11a).

[4] Based on the measured water pH and temperature measured on the day of sampling.

[5] Calculated from percentage of total ammoniacal nitrogen composed of unionised ammonia nitrogen at pH of 8 and 20°C (3.8%).

Table 6: Summary Horizons One Plan water quality targets used in this assessment.

Parameter	Target as per Horizons One Plan (Full Wording of the Target)
pH	The pH of the water must be within the range 7 to 8.5 unless natural levels are already outside this range.
	The pH of the water must not be changed by more than 0.5.
Temp (°C)	The temperature of the water must not exceed 22 degrees Celsius.
	The temperature of the water must not be changed by more than 3 degrees Celsius.
DO (% SAT)	The concentration of dissolved oxygen (DO) must exceed 70 % of saturation.
$ScBOD_5$ (g/m^3)	The monthly average five-days filtered / soluble carbonaceous biochemical oxygen demand ($ScBOD_5$) when the Stream flow is at or below the 20th flow exceedance percentile must not exceed 2 grams per cubic metre.
POM (g/m^3)	The average concentration of particulate organic matter (POM) when the Stream flow is at or below the 50th flow exceedance percentile* must not exceed 5 grams per cubic metre.
Periphyton (Streams)	The algal biomass on the Stream bed must not exceed 120 milligrams of chlorophyll-*a* per square metre.
	The maximum cover of visible Stream bed by periphyton as filamentous algae more than 2 centimetres long must not exceed 30 %.
	The maximum cover of visible Stream bed by periphyton as diatoms or cyanobacteria more than 0.3 centimetres thick must not exceed 60 %.
DRP (g/m^3)	The annual average concentration of dissolved reactive phosphorus (DRP) when the Stream flow is at or below the 20th flow exceedance percentile* must not exceed 0.010 grams per cubic metre unless natural levels already exceed this target.
SIN (g/m^3)	The annual average concentration of soluble inorganic nitrogen (SIN) when the Stream flow is at or below the 20th flow exceedance percentile must not exceed 0.444 grams per cubic metre unless natural levels already exceed this target.
MCI	The Macroinvertebrate Community Index (MCI) must exceed 100 unless natural physical conditions are beyond the scope of application of the MCI. In cases where the Stream habitat is suitable for the application of the soft-bottomed variant of the MCI (sb-MCI) the Water Quality Target* (or standard where specified under conditions/standards/terms in a rule) also apply.
QMCI	There must be no more than a 20 % reduction in Quantitative Macroinvertebrate Community Index (QMCI) score between appropriately matched habitats upstream and downstream of discharges to water.
Ammoniacal Nitrogen	The average concentration of ammoniacal nitrogen must not exceed 0.400 grams per cubic metre.
	The maximum concentration of ammoniacal nitrogen must not exceed 2.1 grams per cubic metre
Visual Clarity	The visual clarity of the water measured as the horizontal sighting range of a black disc must not be reduced by more than 30 %.
	The visual clarity of the water measured as the horizontal sighting range of a black disc must equal or exceed 2.5 metres when the Stream is at or below the 50th flow exceedance percentile*
E. coli / 100 ml (Streams)	The concentration of Escherichia coli must not exceed 260 per 100 millilitres 1 November - 30 April (inclusive) when the Stream flow is at or below the 50th flow exceedance percentile*.
	The concentration of Escherichia coli must not exceed 550 per 100 millilitres year-round when the Stream flow is at or below the 20th flow exceedance percentile*.

2.3.2. Ecology

Periphyton

Periphyton is the brown or green slime coating stones, wood or any other stable surfaces in streams and rivers. In some situations, it can proliferate to form thick masses of green or brown filaments on the river bed degrading the aesthetic and recreational qualities of the river. Periphyton growth is generally controlled by a number of physical (e.g., river flow, sunlight, temperature), chemical (e.g., bioavailable nutrient concentration – DRP and SIN) and biological (e.g., grazing by invertebrates) factors.

The Ministry for the Environment guidelines for periphyton biomass and cover are presented in Table 7. The One Plan also defines targets for periphyton biomass (120 mg chlorophyll-*a*/m^2) and cover (30% filamentous algae over 2cm long; 60% cyanobacteria or diatom mats over 3mm thick) (see Table 6) and these targets have been used for assessment in this report.

Table 7: Provisional biomass and cover guidelines for periphyton growing in gravel/cobble bed streams for three main in-stream values. Reproduced from Table 14 Ministry for the Environment guidelines (Biggs and Kilroy 2000).

In-stream value/variable	Diatoms/cyanobacteria	Filamentous algae
Aesthetics/recreation (1 November – 30 April)		
Maximum cover of visible stream bed	60 % > 0.3 cm thick	30% > 2 cm long
Maximum chlorophyll-*a* (mg/m^2)	N/A	120
Benthic biodiversity		
Mean monthly chlorophyll-*a* (mg/m^2)	15	15
Maximum chlorophyll-*a* (mg/m^2)	50	50
Trout habitat and angling		
Maximum cover of whole stream bed	N/A	30% > 2 cm long
Maximum chlorophyll-*a* (mg/m^2)	200	120

Macroinvertebrates

Macroinvertebrates are good indicators of water quality and ecological health as they show a wide range of responses depending on their degree of sensitivity to pollution. For example, some taxa such as snails (Gastropod) and midges (Chironomidae) are generally considered to be tolerant of poor quality water, while others such as Ephemeroptera (mayflies) and Plecoptera (stoneflies) prefer good water quality. The macroinvertebrate community at a given site may be considered a result of the prevailing water quality at that site. Consequently, macroinvertebrates are used widely both in New Zealand (Stark 1985, Winterbourn 1999) and overseas (Rosenberg and Resh 1993, Hynes 1994) as indicators of ecological condition.

The following biological indices can be calculated to assess relationships between macroinvertebrate communities and water quality at a study site:

- The Macroinvertebrate Community Index (**MCI**) (Stark 1985) considers the presence of macroinvertebrates based on an assigned score which is dependent on their tolerance to pollution (1= highly tolerant, 10 = highly sensitive).

- The Quantitative Macroinvertebrate Community Index (**QMCI**) is similar to the MCI, but also takes into account the abundance of each species collected.
- Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies) (EPT) consist of insects which are generally sensitive to pollution. The percentage of **EPT taxa** is the proportion of all taxa collected that belong to one of these groups.

These biotic indices were calculated for each site and MCI and QMCI compared to the NPS-FM 2020 attribute state descriptions to provide an indication of the ecological effects of the Longburn discharge (Table 8). Statistical differences between sites were assessed using an Analysis of Variance (ANOVA) in Statistix 9. Values at $p < 0.05$ indicate a statistically significant change.

Table 8: Interpretation of MCI and QMCI values based on the National Policy Statement for Freshwater Management (NPS-FM, 2020).

Interpretation	MCI	QMCI
Excellent / Clean water	≥130	≥6.5
Good / Possible Mild pollution	≥110	≥5.5
Fair / Probable Moderate pollution	≥90	≥4.5
Poor / Probable Severe pollution	<90	<4.5

The Horizons One Plan also sets an MCI “State of the Environment” target of 100 for the Lower Manawatū Water Management Zone (Mana_11a) and requires that there should be no more than a 20% change in QMCI (see Table 6). These values have also been used for comparisons in this report.

2.3.3. Section 107(1) assessment

The data and analyses described in Section 2.1, Section 2.3.1 and Section 2.3.2 were used to make a qualitative assessment against the relevant standards set out in Section 107(1) of the Resource Management Act. Specifically, whether after reasonable mixing the Longburn discharge is likely to give rise to all or any of the following effects in the Manawatū River:

- Any conspicuous change in the colour or visual clarity;
- Any emission of objectionable odour;
- The rendering of fresh water unsuitable for consumption by farm animals; and/or
- Any significant adverse effects on aquatic life.

The Section 107(1) standards relating to odour, films, scums, foams and floatable and suspended materials are not considered in this report as relevant monitoring data are not available.

3. Current effects of the Longburn discharge

3.1. Effects on water quality

Water quality data collected between July 2011 and June 2021 upstream and downstream of where the Longburn discharge enters the Manawatū River are presented in Figure 2 to Figure 19 (mean concentrations with error bars representing the 95% confidence intervals (±95% CI)). Key water quality parameters are summarised and assessed against the relevant One Plan targets in Table 9. More detailed descriptive statistics for in-stream water quality data, such as mean, median, distribution percentiles, standard error and confidence intervals are presented in Appendix A.

Table 9: Summary of key water quality determinants measured in the Manawatū River upstream and downstream of the Longburn discharge, and assessment against One Plan water quality targets. July 2011 – June 2021. The most relevant assessment statistics are shaded and a full assessment against the One Plan targets is provided in Appendix A.

Para.	Unit	OP Target	Statistic	Applicable Flow	Site	Av.	Med.	20th %ile	95th %ile	N. samples	OP Target met?
NH_4-N	g/m^3	<0.4	Av.	All flows	U/S	0.096	0.085	0.050	0.208	172	✓
		<2.1	Max.		D/S	0.100	0.089	0.051	0.233	172	✓
SIN	g/m^3	<0.444	Av.	< 20th FEP	U/S	0.60	0.58	0.32	1.10	172	×
					D/S	0.61	0.59	0.34	1.11	172	×
DRP	g/m^3	<0.01		<20th FEP	U/S	0.020	0.020	0.010	0.037	172	×
					D/S	0.020	0.020	0.010	0.038	172	×
E. coli	/100mL	<260	95th %ile	< 50th FEP Summer	U/S	876	200	37	3968	49	×
					D/S	490	162	48	976	49	×
		<550		< 20th FEP	U/S	719	241	76	3126	147	×
					D/S	577	190	70	1683	147	×
Clarity	M	>2.5m	Min.	< 50th FEP	U/S	1.4	1.5	0.6	3.1	75	×
					D/S	1.3	1.3	0.3	3.0	98	×
Clarity Δ	%	<30		All flows		3%	3%	-7%	34%	3%	✓
POM	g/m^3	<5	Av.	<50th FEP	U/S	8.0	1.5	1.5	20.3	115	×
					D/S	10.2	1.5	1.5	25.9	115	×
pH	Unitless	7-8.5	Min.-Max.	All flows	U/S	7.792	7.635	7.500	8.921	172	✓
					D/S	7.763	7.685	7.500	8.620	172	✓
pH Δ	%	<0.5	Max	All flows		-0.03	0.00	-0.10	0.24	169	✓
Temp.	ºC	<22		All flows	U/S	14.8	14.2	10.7	21.8	115	✓
					D/S	14.7	14.5	10.8	21.7	115	✓
Temp Δ	%	<3		All flows		-0.07	0.00	-0.31	0.57	114	✓
$ScBOD_5$	g/m^3	<2	Av.	< 20th FEP	U/S	0.8	0.5	0.5	2.0	172	✓
					D/S	0.8	0.5	0.5	2.0	171	✓
DO sat.	%	>70	Min.	All flows	U/S	109.1	97.8	94.8	155.1	115	✓
					D/S	102.7	97.6	94.9	135.7	115	✓

3.1.1. Ammoniacal nitrogen

Between July 2011 and June 2021 statistically significant increases in NH_4-N concentrations were not observed between the upstream and downstream monitoring sites on the Manawatū River in any flow bin (Figure 2 and Appendix A). However, across most flow bins average concentrations were marginally higher at the downstream site, and there is general pattern of concentrations increasing as flows decrease (Figure 2 and Appendix A).

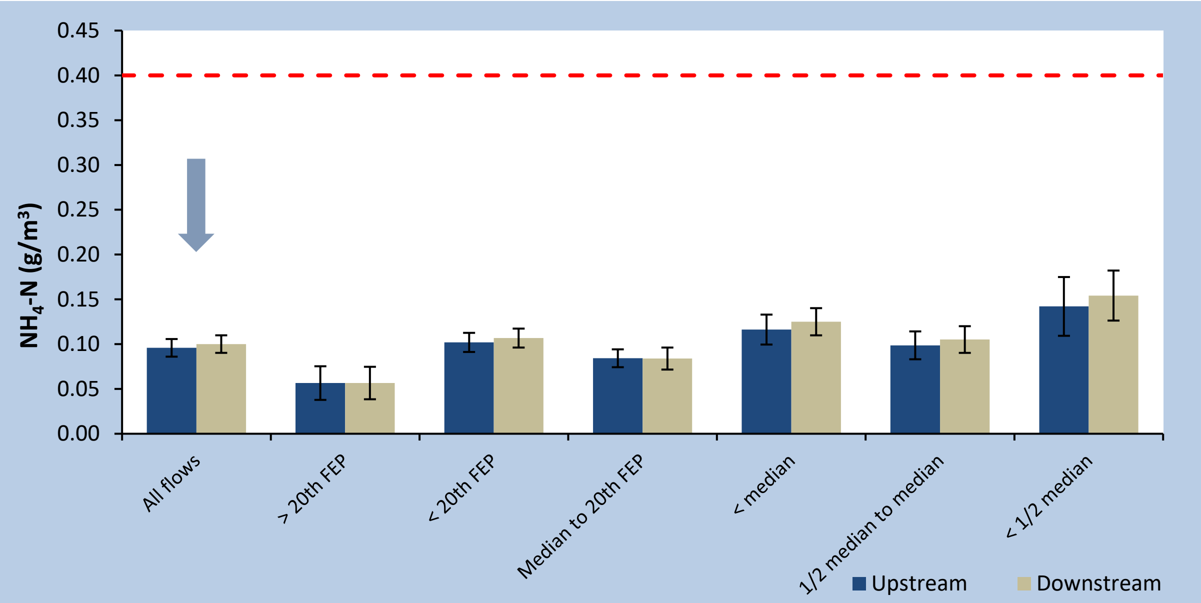

Figure 2: Mean Ammoniacal NH_4-N (± 95% CI) for sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows. The One Plan target for NH_4-N (chronic exposure) is represented as a dashed red line. The blue arrow indicates the flow "bin" to which the One Plan target applies.

Assessment against One Plan targets

The Horizons One Plan sets two in-stream targets for NH_4-N:

- *The average concentration of ammoniacal nitrogen must not exceed 0.400 grams per cubic metre; and*
- *The maximum concentration of ammoniacal nitrogen must not exceed 2.1 grams per cubic metre.*

All recorded concentrations at sites both upstream and downstream of the Longburn discharge were below the One Plan targets (maximum concentration upstream = 0.35 g/m^3, maximum concentration downstream = 0.38 g/m^3) (Appendix A).

Assessment against NPS-FM 2020 attribute states

Between July 2011 and June 2021 unionised ammonia (NH_3-N) concentrations at sites upstream and downstream of the Longburn discharge were assigned to attribute state C for ammonia toxicity under the NPS-FM 2020 and failed to meet the national bottom line for this attribute (based on the overall average of rolling annual median and maximum concentrations) (Table 10). During this period NH_3-N concentrations generally fell within the C attribute state at the upstream site (graded as C on 134 occasions), while the downstream site was in attribute state B slightly more often than it was in attribute state C f (graded as B on 83 occasions and C on 81 occasions) (Figure 3 and Figure 4). These results suggests that, for most of the time, between 5 and 20% of the most sensitive species were impacted by ammonia toxicity at both sites.

Table 10: NPS-FM 2020 Ammonia (NH_3-N)Attribute State calculations for sites sampled on the Manawatū River (July 2011-June 2021).

Statistic	Upstream	Downstream
Av. median (ppb)	2.22	2.42
Av. maximum (ppb)	29.22	19.85
Av. median state	B	B
Av. maximum state	C	C
Overall state	C	C
In A	0	0
In B	32	83
In C	132	81
In D	0	0

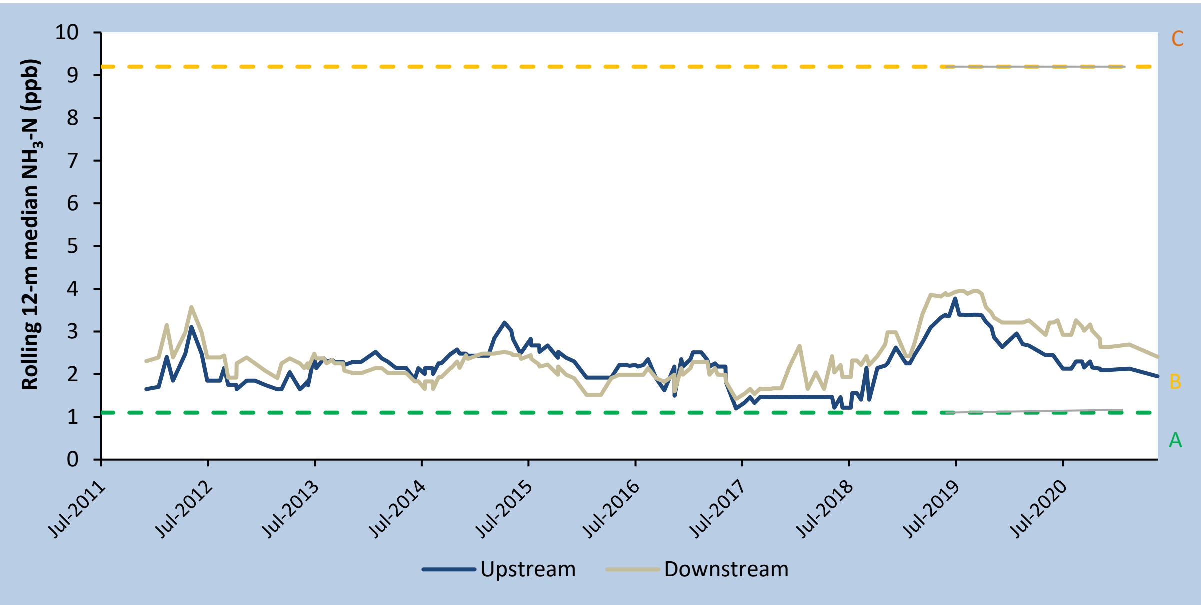

Figure 3: Rolling annual median NH_3-N concentrations at sites sampled on Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge. The thresholds between the NPS-FM 2020 Attribute States (A/B, and B/C) are indicated by the dashed lines.

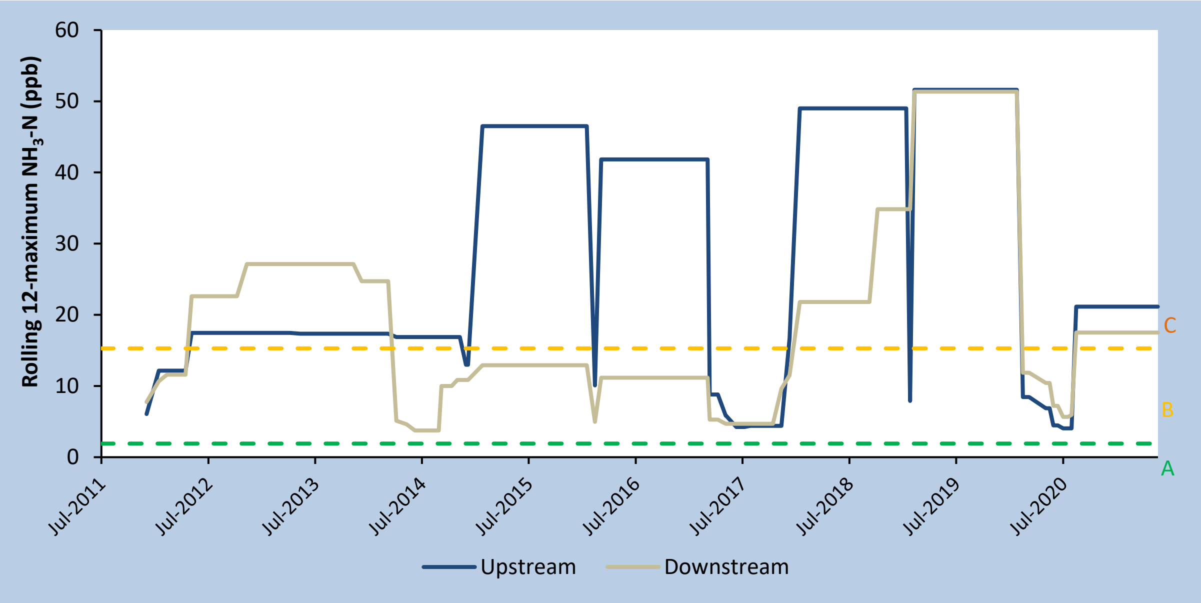

Figure 4: Rolling annual maximum NH_3-N concentrations at sites sampled on Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge. The thresholds between the NPS-FM 2020 Attribute States (A/B, B/C, C/D) are indicated by the dashed lines.

3.1.2. Nitrate nitrogen

Between July 2011 and June 2021 statistically significant increases in NO_3-N concentrations were observed between the upstream and downstream monitoring sites on the Manawatū River in all flow bins except above the 20th FEP and between the median and the 20th FEP (Figure 5 and Appendix A). NO_3-N concentrations at both sites were lowest at flows below half median.

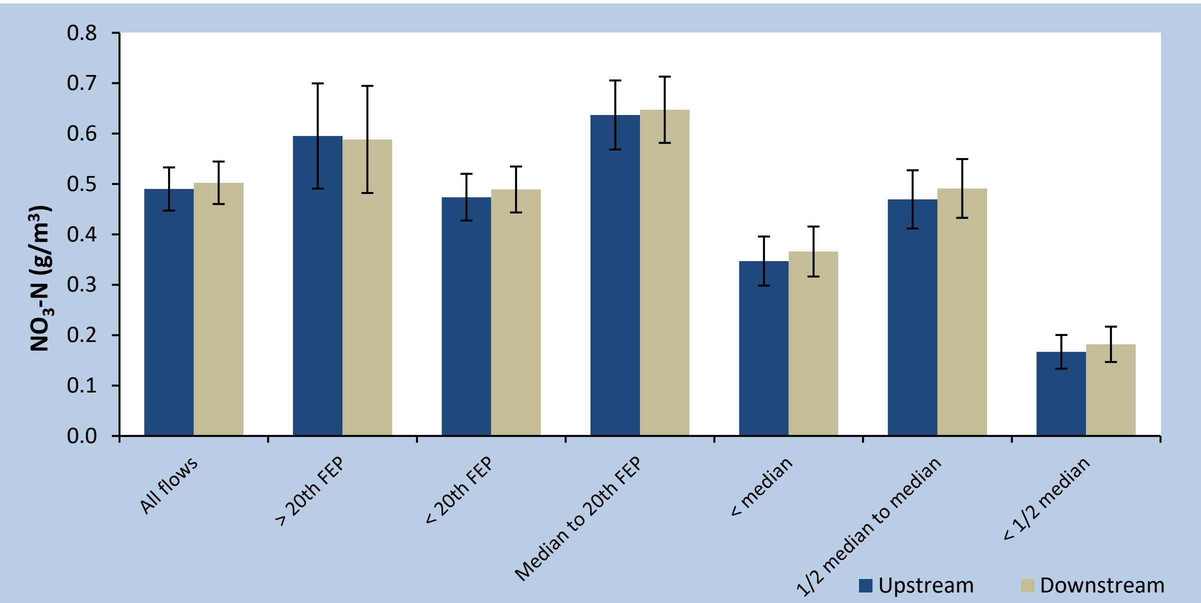

Figure 5: Mean NO_3-N concentrations (± 95% CI) at sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows.

Assessment against NPS-FM 2020 attribute states

Between July 2011 and June 2021, NO_3-N concentrations in the Manawatū River upstream and downstream of the Longburn discharge were assigned to attribute state A under the NPS-FM 2020 (based on the overall average of rolling annual median and 95th percentile concentrations) (Table 11). During this period NO_3-N concentrations were always within the A attribute state (Figure 6 and Figure 7), meaning that there was unlikely to be nitrate toxicity effects, even on sensitive species.

Table 11: NPS-FM 2020 Nitrate Attribute State calculations for sites sampled on the Manawatū River (July 2011-June 2021).

Statistic	Upstream	Downstream
Av. median (g/m^3)	0.48	0.50
Av. 95th %ile (g/m^3)	0.93	0.95
Av. median state	A	A
Av. 95th %ile state	A	A
Overall state	A	A
In A	164	164
In B	0	0
In C	0	0
In D	0	0

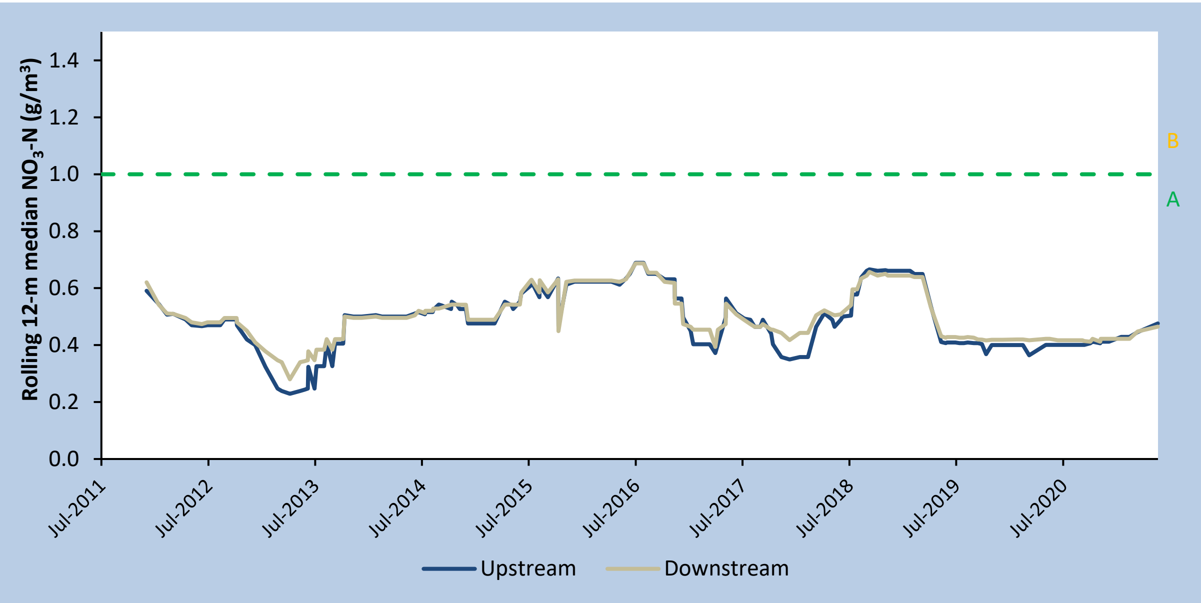

Figure 6: Rolling Annual NO_3-N concentrations at sites sampled on Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge. The threshold between the NPS-FM 2020 A and B attribute states are indicated by the dashed line.

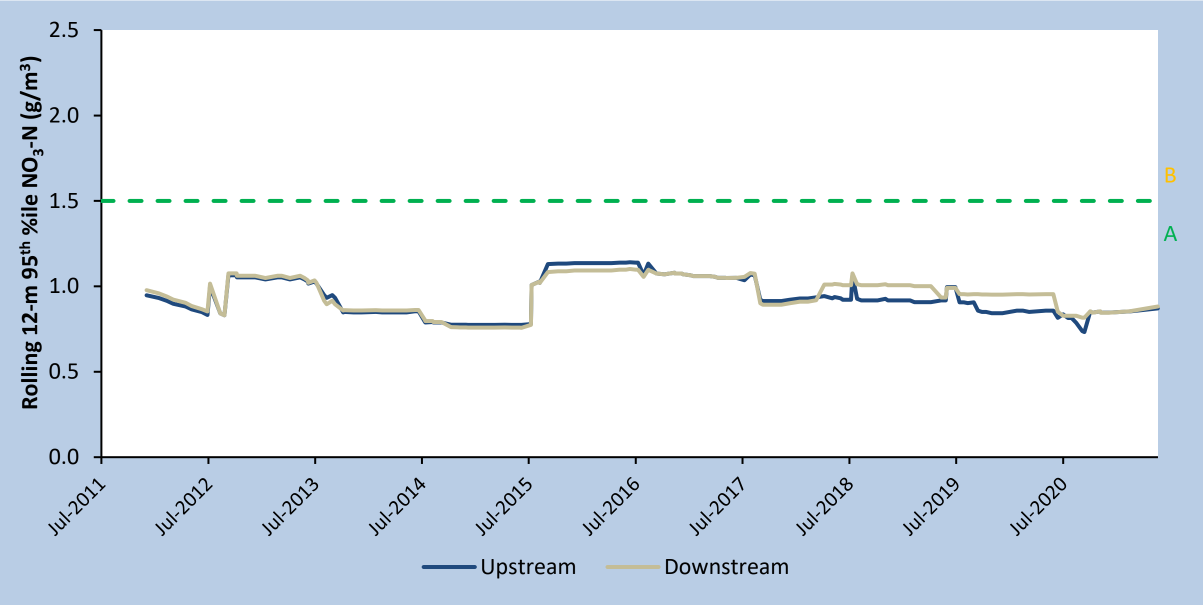

Figure 7: Rolling Annual 95th Percentile NO_3-N concentrations at sites sampled on Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge. The threshold between the NPS-FM 2020 A and B attribute states are indicated by the dashed line.

3.1.3. Soluble inorganic nitrogen

As with NO_3-N, statistically significant increases in SIN concentrations were observed between the upstream and downstream monitoring sites on the Manawatū River in all flow bins except above the 20th FEP and between the median and the 20th FEP (Figure 8 and Appendix A), with the lowest concentrations occurring at flows below half median.

<u>*Assessment against One Plan targets*</u>

The Horizons One Plan sets one in-stream target for SIN:

- *The annual average concentration of soluble inorganic nitrogen (SIN) when the Stream flow is at or below the 20th flow exceedance percentile must not exceed 0.444 grams per cubic metre unless natural levels already exceed this target.*

Average SIN concentrations in the Manawatū River exceeded the One Plan target at flows below the 20th FEP both upstream and downstream of the Longburn discharge (Figure 8).

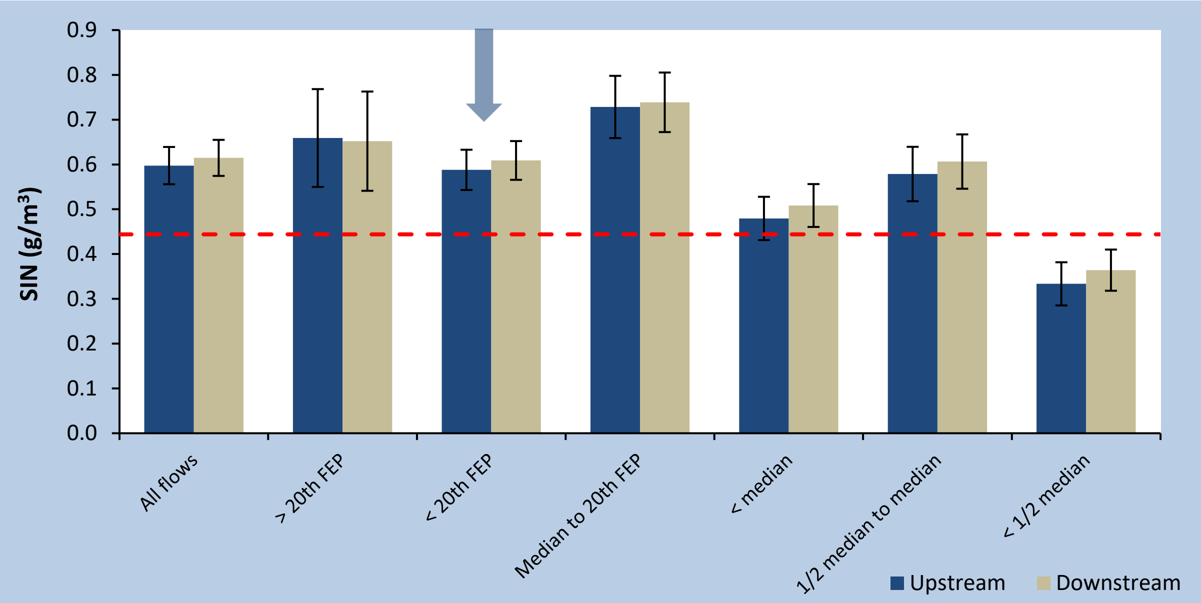

Figure 8: Mean SIN (± 95% CI) at sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows. The One Plan target for SIN is represented as a dashed red line. The blue arrow indicates the flow "bin" to which the One Plan target applies.

3.1.4. Dissolved reactive phosphorus

Between July 2011 and June 2021 statistically significant increases in DRP concentrations were not observed between the upstream and downstream monitoring sites on the Manawatū River in any flow bin (Figure 9 and Appendix A).

<u>*Assessment against One Plan targets*</u>

The Horizons One Plan sets one in-stream target for DRP:

- *The annual average concentration of dissolved reactive phosphorus (DRP) when the Stream flow is at or below the 20th flow exceedance percentile must not exceed 0.010 grams per cubic metre unless natural levels already exceed this target.*

Average DRP concentrations in the Manawatū River upstream and downstream of the Longburn discharge exceeded the One Plan target at flows below the 20^{th} FEP (Figure 9), and the discharge does not appear to be increasing the magnitude or frequency of exceedances at the downstream site.

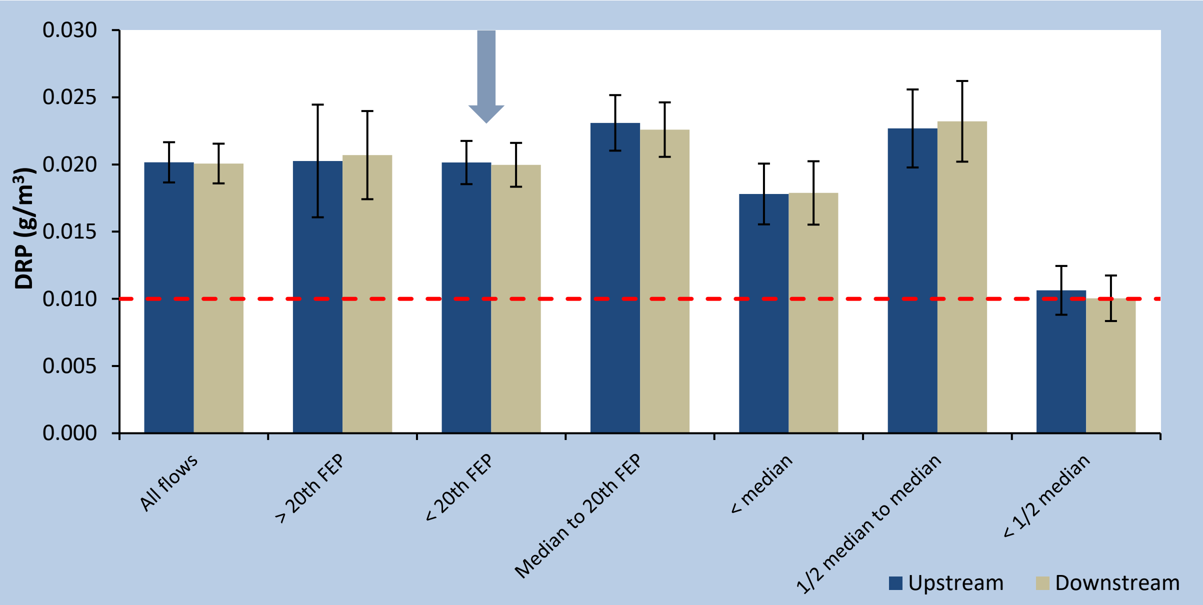

Figure 9: Mean DRP (± 95% CI) at sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn site at various stream flows. The One Plan target for DRP is represented as a dashed red line. The blue arrow indicates the flow "bin" to which the One Plan target applies.

3.1.5. *E. coli*

Statistically significant <u>decreases</u> in *E. coli* concentrations were found between the upstream and downstream monitoring sites on the Manawatū River at all flows, above the 20th FEP and below the median and half median (Figure 11, Figure 12, Figure 10, and Appendix A).

<u>Assessment against One Plan targets</u>

The Horizons One Plan set two in-stream targets for *E. coli*[6]:

- *The concentration of Escherichia coli must not exceed 260 per 100 millilitres 1 November - 30 April (inclusive) when the Stream flow is at or below the 50th flow exceedance percentile; and*
- *The concentration of Escherichia coli must not exceed 550 per 100 millilitres year-round when the Stream flow is at or below the 20th flow exceedance percentile.*

The targets are based on the New Zealand Microbiological water quality guidelines for marine and freshwater areas (MfE/MoH, 2003), which defines a three-tier surveillance framework. The "green mode" (single sample ≤ 260 *E. coli*/100mL) corresponds to a low level of health risk to recreational users of the water body, the "Amber" mode (single sample between 260 and 550 *E. coli*/100mL) indicates a more elevated, yet still acceptable, health risk and the "Red" mode (single sample in excess of 550 *E. coli*/100mL) means that the health risk to swimmers is unacceptable, and the site should be considered unsuitable for swimming.

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[6] The technical report underpinning the definition the One Plan *E. coli* targets recommends a compliance level of 95%.

Between July 2011 and June 2021, the One Plan summer season target of 260 *E. coli* /100mL was met on 26 (53%) sampling occasions upstream of the Longburn site and 32 (65%) occasions downstream of the Longburn site at flows below the median (Figure 11). The year-round target was exceeded on 42 out of 147 sampling occasions upstream of the discharge and 33 out of 147 sampling occasions downstream (at flows below the 20th FEP) (Figure 12). However, both sites had 95th percentile concentrations above the target in that flow bin (Appendix A).

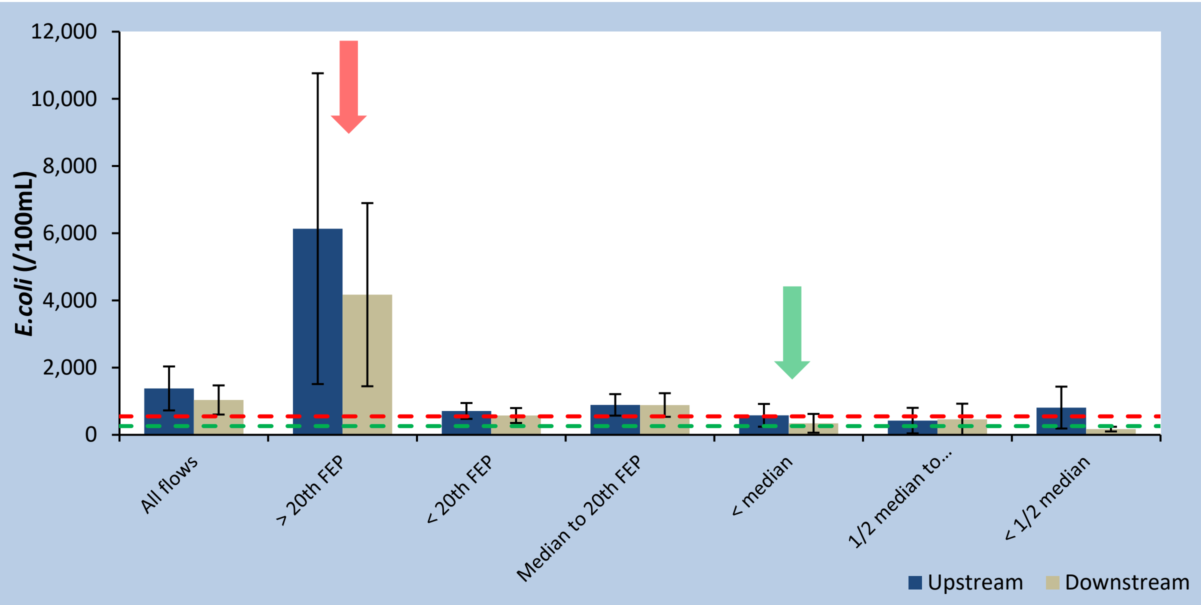

Figure 10: Average concentrations of *E. coli* (± 95% CI) at sites sampled on the on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows. One Plan targets for *E. coli* are represented as dashed lines (green = summer target; red = year round target), with the colour arrows depicting the most relevant flow bin.

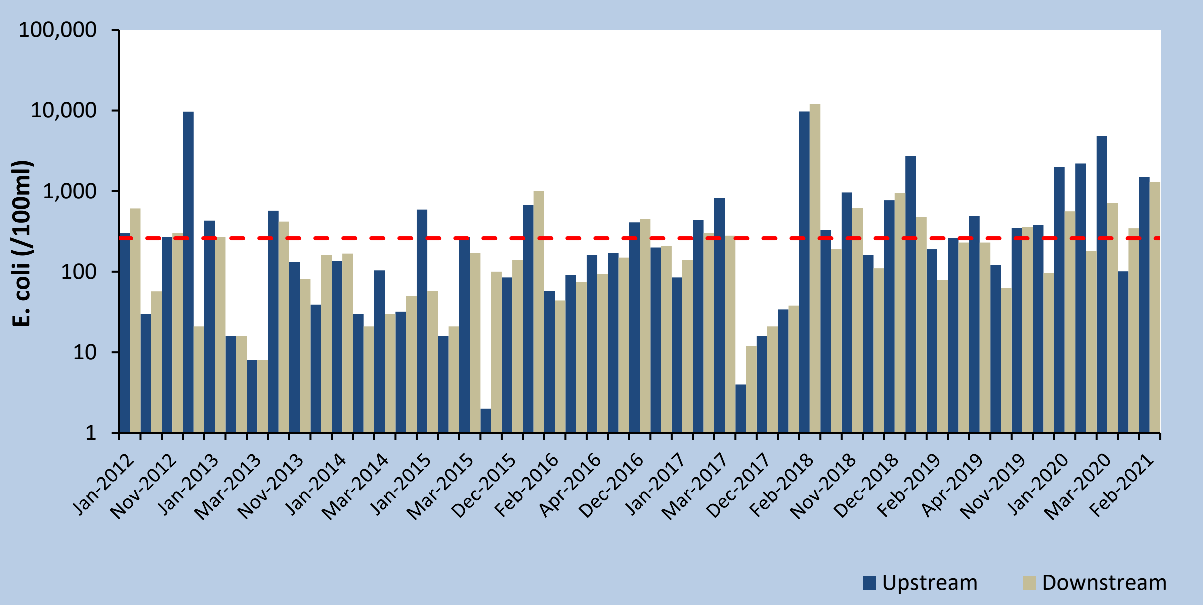

Figure 11: Monthly *E. coli* concentrations (Log scale) during summer months at sites sampled on the on the Manawatū River (2012-2020) upstream and downstream of the Longburn discharge at or below Median flow. The One Plan target for *E. coli* (summer bathing season) is represented as a dashed red line.

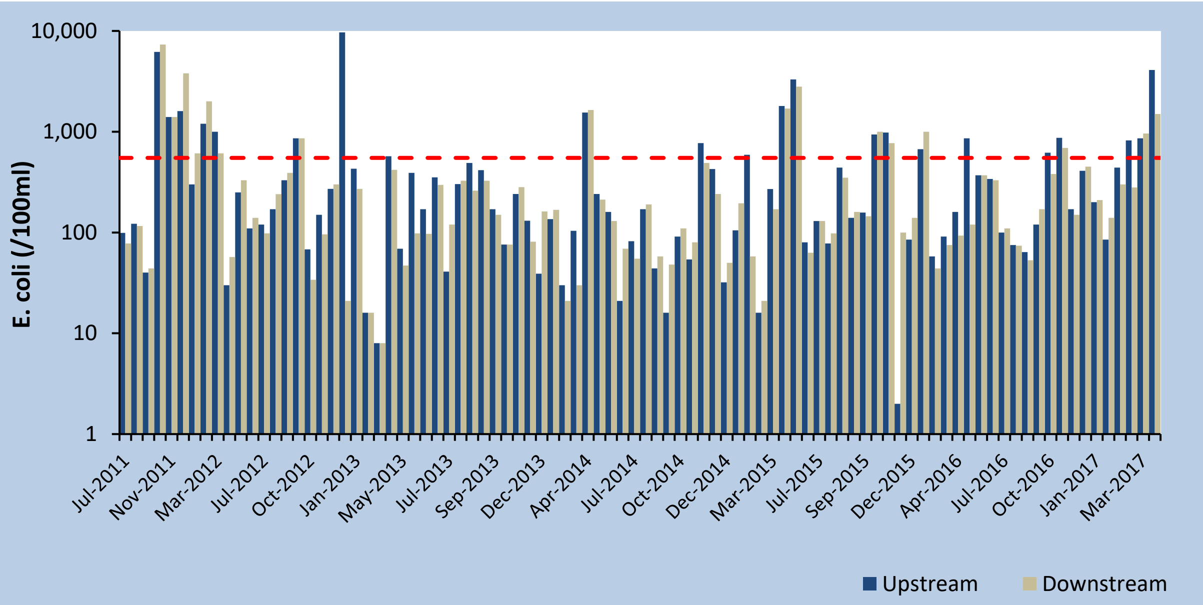

Figure 12: Monthly *E. coli* concentrations (Log scale) year-round at sites sampled on the on the Manawatū River (2011-2020) upstream and downstream of the Longburn discharge at flows below the 20th FEP. The One Plan target for *E. coli* (year-round) is represented as a dashed red line.

Assessment against NPS-FM 2020 attribute states

The NPS-FM 2020 describes five "Attribute states" (A-E) which provide different levels of protection for primary contact recreation. The attribute states set thresholds for the percentage of exceedances over 540 MPN/100ml, the percentage of exceedances over 260 MPN/100ml, the median concentration and the 95th percentile of *E. coli*/100ml based on a minimum of 60 samples over a maximum of 5 years. Rivers and lakes with *E. coli* concentrations that fall into attribute states A, B and C are considered suitable for primary contact recreation, those with *E. coli* concentrations in attribute states D and E are not (see Appendix B for the NPS-FM narrative attribute states).

An assessment of *E. coli* concentrations measured at the different sites against the different attribute states of the NPS-FM 2020 is provided in Table 12. The site upstream of the discharge was assigned to attribute state E. This means that for more than 30% of the time the estimated risk of *campylobacter* infection is greater than 50 in 1000 (>5% risk). In contrast the site downstream of the discharge was assigned to attribute state D, meaning that for more than 20% of the time the estimated risk of *campylobacter* infection is greater than 50 in 1000 (>5% risk). However, due to potential sampling bias (see Section 3.1.9), it would be inappropriate to consider the differences in attribute states between sites as an indication of improving water quality downstream of the Longburn discharge.

Table 12: NPS-FM 2020 attribute states for *E. coli* upstream and downstream of the Longburn discharge.

Site name	Water year	% above 540 cfu/100mL	% above 260 cfu/100mL	Median (cfu/100mL)	95th (cfu/100mL)	Attribute state	Swimmable	n=
Upstream	2015	29	45	170	3510	D	No	84
Upstream	2016	28	45	170	3930	D	No	92
Upstream	2017	30	46	186	4500	D	No	90
Upstream	2018	37	51	270	5678	E	No	92
Upstream	2019	39	56	353	5480	E	No	90
Upstream	2020	41	60	355	6665	E	No	84
Upstream	Average	34	50	251	4961	E	No	89
Downstream	2015	24	39	161	2463	24	No	87
Downstream	2016	21	38	165	1980	21	No	84
Downstream	2017	26	40	173	3300	26	No	92
Downstream	2018	30	43	193	5200	30	No	90
Downstream	2019	32	50	259	5200	32	No	92
Downstream	2020	37	56	320	8030	37	No	90
Downstream	Average	28	45	212	4362	D	No	89

3.1.6. Visual clarity

Between July 2011 and June 2021 statistically significant decreases in visual clarity were detected between the upstream and downstream monitoring sites on the Manawatū River at all flows and at flows below the 20th FEP. However, the average difference between sites in these flow bins was small (<4%). Statistically significant increases (improvements) in visual clarity were recorded at flows below the median and half median (Figure 13 and Appendix A).

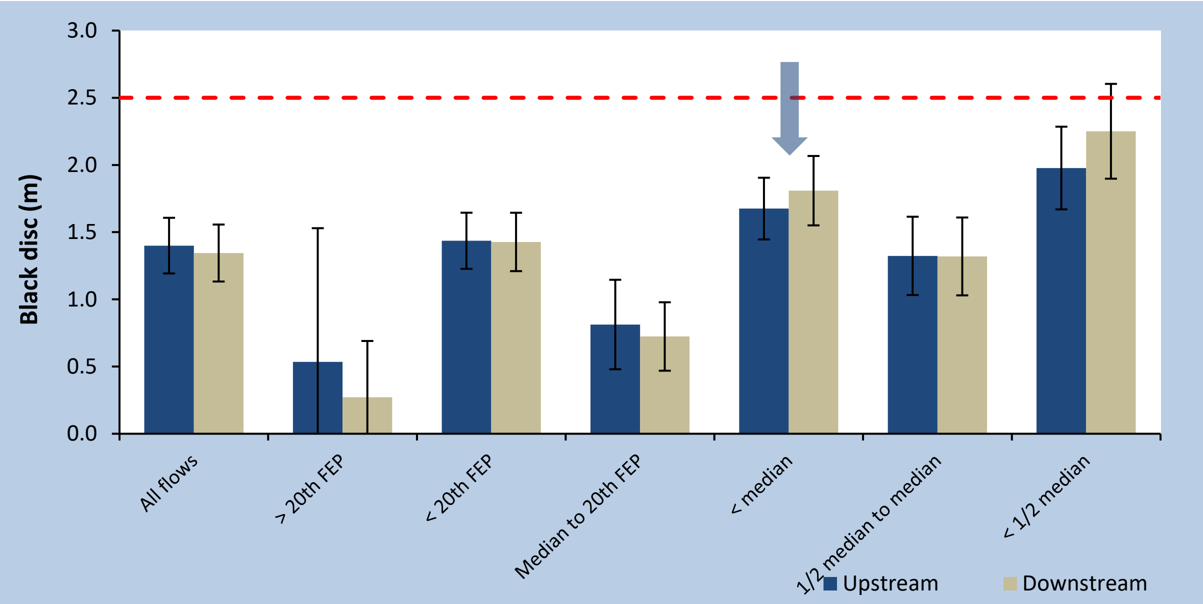

Figure 13: Mean (bars) and 20th percentile (crosses) black disk (± 95% CI) at sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows. The One Plan target for black disk is represented as a dashed red line. The blue arrow indicates flows, below which the One Plan target applies.

<u>*Assessment against One Plan targets*</u>

The Horizons One Plan sets two in-stream targets for visual clarity:

- *The visual clarity of the water measured as the horizontal sighting range of a black disc must not be reduced by more than 30 %; and*
- *The visual clarity of the water measured as the horizontal sighting range of a black disc must equal or exceed 2.5 metres when the Stream is at or below the 50th flow exceedance percentile.*

Average black disc readings both upstream and downstream of the Longburn discharge were below (i.e., did not meet) the One Plan target of 2.5 m minimum visual clarity at flows below median (Figure 13).

Comparisons of upstream versus downstream visual clarity readings on individual days, indicates that there was a reduction in visual clarity of more than 30% between the upstream and downstream monitoring sites on the Manawatū River on just 3 out of the 75 paired upstream/downstream measurements (96% compliance); all of which occurred prior to 2015 (Figure 14).

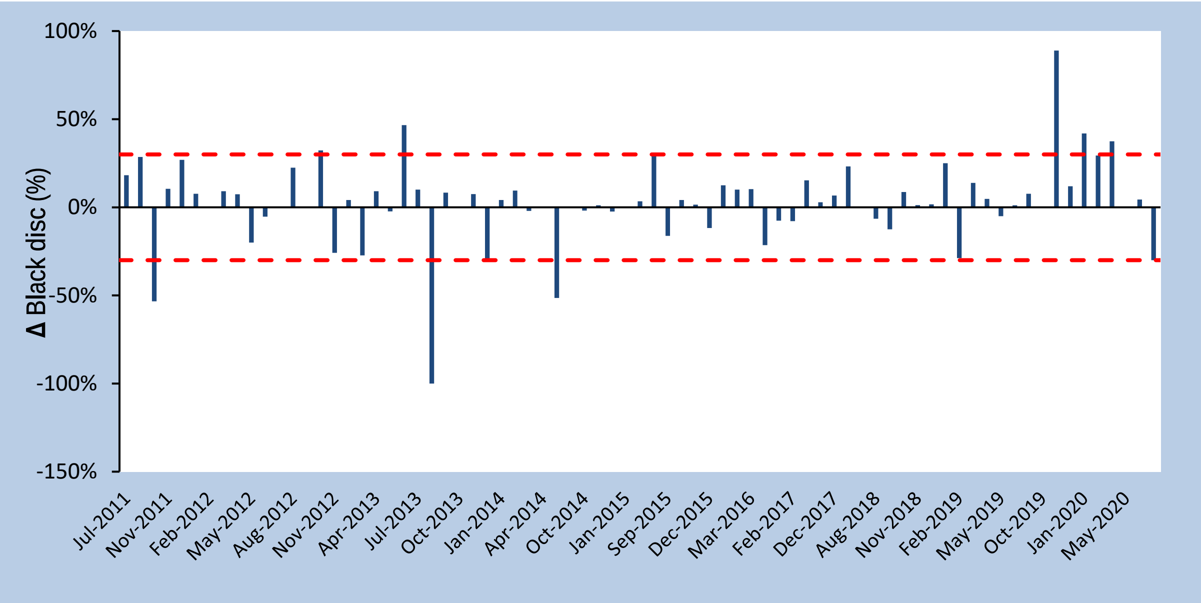

Figure 14: Percent change in visual clarity (measured with a black disc) between upstream and downstream of the Longburn discharge to the Manawatū River, sampled July 2011 – November 2019. Dashed red lines indicate a change of ±30 percent.

3.1.7. Particulate organic matter and biochemical oxygen demand

Between July 2011 and June 2021 concentrations of POM and $ScBOD_5$ in the Manawatū River did not differ significantly between the upstream and downstream sites in any flow bins (Figure 15, Figure 16 and Appendix A).

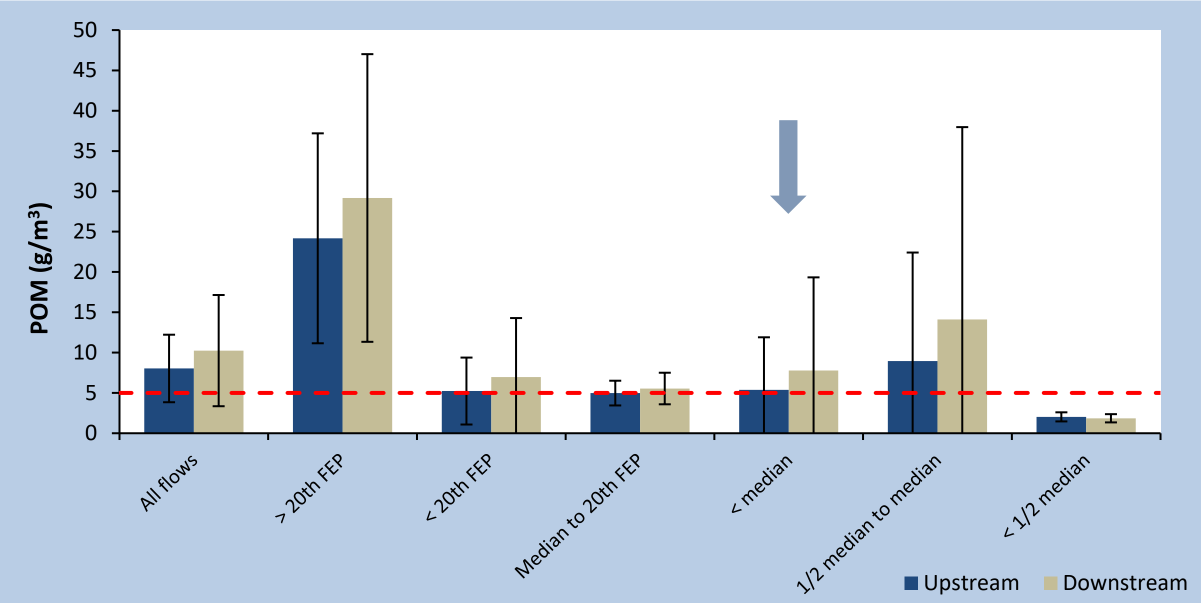

Figure 15: Mean POM (± 95% CI) at sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows. The Consent limit and One Plan target for POM are represented as a dashed red line. The arrows indicate flows, below which the Consent limit (orange) and One Plan (grey) target apply.

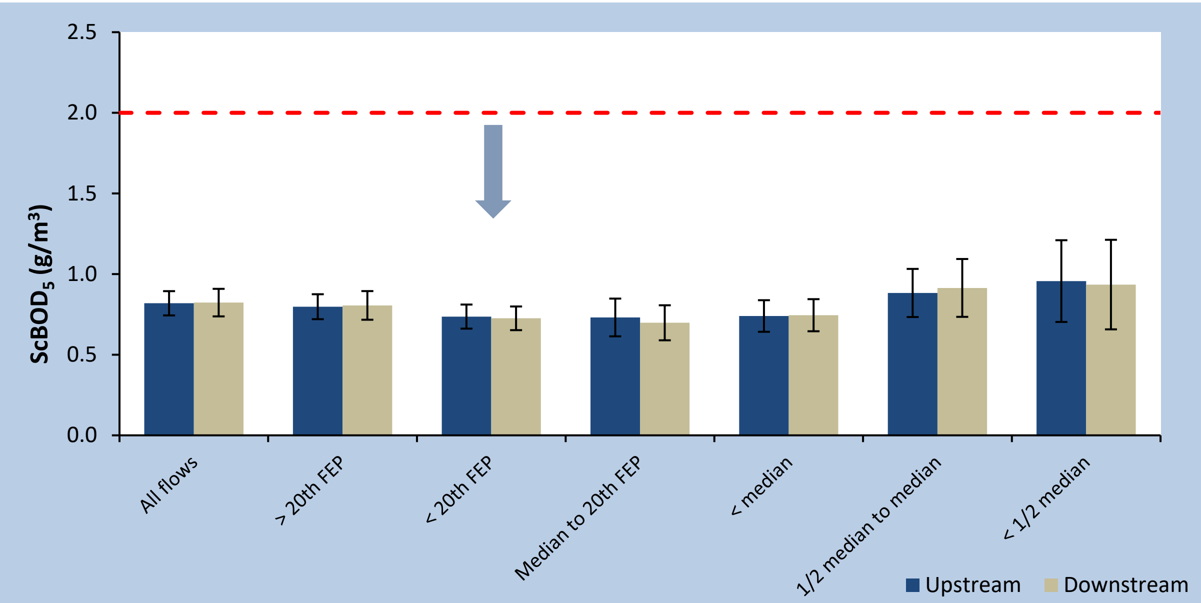

Figure 16: Mean ScBOD5 (± 95% CI) at sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows. The Consent limit and One Plan target for ScBOD$_5$ are represented as a dashed red line. The arrows indicate flows, below which the Consent limit (orange) and One Plan (grey) target apply.

Assessment against One Plan targets

The Horizons One Plan sets one in-stream limit for POM and one in-stream limit for $ScBOD_5$:

- *The average concentration of particulate organic matter (POM) when the Stream flow is at or below the 50th flow exceedance percentile must not exceed 5 grams per cubic metre; and*
- *The monthly average five-days filtered / soluble carbonaceous biochemical oxygen demand ($ScBOD_5$) when the Stream flow is at or below the 20th flow exceedance percentile must not exceed 2 grams per cubic metre.*

POM concentrations in the Manawatū River upstream and downstream of the Longburn discharge exceeded the One Plan target at flows below the median (Figure 15 and Appendix A). In contrast average $ScBOD_5$ concentrations at flows below the 20th FEP in the Manawatū River met the One Plan target both upstream and downstream of the Longburn discharge (Figure 16 and Appendix A).

3.1.8. pH, temperature and dissolved oxygen

Statistically significant increases in pH were observed between the upstream and downstream monitoring sites on the Manawatū River at flows between the median and the 20th FEP (Figure 17 and Appendix A).

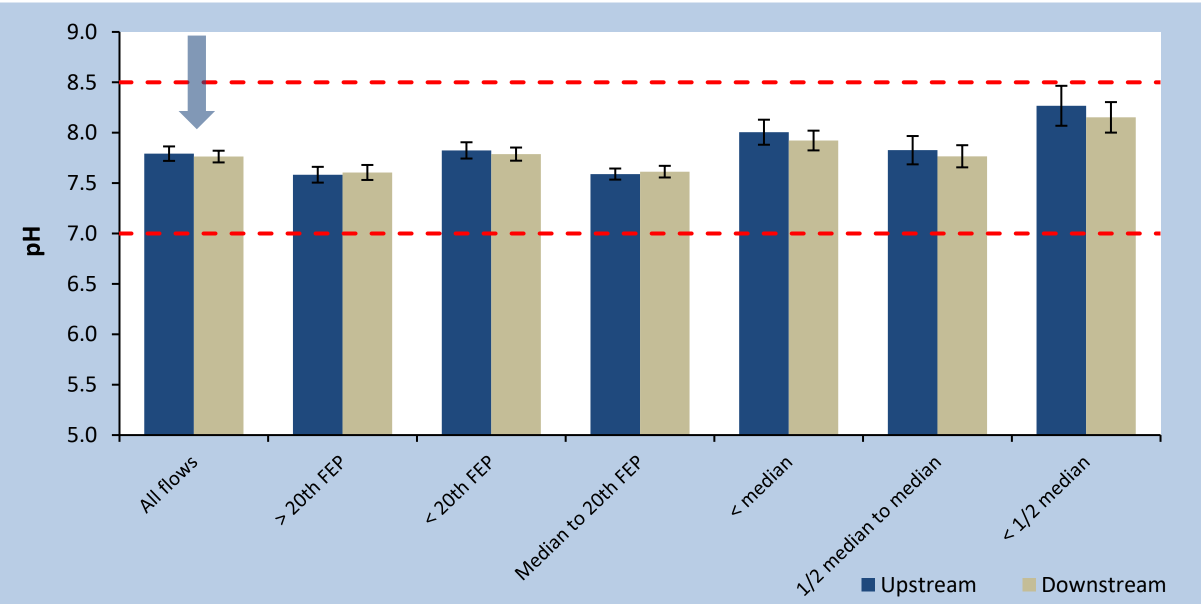

Figure 17: Mean pH (± 95% CI) for sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows. The One Plan targets for pH are represented as dashed red lines.

Statistically significant decreases in temperature were observed between the upstream and downstream monitoring sites on the Manawatū River at flows below the median and below the half median, while statistically significant but small (average = 0.01 °C) increases were found at flows above the 20th FEP (Figure 18 and Appendix A).

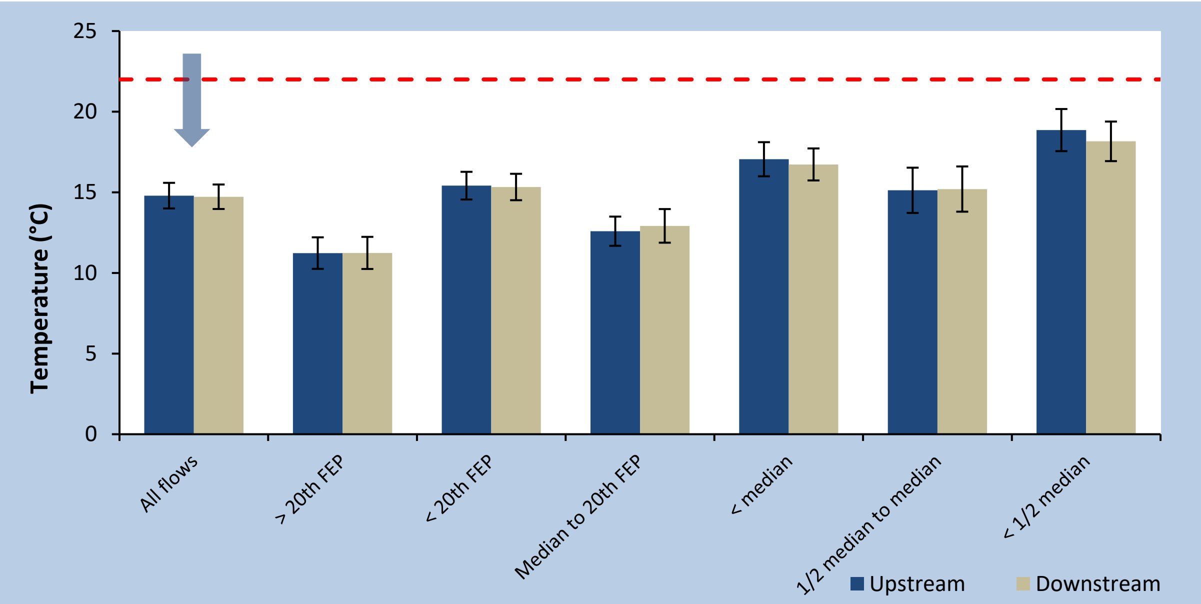

Figure 18: Mean Temperature (± 95% CI) for sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows. The One Plan target is represented as a dashed red line.

Statistically significant decreases in DO saturations were observed between the upstream and downstream monitoring sites on the Manawatū River at all flows, flows below the 20th FEP, flows below the median and flows below the half median (Figure 19 and Appendix A). However, in all flow bins average DO saturation at the downstream site was at or near 100%, indicating that the statistically significant decreases in some flow bins may be the result of supersaturation at the upstream site (due to photosynthesis), rather than adverse effects caused by the discharge (a reduction from 120 to 110% saturation is not a negative effect).

Assessment against One Plan targets

The Horizons One Plan sets two in-stream targets for pH, two in-stream targets for temperature and one in-stream target for DO:

- *The pH of the water must be within the range 7.0 to 8.5 unless natural levels are already outside this range;*
- *The pH of the water must not be changed by more than 0.5;*
- *The temperature of the water must not exceed 22 degrees Celsius;*
- *The temperature of the water must not be changed by more than 3 degrees Celsius; and*
- *The concentration of dissolved oxygen must exceed 70 % of saturation.*

pH was within the One Plan target range (7.0 to 8.5) 88 % of the time upstream and 91% of the time downstream of the Longburn discharge (Figure 17). The One Plan target of no more than a 0.5 pH unit change between sites was complied with on all but 13 monitoring occasions between 2011 and 2021 (92% compliance) (Figure 20).

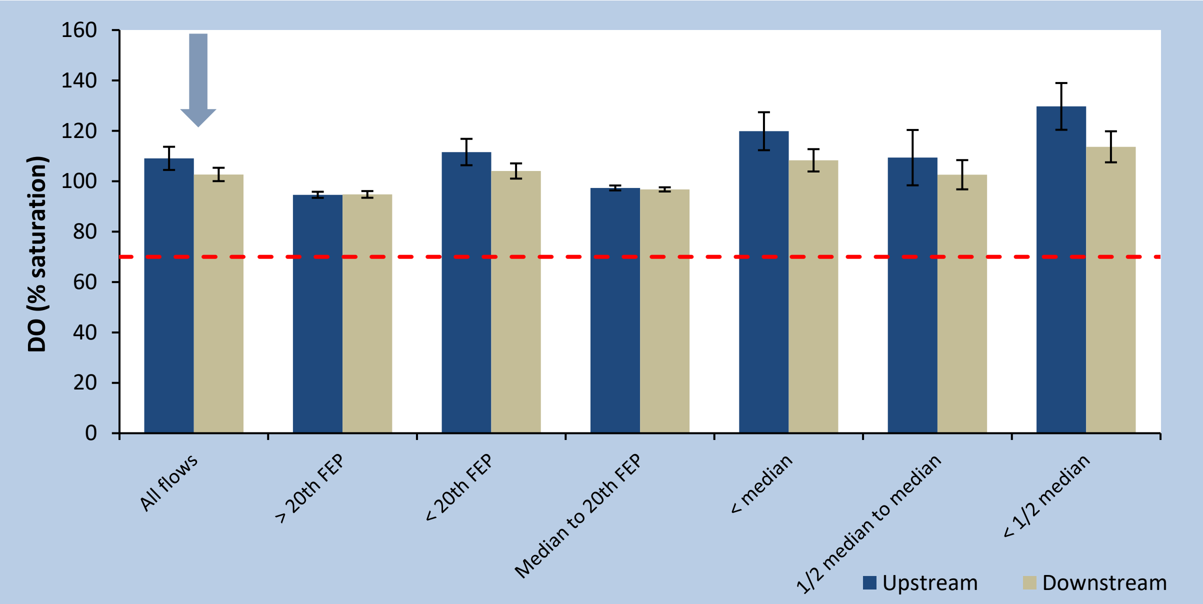

Figure 19: Mean (bars) and 95th percentile (crosses) DO (% saturation) (± 95% CI) for sites sampled on the Manawatū River (July 2011 – June 2021) upstream and downstream of the Longburn discharge at various flows. The One Plan target for DO (% saturation) is represented as a dashed red line.

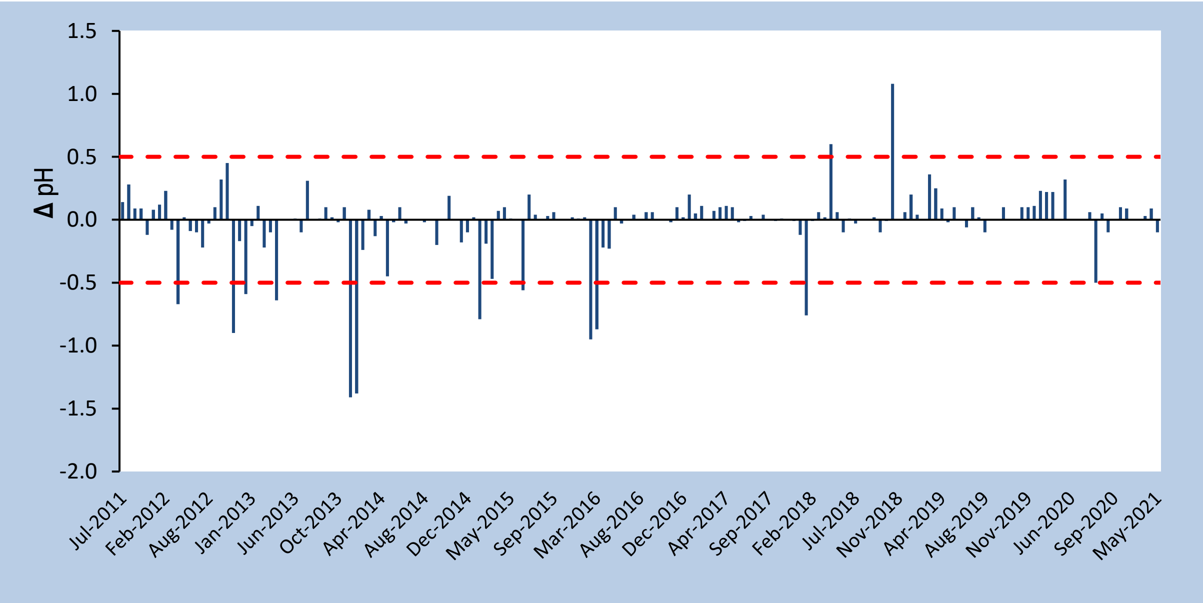

Figure 20: Change in pH between upstream and downstream of the Longburn discharge to the Manawatū River, sampled July 2011 – November 2019. Dashed red lines indicate a change of 0.5 units.

Water temperatures in the Manawatū River were below the One Plan target of 22°C on 96% of sampling occasions upstream of the Longburn site and 97% of sampling occasions downstream (Figure 18 and Appendix A). The One Plan target of no more than a 3°C change in temperature was also complied with on all but three monitoring occasions (Figure 21).

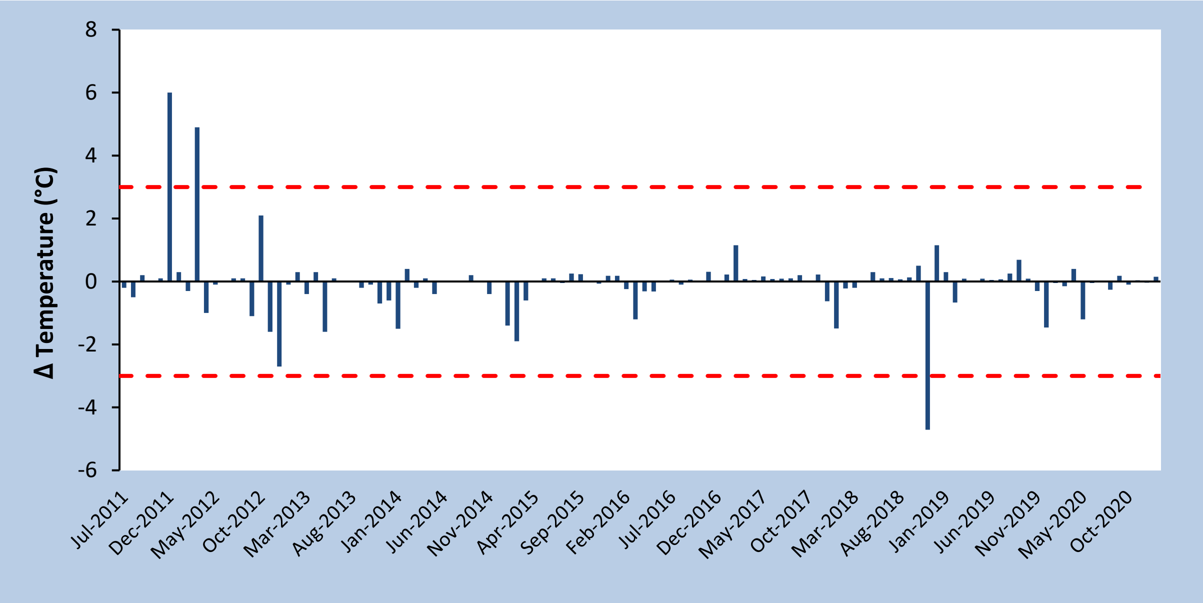

Figure 21: Change in water temperature between upstream and downstream of the Longburn discharge to the Manawatū River, sampled July 2011 – November 2019. Dashed red lines indicate a change of 2°C.

DO saturation in the Manawatū River was above (i.e., met) the One Plan Target of 70% on all sampling occasions both upstream and downstream of the Longburn discharge (minimum saturation across both sites = 81%; see Appendix A).

It is important to note that both DO and temperature vary considerably during the day. Accordingly, the assessment provided above should be considered indicative as it is based on 'spot measurements' rather than continuous data. Continuous DO and temperature data do not exist for the Manawatū River upstream or downstream of the Longburn discharge and given the limited potential for the discharge to adversely effect these parameters (now and in the future) implementing a continuous monitoring programme at those sites would be of limited value.

3.1.9. Assessment of whether the effects of the discharge are captured by the available monitoring data

The past effects of the discharge on downstream instantaneous NH_4-N, NO_3-N, SIN and *E. coli* concentrations may not be fully captured by the data presented in Section 3.1.1 to 3.1.5 due to a portion of the downstream data record being collected when the discharge was not operating. A visual assessment of the data collected by Fonterra shows that more consistent increases in concentrations of these parameters between sites have been detected since 2019 when monitoring was targeted to when the discharge was operating (Figure 22). However, this is unlikely to have resulted in the overall risk of adverse effects being underestimated, as:

- There is already an elevated risk of ammonia toxicity upstream of the discharge and this risk profile did not change after 2019 (see NPS-FM 2020 assessment in Section 3.1.1).
- Statistically significant increases in NO_3-N concentrations downstream of the discharge were still detected in most flow bins (Section 3.1.2), and concentrations have consistently been below toxicity levels over the entire data record (including since 2019 – see NPS-FM 2020 assessment in Section 3.1.2).
- Undetected increases in SIN concentrations are unlikely to have resulted in the risk of periphyton blooms being underestimated due to statistically significant increases still being detected, and sufficiently high SIN concentrations upstream of the site such that periphyton growth will not be limited by this parameter anyway.
- Undetected increases in *E. coli* concentrations are unlikely to have resulted in the overall health risk being underestimated due to the already high concentrations upstream of the Longburn discharge.
- Since 2019, the potential for discharge to cause detectable increases in daily average NH_4-N, NO_3-N, SIN and *E. coli* concentrations after full mixing is limited (see Section 3.1.10 below). Accordingly, the relatively large proportional increases in concentrations observed since then (Figure 22) are potentially due to incomplete mixing and the pulsed nature of the discharge rather than an environmentally meaningful effect on daily average concentrations (see Section 3.1.10 for more detail).
- It does not appear that the monitoring regime (whereby some samples have been collected when the discharge was not operating) have resulted in the effects of the discharge on DRP and $ScBOD_5$ concentrations being underestimated, as visual assessment of the data does not show larger proportional increases since 2019 (Figure 22).

Notes:

- *Fonterra do not monitor visual clarity, temperature, POM or dissolved oxygen as these parameters are not required to be monitored under the consent conditions. Thus, sampling bias for these parameters cannot be assessed. However, the nature of the treatment regime (reverse osmosis) means there is low risk of the discharge causing increases in these parameters now.*
- *While targeting monitoring towards when the discharge is operating is useful for understanding instantaneous effects, for a seasonal discharge it provides limited understanding about the overall state of the river (which is important when assessing data against guideline values etc.).*

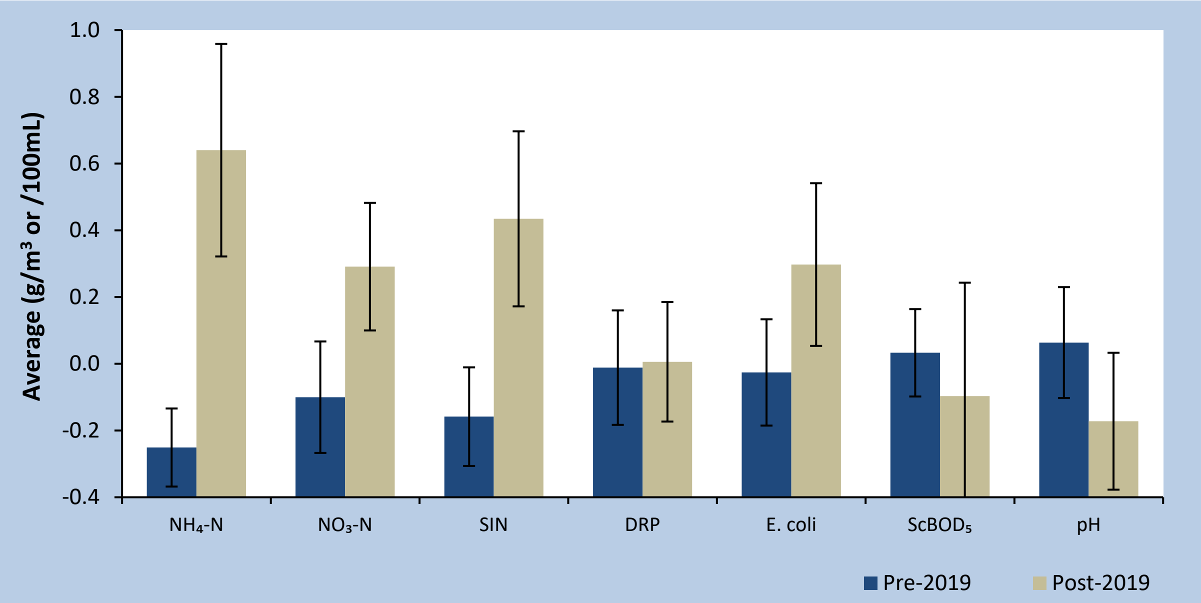

Figure 22: Mean (± standard error) of concentrations of key water quality parameters downstream of the Longburn discharge before (monitoring not targeted to discharge operation) and after 2019 (monitoring targeted to discharge operation). Data for each parameter has been standardised across the entire data record (adjusted so mean = 0 and standard deviation = 1) so multiple parameters can be presented on the same scale. All data collected by Fonterra.

3.1.10. Potential reasons for detectable increases in contaminant concentrations downstream of the discharge and implications for assessment of effects

That NH_4-N, SIN and *E. coli* concentrations have been observed to increase downstream of the Longburn discharge since 2019 is surprising, as since that time all wastewater has been treated via Reverse Osmosis (RO) plants, while prior to that the highest strength effluent was treated to a lesser degree using just the Dissolved Air Flotation (DAF) plant.

Simple mass-balance analysis on effluent quality and quantity monitoring data collected between August 2018 and July 2019 (Table 13) shows that with current plant operations the discharge after full mixing would only be expected to increase daily average DRP, SIN, *E. coli*, and NH_4-N concentrations by 0.004 g/m^3, 0.001 g/m^3, 0.009 g/m^3 and 22 cfu/100mL, respectively under a worst-case type scenario where:

- All of the effluent discharged is from the highest strength waste stream;
- Contaminant concentrations reflect the 90th percentile for that waste stream; and
- The discharge occurs when flow in the Manawatū River is at the half median (the point at which the high strength discharge must stop).

This suggests that the downstream monitoring data are unlikely to be representative of the overall daily average concentrations of these parameters. There are a number of explanations for this. However, the two most likely are:

- The discharge is not fully mixed with the river at the downstream monitoring point under certain flow conditions, resulting in measured concentrations being higher than what would be expected after full mixing.

- As the discharge only occurs for part of the day, (i.e., discharge rates are higher than if the daily volumes were discharged at a constant rate over 24 hours), the instantaneous effects of the discharge (picked up by monitoring) are greater than the effects on daily average contaminant concentrations.

Since 2019, in-river sampling has only been undertaken when the discharge was operating. Whilst this provides a measure of the concentration changes at the sampling point when the discharge is operating, it does not provide a direct measure of the overall, fully mixed concentrations. Monitoring data that represents instantaneous incompletely mixed concentrations are relevant for assessing the effects of the discharge at the monitoring site on attributes for which peak concentrations are particularly relevant, such as ammoniacal nitrogen toxicity effects. However, the risk of potential effects on other attributes, such as periphyton growth is more directly related to overall "ambient" concentrations of nutrients, which is not well represented by these data. Similarly, cumulative effects on downstream environments should be assessed based on fully mixed concentrations. In this context, monitoring data should be used with caution and in conjunction with alternative approaches, such as the mass-balance analysis presented above.

Table 13: Mass balance assessment of potential effects of the discharge under a high volume-high concentration-low flow scenario.

	DRP	SIN	*E. coli*	NH4-N
Discharge volume m^3/d	3075			
Av. discharge volume m^3/s	0.036			
90th %ile concentration through RO (g/m^3 - /100mL)	0.7	10	22600	4.0
Load per second (g – no#)	0.025	0.357	8043926	0.141
Upstream flow (m^3/s)	36.702			
Downstream flow (m^3/s)	36.74			
Δ in concentration (g/m^3 - /100mL)	0.001	0.009	21.9	0.004

3.2. Effects on aquatic ecology

3.2.1. Periphyton Communities

Community composition

Periphyton biomass measured as chlorophyll-*a*, and visual cover were assessed at sites where macroinvertebrates were monitored, upstream and downstream of the Fonterra Longburn discharge. Periphyton community composition at those sites has been as follows:

- In the springs of 2010, 2012 and 2016 periphyton cover at all sites was dominated by thin diatom mats (< 3 mm thick) (Figure 23).

- In the spring of 2018 long filamentous algae (> 2 cm long) dominated periphyton communities at the upstream sites, covering 74-76% of substrate, while thin mats dominated substrates at sites downstream of the discharge (Figure 23).
- Sampling in early summer (January) 2019 showed substrates also dominated by long filamentous algae both upstream and downstream of the discharge but with short filamentous algae and thick mats also present (Figure 23). However, the long filamentous algae were mostly replaced later in the summer/spring (April) 2019 round of sampling by short filamentous algae and thin diatom mats.
- In contrast, and as would be expected, substrates at all sites were mostly clean (85-96%) or covered in a thin diatom mat (4-15%) during winter (July) 2019 (Figure 23).
- Cyanobacterial mats were rarely seen in this reach of the Manawatū on most sampling occasions, and when observed appeared more abundant upstream of the discharge (Figure 23).

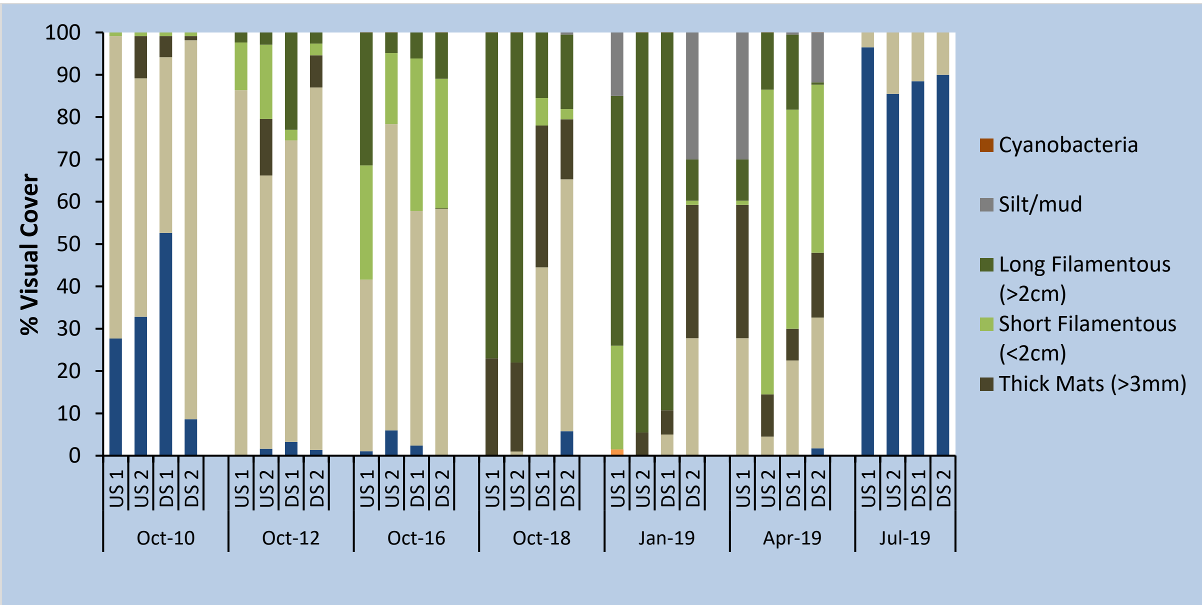

Figure 23: Relative abundance of periphyton communities visually assessed in the Manawatū River upstream and downstream of the discharge from the Fonterra Longburn discharge, 2010-2019.

Periphyton cover

Cover by thick diatom mats was generally low across all sampling occasions both upstream and downstream of the discharge (Figure 24) and well below the One Plan target for cover by thick mats (no more than 60% cover).

Cover by long filamentous algae varied between years and was higher upstream of the discharge on three of seven sampling occasions undertaken between 2010 and 2019 (Figure 25). On the remaining sampling occasions, cover by long filamentous algae was generally similar between upstream and downstream sites. The One Plan target for long filamentous algae (no more than 30% cover) was exceeded at upstream sites in October 2016, October 2018 and January 2019 and met at downstream sites in all years except January 2019.

Note: Heterotrophic growths (sewage fungus) have not been observed in the Manawatū River downstream of the Longburn discharge, or in the side-stream the discharge flows into (see Section 3.3.3)

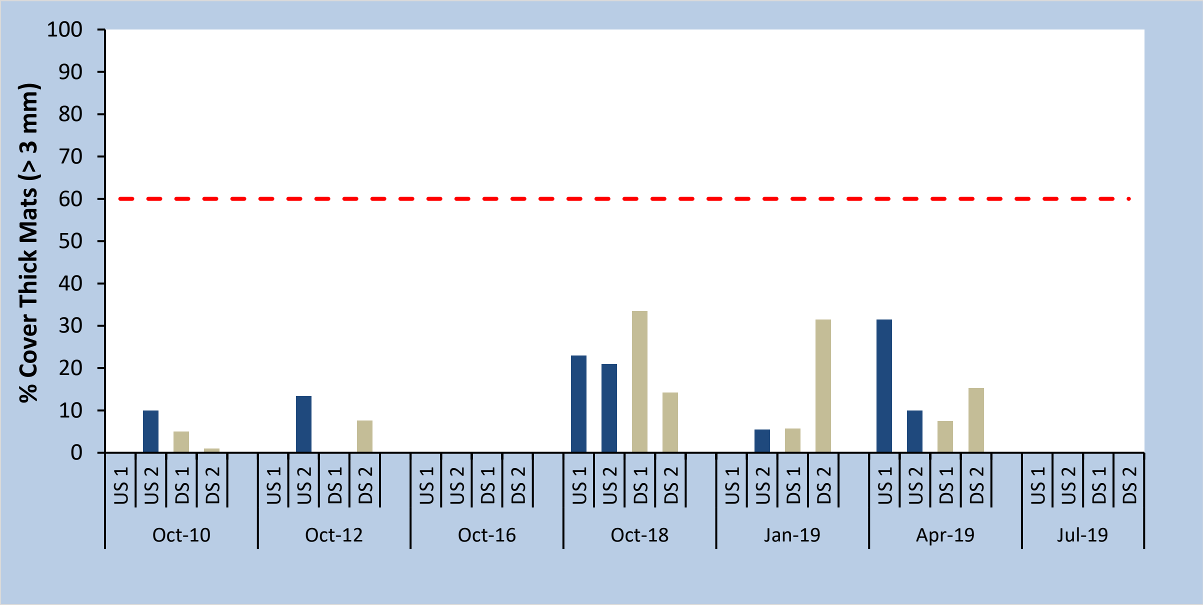

Figure 24: Periphyton cover by thick diatom mats (> 3 mm) at sites sampled on the Manawatū River upstream (blue bars) and downstream (brown bars) of the discharge from the Fonterra Longburn discharge, 2010-2019. Horizons One Plan targets are represented by dashed red lines.

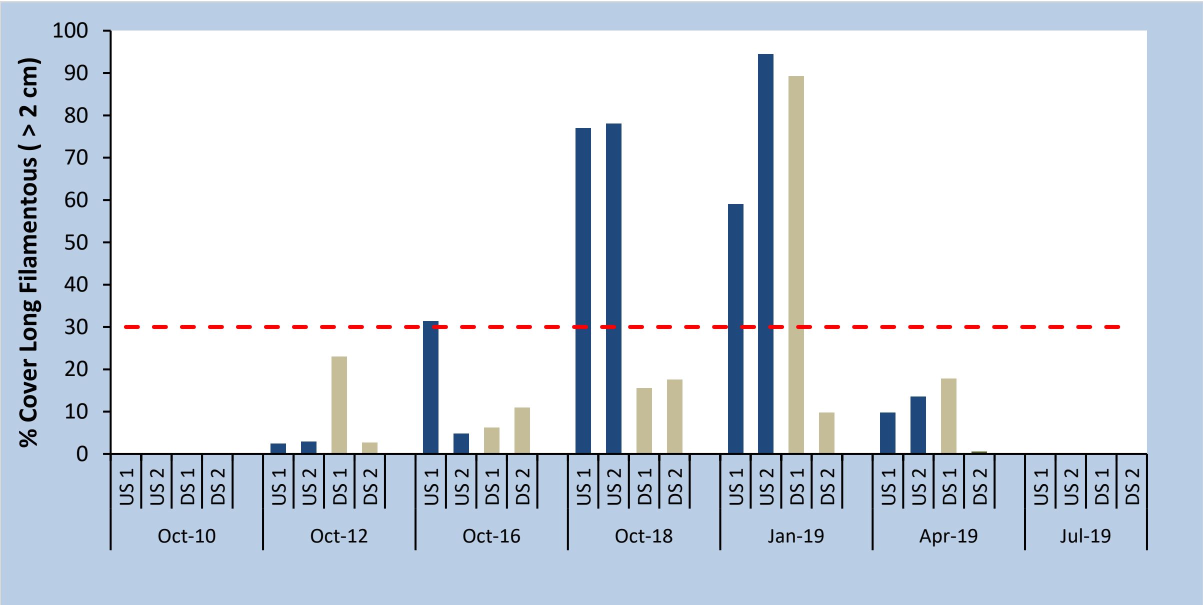

Figure 25: Periphyton cover by Long filamentous algae (> 2 cm) at sites sampled on the Manawatū River upstream (blue bars) and downstream (brown bars) of the discharge from the Fonterra Longburn discharge, 2010-2019. Horizons One Plan targets are represented by dashed red lines.

Examples of substrate cover by periphyton in spring and winter are shown in Figure 26.

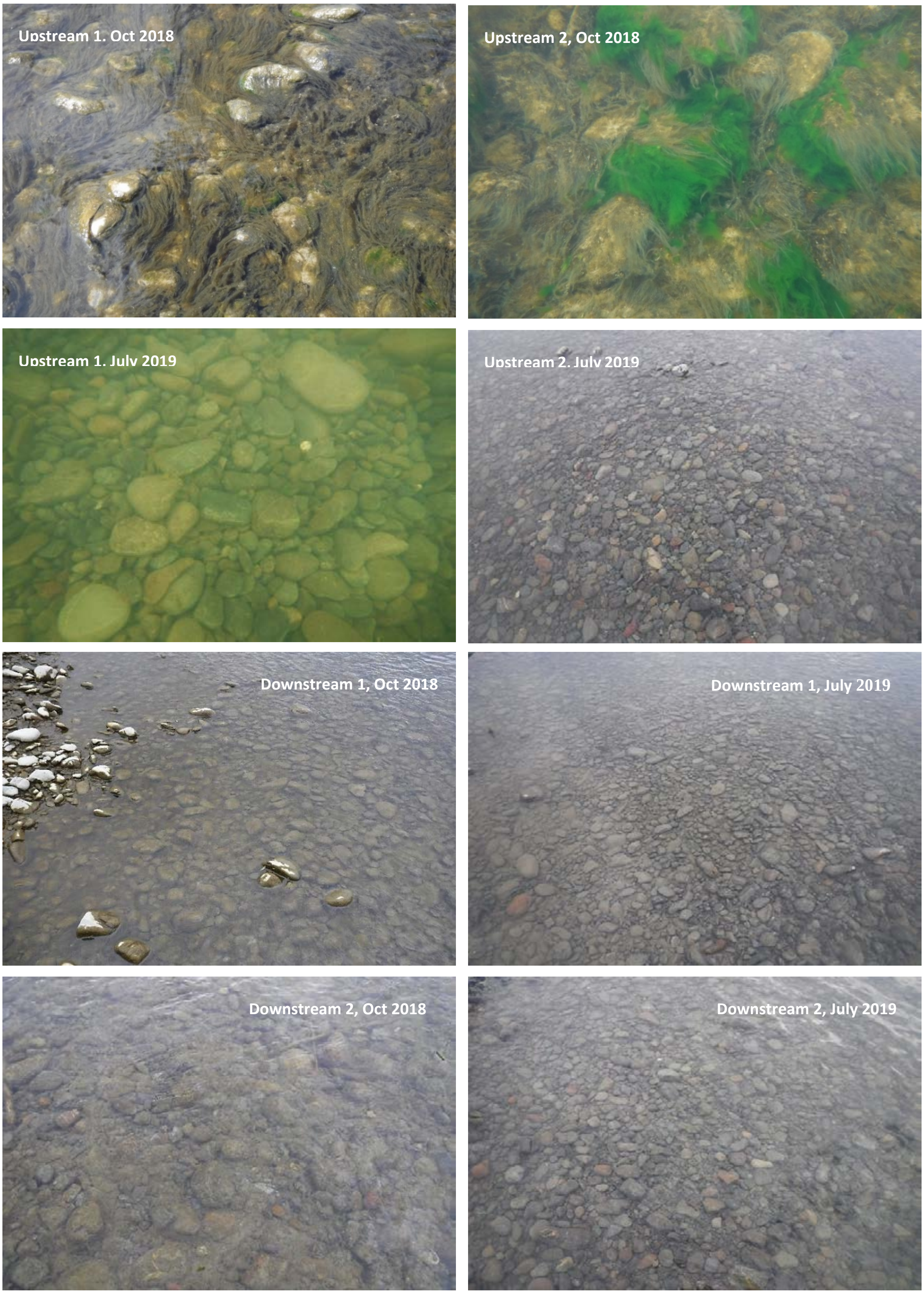

Figure 26: Examples of periphyton observed on substrates at sites sampled in the Manawatū River upstream and downstream of the Fonterra Longburn discharge, October 2018 and July 2019.

Periphyton biomass

Periphyton biomass (measured as chlorophyll-*a*) was generally low at all sites in all years (Figure 27). Chlorophyll-*a* concentrations always remained below the One Plan target of 120 mg/m^2 except at the Upstream 2 site in 2012 and 2018 (129 and 158 mg/m^2, respectively). Chlorophyll-*a* concentrations were very low (< 1 mg/m^2) at all sites during winter 2019 in this stretch of the Manawatū River.

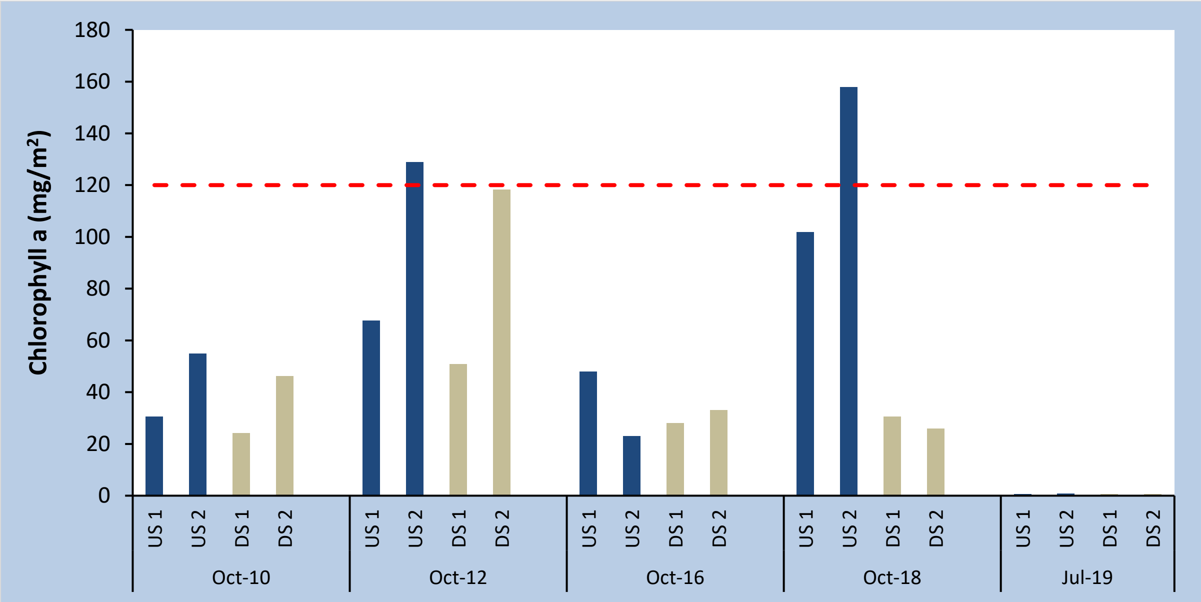

Figure 27: Mean periphyton biomass, measured as chlorophyll-*a* (mg/m^2), for sites sampled on the Manawatū River upstream (blue bars) and downstream (brown bars) of the Fonterra Longburn discharge, 2010 - 2019. The One Plan target for chlorophyll-*a* is represented as a dashed red line.

Summary

Overall, periphyton biomass and visual estimates of periphyton cover were generally higher upstream when compared with sites downstream, suggesting no detectable effect on periphyton proliferation can be attributed to the Fonterra Longburn discharge.

3.2.2. Macroinvertebrate communities

Community composition

Macroinvertebrate communities observed at sites upstream of the Longburn discharge were similar to those seen downstream in each year sampled. In spring 2010 and 2012, macroinvertebrate communities were indicative of fair to good water quality with EPT taxa (mayflies, stoneflies and caddisflies) dominating, and chironomids still present, but less abundant (Figure 28). In spring 2016 and 2018 there was a shift in community structure with fewer EPT taxa and greater abundances of Diptera (mostly chironomids), indicating a change to poorer water quality. Sampling in winter 2019 again showed macroinvertebrate communities more similar to those observed in earlier years with higher numbers of mayflies, stoneflies and caddisflies. These communities are consistent with the patterns observed in periphyton cover where there was a greater abundance of long filamentous algae and thick mats observed in 2016 and 2018.

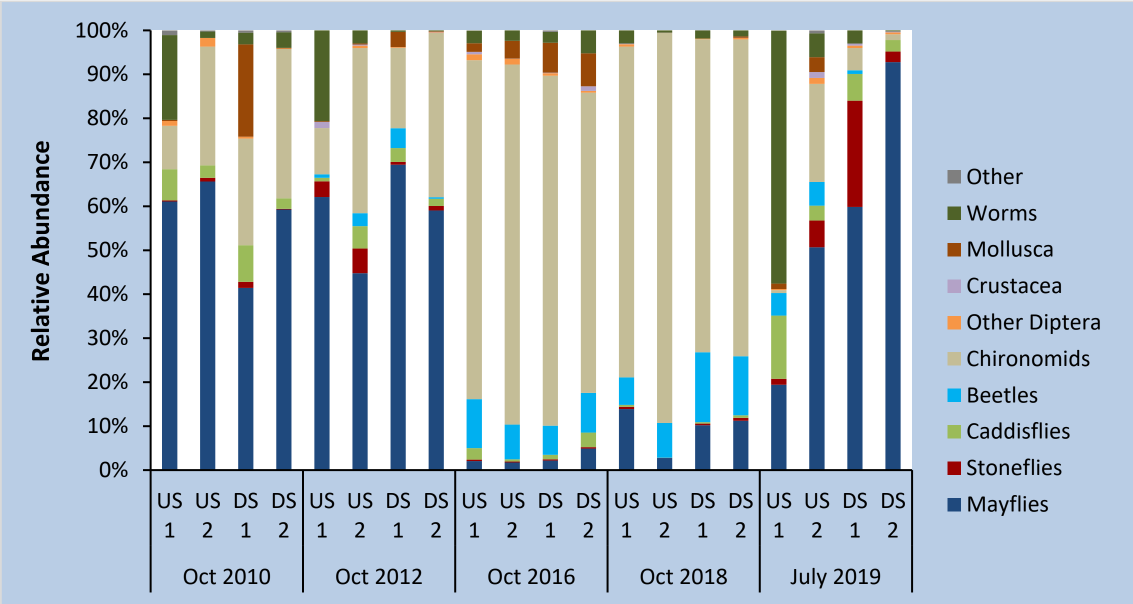

Figure 28: Relative abundance of the main macroinvertebrate taxonomic groups collected at sites on the Manawatū River upstream and downstream of the Fonterra Longburn discharge, 2010 - 2019.

Community health and assessment against One Plan and NPS-FM 2020

Biotic indices for sites sampled upstream and downstream of the Fonterra Longburn discharge are shown in Figure 29. The following conclusions have been drawn from these indices.

- The Horizons One Plan sets a “State of the Environment” target of 100 for MCI in the Lower Manawatū Water Management Zone (Mana_11a). MCI at all sites fell below this target, with four exceptions (Upstream 1 and Downstream 1 in 2010, Upstream 2 in 2012 and Downstream 2 in 2019) (Figure 29).
- The One Plan also sets a target for QMCI of no more than a 20% reduction between upstream and downstream sites. The percent change in QMCI downstream of the discharge met this target in all years, with the greatest reduction being a 10% decrease from upstream to downstream in 2010 (Figure 29). Indeed, most years saw an increase in QMCI between upstream and downstream sites.
- Statistically significant differences between upstream and downstream sites were seen for different biotic indices in different years. However, in most cases where there was a difference, indices showed an improvement at the downstream sites (Figure 29).

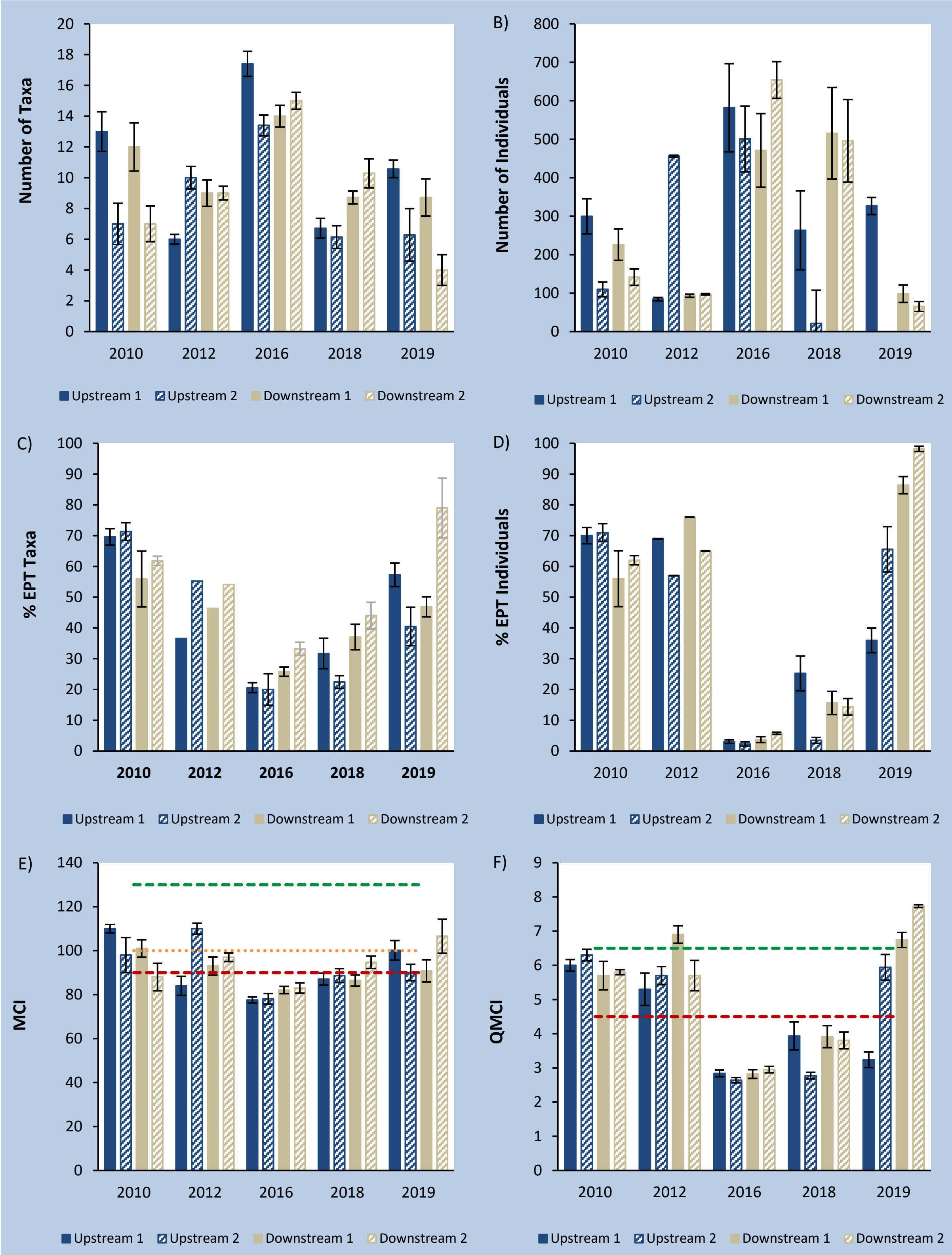

Figure 29: A) Mean (± 1 SE) Number of Taxa, B) Number of Individuals, C) % EPT Taxa, D) % EPT Individuals, E) MCI and F) QMCI for sites sampled on the Manawatū River upstream and downstream of the Fonterra Longburn discharge, 2010-2019. NPS-FM (2020) thresholds for water quality are shown as dashed red (fair) and green (excellent) lines. The Horizons One Plan target for MCI is shown as an orange dotted line.

While Figure 29 shows the NPS-FM 2020 attribute states for MCI and QMCI (green and red dashed lines denoting the A and C attribute states respectively), no formal assessment of macroinvertebrate data against the NPS-FM 2020 provisions has been undertaken here. The NPS-FM 2020 assessment requires that the current state is calculated as the five-year median score using samples collected annually between December and March. Sampling for the Fonterra discharge is required by Consent to be undertaken in October or November every three years (given there is no discharge of high strength effluent in summer months). Therefore, existing data does not fit within these requirements. However, based on available data and as a preliminary assessment, median scores for sites downstream of the Fonterra discharge fall within attribute state C for MCI and attribute state B for QMCI. In contrast monitoring sites upstream of the discharge had median scores for both indices that were either in C or D attribute state.

<u>*Summary*</u>

Sampling of the Manawatū River at Longburn since 2010 has found poor to fair ecological health (as indicated by MCI and QMCI) at all sites but no indication that the Fonterra discharge is having adverse effects on aquatic communities in this stretch of the river.

3.3. Section 107(1) assessment

3.3.1. Clause (d) Conspicuous change in the colour or visual clarity

In the past, small but statistically significant reductions in visual clarity have been recorded in in the Manawatū River downstream of the Longburn discharge (see Section 3.1.6). However, there is no evidence that the Longburn discharge is currently causing a conspicuous reduction in visual clarity as there has not been a single instance of visual clarity reducing by more than 30% between the upstream and downstream monitoring sites in the past five years.

3.3.2. Clause (f) The rendering of fresh water unsuitable for consumption by farm animals

A comparison of median *E. coli* data against the ANZG[7] (2018) livestock drinking water standard of 100 thermotolerant coliforms per 100 mL indicates that the Manawatū River is not suitable as a source of livestock drinking water upstream (286/100 mL) or downstream (238/100 mL) of the Longburn discharge. However, the discharge has a negligible impact on *E. coli* concentrations in the river, with concentrations generally being lowest at the downstream monitoring site. Accordingly, there is no evidence to suggest it is rendering fresh water unsuitable for consumption by farm animals.

3.3.3. Clause (g) Any significant adverse effects on aquatic life.

Macroinvertebrate monitoring data suggests that the discharge’s effects on aquatic life in the Manawatū River is minimal, with community health being highest at the downstream

[7] Australian and New Zealand guidelines for fresh and marine water quality

monitoring sites. This is also supported by the water quality and periphyton monitoring data which demonstrates the discharge:

- Has a negligible effect on the risk of ammonia and nitrate toxicity effects;
- Has limited potential to increase the occurrence of nuisance periphyton growths and does not result in heterotrophic growths (sewage fungus);
- Is unlikely to reduce DO to the extent that aquatic life is adversely affected (based on measured DO data and effects on periphyton and heterotrophic growths).

Note – Conclusions regarding the effects of the Longburn discharge on heterotrophic growths in the Manawatū River have been assessed from:

- *The results of targeted monitoring in 2019 which did not detect any sewage fungus in the side-stream where the Longburn discharge enters;*
- *The limited effect of the discharge on $ScBOD_5$ concentrations (measure of dissolved organic compounds that can stimulate bacterial and fungal growth); and*
- *Compliance with the One Plan $ScBOD_5$ target which was developed specifically for the avoidance of nuisance sewage fungus growth in the Manawatū catchment (Quinn, 2009).*

3.3.4. Summary

Based on the available water quality and ecological data, the discharge of wastewater from the Longburn discharge to the Manawatū River is not expected to result in any of the effects described in clauses (d),(f) and (g) of Section 107(1) of the RMA.

3.4. Summary

The available data indicates that in the past the discharge may have resulted in statistically detectable increases in NO_3-N and SIN concentrations in the Manawatū River and decreases in visual clarity. However, it appears there is limited potential for this to have resulted in adverse ecological effects due to the prevailing water quality conditions upstream exceeding relevant guideline levels, or downstream concentrations/ levels not being degraded beyond guideline levels by the discharge. Nevertheless, it is worth noting that the available data record may not provide a full picture of the past effects of the discharge due to:

- Some downstream samples being collected when the discharge was not operating;
- The discharge potentially not being fully mixed at the downstream site under some flow conditions, leading to cumulative effects being over estimated; and
- The pulse nature of the discharge meaning that the instantaneous effects of the discharge measured through water quality sampling may be greater than the effects on daily average concentrations, which may be more important in understanding the effects on factors such as periphyton growth (see Section 3.1.10).

That the discharge is unlikely to have had a detectable effect on aquatic life is supported by the results of ecological monitoring which shows that while the Manawatū River at Longburn is generally in poor to fair ecological health, there is no indication that the discharge is having adverse effects on aquatic communities (plant or macroinvertebrate) in this stretch of the river.

4. Options assessment

4.1. Aim and scope

In preparing the application to renew the Resource Consent for the discharge, Fonterra undertook a process to determine the Best Practicable Option for treatment and discharge of wastewater from the Longburn site. The first step was to undertake a global scan of all emerging technologies and options that could be reasonably implemented at the Fonterra Longburn site to develop a long-list of options. The wide range of options developed were then assessed against key environmental performance criteria. Any option that did not satisfy the key performance criteria and therefore did not address key environmental effects was not considered for further assessment.

Following the screening assessment, ten options were considered to be the most feasible and warranting further assessment. Then, having identified storage and deferred irrigation as the preferred option for reducing the wastewater discharge to the River (Option C.3), five sub-options were developed in order to refine and optimise the proposal.

The key objective of this part of the assessment was to test the potential water quality effects and operational requirements of the five options being considered. More specifically, the model described in Appendix C was used to:

- Test the water quality effects of various flow-cut-off and discharge volume scenarios that reflect the river discharge options being considered; and
- Determine the storage required to adequately deal with all of the effluent created under the different options.

4.2. Methods

4.2.1. Model structure

The options assessment was run using the Point Source Impact Model (PointSIM) described in Appendix C. Briefly, the water quality component of the model calculates the concentrations of different water quality parameters downstream of the discharge. It is based on simple mass conservation principles: a certain quantity of a given constituent is released into a certain quantity of receiving water, resulting in a certain concentration of the said constituent.

The concentration increase of a constituent C caused by the discharge after full mixing in the river is given by:

$$\Delta C_{ds} = \frac{C_e \times Q_e}{(86.4\ Q_r) + Q_e}$$

Where:

C_{ds}: is the concentration of the constituent in the river downstream of the discharge in g/m^3
C_e: is the concentration of the constituent in the effluent g/m^3
Q_e : is the daily discharge volume to the river in m^3/d
Q_r: is the flow in the river in L/s

As the constituent will generally be present in the river upstream of the discharge, the final concentration downstream is given by:

$$C_{ds} = \frac{(C_e \times Q_e) + (C_{us} \times 86.4\ Q_r)}{(86.4\ Q_r) + Q_e}$$

Where:

C_{ds}: is the concentration of the constituent in the river downstream of the discharge in g/m^3
C_{us}: is the concentration of the constituent in the river upstream of the discharge in g/m^3
C_e: is the concentration of the constituent C in the discharge in g/m^3
Q_e: is the daily discharge volume to the river in m^3/d
Q_r: is the flow in the river in L/s.

The periphyton growth component of the model provides daily estimates of periphyton biomass growth based on daily nutrient concentrations and river flow. It is based on the periphyton growth element of the TRIM model developed by NIWA to simulate periphyton growth in the Tukituki River catchment (Rutherford, 2011) and provides daily time-step predictions of periphyton biomass based on:

- Growth, itself based on predicted daily SIN and DRP;
- Respiration; and
- Scour, expressed as a quadratic function of river flow, up to a re-setting flow (i.e., the river flow at which the periphyton biomass is "reset" to very low levels).

The periphyton biomass present in the river each day was given by the sum of the biomass present the preceding day plus the rate of change of biomass. The rate of change of biomass is given by:

$$\frac{dBIO}{dt} = Growth - Resp - Scour$$

Note: The periphyton biomass in the model is expressed as grams of carbon per square metre (gC/m^2), which corresponds approximately to 10 mg chlorophyll-a) (chl-a)/m^2.

4.2.2. Comparative assessment indicators

To enable a high-level comparative assessment of the potential water quality effects caused by the various scenarios explored during the options refinement phase, the following key indicators[8] were calculated over the 20-year modelling period through a scenario testing module in PointSIM[9]:

- Annual (i.e., overall) and monthly average DRP, SIN and NH_4-N concentration in the Manawatū River downstream of the discharge;
- Annual and monthly average DRP and SIN concentration in the Manawatū River downstream of the discharge when river flow is below the 20th FEP;
- Annual and monthly maximum NH_4-N concentration downstream of the discharge;
- The percent of time at which periphyton biomass is predicted to exceed 120 mg chlorophyll-*a* (chl-a)/m^2 overall and by month;
- The percent of time at which periphyton biomass is predicted to exceed 200 mg chl-a/m^2 overall and by month;
- Median and 95th percentile *E. coli* concentrations; and
- Available storage required.

While all of the parameters listed above were calculated for each option, only the available storage required and average DRP and SIN concentrations below the 20th FEP were considered in this stage of the options assessment. The Horizons One Plan water quality targets considered in this assessment are presented in Table 14.

Table 14: Relevant One Plan water quality targets as they apply to the Manawatū River (Lower Manawatū Water Management Zone; Mana_11a)

Parameter	Target
Av. [SIN] below 20th FEP (g/m^3)	0.444
Av. [DRP] below 20th FEP (g/m^3)	0.010

4.2.3. Baseline data sets

For this assessment, reductions in the discharge's effects on downstream SIN and DRP concentration under each option are calculated against a "design baseline" which assumes:

- The concentration of each water quality parameter in the Wastewater Reverse Osmosis Plant (WWRO) and the Whole Milk Reverse Osmosis Plant (WMRO) permeate waste streams across the entire modelling period reflect average concentrations recorded in 2019 (when both ROs were fully operational) (Table 15);
- Discharge volumes for the WWRO and WMRO permeate reflect those that would have been produced if the plant was operating at capacity in 2019. In order to create a full

[8] The One Plan sets targets for all of the statistics mentioned below except average DRP and SIN concentration and the percent of time at which periphyton biomass exceeds 200 mg chl-a/m^2.

[9] While not presented in this report, the scenario testing module of PointSIM produces a full range of summary statistics for each parameter both by month and by year.

discharge volume series for the entire modelling period, discharge volumes on any given day of the year reflects those produced on the corresponding date in 2019 (Table 16);

- WWRO permeate is not discharged to the river between November and April (inclusive) or when river flows are less than 37 m^3/s (as required by the existing consent). *Note – WMRO permeate is discharged year round at all flows*; and
- Between May and October (inclusive) wastewater is treated through a Dissolved Air Flotation (DAF) plant and the WWRO. Permeate from the WWRO is discharged to the river while the retentate stream is discharged to land. *Note – this differs from the current consent which allows the retentate to be discharged to the Manawatū River in this period subject to discharge volumes and a flow cut-off).*

Table 15: Assumed effluent contaminant concentrations for the "design" baseline (also applies to all of the options tested).

Parameter	Unit	WWRO Permeate	WMRO Permeate
NH_4-N	g/m^3	2.0	2.8
SIN		7	3
DRP		0.28	0.07
E. Coli	cfu/100mL	9,031	24

All of the specific effluent contaminant concentrations cited in Table 15 were provided as average concentrations, and these have been treated as constants in PointSIM (i.e., concentration always reflects the average regardless of season, influent volume or influent concentration). While simplistic, this reflects data available and is considered fit for purpose of option testing.

Table 16: Assumed effluent volumes (permeate only) produced from the WWRO and WMRO (permeates only) on each day of the year for the "design" baseline (also applies to all of the options tested). This does not reflect the actual volume discharged to the river. Data provided by Fonterra

Effluent from WMRO/WWRO (m³/day)												
Day-Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	800/0	0/0	0/0	0/0	0/1031	0/1053	0/813	0/950	400/1487	800/1887	800/1887	800/0
2	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
3	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
4	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
5	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
6	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
7	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
8	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
9	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
10	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
11	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
12	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
13	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
14	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
15	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
16	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
17	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
18	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
19	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
20	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
21	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
22	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
23	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
24	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
25	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
26	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
27	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
28	800/0	0/0	0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
29	800/0		0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
30	800/0		0/0	0/0	0/1053	0/1053	0/813	0/1087	800/1887	800/1887	800/1887	800/0
31	0/0		0/0		0/1053		0/813	0/1087		800/1887		800/0

4.3. Options modelled

Potential future effects under the five options were assessed using PointSIM for the period July 2000 to June 2020. The options all include:

- A river discharge component that operates above a given river flow cut-off and ceases between November and April (inclusive);
- A land discharge component that varies based on rainfall (as provided by Fonterra, with rainfall used as a proxy for soil moisture); and
- An effluent storage component.

Each option is defined by a desired outcome for one or more of the metrics listed below; PointSIM was used to predict the likely outcome for the other metrics under each option (see Table 17 below):

- Storage volume;
- River cut-off flow (the flow below which the discharge must cease);
- In-river nutrient concentration reduction; and/or
- Discharge volume.

Table 17: Assumptions for each of the five options modelled. (?) indicate the variables explored through modelling. For example, for Option 1: "if we assume a total storage volume of 63,719 m^3, and constrain the daily discharge volume to the river to be no more than the previous day's effluent production, what is the river flow cut-off?"

<table>
<tr><th>Option</th><th>Available storage needed</th><th>River cut-off flow (no discharge below)</th><th>Daily discharge volume</th><th>Reduction in DRP below 20th FEP</th><th>Reduction in SIN below 20th FEP</th></tr>
<tr><td>1</td><td>63,719</td><td rowspan="2">?</td><td rowspan="3">Prior days production</td><td>?</td><td rowspan="5">?</td></tr>
<tr><td>2</td><td rowspan="4">?</td><td>57%</td></tr>
<tr><td>3</td><td>80m^3/s</td><td rowspan="3">?</td></tr>
<tr><td>4</td><td rowspan="2">73.4m^3/s</td><td>Flow proportional up to 2,670 m^3/day</td></tr>
<tr><td>5</td><td>Flow proportional up to 4,000 m3/day</td></tr>
</table>

Under each option, effluent volumes from the WWRO and WMRO and contaminant concentrations in each waste stream were assumed to be the same as those used in the baseline dataset (see Table 15, Table 16 and Section 4.2.3). However, how the effluent from each waste stream is discharged differs between the options. Nevertheless, the following assumptions were consistent across all Options (note these all represent a deviation from the baseline).

- WWRO permeate and retentate and WMRO permeate are not discharged to the river between November and April (inclusive). This differs from the baseline in which WMRO permeate can be discharged to the River during this period;
- Some of the WWRO permeate and WMRO permeate goes to land. Exact volume based on a daily record calculated for the entire modelling period based on rainfall data (provided by Fonterra); and
- WWRO permeate and WMRO permeate that is not discharged to the river or the land is held in storage.

A brief description of each option is set out below in sections 4.3.1 to 4.3.5 and a summary is provided in Table 17.

4.3.1. Option 1

This option assesses the potential improvements that can be achieved with a storage pond volume of 95,000 m^3. This is the order of the magnitude for a maximum pond volume that can be emptied onto the wastewater irrigation farms during summer periods under the existing irrigation consents and with optimisation of farming practices. In this option, the maximum volume that can be discharged to the river, subject to cut-off flows being achieved, is the prior day's production volume.

This option provides an effective storage volume of 63,719 m^3. This equates to a pond volume of 95,000 m^3 with allowances for dead volume, rainfall, and contingency for a wet start of the summer period[10].

The input assumptions for Option 1 are:

- Available storage = 63,719 m^3;
- Volume discharged to river = prior day production; and
- Volume discharged to land = variable based on rainfall.

4.3.2. Option 2

This option seeks to find the required storage and river cut-off flow that would result in a reduction in the effects of the discharge on downstream DRP concentrations matching that required on a catchment basis to achieve the One Plan DRP target (a 57% reduction in average DRP at flows below 20th FEP). In this option, the maximum volume that can be discharged to the river, subject to cut-off flows being achieved, is the prior day's production volume.

The specific input assumptions for Option 2 are:

- Volume discharged to river = prior day production;
- Volume discharged to land = variable based on rainfall; and
- Reduction in average DRP concentrations below the 20th FEP = 57%.

4.3.3. Option 3

This option sets a river discharge cut-off flow of 80 m^3/s. This river cut-off flow has been selected as it is one of the scenarios considered by PNCC in relation to its WWTP discharge. Modelling of this option seeks to identify the storage volume required to adhere to this cut-off flow as well as the reduction in DRP and SIN loadings that would be achieved. The maximum volume that can be discharged to the river, subject to cut-off flows being achieved, is the prior day's production volume.

The input assumptions for Option 3 are:

- Volume discharged to river = prior day production;
- Volume discharged to land = variable based on rainfall; and
- River cut-off flow = 80 m^3/s.

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[10] The volume is comprised as follows:

- **Total pond volume = 95,000 m^3**
- **Less:**
    - 5% dead storage at base of pond = 4,750 m^3 (outlet is slightly above bottom to avoid discharge of solids)
    - Rainfall allowance = 16,531 m^3 (average annual rainfall and area of pond)
    - Contingency storage for November = 10,000 m^3 (to allow additional storage if there is a wet start to irrigation season)
- **Provides effective storage volume of 63,719 m^3**

4.3.4. Option 4

This option includes a flow proportional discharge whereby discharge volumes can increase as river flows increase. This enables some drawdown of the pond during the winter months. A river cut-off flow of the median flow (74 m^3/s) has been assumed. In this option, discharge volumes progressively increase up to a maximum of 2,670 m^3/day (which is roughly the maximum production rates). This effectively means that the pond can only be drawn down when production is not at peak volumes.

The input assumptions for Option 4 are:

- Volume discharged to river = flow proportional (~16 × instantaneous river flow) up to 2670 m^3/day at the 20th FEP;
- Volume discharged to land = variable based on rainfall; and
- River cut-off flow = 73.4 m^3/s.

4.3.5. Option 5

This option is the same as Option 4 except in this case the discharge volume progressively increases with river flow up to a maximum of 4,000 m^3/day. This could enable some drawdown of the pond even when production is at its peak. The maximum discharge volume of 4,000 m^3/day is less than the current consented maximum of 6,000 m^3/day.

The input assumptions for Option 5 are:

- Volume discharged to river = flow proportional (~24 × instantaneous river flow) up to 4,000 m^3/day at the 20th FEP;
- Volume discharged to land = variable based on rainfall; and
- River cut-off flow = 73.4 m^3/s.

4.4. Results

4.4.1. Option 1

PointSIM indicates that to ensure that the available storage volume is not exceeded under Option 1, a river cut-off flow of 56.5 m^3/s would be required (Table 18). Ceasing the discharge at this point is predicted to achieve a 39% reduction in average DRP concentrations in the Manawatū River below the 20th FEP, and a 48% reduction in average SIN concentrations at the same flows (Table 18). While this reduction does not meet the DRP reduction target set for Option 2, it still represents a significant improvement, and the effects of the discharge on both DRP and SIN concentrations are unlikely to be detectable under this option. Furthermore, this option significantly reduces the potential for adverse ecological effects caused by nutrients in the discharge by eliminating the discharge at times when the risk of periphyton growth is highest (river cut-off flow increased from 37 m^3/s to 56.5 m^3/s and no effluent discharged to the river during November to April inclusive).

4.4.2. Option 2

Modelling suggests that a river cut-off flow of 72 m^3/s (approximately median flow) would be required to reach the desired 57% reduction in DRP concentrations under this option and suggests that 103,803 m^3 of available storage would be needed to achieve this.

4.4.3. Option 3

Modelling suggests that implementing an 80 m^3/s river cut-off flow under this option would result in greater reductions in the effects on DRP (66 %) and SIN (71%) concentrations than those expected under Options 1 or Option 2. However, it would also require significantly more available storage (121,983 m^3) (Table 18).

4.4.4. Option 4

Option 4 is predicted to achieve greater reductions in effects on SIN (71%) and DRP (64%) concentrations than Option 2, despite having a similar river cut-off flow. However, the storage requirements are also expected to be significantly greater (113,412 m^3 available storage needed) (Table 18).

4.4.5. Option 5

The flow proportional river discharge regime assumed under Option 5 is expected to require significantly less storage than Option 4 (99,307 m^3), while still achieving significantly greater reductions in effects on SIN (63%) and DRP (56%) than Option 1 (Table 18). On the other hand, storage requirements are also still significantly greater than under Option 1.

4.5. Summary

Fonterra explored five sub-options within the preferred option (Option C.3). Based on our modelling, all of these options are likely to reduce the effects of the discharge on SIN and DRP to the point that they are unlikely to be detectable.

Table 18: Assumptions for each of the five options modelled (red italics) and the results of the options testing process (black bold).

<table>
<tr><th>Option</th><th>Total storage needed</th><th>River cut-off flow (no discharge below)</th><th>Daily discharge volume</th><th>Reduction in DRP below 20th FEP</th><th>Reduction in SIN below 20th FEP</th></tr>
<tr><td>1</td><td>63,719 m^3</td><td>56.5 m^3/s</td><td rowspan="3">Prior days production</td><td>39%</td><td>48%</td></tr>
<tr><td>2</td><td>103,803 m^3</td><td>72 m^3/s</td><td>57%</td><td>64%</td></tr>
<tr><td>3</td><td>121,983 m^3</td><td>80 m^3/s</td><td>66%</td><td>71%</td></tr>
<tr><td>4</td><td>113,412 m^3</td><td rowspan="2">73.4 m^3/s</td><td>Flow proportional up to 2,670 m^3/day</td><td>64%</td><td>70%</td></tr>
<tr><td>5</td><td>99,307 m^3</td><td>Flow proportional up to 4,000 m3/day</td><td>56%</td><td>63%</td></tr>
</table>

5. Future effects assessment

5.1. Methods

Through the Options Assessment process described in the ‘Best Practicable Option Report’ and ‘Assessment of Environmental Effects’ (Good Earth Matters), Fonterra has selected Option 1 as their preferred option (see Section 4.3.1 for a full description of the option). The analysis undertaken to assess the future effects of the discharge once this option is fully implemented is more detailed than that undertaken for the operations assessment process (see Section 4.2). Specifically, PointSIM has been used to predict how the distribution of the following parameters will be changed downstream of the discharge under the selected option:

- SIN;
- DRP;
- Ammonia;
- *E. coli*; and
- Periphyton biomass (useful as a qualitative assessment of risk only).

The modelled downstream distributions have been compared to a baseline modelled data set (reflects full plant operation under the existing consent conditions), a modelled upstream dataset and the relevant One Plan targets to provide some context on the magnitude and importance of the future effects of the discharge.

Assumed baseline and future effluent quality have been updated from those used in the Options Assessment to account for new monitoring data collected since that assessment was completed. The concentration of each water quality parameter in the WWRO and WMRO permeate waste streams across the entire modelling period now reflect average concentrations recorded in between 2019 and 2021 (Table 19).

Note – The Options Assessment results were not updated to account for the latest monitoring data as:

- *The existing results have previously been presented to a range of interested parties;*
- *It is the existing results that informed Fonterra's decisions to proceed with Option 1; and*
- *Updating the Options Assessment would not have a material effect on key results (i.e., proportional reduction in effect on average SIN and DRP concentrations below the 20th FEP), as downstream water quality under the "design" baseline would be as affected by the changes as the modelled water quality under each option.*

Table 19: Assumed future and "design" baseline" effluent contaminant concentrations used in the future effects assessment.

Parameter	Unit	WWRO Permeate	WMRO Permeate
NH_4-N	g/m^3	2.6	3.0
SIN		8.0	3.0
DRP		0.76	0.15
E. Coli	cfu/100mL	2,729	62

A full description of PointSIM can be found in Appendix C, and a description of the upgrade assumptions are provided below:

- Available storage = 63,719 m^3;
- Volume discharged to land = variable based on rainfall;
- Volume discharged to river = prior day production; and
- River cut-off flow = 56.5 m^3/s.

Note – In high rainfall years it may be necessary to discharge some of the effluent produced in November to the Manawatū River . The proposed discharge regime and its potential effects on the Manawatū River are assessed separately in Section 5.3.

5.2. Results

5.2.1. Effects on water quality

Modelling results suggest that future upgrades to the wastewater system at the Longburn site will result in a significant proportional reduction in effects across the distribution of NH_4-N, SIN, DRP and *E. coli* concentrations when assessed against the assumed 'design' baseline. Furthermore, the increases in concentrations historically observed in the Manawatū River (see Section 3.1) are expected to be vastly reduced by the upgrades due to:

- The complete removal of the discharge:

- Between November and April (inclusive); and
    - At flows below 56.5 m^3/s year-round.
- Improved treatment performance which has already been implemented (not all of the effluent in the current effects assessment period was treated with a reverse osmosis plant); and
- The change from a pulse discharge to a continuous discharge which will mean that the instantaneous effects of the discharge will no longer be greater than the effects on daily average concentrations. This reduces the risk of potential adverse effects being overstated by monitoring data.

The predicted 39% reduction in average DRP concentrations below the 20th FEP and 46% reduction in average SIN concentrations at the same flows represents a significant improvement (Table 20). As such, the effects of the discharge on average DRP and SIN concentrations are unlikely to be detectable in the future and the potential for adverse ecological effects caused by nutrients in the discharge will be significantly reduced by eliminating the discharge at times where the risk of periphyton growth is highest (low flows and late spring to early autumn).

While the discharge does not currently appear to be increasing the risk of ammonia toxicity downstream of the discharge, modelling suggests its impact will be further reduced in the future, with the effects on median and maximum concentrations (the assessment statistics prescribed for this attribute in the NPS-FM 2020) decreasing by 19.5% and 100% respectively (Table 20). Similarly, the discharge's effects on median and 95th percentile *E. coli* concentrations (relevant for the NPS-FM 2020 attribute) are expected to be near-eliminated in the future (Table 20).

Note: The discharge will only operate at certain times (flows above 56.5 m^3/s between May and October), and future monitoring and/or reporting will need to consider differences in the effects on instantaneous and 'ambient' water quality.

Table 20: Modelled future distribution of key water quality parameters downstream of the Longburn discharge compared to an upstream and baseline data series. Effect is calculated as the relative increase in concentration between upstream and downstream under "baseline" and "future" scenarios

Parameter	Statistic	Upstream	Downstream (Baseline)	Downstream (Future)	Baseline effect	Future effect	Reduction in effect
DRP (g/m^3)	Av.	0.02347	0.02353	0.02351	0.27%	0.17%	35.8%
	Av. <20th FEP	0.02357	0.02364	0.02361	0.29%	0.18%	39.2%
	Med.	0.02241	0.02246	0.02245	0.21%	0.17%	19.4%
	Max.	0.10442	0.10446	0.10442	0.03%	0.00%	100.0%
	95th %ile	0.04335	0.04338	0.04337	0.07%	0.05%	23.1%
SIN (g/m^3)	Av.	0.57816	0.57889	0.57858	0.13%	0.07%	42.8%
	Av. <20th FEP	0.56587	0.56667	0.56630	0.14%	0.08%	46.4%
	Med.	0.55367	0.55441	0.55441	0.13%	0.13%	0.0%
	Max.	1.38324	1.38430	1.38430	0.08%	0.08%	0.0%
	95th %ile	1.02774	1.02843	1.02843	0.07%	0.07%	0.0%
NH_4-N (g/m^3)	Av.	0.10130	0.10170	0.10147	0.39%	0.16%	58.2%
	Av. <20th FEP	0.11055	0.11100	0.11073	0.41%	0.16%	61.5%
	Med.	0.08442	0.08499	0.08488	0.68%	0.54%	19.5%
	Max.	0.42329	0.42460	0.42329	0.31%	0.00%	100.0%
	95th %ile	0.23083	0.23097	0.23083	0.06%	0.00%	100.0%
E.coli (/100mL)	Av.	1006.0	1006.1	1006.1	0.01%	0.01%	20.3%
	Av. <20th FEP	409.6	409.8	409.7	0.04%	0.03%	20.5%
	Med.	281.3	281.3	281.3	0.00%	0.00%	0.0%
	Max.	36432.4	36432.4	36432.4	0.00%	0.00%	0.0%
	95th %ile	4410.1	4410.1	4410.1	0.00%	0.00%	100.0%

*0% reductions are the result of a statistic currently being driven by upstream concentrations at times when the discharge wasn't operating.
**100% reductions in effect are the result of the removing the discharge at times when upstream concentrations were high, meaning the relevant statistic is now driven by the upstream concentration.

5.2.2. Effects on aquatic ecology

The available monitoring data indicate that the discharge is not currently having an effect on periphyton biomass, and this is supported by the modelled baseline dataset. Given the discharge currently has a limited effect on periphyton, it is self-evident that further reductions in SIN and DRP loads from the Longburn discharge will have even less of an effect on algal growth in the Manawatū River. This is also supported by the modelling results (Table 21), which highlight that the discharge is only expected to have a very minor effect on SIN and DRP concentrations (change in average concentrations = 0.0004 g/m^3 and 0.00004 g/m^3 respectively) at certain flow conditions in winter, and that it is improvements in upstream nutrient concentrations that are needed to reduce periphyton biomass in the Manawatū River downstream of the Longburn discharge. While such upstream improvements would mean that the Longburn discharge would have a greater proportional effect on in-river SIN and DRP concentrations than it otherwise would, this would not translate to a greater effect on periphyton growth as the absolute increases in mass concentrations caused by the discharge would be unchanged and negligible.

There is no evidence of the discharge currently having a detectable effect on macroinvertebrate community health, and this is expected to remain the case in the future as:

- Significant changes in the mass-concentrations of key contaminants are not expected (despite significant proportional decreases in loads from the plant); and
- Any risk of effects of the discharge on periphyton (currently undetectable) are expected to be reduced.

Table 21: Baseline and future modelled periphyton biomass in the Manawatū River downstream of the Longburn discharge compared to the NPS-FM 2020 attribute states. Upstream results are provided for context.

Statistic	Upstream	Baseline	Future
% over 50 (A state)	55%	55%	55%
% over 120 (A state)	33%	33%	33%
% over 200 (B state)	16%	16%	16%
Attribute state	D	D	D

5.2.3. Section 107(1) assessment

The available water quality and ecological data suggests that the discharge of wastewater from the Longburn site to the Manawatū River does not currently result in any of the effects described in clauses (d),(f) and (g) of Section 107(1) of the RMA (see Section 3.3). Given that proposed improvements to the Longburn discharge, there is no reason to expect that such effects will occur in the future.

5.3. Effects of November contingency discharge

5.3.1. Discharge regime

The proposed November contingency discharge regime is designed to ensure that the effects are at all times no more than what is allowed for by the existing consent. Accordingly, all WWRO permeate (referred to as High Strength Effluent (HSE) in the existing consent) is stored in November, while the lower strength WMRO permeate (Low Strength Effluent (LSE) in existing consent) is diverted around the storage pond and discharged directly to the Manawatū River at the same rate as daily production. This reflects the current discharge regime, although potential effects are minimised by only discharging the WMRO permeate (LSE) to the river once all ‘available’ winter storage (up to 63,719 m^3) is full. To ensure that the amount of WWRO permeate (HSE) stored in November is kept to a minimum, it is assumed that it is prioritised for irrigation.

5.3.2. Assessment methods

Assumptions and data sources

The key assumptions made when assessing the November discharge were:

- May to October effluent volumes and discharge regime are the same as Option 1 (Table 16);
- Effluent concentrations are as per the future effects assessment (see Table 19);
- If Option 1 had been implemented between 2000 and 2020 November discharges would have been required in 2001, 2006, 2009, 2011 and 2016 (determined by Fonterra based on rainfall);
- Wastewater is prioritised over WMRO permeate for irrigation in November;
- All effluent is stored until the winter storage (63,719 m^3) is full (not including an additional 10,000 m^3 contingency storage volume);
- After winter storage is full:
  - All WMRO permeate is discharged directly to river (i.e., not mixed with WWRO permeate in storage) in accordance with existing consent conditions; and
  - All WWRO permeate stored in 10,000 m^3 contingency storage (WWRO retentate continues to be discharged to land).

Effluent volumes for each year between 2000 and 2020 were provided by Fonterra.

Analysis

The ability for the proposed November discharge regime to adequately deal with the effluent produced in that month was assessed using PointSIM:

- On all years in the 20-year modelling period when a November discharge was likely to have been required (2001, 2006, 2009, 2011 and 2016);
- Under a worse case scenario where the 2001 (year with fullest pond in the years with likely November discharge) season end storage is combined with 2016 (wettest November in modelling period) effluent volumes; and
- Under a worst case scenario where winter storage is assumed to be full heading into November 2016.

The effects of the November discharge on future reductions in average SIN and DRP concentrations below the 20th FEP in the Manawatū River were assessed for the entire modelling period (2000-2020) under the assumption that a November discharge occurs every year. This provides the most conservative assessment of effects possible.

5.3.3. Results

Modelling results suggest that:

- If the November discharge regime had been implemented between 2000 and 2020 then the proposed storage (including the 10,000 m^3 contingency) would have been sufficient to deal with all effluent produced in November that could not be discharged to land or the river (Table 22).

- The proposed storage would also have been sufficient if the pond had been full to 2001 levels in (year with the least available season end storage) October 2016 (year with the greatest November rainfall).
- However, if all available winter storage has been full at the end of October 2016 then there would have been 3,505 m^3 of WWRO permeate that could not have been stored, discharged to land or discharged to the river (Table 22).
- The proposed November contingency discharges are not predicted to materially change the overall future in-river effects of the discharge, including the relative reduction in the discharge's overall effects on in-river DRP and SIN concentrations. (Table 23).

Overall, it is expected that the proposed November discharge will adequately deal with the effluent produced in that month without adversely effecting water quality and aquatic ecology beyond the already negligible effects expected under Option 1.

Table 22: Predicted effluent surpluses (i.e., the volume that can not be stored or discharged) at the end of November 2016 when winter storage is at the end of October was either full or reflected predicted levels for 2001 (driest year with November discharge).

Winter storage to 2016 levels (m^3)	Winter storage full to 2001 levels (m^3)	Winter storage full (m^3)
0	0	3505

Table 23: Predicted reduction in the effect of the discharge on average SIN and DRP concentrations (below the 20th FEP) under Option 1 with and without a November discharge.

Scenario	Reduction in effects - SIN	Reduction in effects - DRP
No November discharge	46%	39%
November discharge	46%	39%

6. Discussion

6.1. Current effects

From the available monitoring data (July 2011 to June 2021) the following conclusions were made about the current effects of the Longburn discharge on water quality and ecology in the Manawatū River:

- The available data indicates that in the past statistically detectable degradations in NO_3-N , SIN and visual clarity occurred in the Manawatū River downstream of the Longburn discharge. However, there is limited potential for this to have resulted in adverse effects due the prevailing water quality conditions upstream exceeding relevant guideline levels, or downstream concentrations/ levels not being degraded beyond guideline levels by the discharge.
- Across all available data, statistically detectable degradations in NH_4-N, DRP, POM, $ScBOD_5$, pH, visual clarity and temperature were not detectable in the Manawatū River downstream of the discharge. However, under certain flow conditions the effects of the discharge on pH and temperature were detectable.
- The One Plan water quality targets were complied with as follows:
  - NH_4-N, $ScBOD_5$, pH, and temperature in the Manawatū River generally met the One Plan targets upstream and downstream of the Longburn discharge;
  - Visual clarity and E. coli, SIN, DRP and POM concentrations did not meet the One Plan targets upstream or downstream of the discharge; and
  - The change in pH, temperature and visual clarity between the upstream and downstream sites generally met the relevant One Plan targets.
- Sampling of the Manawatū River at Longburn since 2010 has found poor to fair ecological health at all sites (upstream and downstream) but there is no indication that the Fonterra discharge is having adverse effects on aquatic communities in this stretch of the river.
- Macroinvertebrate communities observed at the downstream, sites were similar to those seen upstream of the discharge with biotic indices showing either no statistically significant differences between the upstream and downstream sites or an improvement at the downstream sites.
- MCI was generally below the One Plan “State of the Environment” target of 100 at all sites upstream and downstream of the discharge. However, the percent change in the QMCI between upstream and downstream sites consistently met the One Plan target of no more than a 20% reduction, and in most years this metric was found to improve downstream of the discharge.
- Periphyton biomass and cover were generally higher upstream of the discharge when compared with sites downstream, suggesting no detectable effect on periphyton.
- Sites downstream of the discharge met the One Plan periphyton cover and biomass targets in all years, despite the biomass and long filamentous algae target being exceeded occasionally at the upstream sites.
- The NPS-FM 2020 assigns sites as follows:

- NH_4-N concentrations were assigned to attribute state C at the upstream and downstream monitoring sites;
- NO_3-N concentrations at both the upstream site and downstream site were assigned to attribute state A; and
- Concentrations of *E. coli* fell within attribute state E upstream of the discharge (which represents the highest risk of effects) and attribute state D downstream of the discharge.

In summary water quality data indicates that while the discharge may have increased contaminant concentrations in the past, there appears to be limited potential for this to have resulted in adverse ecological effects due the prevailing water quality conditions upstream exceeding relevant guideline levels, or downstream concentrations/ levels not being degraded beyond guideline levels by the discharge. This is supported by the results of ecological monitoring data which shows no evidence of the Longburn discharge having adverse effects on aquatic communities (plant or macroinvertebrate) in this stretch of the river. Nevertheless, it is worth noting that the available water quality data record may not provide a full picture of the past effects of the discharge due to:

- Some downstream samples being collected when the discharge was not operating;
- The discharge potentially not being fully mixed at the downstream site under some flow conditions, leading to cumulative effects being over estimated; and
- The pulse nature of the discharge meaning that the instantaneous effects of the discharge measured through water quality sampling may be greater than the effects on daily average concentrations, which may be more important in understanding the effects on factors such as periphyton growth.

6.2. Options assessment

Fonterra are exploring five options to reduce their impacts further. Based on our modelling, all of these options are likely to reduce the effects of the discharge on SIN and DRP to the point that they are unlikely to be detectable (Table 24).

Table 24: Assumptions for each of the five options tested (red) and the results of the options testing process (black).

Option	Total storage needed	River cut-off flow (no discharge below)	Daily discharge volume	Reduction in DRP below 20th FEP	Reduction in SIN below 20th FEP
1	63,719 m^3	56.5 m^3/s	Prior days production	39%	48%
2	103,803 m^3	72 m^3/s		57%	64%
3	121,983 m^3	80 m^3/s		66%	71%
4	113,412 m^3	73.4 m^3/s	Flow proportional up to 2,670 m^3/day	64%	70%
5	99,307 m^3		Flow proportional up to 4,000 m3/day	56%	63%

6.3. Future effects

Modelling results suggest that future changes to the wastewater system at the Longburn site will result in a significant proportional reduction in effects across the distribution of NH_4-N, SIN, DRP and *E. coli* concentrations. While modelling suggests that these reductions are unlikely to be detectable in-river when assessed against the assumed 'design' baseline, the material increases in concentrations observed in the current effects assessment are expected to be all vastly reduced by the upgrades due to:

- The complete removal of the discharge:
  - Between November and April (inclusive); and
  - At flows below 56.5 m^3/s year-round.
- Improved treatment performance which has already been implemented (not all of the effluent in the current effects assessment period was treated with a reverse osmosis plant); and
- The change from a pulse discharge to a continuous discharge which will mean that the instantaneous effects of the discharge will no longer be greater than the effects on daily average concentrations. This reduces the risk of potential adverse effects being overstated by monitoring data.

In the future it is expected that the effects of the discharge on both DRP and SIN concentrations will be unlikely to be detectable and the potential for adverse ecological effects caused by nutrients in the discharge will be significantly reduced by eliminating the discharge at times where the risk of periphyton growth is highest (low flows and late spring to early autumn). Furthermore, the discharge's negligible current effect on ammonia toxicity risk is expected to be further reduced, as will its effects on human health as it is not predicted to cause an increase in median and 95th percentile *E. coli* concentrations going forward.

The discharge is not currently having a detectable effect on periphyton or macroinvertebrate community health, and this is likely to remain the case in the future.

To avoid exceeding storage capacity in high rainfall years, it may be necessary to discharge some of the effluent produced in November to the Manawatū River at a strength and volume that is consistent with what is allowed by the conditions of the existing consent. PointSIM results suggest that a November discharge regime designed in this way will adequately deal with the effluent produced in that month without adversely effecting water quality and aquatic ecology beyond the already negligible effects expected under Option 1. Nevertheless, it is expected that these November discharges will be rare and subject to specific consent conditions

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APPENDICES

Appendix A: Summary of data for sites sampled on the Manawatū River upstream (U/S) and downstream (D/S) of the Longburn Dairy Products Plants between July 2011 – June 2021.

Bin	Statistic	NH_4-N (g/m³)		NH_3-N (ppb)		NO_3-N (g/m³)		SIN (g/m³)		DRP (g/m³)		E. coli (/100mL)		$ScBOD_5$ (g/m³)		POM (g/m³)		Temp. (°C)		B.D. (m)		pH		DO (%)	
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S
All flows	Av.	0.096	0.100	4.15	3.85	0.49	0.50	0.60	0.61	0.020	0.020	1381	1038	0.8	0.8	8.0	10.2	14.8	14.7	1.4	1.3	7.79	7.76	109	103
	Min	0.001	0.005	0.01	0.03	0.04	0.05	0.12	0.16	0.001	0.003	2	8	0.0	0.0	1.5	1.5	6.9	6.9	0.0	0.0	6.82	6.81	82	81
	5%ile	0.005	0.015	0.11	0.14	0.11	0.12	0.18	0.22	0.003	0.005	30	34	0.5	0.5	1.5	1.5	8.7	8.8	0.0	0.0	7.32	7.40	91	92
	10%ile	0.022	0.030	0.28	0.28	0.13	0.13	0.25	0.28	0.007	0.007	44	48	0.5	0.5	1.5	1.5	9.7	9.5	0.1	0.1	7.40	7.44	93	93
	20%ile	0.050	0.051	0.57	0.59	0.19	0.22	0.32	0.34	0.010	0.010	84	76	0.5	0.5	1.5	1.5	10.7	10.8	0.6	0.3	7.50	7.50	95	95
	25%ile	0.059	0.058	0.79	0.82	0.24	0.26	0.35	0.40	0.014	0.013	100	97	0.5	0.5	1.5	1.5	11.3	11.2	0.9	0.4	7.50	7.54	95	95
	Med.	0.085	0.089	2.24	2.28	0.48	0.48	0.58	0.59	0.020	0.020	286	238	0.5	0.5	1.5	1.5	14.2	14.5	1.5	1.3	7.64	7.69	98	98
	75%ile	0.114	0.132	3.93	3.79	0.69	0.70	0.79	0.80	0.025	0.026	860	760	1.0	1.0	6.0	5.2	17.8	18.2	1.9	2.0	7.88	7.87	115	104
	90%ile	0.178	0.181	8.48	8.15	0.90	0.91	0.97	0.99	0.032	0.032	2758	2000	1.0	1.0	13.6	14.6	21.2	20.9	2.5	2.6	8.46	8.21	146	118
	95%ile	0.208	0.233	16.20	11.71	1.00	1.00	1.10	1.11	0.037	0.038	5601	4500	2.0	2.0	20.3	25.9	21.8	21.7	3.1	3.0	8.92	8.62	155	136
	Max	0.350	0.383	51.61	51.35	1.18	1.17	1.26	1.26	0.050	0.052	46000	29000	4.0	5.0	208.0	367.0	26.1	24.6	3.8	5.4	9.51	9.57	240	172
	StDev	0.066	0.066	7.64	6.15	0.29	0.28	0.28	0.27	0.010	0.010	4352	2895	0.5	0.6	22.9	37.7	4.3	4.2	0.9	1.1	0.48	0.39	25	14
	95% C.I.	0.010	0.010	1.14	0.92	0.04	0.04	0.04	0.04	0.001	0.001	654	434	0.1	0.1	4.2	6.9	0.8	0.8	0.2	0.2	0.07	0.06	5	3
	Guideline	0.4	0.4					0.444	0.444	0.01	0.01	550	550	2	2	2	2	22	22	2.5	2.5	8.5	8.5	70	70
	%compliance	100%	100%					32%	30%	17%	17%	65%	70%	94%	93%	56%	62%	95%	97%	9%	11%	90%	92%	100%	100%
	N. of Samples	172	172	172	172	172	172	172	172	172	172	170	171	172	171	115	115	115	115	75	98	172	172	115	115
	Z-stat	1.263		1.336		3.877		2.695		0.405		2.745		0.388		0.554		0.648		2.680		0.835		2.364	
	P-value	0.207		0.182		0.000		0.007		0.685		0.006		0.698		0.579		0.517		0.007		0.403		0.018	

Bin	Statistic	NH_4-N (g/m³)		NH_3-N (ppb)		NO_3-N (g/m³)		SIN (g/m³)		DRP (g/m³)		E. coli (/100mL)		ScBOD₅ (g/m³)		POM (g/m³)		Temp. (°C)		B.D. (m)		pH		DO (%)	
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S
> 20th FEP	Av.	0.057	0.057	1.17	1.15	0.60	0.59	0.66	0.65	0.020	0.021	6137	4172	1.0	0.9	24.2	29.2	11.2	11.2	0.5	0.3	7.58	7.61	95	95
	Min	0.001	0.005	0.01	0.08	0.13	0.13	0.18	0.18	0.001	0.005	230	120	0.5	0.5	5.0	4.0	8.5	8.5	0.0	0.0	7.30	7.34	91	88
	5%ile	0.002	0.017	0.02	0.13	0.20	0.18	0.27	0.23	0.002	0.006	259	248	0.5	0.5	5.0	4.8	8.8	8.9	0.0	0.0	7.32	7.40	91	91
	10%ile	0.006	0.022	0.09	0.19	0.30	0.30	0.31	0.32	0.005	0.011	530	446	0.5	0.5	5.6	5.0	9.3	9.2	0.0	0.0	7.41	7.40	91	92
	20%ile	0.024	0.030	0.22	0.20	0.38	0.40	0.44	0.46	0.017	0.016	689	799	0.5	0.5	9.0	6.2	9.7	9.7	0.0	0.0	7.46	7.47	92	93
	25%ile	0.031	0.032	0.26	0.23	0.43	0.42	0.48	0.50	0.017	0.018	800	960	0.5	0.5	9.0	7.0	9.8	9.9	0.0	0.0	7.48	7.48	93	93
	Med.	0.050	0.041	0.46	0.58	0.58	0.61	0.61	0.64	0.021	0.020	2452	1900	1.0	0.5	14.0	13.0	10.9	11.1	0.0	0.1	7.51	7.59	96	96
	75%ile	0.075	0.060	1.05	0.92	0.78	0.73	0.86	0.84	0.025	0.025	5480	3300	1.0	1.3	20.0	28.0	11.5	11.6	0.8	0.1	7.67	7.70	96	97
	90%ile	0.103	0.100	2.77	2.27	0.89	0.96	0.93	1.02	0.027	0.028	11000	9680	1.5	1.9	58.8	77.8	13.8	14.0	1.2	0.7	7.85	7.85	97	97
	95%ile	0.109	0.118	4.03	3.74	1.02	1.04	1.08	1.10	0.032	0.031	26000	13795	2.0	2.0	74.0	92.0	14.7	14.9	1.4	1.1	7.89	7.89	98	98
	Max	0.207	0.214	7.91	8.18	1.10	1.11	1.22	1.21	0.050	0.043	46000	29000	3.0	3.0	106.0	144.0	16.6	16.5	1.6	1.6	8.11	8.11	100	99
	StDev	0.046	0.044	1.81	1.79	0.26	0.26	0.27	0.27	0.010	0.008	10815	6523	0.6	0.7	27.4	37.5	2.1	2.1	0.9	0.6	0.19	0.18	3	3
	95% C.I.	0.019	0.018	0.74	0.73	0.10	0.11	0.11	0.11	0.004	0.003	4626	2726	0.3	0.3	13.0	17.8	1.0	1.0	1.0	0.4	0.08	0.07	1	1
	Guideline	0.4	0.4					0.444	0.444	0.01	0.01	550	550	2	2	2	2	22	22	2.5	2.5	8.5	8.5	70	70
	%compliance	100%	100%					22%	22%	13%	9%	14%	18%	91%	87%	0%	0%	100%	100%	0%	0%	100%	100%	100%	100%
	N. of Samples	23	23	23	23	23	23	23	23	23	23	21	22	23	23	17	17	17	17	3	7	23	23	17	17
	Z-stat	0.087		0.049		1.060		1.445		0.966		2.072		0.365		0.596		2.072		-		1.293		0.947	
	P-value	0.931		0.961		0.289		0.149		0.334		0.038		0.715		0.551		0.038		-		0.196		0.344	

Bin	Statistic	NH4-N (g/m³)		NH3-N (ppb)		NO3-N (g/m³)		SIN (g/m³)		DRP (g/m³)		E. coli (/100mL)		ScBOD5 (g/m³)		POM (g/m³)		Temp. (°C)		B.D. (m)		pH		DO (%)	
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S
	Av.	0.102	0.107	4.61	4.27	0.47	0.49	0.59	0.61	0.020	0.020	711	575	0.8	0.8	5.2	7.0	15.4	15.3	1.4	1.4	7.82	7.79	111.6	104.1
	Min	0.003	0.005	0.02	0.03	0.04	0.05	0.12	0.16	0.003	0.003	2	8	0.0	0.0	1.5	1.5	6.9	6.9	0.0	0.0	6.82	6.81	81.9	81.0
	5%ile	0.005	0.015	0.17	0.16	0.10	0.11	0.18	0.22	0.005	0.004	25	32	0.5	0.5	1.5	1.5	8.7	8.8	0.1	0.1	7.32	7.39	92.7	93.2
	10%ile	0.022	0.040	0.41	0.37	0.13	0.13	0.25	0.28	0.007	0.007	41	44	0.5	0.5	1.5	1.5	9.9	9.9	0.2	0.2	7.40	7.46	93.9	94.0
	20%ile	0.060	0.060	0.87	1.02	0.17	0.21	0.31	0.33	0.010	0.010	76	70	0.5	0.5	1.5	1.5	11.7	11.5	0.7	0.4	7.50	7.50	95.3	95.2
	25%ile	0.062	0.064	1.00	1.21	0.23	0.24	0.35	0.39	0.013	0.012	91	80	0.5	0.5	1.5	1.5	12.1	12.4	0.9	0.6	7.53	7.56	96.2	95.8
	Med.	0.090	0.092	2.45	2.52	0.43	0.46	0.56	0.59	0.020	0.020	241	190	0.5	0.5	1.5	1.5	15.3	15.2	1.5	1.4	7.67	7.70	99.4	98.4
	75%ile	0.120	0.140	4.15	3.91	0.68	0.70	0.78	0.80	0.027	0.026	670	437	1.0	1.0	3.8	3.0	18.7	18.6	1.9	2.1	7.90	7.89	118.0	106.2
	90%ile	0.180	0.187	9.10	10.08	0.90	0.90	0.98	0.98	0.032	0.032	1561	1014	1.0	1.0	7.0	8.0	21.3	21.2	2.5	2.7	8.64	8.33	151.3	121.0
< 20th FEP	95%ile	0.217	0.249	16.80	12.49	0.99	0.99	1.10	1.11	0.038	0.038	3068	1677	2.0	2.0	10.0	11.5	22.4	21.7	3.2	3.2	8.99	8.64	157.4	139.0
	Max	0.350	0.383	51.61	51.35	1.18	1.17	1.26	1.26	0.049	0.052	9700	12000	4.0	5.0	208.0	367.0	26.1	24.6	3.8	5.4	9.51	9.57	240.0	172.0
	StDev	0.066	0.066	8.09	6.47	0.29	0.28	0.28	0.27	0.010	0.010	1470	1383	0.5	0.6	21.0	37.0	4.3	4.1	0.9	1.1	0.50	0.41	26.4	15.3
	95% C.I.	0.011	0.011	1.30	1.04	0.05	0.05	0.04	0.04	0.002	0.002	236	222	0.1	0.1	4.2	7.3	0.9	0.8	0.2	0.2	0.08	0.07	5.2	3.0
	Guideline	0.4	0.4					0.444	0.444	0.01	0.01	550	550	2	2	2	2	22	22	2.5	2.5	8.5	8.5	70	70
	%compliance	100%	100%					34%	31%	18%	18%	72%	77%	94%	94%	65%	72%	94%	97%	10%	12%	88%	91%	100%	100%
	N. of Samples	149	149	149	149	149	149	149	149	149	149	149	149	149	148	98	98	98	98	72	91	149	149	98	98
	Z-stat	1.303		1.370		4.694		3.321		0.092		1.922		0.235		0.288		1.196		2.680		0.389		2.776	
	P-value	0.193		0.171		0.000		0.001		0.927		0.055		0.814		0.773		0.232		0.007		0.697		0.006	

Bin	Statistic	NH_4-N (g/m^3)		NH_3-N (ppb)		NO_3-N (g/m^3)		SIN (g/m^3)		DRP (g/m^3)		E. coli (/100mL)		ScBOD$_5$ (g/m^3)		POM (g/m^3)		Temp. (°C)		B.D. (m)		pH		DO (%)	
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S
Median to 20th FEP	Av.	0.084	0.084	2.08	2.27	0.64	0.65	0.73	0.74	0.023	0.023	892	888	0.9	0.9	5.0	5.5	12.6	12.9	0.8	0.7	7.59	7.61	97.3	96.8
	Min	0.005	0.005	0.02	0.03	0.08	0.09	0.17	0.17	0.006	0.006	41	41	0.0	0.0	1.5	1.5	6.9	6.9	0.0	0.0	7.02	7.03	92.9	91.9
	5%ile	0.022	0.021	0.17	0.12	0.19	0.22	0.25	0.29	0.010	0.009	76	76	0.5	0.5	1.5	1.5	7.9	8.0	0.0	0.0	7.22	7.27	93.9	93.6
	10%ile	0.050	0.042	0.36	0.34	0.25	0.29	0.33	0.38	0.016	0.014	99	102	0.5	0.5	1.5	1.5	9.1	9.0	0.0	0.0	7.40	7.41	94.5	94.1
	20%ile	0.060	0.055	0.53	0.50	0.40	0.42	0.51	0.53	0.017	0.017	128	146	0.5	0.5	1.5	1.5	10.2	10.2	0.1	0.2	7.49	7.50	95.1	95.1
	25%ile	0.062	0.060	0.64	0.67	0.45	0.46	0.53	0.56	0.018	0.018	168	185	0.5	0.5	1.5	1.5	10.5	10.5	0.1	0.2	7.50	7.50	95.3	95.2
	Med.	0.081	0.074	1.78	1.91	0.63	0.64	0.72	0.72	0.023	0.023	380	355	0.5	0.5	3.0	3.0	12.8	13.4	0.6	0.4	7.60	7.60	96.8	96.8
	75%ile	0.101	0.094	2.89	2.75	0.87	0.89	0.97	0.95	0.027	0.026	943	919	1.0	1.0	6.7	7.3	14.3	14.6	1.6	1.0	7.68	7.69	98.5	97.9
	90%ile	0.122	0.131	3.98	3.70	1.01	1.00	1.12	1.11	0.035	0.029	1940	1683	1.9	1.9	10.0	12.5	15.8	16.3	1.9	2.0	7.80	7.80	101.4	99.2
	95%ile	0.161	0.181	5.86	7.38	1.05	1.06	1.15	1.16	0.036	0.036	3980	3650	2.0	2.0	14.3	20.0	16.3	18.3	2.1	2.1	7.87	7.92	103.8	100.1
	Max	0.222	0.284	8.48	11.59	1.18	1.17	1.26	1.26	0.049	0.052	6200	7330	4.0	5.0	21.0	25.0	18.8	21.4	2.1	2.6	8.44	8.53	106.1	106.0
	StDev	0.041	0.050	1.77	2.40	0.28	0.27	0.28	0.27	0.008	0.008	1306	1435	0.6	0.7	4.7	6.0	2.8	3.2	0.8	0.7	0.22	0.24	3.0	2.5
	95% C.I.	0.010	0.012	0.43	0.59	0.07	0.07	0.07	0.07	0.002	0.002	320	352	0.1	0.2	1.5	2.0	0.9	1.0	0.3	0.3	0.05	0.06	1.0	0.8
	Guideline	0.4	0.4					0.444	0.444	0.01	0.01	550	550	2	2	2	2	22	22	2.5	2.5	8.5	8.5	70	70
	%compliance	100%	100%					16%	14%	5%	6%	58%	61%	89%	89%	36%	47%	100%	100%	0%	3%	100%	97%	100%	100%
	N. of Samples	64	64	64	64	64	64	64	64	64	64	64	64	64	64	36	36	36	36	20	32	64	64	36	36
	Z-stat	0.914		0.438		1.303		0.530		1.005		0.627		0.000		1.066		1.617		1.913		2.111		0.086	
	P-value	0.361		0.662		0.193		0.596		0.315		0.531		1.000		0.286		0.106		0.056		0.035		0.931	

Bin	Statistic	NH4-N (g/m³)		NH3-N (ppb)		NO3-N (g/m³)		SIN (g/m³)		DRP (g/m³)		E. coli (/100mL)		ScBOD5 (g/m³)		POM (g/m³)		Temp. (°C)		B.D. (m)		pH		DO (%)	
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S
	Av.	0.116	0.125	6.57	5.82	0.35	0.37	0.48	0.51	0.018	0.018	581	342	0.7	0.7	5.4	7.8	17.1	16.7	1.7	1.8	8.00	7.92	119.9	108.3
	Min	0.003	0.005	0.04	0.03	0.04	0.05	0.12	0.16	0.003	0.003	2	8	0.0	0.0	1.5	1.5	7.7	7.7	0.1	0.0	6.82	6.81	81.9	81.0
	5%ile	0.005	0.011	0.19	0.28	0.09	0.09	0.14	0.20	0.003	0.003	16	21	0.5	0.5	1.5	1.5	9.9	9.7	0.6	0.5	7.39	7.43	90.4	93.3
	10%ile	0.018	0.049	0.76	1.06	0.11	0.12	0.23	0.26	0.005	0.005	30	34	0.5	0.5	1.5	1.5	11.6	11.0	0.9	0.7	7.41	7.50	92.9	94.1
	20%ile	0.060	0.067	1.37	1.57	0.13	0.15	0.27	0.31	0.008	0.008	44	49	0.5	0.5	1.5	1.5	13.1	13.1	1.0	1.0	7.59	7.60	96.6	95.9
	25%ile	0.070	0.080	1.61	1.89	0.15	0.16	0.29	0.32	0.009	0.009	58	57	0.5	0.5	1.5	1.5	14.3	14.1	1.1	1.1	7.60	7.64	97.6	97.2
	Med.	0.107	0.118	3.08	3.54	0.28	0.30	0.46	0.47	0.016	0.017	134	110	0.5	0.5	1.5	1.5	17.0	17.0	1.5	1.6	7.82	7.80	114.1	101.8
	75%ile	0.150	0.160	5.91	5.37	0.53	0.55	0.65	0.65	0.025	0.026	361	240	1.0	1.0	1.5	1.5	20.7	19.9	2.0	2.3	8.22	8.11	134.7	112.6
	90%ile	0.200	0.200	16.42	11.76	0.70	0.71	0.82	0.83	0.031	0.032	930	536	1.0	1.0	4.0	3.0	21.6	21.7	2.8	2.9	8.94	8.62	154.1	134.3
<	95%ile	0.290	0.261	20.59	22.49	0.74	0.77	0.89	0.90	0.038	0.040	2170	795	1.0	1.0	6.2	5.0	23.1	21.9	3.5	3.8	9.19	8.88	166.2	143.5
median	Max	0.350	0.383	51.61	51.35	0.90	0.95	0.98	1.14	0.045	0.044	9700	12000	2.0	2.0	208.0	367.0	26.1	24.6	3.8	5.4	9.51	9.57	240.0	172.0
	StDev	0.078	0.071	10.26	8.05	0.23	0.23	0.23	0.22	0.011	0.011	1585	1310	0.3	0.3	26.2	46.4	4.3	4.0	0.8	1.0	0.58	0.46	30.3	17.8
	95% C.I.	0.017	0.015	2.19	1.72	0.05	0.05	0.05	0.05	0.002	0.002	339	280	0.1	0.1	6.5	11.5	1.1	1.0	0.2	0.3	0.12	0.10	7.5	4.4
	Guideline	0.4	0.4					0.444	0.444	0.01	0.01	550	550	2	2	2	2	22	22	2.5	2.5	8.5	8.5	70	70
	%compliance	100%	100%					48%	44%	29%	27%	82%	89%	98%	98%	82%	87%	90%	95%	13%	17%	79%	86%	100%	100%
	N. of Samples	84	84	84	84	84	84	84	84	84	84	84	84	84	83	62	62	62	62	52	59	84	84	62	62
	Z-stat	1.898		0.707		4.952		3.552		0.869		2.019		0.118		0.800		2.370		2.027		0.945		3.254	
	P-value	0.058		0.479		0.000		0.000		0.385		0.043		0.906		0.424		0.018		0.043		0.345		0.001	

Bin	Statistic	NH_4-N (g/m^3)		NH_3-N (ppb)		NO_3-N (g/m^3)		SIN (g/m^3)		DRP (g/m^3)		E. coli (/100mL)		$ScBOD_5$ (g/m^3)		POM (g/m^3)		Temp. (°C)		B.D. (m)		pH		DO (%)	
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S
1/2 median to median	Av.	0.099	0.105	3.18	3.06	0.47	0.49	0.58	0.61	0.023	0.023	424	460	0.7	0.7	9.0	14.1	15.1	15.2	1.3	1.3	7.83	7.77	109.4	102.6
	Min	0.003	0.005	0.04	0.03	0.12	0.16	0.14	0.22	0.003	0.003	2	34	0.0	0.0	1.5	1.5	7.7	7.7	0.1	0.0	6.82	6.81	81.9	84.0
	5%ile	0.005	0.005	0.10	0.12	0.16	0.19	0.24	0.29	0.003	0.004	26	49	0.5	0.5	1.5	1.5	8.8	8.8	0.3	0.3	7.39	7.40	91.3	93.5
	10%ile	0.015	0.046	0.54	0.50	0.22	0.23	0.29	0.31	0.010	0.008	40	55	0.5	0.5	1.5	1.5	10.0	10.0	0.6	0.5	7.40	7.44	92.7	93.8
	20%ile	0.058	0.062	1.06	1.20	0.27	0.28	0.39	0.42	0.014	0.013	56	67	0.5	0.5	1.5	1.5	11.8	11.8	0.9	0.8	7.50	7.50	94.5	94.8
	25%ile	0.071	0.071	1.28	1.34	0.28	0.31	0.43	0.45	0.016	0.015	70	71	0.5	0.5	1.5	1.5	12.4	12.6	1.0	0.9	7.58	7.52	96.0	95.2
	Med.	0.100	0.103	2.65	2.71	0.42	0.46	0.60	0.58	0.024	0.025	121	140	0.5	0.5	1.5	1.5	15.6	15.7	1.1	1.3	7.70	7.70	98.7	98.4
	75%ile	0.119	0.146	3.81	3.86	0.64	0.65	0.75	0.76	0.029	0.029	323	256	1.0	1.0	1.5	1.5	18.3	18.4	1.7	1.6	7.90	7.86	109.7	101.8
	90%ile	0.170	0.161	5.77	5.96	0.73	0.75	0.88	0.89	0.035	0.038	680	611	1.0	1.0	4.2	4.5	20.1	20.2	2.1	2.1	8.48	8.14	133.0	110.0
	95%ile	0.180	0.176	9.56	7.63	0.78	0.83	0.89	0.96	0.040	0.041	982	973	1.0	1.0	6.0	5.0	21.5	21.5	2.1	2.4	8.99	8.42	162.1	130.4
	Max	0.290	0.270	16.88	10.66	0.90	0.95	0.98	1.14	0.045	0.044	9700	12000	2.0	2.0	208.0	367.0	21.6	21.9	3.6	3.9	9.51	9.57	240.0	172.0
	StDev	0.056	0.054	3.22	2.36	0.21	0.21	0.22	0.22	0.010	0.011	1370	1686	0.4	0.4	37.6	66.7	3.9	3.9	0.7	0.8	0.51	0.40	30.7	16.2
	95% C.I.	0.016	0.015	0.89	0.65	0.06	0.06	0.06	0.06	0.003	0.003	380	467	0.1	0.1	13.5	23.9	1.4	1.4	0.3	0.3	0.14	0.11	11.0	5.8
	Guideline	0.4	0.4					0.444	0.444	0.01	0.01	550	550	2	2	2	2	22	22	2.5	2.5	8.5	8.5	70	70
	%compliance	100%	100%					28%	22%	10%	12%	88%	88%	98%	98%	77%	80%	100%	100%	4%	4%	88%	92%	100%	100%
	N. of Samples	50	50	50	50	50	50	50	50	50	50	50	50	50	49	30	30	30	30	24	28	50	50	30	30
	Z-stat	1.693		1.691		4.159		2.912		1.071		0.642		0.270		0.254		0.646		0.456		0.258		0.761	
	P-value	0.090		0.091		0.000		0.004		0.284		0.521		0.787		0.800		0.518		0.648		0.796		0.447	

Bin	Statistic	NH_4-N (g/m^3)		NH_3-N (ppb)		NO_3-N (g/m^3)		SIN (g/m^3)		DRP (g/m^3)		E. coli (/100mL)		$ScBOD_5$ (g/m^3)		POM (g/m^3)		Temp. (°C)		B.D. (m)		pH		DO (%)	
		U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S	U/S	D/S
< 1/2 median	Av.	0.142	0.154	11.56	9.89	0.17	0.18	0.33	0.36	0.011	0.010	811	170	0.7	0.7	2.0	1.9	18.9	18.2	2.0	2.3	8.27	8.15	129.7	113.7
	Min	0.005	0.010	0.17	0.27	0.04	0.05	0.12	0.16	0.003	0.003	4	8	0.5	0.5	1.5	1.5	9.9	9.6	0.6	0.5	7.32	7.54	82.3	81.0
	5%ile	0.005	0.034	0.69	1.46	0.05	0.06	0.14	0.18	0.003	0.003	13	15	0.5	0.5	1.5	1.5	12.8	12.2	0.9	1.0	7.47	7.60	90.6	93.1
	10%ile	0.022	0.052	1.19	1.94	0.09	0.08	0.15	0.19	0.005	0.004	16	21	0.5	0.5	1.5	1.5	14.3	14.0	1.1	1.4	7.59	7.70	101.7	96.7
	20%ile	0.060	0.093	2.26	3.29	0.10	0.11	0.23	0.26	0.007	0.006	32	26	0.5	0.5	1.5	1.5	15.5	15.0	1.4	1.6	7.75	7.77	111.2	101.2
	25%ile	0.071	0.103	2.52	3.45	0.11	0.12	0.24	0.27	0.007	0.007	48	35	0.5	0.5	1.5	1.5	16.4	15.2	1.5	1.6	7.80	7.81	114.6	101.5
	Med.	0.130	0.150	5.73	5.01	0.14	0.14	0.32	0.32	0.009	0.010	175	77	0.5	0.5	1.5	1.5	19.3	18.7	1.8	2.1	8.15	8.06	121.7	108.7
	75%ile	0.198	0.198	14.47	11.78	0.19	0.23	0.37	0.44	0.015	0.013	552	230	1.0	1.0	1.5	1.5	21.3	20.8	2.5	2.7	8.71	8.46	147.6	119.8
	90%ile	0.298	0.259	35.62	24.09	0.29	0.33	0.54	0.58	0.019	0.018	2140	461	1.0	1.0	2.9	1.5	23.1	21.7	3.1	3.5	9.06	8.88	154.1	138.5
	95%ile	0.326	0.287	47.38	29.83	0.35	0.37	0.60	0.62	0.021	0.019	3448	612	1.2	1.0	5.6	3.3	24.0	22.7	3.7	4.0	9.26	9.00	175.1	147.1
	Max	0.350	0.383	51.61	51.35	0.51	0.48	0.67	0.65	0.022	0.020	9678	810	2.0	2.0	8.6	9.0	26.1	24.6	3.8	5.4	9.41	9.03	200.6	160.9
	StDev	0.098	0.083	14.36	11.22	0.10	0.10	0.14	0.14	0.005	0.005	1855	207	0.3	0.3	1.6	1.5	3.8	3.5	0.8	1.0	0.59	0.45	26.8	17.8
	95% C.I.	0.033	0.028	4.83	3.77	0.03	0.04	0.05	0.05	0.002	0.002	623	70	0.1	0.1	0.6	0.5	1.3	1.2	0.3	0.4	0.20	0.15	9.3	6.2
	Guideline	0.4	0.4					0.444	0.444	0.01	0.01	550	550	2	2	2	2	22	22	2.5	2.5	8.5	8.5	70	70
	%compliance	100%	100%					76%	76%	56%	50%	74%	91%	97%	97%	88%	94%	81%	91%	21%	29%	65%	76%	100%	100%
	N. of Samples	34	34	34	34	34	34	34	34	34	34	34	34	34	34	32	32	32	32	28	31	34	34	32	32
	Z-stat	1.121		0.563		2.749		2.107		0.091		3.802		0.548		0.730		3.302		2.186		1.372		3.273	
	P-value	0.262		0.574		0.006		0.035		0.927		0.000		0.584		0.465		0.001		0.029		0.170		0.001	

Appendix B: Summary of attribute states adapted from Appendix 2 of the National Policy Statement for Freshwater Management (2020).

Table B-1: Attribute states for Ammonia (Toxicity) taken from Appendix 2 of the National Policy Statement for Freshwater Management 2020.

Value	Ecosystem health		
Freshwater Body Type	Lakes and Rivers		
Attribute	Ammonia (Toxicity)		
Attribute Unit	mg NH_4-N/L (milligrams ammoniacal-nitrogen per litre)		
Attribute State	Numeric Attribute State		Narrative Attribute State
	Annual Median*	Annual Maximum*	
A	≤ 0.03	≤ 0.05	99% species protection level. No observed effect on any species.
B	>0.03 and ≤ 0.24	>0.05 and ≤ 0.40	95% species protection level. Starts impacting occasionally on the 5% most sensitive species.
National Bottom Line	1.30	2.20	
C	>0.24 and ≤ 1.30	>0.40 and ≤ 2.020	80% species protection level. Starts impacting regularly on the 20% most sensitive species (reduced survival of most sensitive species).
D	>1.30	>2.20	Starts approaching acute impact level (i.e., risk of death) for sensitive species.

*Based on pH 8 and temperature of 20ºC

Compliance with the numeric attribute states should be undertaken after pH adjustment.

Table B-2: Attribute states for Nitrate (Toxicity) taken from Appendix 2 of the National Policy Statement for Freshwater Management 2020.

<table>
<tr><td>Value</td><td colspan="3">Ecosystem health</td></tr>
<tr><td>Freshwater Body Type</td><td colspan="3">Rivers</td></tr>
<tr><td>Attribute</td><td colspan="3">Nitrate (Toxicity)</td></tr>
<tr><td>Attribute Unit</td><td colspan="3">mg NO_3-N/L (milligrams nitrate-nitrogen per litre)</td></tr>
<tr><td>Attribute State</td><td colspan="2">Numeric Attribute State</td><td>Narrative Attribute State</td></tr>
<tr><td></td><td>Annual Median</td><td>Annual 95th Percentile</td><td></td></tr>
<tr><td>A</td><td>≤ 1.0</td><td>≤ 1.5</td><td>High conservation value system.
Unlikely to be effects even on sensitive species.</td></tr>
<tr><td>B</td><td>>1.0 and ≤ 2.4</td><td>>1.5 and ≤ 3.5</td><td rowspan="2">Some growth effect on up to 5% of species.</td></tr>
<tr><td>National Bottom Line</td><td>6.9</td><td>9.8</td></tr>
<tr><td>C</td><td>>2.4 and ≤ 6.9</td><td>>3.5 and ≤ 9.8</td><td>Growth effects on up to 20% of species (mainly sensitive species such as fish).
No acute effects.</td></tr>
<tr><td>D</td><td>>6.9</td><td>>9.8</td><td>Impacts on growth of multiple species, and starts approaching acute impact level (i.e., risk of death) for sensitive species at higher concentrations (> 20 mg/l).</td></tr>
</table>

Note: This attribute measures the toxic effect of nitrate, not the trophic state. Where other attributes measure trophic state, for example periphyton, freshwater objectives, limits and/or methods for those attributes will be more stringent.

Table B-3: Attribute states for *E. coli* taken from Appendix 2 of the National Policy Statement for Freshwater Management (2020).

Value	Human health for recreation				
Freshwater Body Type	Lakes and rivers				
Attribute	*E. coli*				
Attribute Unit	*E. coli* / 100ml (number of *E. coli* per hundred millilitres)				
Attribute State	Numeric Attribute State				Narrative Attribute State
	% exceedances over 540 cfu/100ml	% exceedances over 260 cfu/100ml	Median concentration (cfu/100ml)	95th percentile of *E. coli* /100ml	Description of risk of *Campylobacter* infection (based on *E. coli* indicator)
A (blue)	<5%	<20%	<130	<540	For at least half the time, the estimated risk is <1 in 1000 (0.1% risk). The predicted average infection risk is 1% *.
B (green)	5-10%	20-30%	<130	<1000	For at least half the time, the estimated risk is <1 in 1000 (0.1% risk). The predicted average infection risk is 2% *.
C (yellow)	10-20%	20-34%	<130	<1200	For at least half the time, the estimated risk is <1 in 1000 (0.1% risk). The predicted average infection risk is 3% *.
D (orange)	20-30%	>34%	>130	>1200	20-30% of the time the estimated risk is >50 in 1000 (>5% risk). The predicted average infection risk is >3% *.
E (red)	>30%	>50%	>260	>1200	For more than 30% of the time the estimated risk is >50 in 1000 (>5% risk). The predicted average infection risk is >7% *.

* The predicted average infection risk is the overall average infection to swimmers based on a random exposure on a random day, ignoring any possibility of not swimming during high flows or when surveillance advisory is in place (assuming that the *E. coli* concentration follows a lognormal distribution). Actual risk will generally be less if a person does not swim during high flows.

Table 4: Attribute states for Periphyton taken from Appendix 2 of the National Policy Statement for Freshwater Management (2014).

Value	Ecosystem health		
Freshwater Body Type	Rivers		
Attribute	Periphyton (Trophic state)		
Attribute Unit	mg chl-a/m² (milligrams chlorophyll-*a* per square metre)		
Attribute State	Numeric Attribute State (Default Class)	Numeric Attribute State (Productive Class[1])	Narrative Attribute State
	Exceeded no more than 8% of samples[2]	Exceeded no more than 17% of samples[2]	
A	≤ 50	≤ 50	Rare blooms reflecting negligible nutrient enrichment and/or alteration of the natural flow regime or habitat
B	>50 and ≤ 120	>50 and ≤ 120	Occasional blooms reflecting low nutrient enrichment and/or alteration of the natural flow regime or habitat
C	>120 and ≤ 200	>120 and ≤ 200	Periodic short-duration nuisance blooms reflecting moderate nutrient enrichment and/or alteration of the natural flow regime or habitat
National Bottom Line	200	200	
D	>200	>200	Regular and/or extended-duration nuisance blooms reflecting high nutrient enrichment and/or significant alteration of the natural flow regime or habitat

1. Classes are streams and rivers defined according to types in the River Environment Classification (REC). The Productive periphyton class is defined by the combination of REC “Dry” Climate categories (i.e., Warm-Dry (WD) and cool-Dry (CD)) and REC Geology categories that have naturally high levels of nutrient enrichment due to their catchment geology (i.e., Soft-Sedimentary (SS), Volcanic Acidic (VA) and Volcanic Basic (VB)). Therefore, the productive category is defined by the following REC defined types: WD/SS, WD/VB, WD/VA, CD/SS, CD/VB, CD/VA. The default class includes all REC types not in the Productive class.
2. Based on monthly monitoring regime. The minimum record length for grading a site based on periphyton (chl-a) is 3 years.

Appendix D: Model description

Water quality modelling methods

Introduction

The first step in the assessment of the effects of a discharge on an aquatic receiving environment is generally to estimate or calculate the changes in water quality (e.g., concentration of nutrients, water clarity) caused by the discharge, and the resulting water quality after reasonable mixing. Once effects on water quality are known, likely effects on aquatic life can be inferred.

In the case of discharges of effluent to rivers, the water quality assessment is often conducted on the basis of a limited number of assumed river and discharge conditions: i.e., if we assume the river is flowing at *x* m^3/s and the discharge is *y* m^3/day with a dissolved reactive phosphorus (DRP) concentration of *z* g/m^3, then the concentration increase caused by the discharge can be calculated. Scenarios with different likeliness of occurrence, including "worst-case" scenarios are generally developed to provide a range of likely downstream conditions.

Whilst acceptable in the case of continuous discharges to water, the type of static approach described above is ill-suited to assessing the effects of dual land/water discharge systems, as it is inherently unable to reflect the "stop-and-go" nature of the river discharge component. Furthermore, a number of the water quality targets set out in Schedule E of the Horizon's One Plan are expressed as average values over variable combinations of river flow and/or time periods – for example, soluble inorganic nitrogen (SIN) and dissolved reactive phosphorus (DRP) water quality targets are expressed as annual average concentrations measured at flows below the 20th flow exceedance percentile. "Static" scenario assessments are again ill-suited to assessing the degree of likely compliance with these water quality targets. A daily time-step approach, which accounts for the key elements, including discharge volumes, river flow, discharge quality and river water quality on a daily basis over a significant period of time (20 years in this case), is better suited to evaluating the likely outcomes of different discharge scenarios.

Aquanet have also been using PointSIM to inform the Nature Calls Best Practicable Option (BPO) process for the Palmerston North City Council (PNCC) Totora Road Wastewater Treatment Plant (WWTP). The PNCC WWTP discharges to the Manawatū River approximately 3.5 kilometres upstream of the Longburn discharge, and wherever possible text in the sections below has been drawn from reports drafted for that process to ensure consistency (Greer & Ausseil 2020).

In the work presented in this report, the model covers the period 01/07/2000 to 30/06/2020, hereafter referred to as the "modelling period".

Available data and preparation

The river and discharge flow and water quality data used in this assessment are summarised in Table C-1. The river and effluent water quality datasets contained a small proportion of "less than detection limit" results. To conduct statistical analysis, such censored data were replaced by numerical values. Specifically, they were replaced by half of the detection limit, which is consistent with the recommendations of Scarsbrook and McBride (2007).

Daily discharge volume (m^3/day) discharged to the river in the 20-year modelling period were provided by Fonterra. The basic flow statistics at the Manawatū at Teachers College flow site used in this assessment were the same as those set out in Henderson and Diettrich (2007) (Table C-2).

Table C-1: Summary of data used in the PointSIM model.

Site	Type	Parameters	Frequency	Period	Source
Manawatū River at Teachers College	River flow	Daily Mean flow	Daily	Jan 1995 –June 2020	Horizons
Manawatū R. U/S discharge	Water quality	DRP, SIN, NO_3-N, NO_2-N, NH_4-N, *E. coli*, TSS, Clarity, $ScBOD_5$	~Monthly	July 2012 – June 2019	Horizons and Fonterra (from 2012)
Manawatū R. D/S discharge					
Manawatū R. U/S & D/S discharge	Periphyton biomass	Chl-*a* (mg/m^2)	Monthly	July 2012 – June 2019	Fonterra
Longburn effluent	Effluent quality	DRP, SIN, NO_3-N, NO_2-N, NH_4-N, *E. coli*, TSS, $ScBOD_5$, TKN	Monthly	July 2012 – June 2019	
	Effluent quantity	Daily discharge volume	Daily	July 2012 –June 2019	

Table C-2:Flow statistics for the Manawatū River at Teachers College, from Henderson and Diettrich (2007).

Flow statistic	Value (L/s)
MALF	15,735
Half median flow	36,702
Median flow	73,404
20^{th} percentile exceedance flow (Q^{20})	164,281
3 × median flow	220,212

Water quality model structure

The water quality component of the model calculates the concentrations of different water quality parameters downstream of the discharge. It is based on very simple mass conservation principles: a certain quantity of a given constituent is released into a certain quantity of receiving water, resulting in a certain concentration of the said constituent.

The concentration increase of a constituent C caused by the discharge after full mixing in the river is given by:

$$\Delta C_{ds} = \frac{C_e \times Q_e}{(86.4\ Q_r) + Q_e}$$

Where:

C_{ds}: is the concentration of the constituent in the river downstream of the discharge in g/m^3
C_e: is the concentration of the constituent in the effluent g/m^3
Q_e : is the daily discharge volume to the river in m^3/d
Q_r: is the flow in the river in L/s

As the constituent will generally be present in the river upstream of the discharge, the final concentration downstream is given by:

$$C_{ds} = \frac{(C_e \times Q_e) + (C_{us} \times 86.4\ Q_r)}{(86.4\ Q_r) + Q_e}$$

Where:

C_{ds}: is the concentration of the constituent in the river downstream of the discharge in g/m^3
C_{us}: is the concentration of the constituent in the river upstream of the discharge in g/m^3
C_e: is the concentration of the constituent C in the discharge in g/m^3
Q_e: is the daily discharge volume to the river in m^3/d
Q_r: is the flow in the river in L/s.

Mixing

The model predictions presented in this report assume full mixing of the discharge with the river. This assumption may not always be correct at the downstream monitoring site (see Section 3.1.10 in the body of this report) and mixing characteristics may differ at different river flows. Simplistically, this means that higher than predicted concentrations of the given constituent may prevail on one “side” of the river, with lower than predicted concentrations on the other side of the river.

Synthetic upstream water quality input data series

In order to provide “background” river water quality, a synthetic daily river water quality data series was created. The aim of this synthetic data series was to simulate upstream water quality based on measured historical water quality.

River water quality data for the Manawatū River upstream of the Longburn discharge were sourced from Horizons Regional Council (HRC) and Fonterra and paired with daily mean flow data from the flow recorder site at Teachers College. Based on river flow at the time of sampling, water quality data were partitioned into 20 “bins”, based on two seasons, “winter” (April to November) and “summer” (December to March), and 10 river flow “tranches”. Those bins that had insufficient existing water quality data to enable robust characterisation, and thus simulation of the data distribution within that bin, were then merged, resulting in twelve final data "bins" (Table C-3).

Box-cox transformations were applied to the measured DRP, SIN, ammoniacal nitrogen (NH_4-N), nitrate (NO_3-N) and *E. coli* data collected within each bin using the Real Statistics package in Microsoft Excel. Box-Cox transformations transform non-normal dependent variables into a normal distribution which allows for the concentration of each of the aforementioned parameters to be simulated for each day of the 20-year modelling period by sampling within the transformed data frequency in a normal distribution using the RANDBETWEEN and the NORMINV functions in excel. The limits of the synthetic data series were constrained to the outer bounds of the measured data by not selecting values from the top or bottom 2.5th percentile of the measured distributions (except for *E. coli* where the top and bottom 5th percentiles were excluded).

Table C-3:Flow and seasonal data bins used in the modelling of synthetic water quality datasets. (Flow exceedance percentiles from Henderson and Diettrich, 2007). Summer defined as 1 December to 31st March

Bin	River flow		Season
	Exceedance percentile	Flow (L/s)	
1	100-90	min-22,008	All
2	90-80	22,008-32,616	Summer
3	90-80	22,008-32,616	Winter
4	80-70	32,616-44,051	Summer
5	80-70	32,616-44,051	Winter
6	70-60	44,051-56,926	All
7	60-50	56,926-73,404	All
8	50-40	73,404-94,266	All
9	40-30	94,266-121,943	All
10	30-20	121,943-164,281	All
11	20-10	164,281-248,017	All
12	10-0	248,017-3,504,700	All

Outputs and performance

Figure C-1 to Figure C-5 present the measured (observed) and modelled (predicted) probability distributions of the nutrient concentrations in the Manawatū River upstream of the discharge point. The black dotted lines represent the observed concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability. These figures show that the predicted NH_4-N (Figure C-2), SIN (Figure C-3), and NO_3-N (Figure C-4) were within the tolerance range given by the observed concentrations ± one standard deviation, indicating an acceptable fit between observed and predicted concentrations. While there was also a reasonable fit between measured and modelled DRP and *E. coli* concentrations across 99% and 98% of their concentration range respectively, the highest 1% to 2% of predicted concentrations for both parameters were outside the measured ± one standard deviation range (Figure C-1 and Figure C-5).

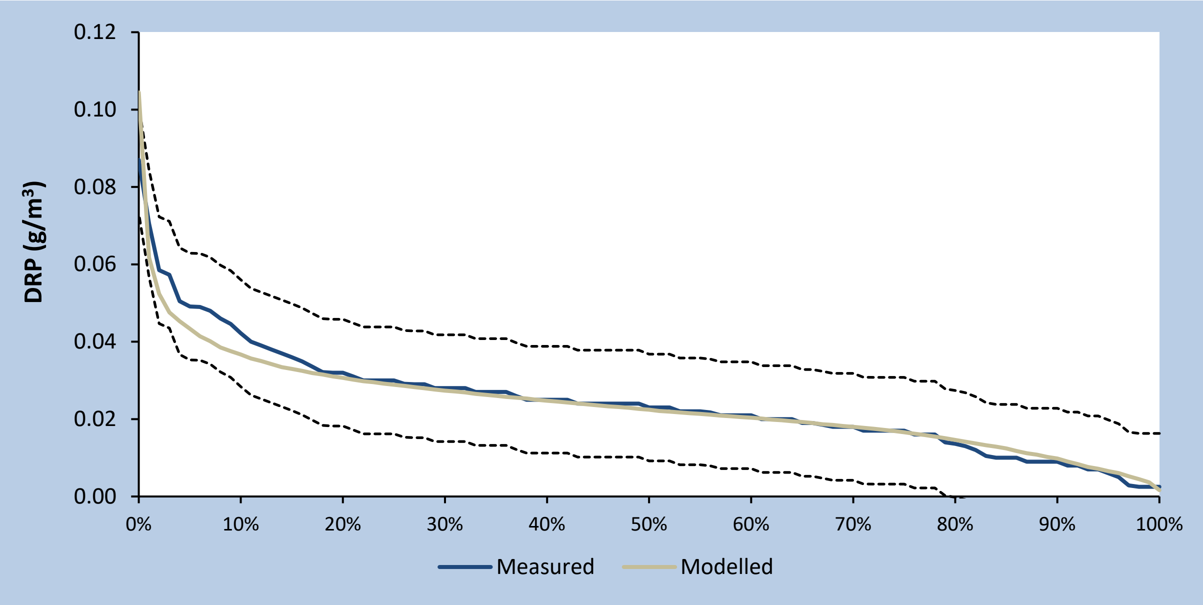

Figure C-1: Probability distribution of DRP concentrations upstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

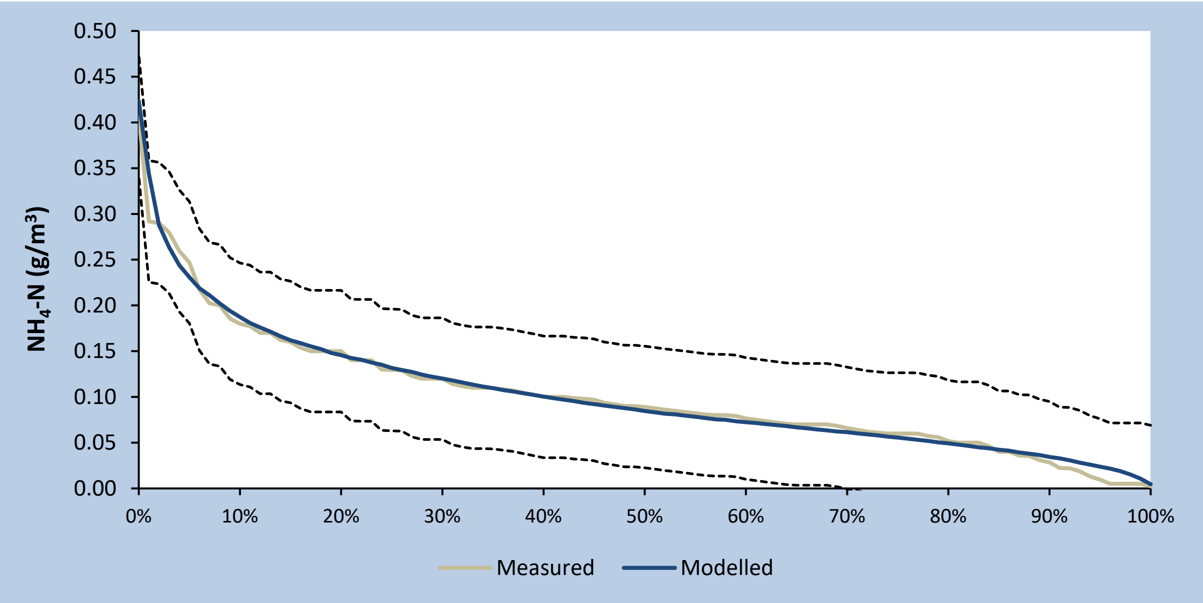

Figure C-2: Probability distribution of NH_4-N concentrations upstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

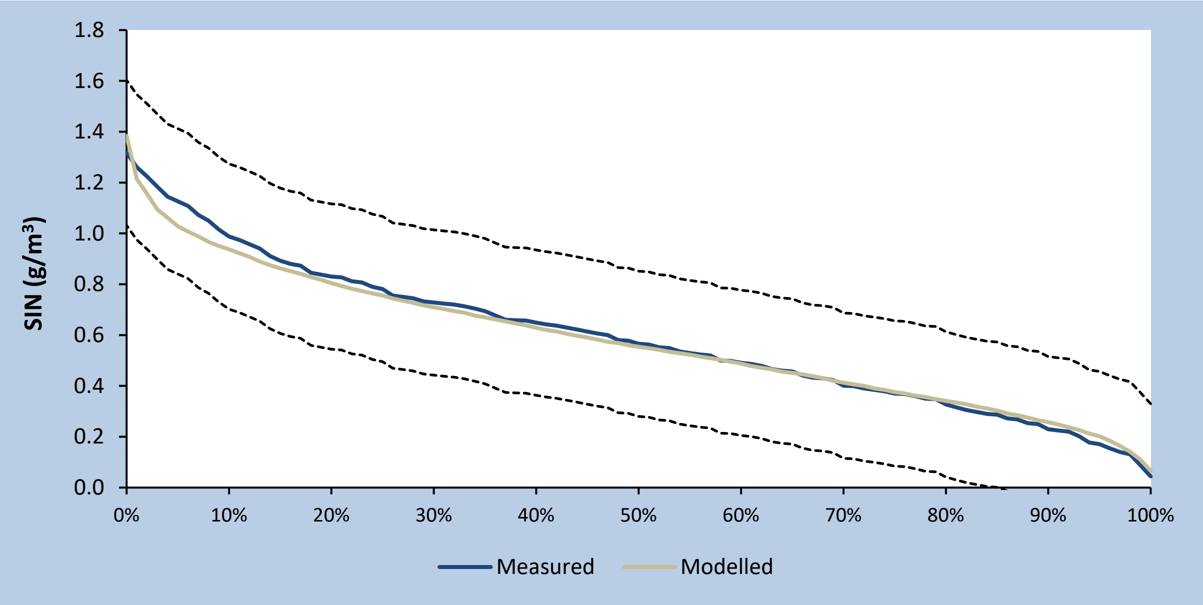

Figure C-3: Probability distribution of SIN concentrations upstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

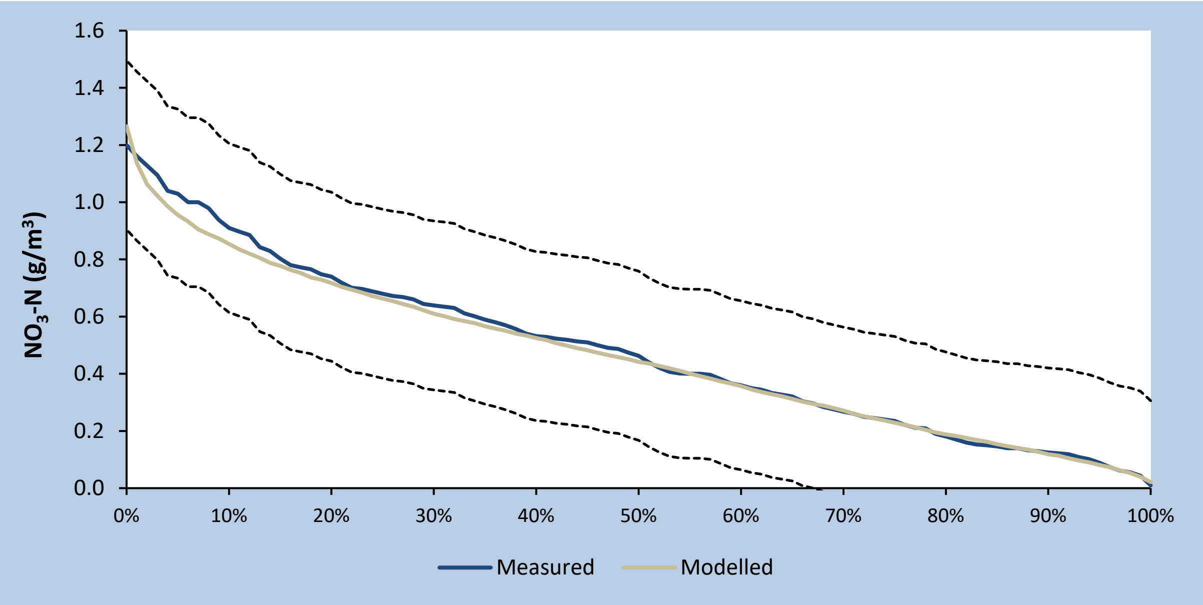

Figure C-4: Probability distribution of NO_3-N concentrations upstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

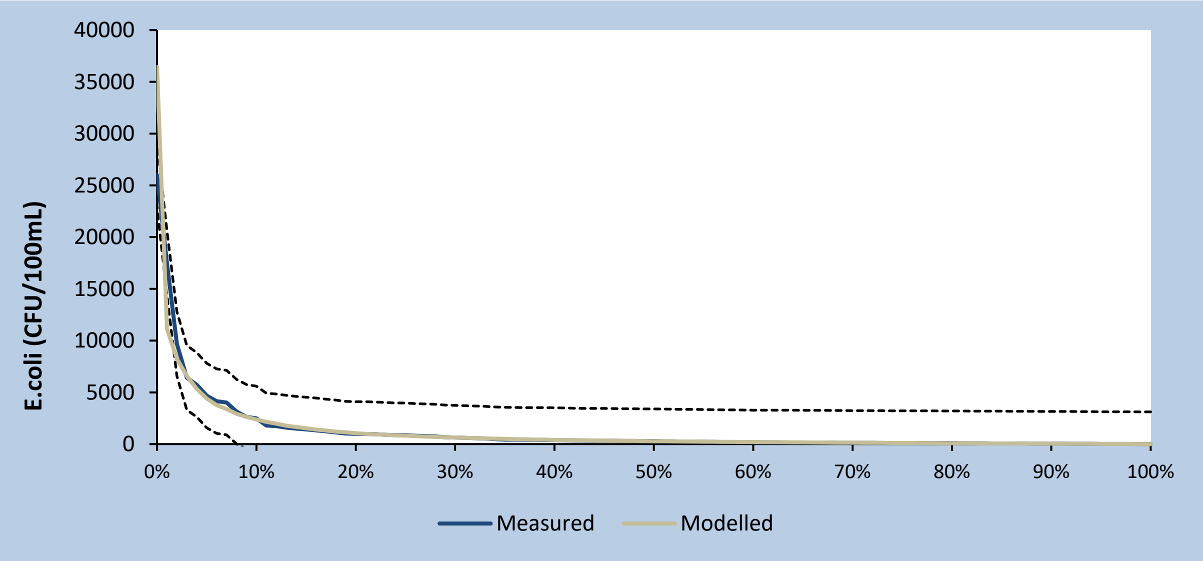

Figure C-5: Probability distribution of *E. coli* concentrations upstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

Discharge quality data series

Three daily discharge quality data series were created for DRP, SIN, NH_4-N, NO_3-N , TN and *E. coli* which covered the period between July 2012 and June 2019. Three data series were needed to account for the different waste streams in operation during the remodelling period:

- Wastewater from a dissolved air flotation plant (WWDAF);
- Wastewater permeate from a reverse osmosis plant (WWRO);
- Wastewater permeate from a whole milk reverse osmosis plant (WMRO).

These data series were constructed using a simple 'straight line' modelling approach, which assumed the rate of change in contaminant concentrations between successive samples was linear (i.e., concentrations increased/ decreased by the same amount each day). Thus, for days without measured data, concentration was calculated as:

$$C_{sim} = \left(\frac{C_{ns} - C_{ps}}{D_{ns} - D_{ps}}\right) \times \left(D_{sim} - D_{ps}\right)$$

Where:

C_{sim}: is the simulated concentration of the parameter
C_{ps}: is the concentration of the parameter measured in the previous sample
C_{ns}:is the concentration of the parameter measured in the next sample
D_{ps}:is the serial date of the day that C_{sim} is being calculated for
D_{ps}: is the serial date of the day that the previous sample was taken
D_{ns}: is the serial date of the day that the next sample was taken on.

The final data series for each parameter in each waste stream was created by assigning either a measured value (when available) or the modelled value to each day of the modelling period.

Modelled downstream water quality

Methods

The model structure utilised is described above under "*Water quality model structure*" with effluent concentration and volume calculated from the average and sum of the three waste streams respectively.

Outputs and performance

The probability distributions of the measured and modelled nutrient concentrations downstream of the discharge point are presented in Figure C-6 to Figure C-10. These figures demonstrate that for NH_4-N, SIN and NO_3-N concentrations there was an acceptable fit between observed and predicted concentrations across the entire probability distribution (Figure C-7 to Figure C-9). Reasonable agreement between observed and predicted concentrations was also achieved across 98% of the range of *E. coli* concentrations with only the highest 2% outside the measured ± one standard deviation range (Figure C-10), which is consistent with the upstream results (Figure C-5). The model performed worse for DRP, with the highest 20% being underestimated and 4% of predictions outside the measured ± one standard deviation range (Figure C-6). Exactly, why this has happened is unclear, although incomplete mixing is a possible explanation, and the pattern does largely follow predictions at the upstream site (Figure C-1).

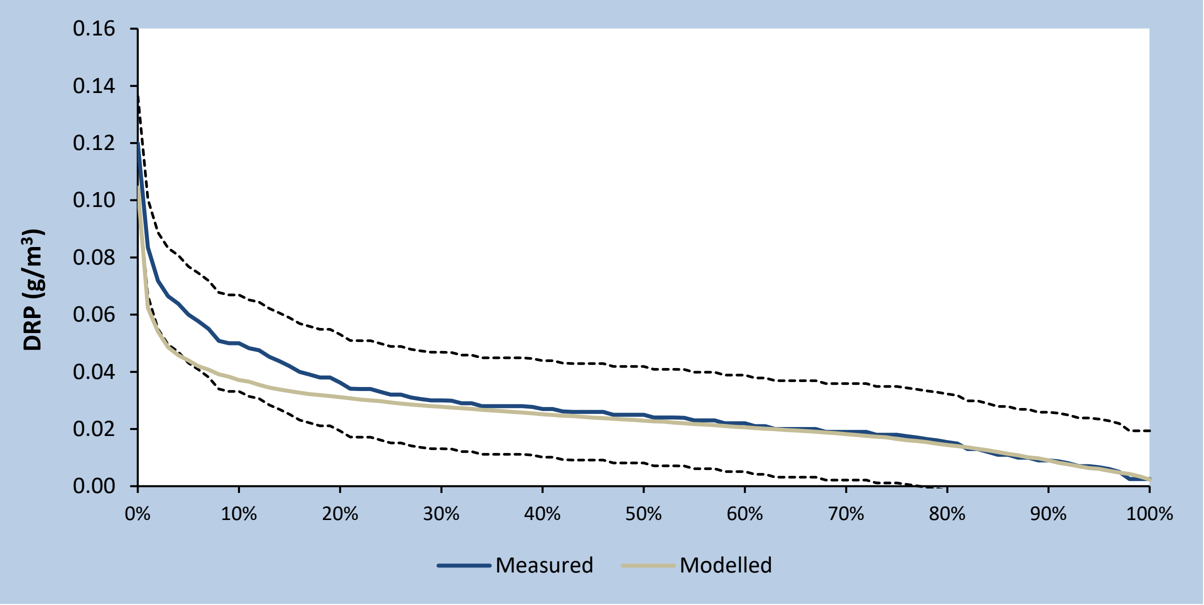

Figure C-6: Probability distribution of DRP concentrations downstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

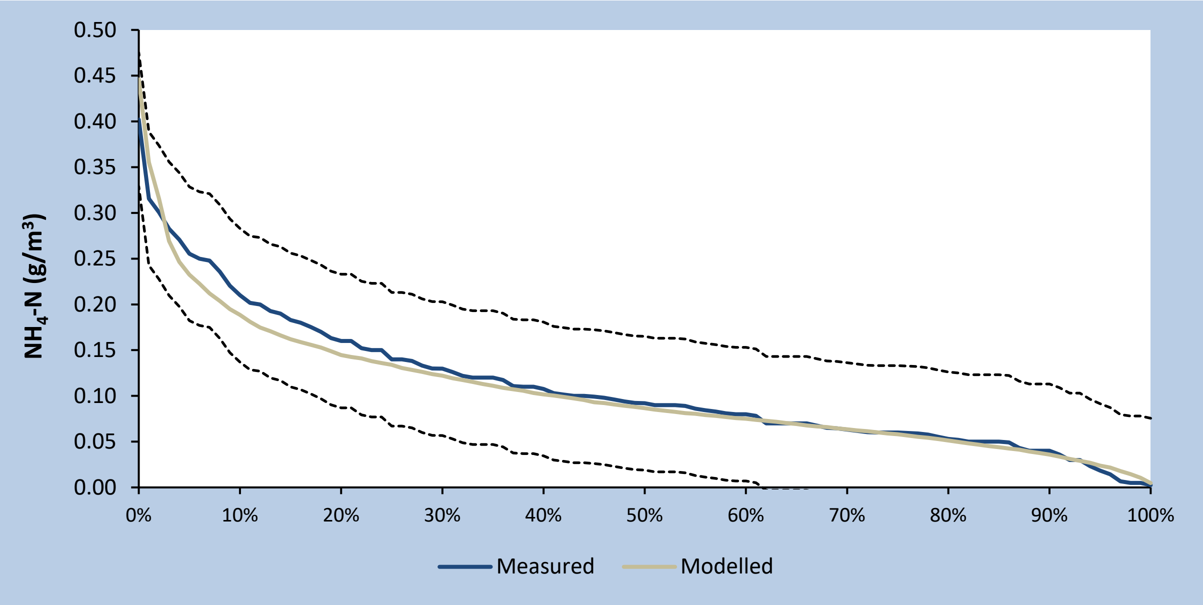

Figure C-7: Probability distribution of NH_4-N concentrations downstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

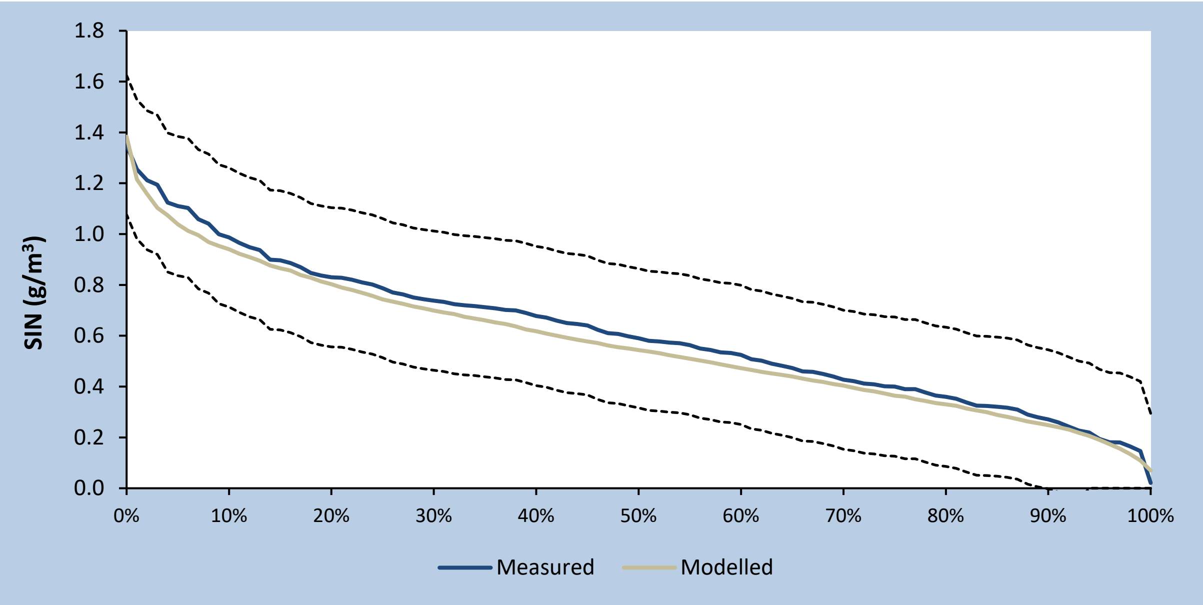

Figure C-8: Probability distribution of SIN concentrations downstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

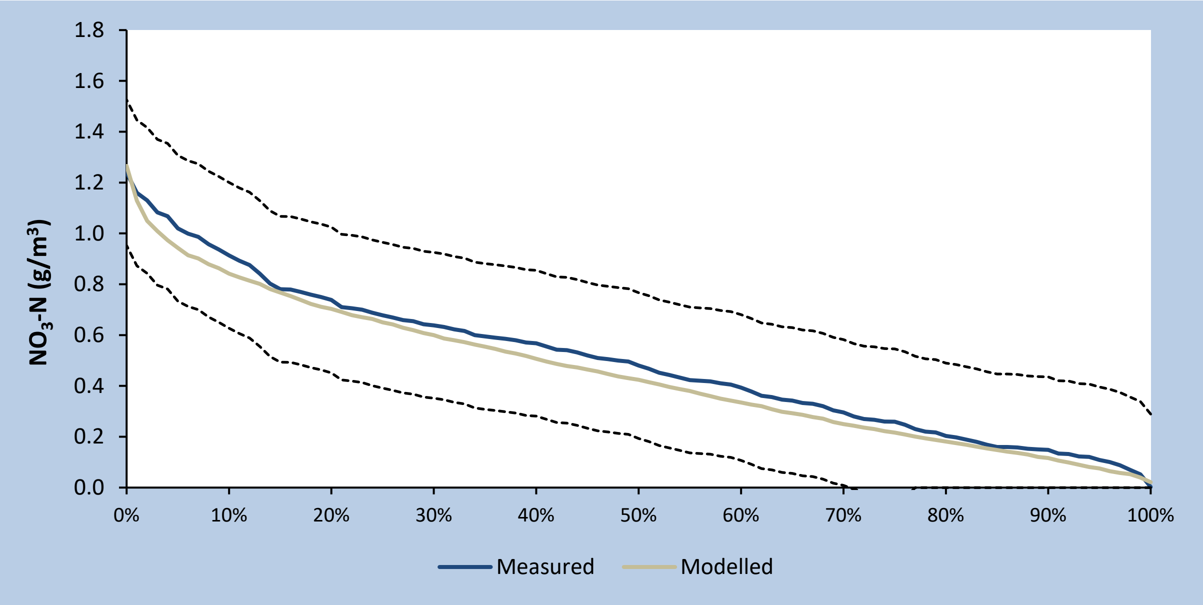

Figure C-9: Probability distribution of NO_3-N concentrations downstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

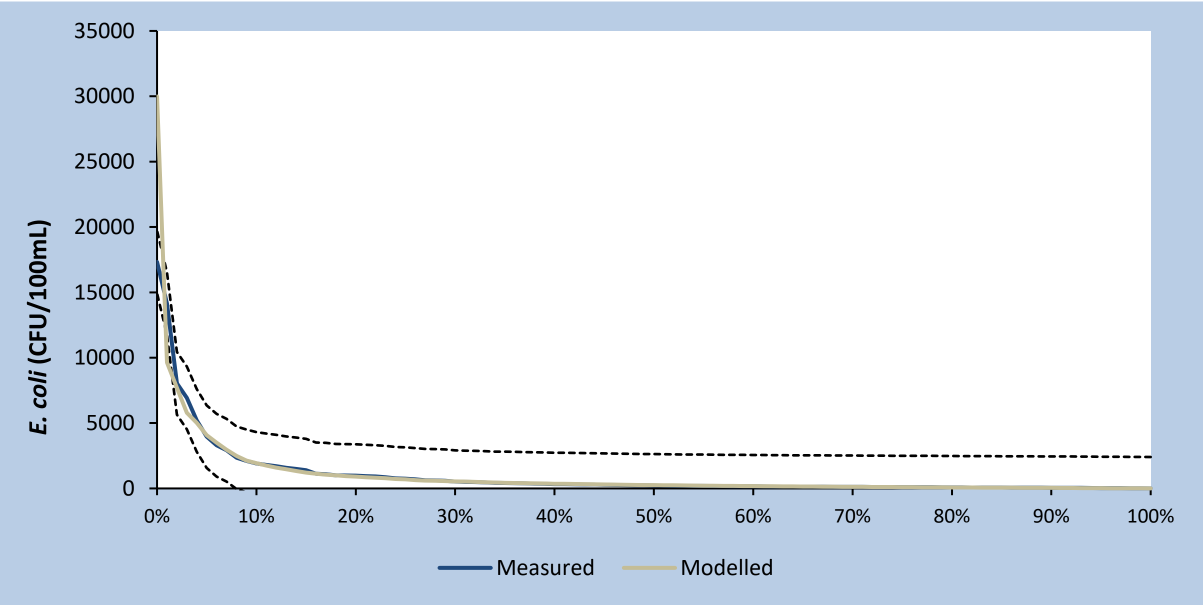

Figure C-10: Probability distribution of *E. coli* concentrations downstream of the Fonterra Longburn discharge point, as measured in the river (blue line) and predicted by the model (tan line). The dotted black lines represent the measured concentrations plus or minus the standard deviation of the observed data, as a measure of tolerance in variability.

Scenario testing module

To streamline the options refinement process Aquanet have built a scenario testing module into PointSIM to enable the rapid adjustment of input assumptions and calculation of key water quality statistics under the various scenarios explored during the options refinement phase.

The scenario testing module has been set up to assess options that include a storage component (through which the WMRO and WWRO effluent flow before entering the river) and a land discharge component. Accordingly, it calculates a final mixed effluent concentration for each day using the following equation;

$$C_e = \frac{(C_{wwro} \times Q_{wwro}) + (C_{wmro} \times Q_{wmro}) + (C_{storage} \times Q_{storage})}{Q_{wwro} + Q_{wmro} + Q_{storage}}$$

Where:

C_e: is the concentration of the final effluent discharged to the river
$C_{wwro/wmro}$: is the concentration of the parameter in the relevant waste stream
$C_{storage}$: is the concentration of the parameter in the stored effluent (equal to C_e on the previous day)
$Q_{wwro/wmro}$: is the volume of effluent from the relevant waste stream
$Q_{storage}$: is the volume of effluent in storage at the beginning of the day and is calculated based on the volume of effluent produced and discharged (including to land) on the previous day.

The module enables adjustment of the following input parameters:

- Cut-off flow (m^3/s) – Removes the effect of the discharge below a specified river flow;
- Discharge period – Adjusts effluent discharge volume to zero on date outside of a specified range;
- Storage volume – The amount of surplus effluent (i.e., Δ production volume – discharge volume) that can be stored at any one time;
- Fixed effluent volume – Adjusts daily effluent volume to specified rate;
- Flow proportional discharge volume – Adjusts daily effluent volume based on river flow and a specified multiplication factor;
- Maximum effluent volume – Caps effluent volume at a specified level regardless of the effluent input data series or the "Flow proportional discharge volume";
- Effluent concentration – Adjusts effluent DRP, SIN, NO_3-N , NH_4-N and *E. coli* concentrations to specified values;
- Effluent load – Adjusts effluent DRP, SIN, NO_3-N and NH_4-N loads to specified values;
- Effluent treatment – Adjusts effluent DRP, SIN, NO_3-N and NH_4-N loads by specified reduction factors; and
- Effluent treatment regime – Adjusts effluent DRP, SIN, NO_3-N and NH_4-N concentrations to specified values below a specified river flow threshold.

The following input parameters can be set independently for the WMRO permeate, the WWRO permeate and the final discharge to the river; all other input parameters only apply to the final river discharge. (Note - under all options it is assumed that all effluent from the WWDAF is treated by the WWRO plant and that WWRO retentate is discharged direct to land)):

- Discharge period;
- Fixed effluent volume;
- Effluent concentration;
- Effluent load; and
- Effluent treatment.

The input parameters can be set up to interact with each other. For example, it is possible to run a scenario which specifies a Cut-off flow, an Effluent Volume and an Effluent treatment regime.

The key outputs[11] produced by the scenario testing module on each run are

- Annual (i.e., overall) and monthly average DRP, SIN and NH_4-N concentration in the Manawatū River downstream of the discharge;
- Annual and monthly average DRP, SIN concentration in the Manawatū River downstream of the discharge when river flow is below the 20th FEP;
- Annual and monthly maximum NH_4-N concentration;
- Annual and monthly median and 95th percentile *E. coli* concentrations; and
- Annual and monthly surplus effluent volume (i.e., the amount of effluent that could not be stored or discharged).

Water quality model accuracy and uncertainty

The points below summarise the key considerations in relation to the accuracy and uncertainty of the model predictions:

- The main water quality component of the model is based on simple mass-conservation equations, and does not involve any calibration parameters, and has therefore no uncertainty associated with the water quality calculations themselves;
- Sources of error and uncertainty are primarily associated with the input data;
- Effluent quality data series assume a consistent change in contaminant concentrations between samples;
- Effluent quality has been modelled on the basis of fixed ranges. Extreme values outside these ranges are not predicted by the model.

[11] The scenario testing module of PointSIM also produces a full range of summary statistics for each parameter both by month and by year.

Periphyton modelling

Structure

The periphyton growth component of the model provided daily estimates of periphyton biomass growth based on daily nutrient concentrations and river flow. It is based on the periphyton growth element of the TRIM model developed by NIWA to simulate periphyton growth in the Tukituki River catchment (Rutherford, 2011) and provides daily time-step predictions of periphyton biomass based on:

- Growth, itself based on predicted daily SIN and DRP;
- Respiration;
- Scour, expressed as a quadrat function of river flow, up to a re-setting flow (i.e., the river flow at which the periphyton biomass is "reset" to very low levels).

The periphyton biomass present in the river each day was given by the sum of the biomass present the preceding day plus the rate of change of biomass. The rate of change of biomass is given by:

$$\frac{dBIO}{dt} = Growth - Resp - Scour$$

Note: The periphyton biomass in the model is expressed as grams of carbon per square metre (gC/m^2), which corresponds approximately to 10 mg chlorophyll-a) (chl-a)/m^2.

Growth component

The periphyton growth component calculated daily biomass growth based on the concentration of each nutrient, then retained the lowest value, thus reflecting nutrient limitation on that day:

$$Growth = \begin{cases} \mu_{max} \left(\frac{DRP}{\alpha+DRP}\right)\left(\frac{\chi}{\chi+BIO}\right) & \text{if } \left(\frac{DRP}{\alpha+DRP}\right) < \left(\frac{SIN}{\beta+SIN}\right) \\ \mu_{max} \left(\frac{SIN}{\alpha+SIN}\right)\left(\frac{\chi}{\chi+BIO}\right) & \text{if } \left(\frac{DRP}{\alpha+DRP}\right) > \left(\frac{SIN}{\beta+SIN}\right) \end{cases}$$

Respiration component

The daily respiration was calculated as:

$$Resp = \rho 1 \, BIO$$

Scour component

The Rutherford (2011) model employs the following scour equation:

$$Scour = \sigma s \times \left(\frac{u^*}{u_1}\right)^{\lambda 1} \times BIO$$

Where u* and u_1 are the shear velocity and the shear velocity at which scour equals σs. With no information on shear velocity at the site, that component of the equation was replaced by the river flow times a calculated factor φ:

Thus, the daily scour rate was calculated as:

$$Scour = \sigma s \times (\varphi Q_r)^{\lambda 1} \times BIO$$

The biomass resetting flow was assumed to be equal to two times the median flow (146,808 L/s) at sites upstream and downstream of the Longburn discharge. This assumption is consistent with the resetting flows cited for the HRC site at Teachers College in Kilroy *et al.* 2018.

In the absence of site-specific information, the Rutherford (2011) $\lambda 1$ and σs values were assumed (Table C-4), and φ was calculated so that the $\sigma s \times (\varphi Q)^{\lambda 1}$ scour factor was equal to 1 at the resetting flow of twice the median.

Table C-4: Parameters used in the periphyton growth component of the model.

Parameters		Definition	Unit	Value
Input data	DRP	DRP concentration	g/m^3	N/A
	SIN	SIN concentration	g/m^3	
	Q	River flow	L/s	
Calculated variables	BIO	Periphyton biomass	gC/m^2	N/A
	t	Time	d (day)	
	Growth	Biomass growth rate	$gC/m^2/d$	
	Resp.	Biomass respiration rate	$gC/m^2/d$	
	Scour	Biomass scour rate	$gC/m^2/d$	
Periphyton Growth coefficients	μ_{max}	Maximum growth rate under idealised conditions	$gC/m^2/d$	2.9
	α	Half-saturation coefficient for DRP	g/m^3	0.03
	β	Half-saturation coefficient for SIN		0.3
	ρ_1	Biomass daily respiration rate		0.02
	χ	Biomass limitation coefficient	gC/m^2	50
Scour coefficients	σs	Biomass scour rate	d^{-1}	0.1
	λ1	Exponent of scour flow relationship	N/A	4
	φ	Flow scour factor	N/A	0.00011
	Qreset	Periphyton biomass resetting flow	L/s	146,808
	BioReset	Periphyton biomass after a flood	gC/m^2	0.01

Calibration

The periphyton module of PointSIM was calibrated by adjusting a single parameter, maximum growth rate (μ_{max}); all other parameters were left as per Rutherford (2011). Given the paucity of periphyton biomass data for the Manawatū River upstream and downstream of the Longburn discharge a μ_{max} of 2.9 was selected (Table C-4), as it corresponds with what was used in PNCC WWTP PointSIM periphyton module. This value is within the measured range of growth rates downstream of the PNCC WWTP discharge (Greer & Ausseil 2021) and achieves the highest possible Nash–Sutcliffe model efficiency coefficient (NSE) at that site. The NSE is a measure of how well observed and predicted values fit a 1:1 line when plotted against each other, with values of 0 to 1 considered acceptable and values greater than 0.5 indicating good model performance, (Chiew & McMahon 1993; Schaefli & Gupta 2007). Statistically, model fit at the site downstream of the PNCC discharge was acceptable, approaching good (NSE = 0.315), when μ_{max} was set at 2.9

Model outputs and performance

Figure C-11 and Figure C-12 depict the periphyton model outputs for sites upstream and downstream of the Totara Road discharge respectively and provide comparisons of observed and modelled data for each site.

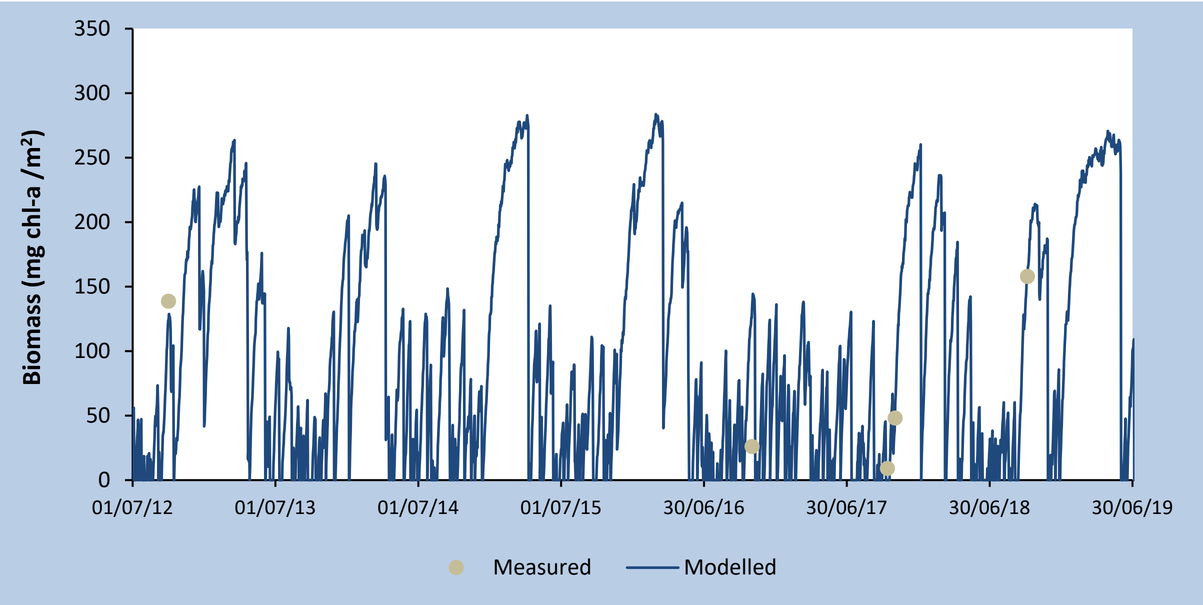

Figure C-11: Predicted (blue line) and observed periphyton biomass (gC/m^2) upstream of the Totara Road WWTP.

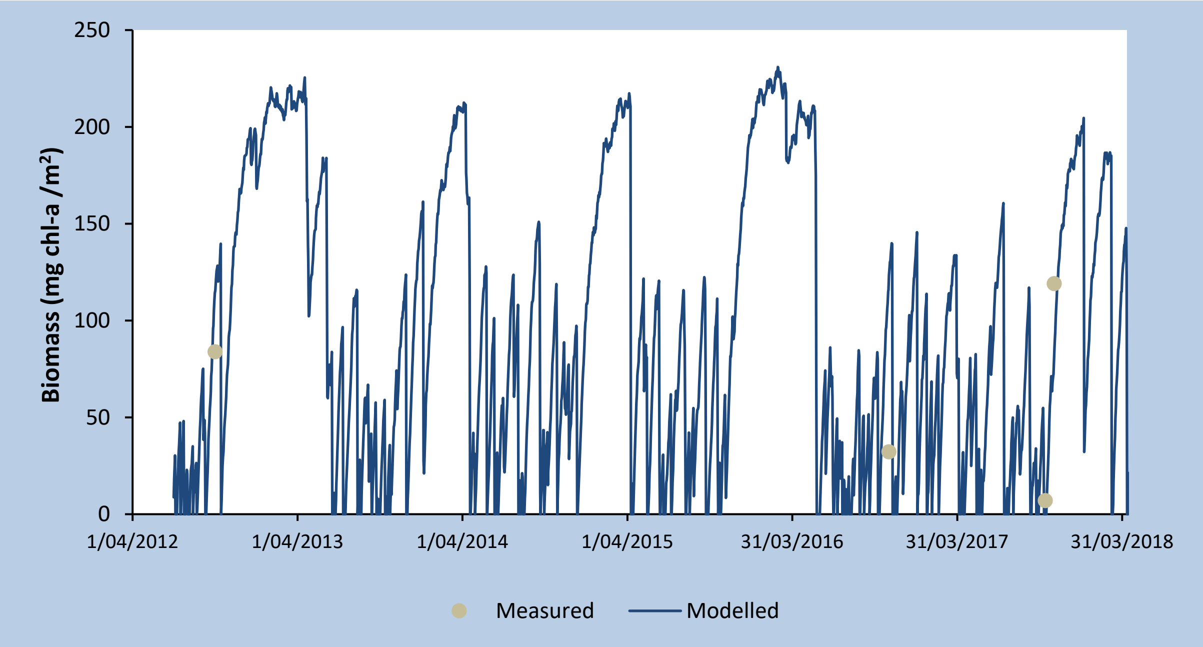

Figure C-12: Predicted (blue line) and observed periphyton biomass (gC/m^2) downstream of the Totara Road WWTP.

Limitations and applications

The site-specific field data used to calibrate the periphyton component of the model was collected ~3.5 km upstream of the Longburn discharge (downstream of the PNCC WWTP discharge). As a result, modelled periphyton biomass values should be used with caution. For instance, the model is not fit for assessing absolute future compliance with specific periphyton biomass target under a given discharge scenario. However, it is considered a useful tool to assess the direction of change (i.e., increase or decrease) and an indication of the degree and timing of change in periphyton growth under different scenarios.

Scenario testing module

The water quality scenario testing module described above in the "Water quality modelling methods" section feeds directly into the periphyton module of PointSIM allowing for the rapid calculation of key periphyton measures by adjusting a suite of input assumptions. This allows for a high-level comparative assessment of the potential periphyton growth effects of the various scenarios explored during the options refinement phase.

The key outputs[12] produced by the scenario testing module on each run are

- The percent of time at which periphyton biomass exceeds 120 mg chlorophyll-*a* (chl-a)/m^2 overall and by month; and
- The percent of time at which periphyton biomass exceeds 200 mg chl-a/m^2 overall and by month.

[12] The scenario testing module of PointSIM also produces a full range of summary statistics for each parameter both by month and by year.

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Appendix E

ECONOMIC EFFECTS ASSESSMENT

RENEWAL OF RESOURCE CONSENT TO DISCHARGE WASTEWATER INTO THE MANAWATŪ RIVERENABLING CONTINUED OPERATIONS AT FONTERRA AND GOODMAN FIELDER'S LONGBURN MANUFACTURING SITES

ASSESSMENT OF THE ECONOMIC EFFECTS

Mike Copeland
Brown, Copeland & Co Ltd

17September, 2021

1. INTRODUCTION

Background

1.1 During the milk production seasonof the 2020-21 financial year (1 August 2020 to 31 July 2021),Fonterra’s tankers collected177 million litres of milk[1](up to 3 million litres per day)for processing at Fonterra’s Longburn dairy manufacturing site (“Longburn site”) near Palmerston North.

1.2 Fonterra’s Longburn site has two key processing facilities. The first is a casein plant which operates for up to 90 days during the peak milk production period (September to November). The resultant casein is transported to other Fonterra sites, such as Reporoa, for further processing. The second is a whole milk reverse osmosis (WMRO) plant which enables Fonterra to concentrate “fresh” milk by removing about 50 percent of the water content. The remaining product is railed to Whareroa in South Taranaki for further processing.

1.3 The Longburn site typically produces around 600 metric tonnes (MT) of casein and 110 million litres of reverse-osmosis milk per annum. However, the actual tonnage and product mix is dependent on both on-farm seasonal influences such as climatic conditions and cow numbers, and manufacturing aspects such as global milk supply, capacity across Fonterra’s network during the peak milk period, and consumer demand. Milk load outs from the site average around 70 million litres per annum.

1.4 Milk is collected by tankers from dairy farms principally in the Manawatū-Whanganui region (stretching from Otaki in the south to Whanganui in the north), although at times during the season milk is transported in or out of the region depending on product mix requirements. Payments to farms supplying the plant in 2019/20 were in the order of $480 million. The plant employs around 90employees (including milk tanker drivers stationed at the site), pays $9 million per annum in wages and salaries, and in addition spends an estimated $3.2 million per annum on goods and services provided by businesses in the Manawatū-Whanganui regional economy, with a substantial proportion of this spend with businesses in the Palmerston North economy.

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1 In the previous year 296 million litres of milk was collected and in the year before that 325 million litres of milk was collected. Yearly fluctuations occur in accordance with product mix requirements and available processing capacity at different sites.

1.5 Adjacent to Fonterra's Longburn site is Goodman Fielder New Zealand's (Goodman Fielder) Longburn manufacturing site (Goodman Fielder site), which is one of their largest manufacturing sites producing a range of over 200 different products including fresh white milk, flavoured milk, cream, yoghurt, cream cheese, sour cream, custard and dairy desserts. The site is of key importance as it supplies a large portion of the North Island's packaged fresh white milk and is a major supplier of dairy food products for all of New Zealand. The Goodman Fielder site has 210 employees and is manned 24/7, 365 days of the year. It processes over 110 million litres of milk each year.

1.6 Goodman Fielder's Longburn site contributes over $12 million annually to the local economy by way of employee wages and salaries. Also over $1 million per annum is spent locally on goods and services which are vital to the site's operation.

1.7 Fonterra, who is responsible for providing trade waste services to Goodman Fielder, is applying for a new resource consent to replace its existing one that authorises the discharge of wastewater to the Manawatū River. Within three years of grant of consent Fonterra is proposing to construct a large storage facility that will be used to store the permeates from both the wastewater reverse osmosis and whole milk reverse osmosis plants. This will enable Fonterra to reduce the overall volumes of wastewater being discharged to the Manawatū River by "holding-back" wastewater generated in the winter months for irrigation over the summer period when soil moisture levels allow.

1.8 Fonterra will cease the discharge of "higher-strength wastewater reverse osmosis retentate" wastewater (which is authorised under the existing consent) to the Manawatū River. It also proposes to reduce both the maximum daily and annual volumes of wastewater that can be discharged to the Manawatū River, including their timing and propose changes to the flow conditions within which this can occur. The consent will continue to require Fonterra to discharge to land unless conditions do not enable this. Overall, the proposals put forward in the resource consent application will reduce Fonterra and Goodman Fielder's Longburn sites' nitrogen and phosphorus contribution to the Manawatū River by 46%and 39% percent, respectively.

Report Objective

1.9 The objective of this report is to assess the economic significance and the economic benefits associated with the ongoing operation of Fonterra and Goodman Fieldersites for Palmerston North City and the Manawatū-Whanganui regional economies.

Report Format

1.10 This report is divided into five parts (in addition to this introductory section). These are:

(a) The background to Fonterra and Goodman Fielder's Longburn sites;

(b) A consideration of the relevance of economic effects under the Resource Management Act 1991 (RMA);

(c) A description of the Palmerston North City economy and the Manawatū-Whanganui regional economy;

(d) The economic benefits from ongoing operation of the processing plants on the Fonterra and Goodman Fielder Longburn dairy manufacturing sites; and

(e) Some overall conclusions.

2. BACKGROUND TO FONTERRA AND GOODMAN FIELDER'S LONGBURN MANUFACTURING SITES[2]

Fonterra and its Longburn Site Operations

2.1 Fonterra is a global leader in dairy nutrition and the preferred supplier of dairy ingredients to many of the world's leading food companies. Fonterra is a farmer owned co-operative, and the largest processor of milk in the world. It is one of the world's largest investors in dairy research and innovation drawing on generations of dairy expertise to produce (per annum) more than two million tonnes of dairy ingredients, including value added dairy ingredients, specialty ingredients and consumer products for 140 markets.

2.2 Annually, Fonterra collects more than 18 billion litres of milk from New Zealand farms and exports more than 2.4 million tonnes of dairy products. Fonterra owns 26operations sites, 5 brands sites and 3 logistics/distribution sites within New Zealand (refer to **Figure 1**).

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2 Material in this section provided by Fonterra and Goodman Fielder.

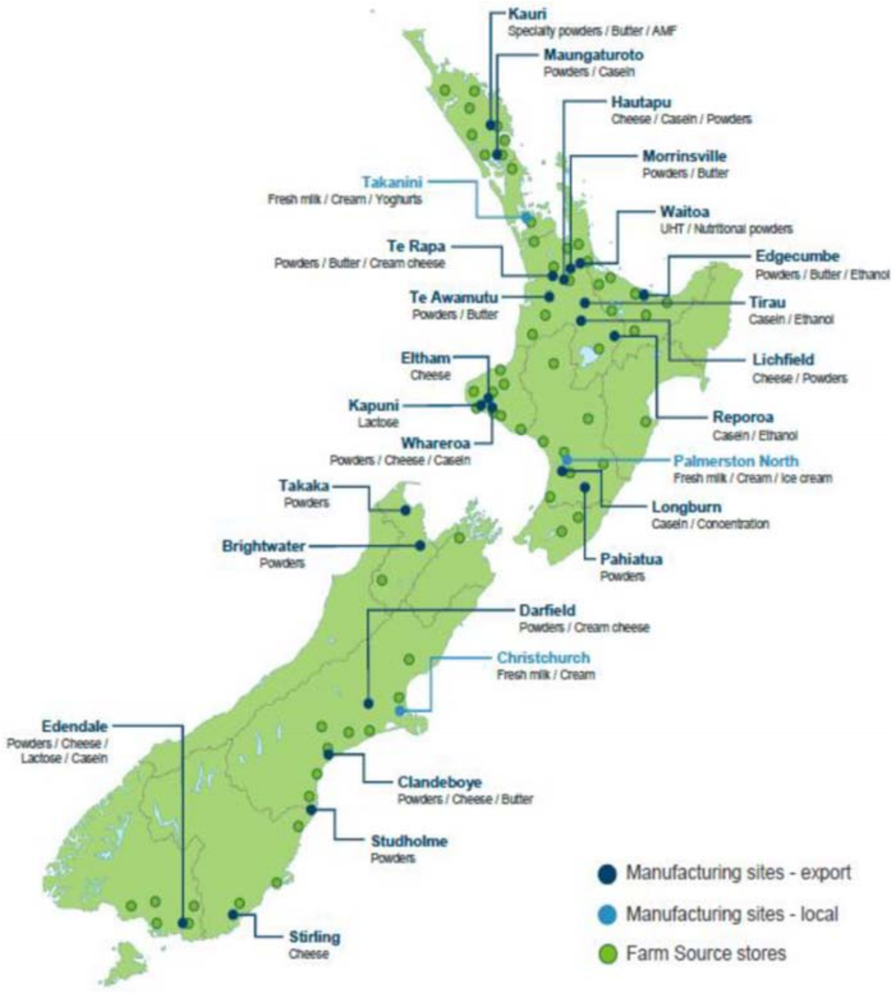

Figure 1: Fonterra's New Zealand manufacturing and logistics locations

2.3 Fonterra is New Zealand's largest company, and a significant employer, with more than 11,000 New Zealand based staff and more than 8,000 employees based overseas. Globally, Fonterra processes more than 22 billion litres of milk and owns leading dairy brands in Australasia, Asia, the Middle East and Latin America. In the 2019/20 financial year, Fonterra's global revenue was over $22 billion.

2.4 Farm suppliers to Fonterra's Longburn site are principally located within the Manawatū-Whanganui region. Occasionally milk is also supplied to the site from other regions (e.g.

the Taranaki and Hawke's Bay regions) if, for example, plants in these regions have breakdowns or to meet product mix demand peaks requiring additional processing at the Longburn site.

2.5 Fonterra's operations at its Longburn site were established in 1966, and today annual production includes about 600 metric tonnes (MT) of casein, 110 million litres of RO milk and 70 million litres of milk loadouts. The Longburn site has two critical roles as part of the wider Fonterra manufacturing network.

2.6 Firstly, and due to the lack of "major" processing capacity in the Lower Manawatū, the Longburn site serves as a large "transfer" station whereby milk is collected from on-farm, processed through a WMRO plant which reduces its water content by about 50 percent, and then transported to other Fonterra sites for processing. This is both more efficient and more sustainable.

2.7 Secondly, and during the peak milk processing period (September to November each year), the Longburn site is able to provide additional processing capacity, and serve as a contingency should another plant at another site fail, through the use of its casein plant. Hence, Longburn is a key "contingency" site for Fonterra during this period.

2.8 21 milk tankers are based at the Longburn site. These tankers travel an estimated 4.2 million kilometres per annum.

2.9 The latest estimate (August, 2021) for the reinstatement value of the Fonterra plants at its Longburn site is $249 million. Much of this value is "sunk" in that, should the plants at the site be forced to cease operating, many of the assets on the site would become "stranded" and could not be sold or relocated to be used elsewhere.

Goodman Fielder and its Longburn Site Operations

2.10 Goodman Fielder is one of the largest branded food manufacturers and suppliers in New Zealand. GFNZ has 13 manufacturing sites and many depots and warehouses throughout New Zealand and has over 1,800 employees. Its Longburn site processes over 110 million litres of milk each year and Goodman Fielder does not have any other site that could absorb the volume of products made at Longburn. The site is manned 24/7, 365 days of the year and processes over 110 million litres of milk each year.

2.11 Goodman Fielder estimates the current (August, 2021) replacement value for its Longburn plant to be over $100 million. Much of this value is "sunk" in that, should the plant at the site be forced to cease operating, many of the assets on the site would become “stranded” and could not be sold or relocated to be used elsewhere.

The Benefits to Fonterra and Goodman Fielder of Consent Renewal

2.12 Fonterra and Goodman Fielder have analysed the advantages of retaining production at their Longburn sites relative to other potential new sites and/or the expansion of other existing plants. The key advantages are:

(a) The continued use of existing plant and equipment having significant sunk costs;

(b) For Fonterra -the critical role of the Longburn site in the wider manufacturing network, particularly during the peak milk production period;

(c) Sufficient milk production capacity in the immediate area and wider surrounding catchment;

(d) Optimised location from the perspective of milk, and dairy products transportation;

(e) The proximity of a trained and experienced workforce;

(f) The proximity of supplier businesses with appropriate expertise and experience. The sites use a range of local contractors – e.g. electricians, plumbers, engineers, trucking contractors, etc;

(g) The proximity of a good road and rail networkfor plant inputs and outputs;

(h) Proximity to a low-cost energy source. The sites use on-site gas fired boilers to generate steam. This energy may not be available from the local grid elsewhere within the region;

(i) The ability to minimise and mitigate adverse environmental effects for neighbours and the wider community. The sites are within a recognised industrial zone;

(j) The “industrial” zoning of the manufacturing land is appropriate to enable Fonterra and Goodman Fielder’s operations;

(k) For Fonterra - the site is large enough for some future expansion (noting the Braeburn Farm has a "deferred industrial" zoning). This is unlikely, but it provides options for alternative processing plants, and the re-location of existing plants (for example); and

(l) Economies of scale as compared to relocating processing capacity to a number of alternative sites.

2.13 The ongoing operation of the plants at Longburn will enable Fonterra, Goodman Fielder and the Palmerston North and Manawatū-Whanganui communities to continue to benefit from these economic advantages of the sites.

2.14 Without the wastewater discharge consent renewal, Fonterra's plants at the Longburn site would need to downsize since wastewater volumes would be limited to Fonterra's land discharge capacity. Milk would need to be diverted to another Fonterra site where capacity existed. This would lead to (i) considerable additional transport costs, (ii) a suboptimal product-mix (as milk would need to be diverted to plants where capacity was available reducing product-mix production flexibility) and (iii) a lower payout to Fonterra's farmer shareholders. However, this is noting that the Fonterra Longburn site acts as one of the key "contingency" sites during the peak milk processing period when arguably "all other sites" are also at processing capacity.

2.15 Similarly without the wastewater discharge consent renewal, Goodman Fielder's site would need to close or downsize, requiring new production capacity to be constructed elsewhere. Goodman Fielder does not have any other site that could absorb the volume of products made at its Longburn site.

3. ECONOMICS AND THE RMA

Community Economic Wellbeing

3.1 Economic considerations are intertwined with the concept of the sustainable management of natural and physical resources, which is embodied in the RMA. In particular, Part II section 5(2) refers to enabling "*people and communities to provide for their … economic ... well-being*" as a part of the meaning of "*sustainable management*", the promotion of which is the purpose of the RMA.

3.2 As well as indicating the relevance of economic effects in considerations under the RMA, this section also refers to *"people and communities"*, which highlights that in assessing the impacts of a proposal it is the impacts on the community and not just the applicant or particular individuals or organisations, that must be taken into account. This is underpinned by the definition of *"environment"* which also extends to include people and communities.

3.3 The continued operation of Fonterra and Goodman Fielder's manufacturing activities at their Longburn sites enables the residents and businesses of Palmerston North City and Manawatū-Whanganui Region to provide for their social and economic wellbeing.

Economic Efficiency

3.4 Part II section 7(b) of the RMA notes that in achieving the purpose of the Act, all persons *"shall have particular regard to ... the efficient use and development of natural and physical resources"* which includes the economic concept of efficiency[3]. Economic efficiency can be defined as:

> *"the effectiveness of resource allocation in the economy as a whole such that outputs of goods and services fully reflect consumer preferences for these goods and services as well as individual goods and services being produced at minimum cost through appropriate mixes of factor inputs"*[4].

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3 See, for example, in *Marlborough Ridge Ltd v Marlborough District Council* [1998] NZRMA 73, the Court noted that all aspects of efficiency are "*economic*" by definition because economics is about the use of resources generally.

4 Pass, Christopher and Lowes, Bryan, 1993, *Collins Dictionary of Economics* (2nd edition), Harper Collins, page 148.

3.5 More generally economic efficiency can be considered in terms of:

- Maximising the value of outputs divided by the cost of inputs;
- Maximising the value of outputs for a given cost of inputs;
- Minimising the cost of inputs for a given value of outputs;
- Improving the utilisation of existing assets; and
- Minimising waste.

3.6 The continuation of dairy manufacturing at Fonterra's Longburn site is consistent with the efficient use of resources, especially in regard to the ongoing use of significant existing assets, the economies of scale in production available at the site, the retention of the optimum product-mix production at Fonterra's various manufacturing sites and the saving in road transport costs from not needing to divert milk for processing to other sites. The continuation of Goodman Fielder's manufacturing activity on its Longburn site is consistent with the efficient use of resources, especially in regard to the ongoing use of significant existing assets and its optimised location from the perspective of input and output transport costs.

Value of Investment to the Existing Consent Holder

3.7 Part 6, section 104 (2A) of the RMA requires the consent authority when considering a renewal of an existing consent to *"have regard to the value of the investment of the existing consent holder."* The value to Fonterra of its investment in the Longburn site can be considered in terms of either the reinstatement value of the plants at the site ($249 million for Fonterra) or the foregone future earnings of the plants on the site if they were forced to close or downsize. By both of these measures, the value of investment to the existing consent holder is significant. Although not the consent holder, Goodman Fielder, who are provided trade waste services by Fonterra, estimates the replacement value of its Longburn plant to be over $100 million and foregone future earnings if its plant was forced to downsize or close would also be significant.

Viewpoint

3.8 An essential first step in carrying out an evaluation of the positive and negative economic effects of a development project is to define the appropriate viewpoint that is to be adopted. This helps to define which economic effects are relevant to the analysis.

Typically, a district or wider regional viewpoint is adopted and sometimes even a nationwide viewpoint might be considered appropriate.

3.9 Fonterra and Goodman Fielder's Longburn sites are located in Palmerston North City, which is part of the Manawatū-Whanganui Region. The continued operation of the plants at these sites has significant positive economic effects for Palmerston North City and the wider Manawatū-Whanganui Region. Therefore, in this report the economic effects are considered in relation to Palmerston North City and the Manawatū-Whanganui Region.

3.10 There are also private or financial benefits associated with the ongoing operation of the plants on the Longburn sites. Generally, these benefits are not relevant under the RMA and the main focus of this report is therefore on the wider economic effects on parties other than Fonterra and Goodman Fielder, and their customers. Economists refer to such effects as "externalities"[5].

3.11 However, Fonterra is owned by its farmer shareholders and financial benefits to Fonterra impact on the *"economic (and social) well-being"* of these farmer shareholders including those within the local community – i.e. the Manawatū-Whanganui Region. Also financial benefits to Fonterra and Goodman Fielder are relevant with respect to the *"efficient use and development of natural and physical resources"* and, in the case of Fonterra, New Zealand's export competitiveness, given its Longburn site's dairy manufacturing operations' significant scale and the importance of dairy product exports to the New Zealand economy.

3.12 BACKGROUND TO PALMERSTON NORTH AND MANAWATŪ-WHANGANUIREGION'S ECONOMIES[6]

3.13 Statistics New Zealand's June 2020 population estimate for Palmerston North City is 90,400 or 1.8% of New Zealand's population. In 2010 population in the City was estimated to be 82,200, implying an increase of 10.0%over the period 2010 to 2020, as compared to growth of 16.9% for New Zealand as whole. Statistics New Zealand's 'medium' population projections[7] have Palmerston North City's population increasing to

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5 Defined as the side effects of the production or use of a good or service, which affects third parties, other than just the buyer and seller.

6 Data in this section from Statistics New Zealand.

7 Statistics New Zealand prepare three sets of projections – high, medium and low – according to natural population change (i.e. the net effect of birth and death rate assumptions) and net migration assumptions. These projections do not explicitly incorporate assumptions about different rates of economic development.

102,100 in 2048 – i.e. an average rate of growth of 0.4% per annum over the period 2020-48, compared to an average rate of growth for New Zealand of 0.7% per annum.

3.14 Statistics New Zealand's June 2020 population estimate for the Manawatū-Whanganui Region is 254,300 or 5.0% of New Zealand's total population. In 2010 population in the Region was 230,400 persons, which represented 5.2% of New Zealand's population. The Region's population over the period 2010 to 2020 has grown by 10.4%.Statistics New Zealand's 'medium' population projections have the Region's population increasing to 276,700 – i.e. at an average rate of 0.3% per annum over the period 2020-48.

3.15 Employment data for Palmerston North City shows that in February 2020, 3,300 jobs (6.3%) of Palmerston North's 52,200 jobs were in the manufacturing sector, including 900 in food manufacturing (1.7% of total employment), 590 in machinery and equipment manufacturing (1.1% of total employment) and 530 in fabricated metal products manufacturing (1.0% of total employment).

3.16 Other important employment sectors in the District are health care and social assistance (7,900 jobs or 15.1% of the total), education and training (6,400 jobs or 12.3% of the total), public administration and safety (6,200 jobs or 11.9% of total jobs), retail trade (4,900 jobs or 9.4% of the total),construction (4,300 jobs or 8.2% of the total), wholesale trade (3,500 jobs or 6.7% of the total), and accommodation and food services (2,800 jobs or 5.3% of the total). By and large apart from a comparatively small manufacturing base and the presence of Massey University and the Linton Military Camp, the Palmerston North economy provides a range of services for the lower central North Island.

3.17 For the Manawatū-Whanganui Region in February 2020, there were 107,000 jobs. Agriculture, forestry and fishing is an important sector with 8,800 jobs (8.2% of total employment). Of these 8,357 jobs are in agriculture[8] (7.8% of total employment), with 2,000 in dairy cattle farming and 2,800 in sheep and beef cattle and grain farming.[9] Manufacturing with 11,900 jobs (11.1% of total employment) is a significant sector and this included 5,500 jobs in food manufacturing (including 3,400 jobs in meat and meat products manufacturing and 780 jobs in dairy products manufacturing);1,300 jobs in fabricated metal products manufacturing and 1,200 jobs in machinery and equipment manufacturing. Other important sectors include health care and social assistance (14,000 jobs or 13.1% of the total), education and training (11,500 jobs or 10.7% of the

8 Including an estimated 1,850 agriculture support services jobs.
9 Also a significant proportion of the 1,850 agriculture support services jobs would be linked to these types of farming.

total), retail trade (10,200jobs or 9.5% of the total), construction (8,000 jobs or 7.5% of the total), and accommodation and food services (5,300 jobs or 7.4% of the total).

3.18 Dairy farming and dairy products manufacturing are important activities within the Manawatū-Whanganui regional economy and generate expenditure, employment and incomes for the Region's residents and businesses, including those of Palmerston North City.

4. ECONOMIC BENEFITS FROM THE ONGOING OPERATION OF THE FONTERRA AND GOODMAN FIELDER PLANTS AT THEIRLONGBURN SITES

Maintaining Economic Activity within the District and Regional Economies[10]

4.1 At Fonterra's Longburn site there are around 90 full time equivalent staff (FTEs), paid$9 million in wages and salaries per annum. Of these staff around 60% are resident in Palmerston North, 30% are resident in the wider Manawatū region and 10% from Horowhenua, Taurua and Whanganui. The Goodman Fielder site employs 210 staff (approximately 85% residing in Palmerston North), who are paid $12 million in wages and salaries per annum.

4.2 Fonterra spends an estimated additional $3.2 million per annum with local Manawatū-Whanganui Region businesses on goods and services, whilst Goodman Fielder spends at least $1 million per annum with local businesses. Nearly all of these businesses are located within or around Palmerston North City. Local firms are prioritised where the required services and expertise are available. Goods and services to the plant provided by local firms include engineering support, retail (appliances and hardware), security, building and plant maintenance services, accommodation, food and beverages, vehicle maintenance and repair, rental cars, temporary staff, cleaning and waste disposal. These are the direct economic impacts for Palmerston North City and the Region's economies from the manufacturing sites' continued operation.[11]

10 Unless stated otherwise data in this section provided by Fonterra.

11 No account is taken in this section of the direct and indirect economic impacts of dairy cattle farming within the Region. Dairy cattle farming will in general not be affected by whether the resource consent is not renewed – i.e. milk production within the Region is assumed to be maintained and diverted to other milk processing plants if the consent is not renewed. However, to the extent the non-renewal of the consent or stricter consent conditions add costs to milk transportation and/or reduces product-mix optimality, dairy farmers will be impacted through a lower payout.

4.3 However, and in addition to these direct economic impacts, there are indirect impacts arising from:

a. The effects on suppliers of goods and services provided to the sites from within the City and Region (i.e. the "forward and backward linkage" effects); and

b. The supply of goods and services from within the City and Region to employees at the plants and to those engaged in supplying goods and services to the plants (i.e. the "induced" effects). For example, there will be additional jobs and incomes for employees of supermarkets, restaurants and bars as a consequence of the additional expenditure by employees directly employed at the sites.

4.4 Multipliers can be estimated to gauge the size of these indirect effects. The size of the multipliers is a function of the extent to which an area's economy is self-sufficient in the provision of a full range of goods and services and the area's proximity to alternative sources of supply. Multipliers typically fall in the range of 1.5 to 2.0 and taking the top end of this range of 2.0 for the wider Manawatū-Whanganui region (as compared to individual districts within the Region) implies total impacts (i.e. direct plus indirect impacts) of:

(a) 600FTE jobs retained for Manawatū-Whanganui residents;

(b) $42 million per annum in retained wages and salaries for Manawatū-Whanganui residents; and

(c) $8.4 million retained expenditure with Manawatū-Whanganui businesses.

4.5 Fonterra proposes, within three years of grant of consent, to spend additional capital to construct a storage facility(~95,000 m^3) on their existing wastewater irrigation farm (Innesmoor). In addition to the storage facility construction, there will be associated infrastructure including pipework, pump station upgrades, telemetry and metering. Therefore during the construction of the storage facility there will be additional jobs, income and expenditure for the local economy.

Economic Benefits from Retained Economic Activity

4.6 As indicators of levels of economic activity, economic impacts in terms of increased or, as in this case, retained expenditure, incomes and employment within the localeconomy are not in themselves measures of improvements in economic welfare or economic wellbeing. However, there are economic welfare enhancing benefits associated with retaining levels of economic activity. These relate to one or more of:

a. Increased economies of scale: Businesses and public sector agencies are able to provide increased amounts of outputs with lower unit costs, hence increasing profitability or lowering prices;

b. Increased competition: Increases in the demand for goods and services allow a greater number of providers of goods and services in markets and there are efficiency benefits from increased levels of competition;

c. Reduced unemployment and underemployment[12] of resources: To the extent resources (including labour) would be otherwise unemployed or underemployed, higher levels of economic activity can bring efficiency benefits when there is a reduction in unemployment and underemployment. The extent of such gains is of course a function of the extent of underutilised resources within the local economy at the time and the match of resource requirements and those resources unemployed or underemployed within the local economy; and

d. Increased quality of central government provided services: Sometimes the quality of services provided by central government such as education and health care are a function of population levels and the breadth and quality of such services in a community is higher with higher levels of economic activity, particularly to the extent they lead to or maintain higher levels of population.

4.7 The activities at the Longburn manufacturing sites give Palmerston North greater critical mass and as a consequence the residents and businesses within the City benefit from economies of scale, greater competition, increased resource utilisation and better central government provided services. This is also true for the Manawatū-Whanganui Region, although to a lesser extent given the economic activity generated at the Longburn sites are proportionately less for the Region as compared to Palmerston North City.

Economic Efficiency Benefits from Optimising Plant Location

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12 Underemployment differs from unemployment in that resources are employed but not at their maximum worth; e.g. in the case of labour, it can be employed at a higher skill and/or productivity level, reflected in higher wage rates.

4.8 There are a number of economic efficiency benefits from the continuation of manufacturing at Longburn sites. These have been listed earlier in section 2 of this report and include:(i) the continued use of existing plant and equipment with a reinstatement value of $249 million for Fonterra's plants and over $100 million for Goodman Fielder's site;(ii) for Fonterra - the minimisation of transport costs (and carbon footprint) for milk collection – if the wastewater consent is not renewed milk would need to be transported to Fonterra's other sites;(iii) the availability of a trained and experienced workforce and businesses with appropriate expertise and experience within close proximity of the sites; and (iv) for Fonterra - optimisation of the product mix to maximise returns – without the renewal of wastewater consent product-mix would become a function of which plants had spare capacity. Maintaining these economic efficiency benefits is consistent with *"the efficient use and development of natural and physical resources"* (Part II section 7(b) of the RMA) as well as enabling *"people and communities to provide for their economic and social well-being"* (Part II, section 5(2) of the RMA).

Greater Economic Resilience for Palmerston North City

4.9 Palmerston North's manufacturing base is comparatively small and its economy is generally orientated to providing a range of services to the lower central North Island. Therefore, the manufacturing activity at the Fonterra and Goodman Fielder Longburn sites helps provide greater diversity and balance to the Palmerston North economy.

Rates Income to the Palmerston North Council and Horizons Regional Council

4.10 In 2020/21 Fonterra paid $150,000 in rates on its Longburn site to the Palmerston North Council and the Manawatū-Whanganui (Horizons) Regional Council. In the same year Goodman Fielder paid $195,000 to the Palmerston North City Council and the Horizons Regional Council. Whilst these payments were for services provided by the Councils and from which Fonterra, Goodman Fielder and their employees benefit, economies of scale mean that should the Councils lose some of this income[13], the range and quality of services provided by them would diminish and/or payments by other ratepayers in the City and Region would need to increase.

Community Sponsorship Programmes

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13 As a consequence of the value of the site and the plants on it reducing in value, due to the reduction in wastewater disposal capability.

4.11 In recognition of the important role the community plays in helping Fonterra realise its potential, the company provides financial support to a number of initiatives at the community and national level. In 2020/21 local organisations supported by Fonterra have included financial support to Tanenuiarangi Manawatū Inc. (as the Iwi authority for Rangitāne O Manawatū) to undertake fencing, planting, fish passage maintenance and pest control work in and around Pukepuke Lagoon,[14] Tararau College for its planting project, local primary schools, the Dannevirke Volunteer Fire Brigade, the local branch of Cystic Fibrosis Association of New Zealand, the Manawatū River Leaders Accord, Connect Youth and Community Trust, and NZ Young Farmer regional branches.

4.12 Fonterra and Goodman Fielder also provide grants and sponsorships at a national level that support community programmes and local residents and organizations within the Manawatū-Whanganui region will benefit from this funding.

5. CONCLUSIONS

5.1 The continued operation of manufacturing activities at Fonterra and Goodman Fielder's Longburn sites will maintain the economic wellbeing of the people and communities within Palmerston North City and the Manawatū-Whanganui Region by:

(a) Maintaining significant direct and indirect employment opportunities for local residents;

(b) Maintaining significant direct and indirect wages and salaries for local residents;

(c) Maintaining significant levels of direct and indirect expenditure with local businesses;

(d) Maintaining population and economic activity levels within local communities thereby maintaining the breadth and quality level of services available to local residents and businesses;

(e) Providing greater employment choice for local residents; and

[14] This work fits within the context of a wider natural heritage management plan that was prepared for the lagoon in 2017 to help facilitate co-management by the Iwi and Fonterra of the area.

(f) Fonterra and Goodman Fielder continuing to pay rates to the Palmerston North City and Horizons Regional Councils and contributing to assist local community activities.

5.2 The proposed storage facility at Fonterra's Longburn wastewater irrigation farm site will result in additional direct and indirect employment, incomes and expenditure within the local Palmerston North and Manawatū-Whanganui economies during its construction.

5.3 The continuation of Fonterra and Goodman Fielder Longburn sites' manufacturing activities will maintain resource use efficiency by:

(a) The continued use of existing plant and equipment with significant sunk costs;

(b) The minimisation of transport costs for milk collection, other inputs and outputs;

(c) The continued utilisation of a trained and experienced workforce and businesses with appropriate expertise and experience within close proximity of the plant;

(d) The continued benefits from optimising Fonterra's production product-mix at its manufacturing plants; and

(e) The maintenance of population and economic activity levels (or "critical mass") in Palmerston North City, thereby providing economies of scale and competition in the local provision of goods and services.

5.4 The value to Fonterra and Goodman Fielder of their investment in their Longburn sites can be considered in terms of either the reinstatement value of their plants ($249 million for Fonterra and over $100 million for Goodman Fielder) or the foregone future earnings of the plants on the sites if they were forced to close or downsize. By both of these measures, the value of investment to the existing consent holder and Goodman Fielder is significant.

Appendix F

MANAWATŪ RIVER STATUTORY ACKNOWLEDGEMENT AREA DOCUMENT

Statutory Acknowledgment for the Manawatu River and Tributaries

Statutory Area

The area to which this statutory acknowledgement applies is the Manawatu River and its tributaries, as shown by OTS-182-20.

Statement of Association

Preamble

Under section 29 of the Rangitāne o Manawatu Claims Settlement Act the statement, the Crown acknowledges the statement of association made by Rangitāne o Manawatu of their particular cultural, spiritual, historical, and traditional association with the Manawatu River and its tributaries.

Rangitāne o Manawatu cultural, spiritual, historical, and traditional association with the Manawatu River and its tributaries

The Manawatu River is of immense historical, cultural, spiritual and traditional significance to Rangitāne o Manawatu. The Manawatu River was the main route for travel and communication for Rangitāne o Manawatu with settlements along the margins of the river.

Rangitāne o Manawatu has a rich belief system and structure that has developed over hundreds of years of occupation. The belief system developed a number of spiritual and ritualistic practices that occur at different times and locations along the Manawatu River. A large number of these practices have disappeared due to the introduction of European culture and Christianity. The Manawatu River was created through the spirit of Okatia, who gave life to a totara growing on the slopes of the Puketoi Range in the Hawkes Bay. The totara made its way to the mountain ranges of the Ruahine and Tararua, and as it forced its way through the ranges, it created the Manawatu Gorge and the Manawatu River as it made its way out to sea. For Rangitāne o Manawatu traditions such as this, represent the significant links between the cosmological world and the modern world, which have shaped Rangitāne o Manawatu.

The name Manawatu was bestowed on the River by the Rangitāne Tohunga Haunui a Nanaia, over six hundred years ago. Whilst searching for his wife, Waireka, Hau travelled down the West Coast of the North Island crossing and naming many waterways. When he reached a turbulent flowing river which caused his heart to sink as he thought he may not be able to cross it and continue his search, he called the River Manawatu.

The spiritual connection that Rangitāne o Manawatu have with the River is evidenced by the building of churches along the River such as the Church Turongo Hiha. It was here that an aged Rangitāne Chief related to the assembled people that he had had a momentous dream the previous night. He dreamed that he was standing at the foot of two great totara trees somewhere on the bank of the Manawatu River and that these trees were talking to each other. The first tree said, "Do you know who I am?" "No," was the reply. "I am whangarae (the god of the forehead)," said the first. "Oh. Do you know who I am?" asked the second. "I am whangaihu (the god of the nose)." And they both chanted an incantation. Hiha remembered this karakia and recited it to the assembly. So, on an appointed day, three large canoes made their way up the River to search for the trees. They finally discovered them at a place called Kairanga, near where the Linton Army Camp now stands. The trees were felled and floated down the River to Moutoa where they were pit-sawn into timber. The timber produced by these two great totara was sufficient not only to build the Church but also the furnishings, including a beautifully carved altar. The church was subsequently bestowed with the name Turongo.

Located within the Manawatu River, are many taonga of significance to Rangitāne o Manawatu. There is Te Au-rere-a-te-Tonga, the flowing current of the south, Te Au-nui-a-Tonga, the waterfall located in the gorge, as is the tapu rock Te Ahu a Turanga, which remains visible even in the highest of floods.

There were many Rangitāne o Manawatu kaitiaki guardians of the River. These included Peketahi who lived at Puketotara, and Whangaimokopuna who lived near Hotuiti, also known as Motuiti until he was banished and now lives up in the hills at Raekatia. Whenever Rangitāne people from the lower reaches of the River visit that area, a mist descends which is Whangaimokopuna weeping for his old friends.

Rangitāne o Manawatu practised a number of rituals along the Manawatu River where its resources were utilised. These sites later developed into tapu or wāhi tapu sites. Most if not all of these sites have now been lost (in private or local government ownership) or destroyed due to engineering works.

The Manawatu River and its large number of waterways provided the main highway for Rangitāne o Manawatu and as well as being a mahinga kai in its own right, it fed into the land based mahinga kai. Along the Manawatu River, were located numerous Rangitāne o Manawatu Pa, which have now become one with the River and their locations and the myriad of trails used by Rangitāne o Manawatu, remain an integral part of our traditional history. The traditional mobile lifestyle of Rangitāne o Manawatu, led to their dependence on the Manawatu River and its resources.

Because of the long history of the Manawatu River in providing the highway and mahinga kai to Rangitāne o Manawatu, both on a temporary and permanent basis, there are numerous urupa, wāhi tapu and wāhi taonga associated with the River and Rangitāne o Manawatu. These associations hold the memories, traditions, victories and wairua of Rangitāne o Manawatu tupuna, and many locations therefore, remain unknown to the wider public.

The most significant quality that flows through the Manawatu River is its mauri which binds all the physical, traditional and spiritual elements of all things together, generating, nurturing and upholding all life. That mauri is the most crucial element that binds Rangitāne o Manawatu with the Manawatu River, and that relationship has consisted for over seven hundred years of unbroken occupation.

The interconnected waterways of the Manawatu form a dendritic pattern across the landscape. The mauri supplied from the mountains and areas in the gorge is transported along these waterways to nourish and feed the land and everything living on the land. The Manawatu River for Rangitāne o Manawatu is seen as the main artery in this network containing the strongest and greatest amount of mauri. If any activity that disrupts the flow of the waterway or pollutes the watercourse it is seen as having a negative impact on the mauri which then in turn has a direct negative impact on Rangitāne o Manawatu land and people.

Rangitāne o Manawatu occupation of the Manawatu River continues today after several hundred years. To secure the natural resources needed to sustain Rangitāne o Manawatu and protect the people from neighbouring iwi, Rangitāne o Manawatu developed a number of Pa in strategic locations. These Pa were situated near their most valuable natural resources as well as in strategic positions, particularly along the Manawatu River.

Rangitāne o Manawatu occupied a large area of the Manawatu and developed into a number of whanau based hapu that were responsible for certain geographical areas and natural resources along the Manawatu River. Each hapu interacted with the river and the river flowed through each hapu rohe. These are outlined:

Ngāti Mairehau (Also known as Ngāi Tuahuriri)
Occupied the east bank of the Manawatu River around Turitea to Tokomaru and over the Tararua Ranges to Pahiatua. More specifically along the northwest bank between Ngāwhakaraua and Awapuni.

Ngāti Hineaute
Occupied the land along the Manawatu River from Te Apiti to the northern boundary of Palmerston North City.

Ngāti Rangitepaia (Also known as Ngāti Rangi)
Were based on land from the southern boundary of the city to the confluence of the Oroua and Manawatu Rivers.

Ngāti Rangiaranaki
Shared the riverbank of the Manawatu River from Te Apiti to Palmerston North with Ngāti Hineaute.

Ngāti Tauira
A shared Rangitāne – Ngāti Apa hapu located around the Oroua River above Mangawhata extending to the Rangitikei River and coastal area.

Ngāti Te Kapuarangi
Occupied the upper Manawatu catchment and Pohangina area. The Manawatu River, its geomorphology and human geography can be divided into distinct reaches. Each reach, having a unique environment, meant Rangitāne o Manawatu interacted with that environment accordingly.

Te Apiti ("The Gorge")
This part of the River was recognised for its spiritual connections and significance. As identified the Gorge was carved by a great spirit Okatia cutting its way through the active rising mountain range, the backbone of Te Ika A Maui, allowing the waters to flow from east to west. This active mountain range is a source of mauri for Rangitāne o Manawatu hence the mauri is then transported by the waters of the River to the rest of the rohe. The majority of the sites of significance in this stretch of the River are related to the identification and preservation of mauri in the River.

Otangaki – Papaeioa (Palmerston North) – Puketotara
Geographically this stretch consisting of a steep, gravely bed with defined flood plain contained a number of strongholds and Pa. These Pa were used in times of attack as well as to prepare warriors for battle. These Pa also controlled the entrance to the Gorge as well as various crossings over the Ranges.

This stretch of what used to be clear clean water was also used seasonally to gather resources and foods from various locations in the Ranges as well as along the River and used in ritual practises at the related Pa.

Puketotara was the largest Pa in the area and the central point of the Rangitāne rohe. This site was home to all Rangitāne and numerous events occurred there that determined the future of Rangitāne o Manawatu.

Puketotara – Te Papa Ngaio (Shannon/Opiki/Foxton)
This stretch of the River was the most intensively populated and utilised section of the River for Rangitāne o Manawatu. In this area were numerous Rangitāne o Manawatu papakainga and kainga as well as large areas of cultivations. This part of the Manawatu River was a highway for a large amount of traffic for travel, communication and to access the rich supply of resources contained with the lowland forests and swamps. Associated with the intense population were also numerous sites of ritualistic practice and worship.

Ngāwhakaraua was a large Pa situated on a great horseshoe bend of the Manawatu River, slightly upriver and east of the river's confluence with the Oroua River, and one mile south of the Opiki toll bridge. The pa was occupied by Rangitāne o Manawatu and covered 86 acres of land. The principal buildings were, Te Ahu A Turanga Church, moved from Puketotara c.1879 and destroyed by fire c.1907, although replaced with a smaller building and a wooden whare runanga, 'Kotahitanga.' Kotahitanga represented the kaupapa of unity. Ngāwhakaraua was in use as a mahinga kai for some time before the establishment of a Pa in the locality, which indicates there were sufficient food resources on the surrounding land to sustain a resident population.

Te Papa Ngaio – Okatia Beach (Opiki to Foxton Beach)
The coastal area of the Manawatu River was extremely important to Rangitāne o Manawatu. Not only was this area a rich source of kai moana and other natural resources but Rangitāne o Manawatu were also able to participate in trade with other iwi and groups travelling along the coastline. One of the greatest resources in this area was the Tapuiwaru swamp (now referred to as the Moutoa floodway). It was also a very important area as it was the main access point to the Manawatu River and to the East Coast of the North Island.

Rangitāne o Manawatu - Significant Sites

Along the Manawatu River in the Rangitāne o Manawatu rohe there are 185 recorded sites of significance. The majority of these sites of settlement and occupation and would have had permanent structures associated with them.

Approximately ten of these sites were substantial cultivations or eel weirs that were recorded in historical accounts.

A number of mahinga kai, traditional food gathering areas, and nohoanga, areas of seasonal settlement were located along the River. However a number of these have been destroyed and lost due to engineering works and the moving of the watercourse of the River as the result of engineering works. Over the last one hundred years with constant land use change Rangitāne o Manawatu cultural landscape and its traditional use has been destroyed and lost.

Significant Sites Associated with the Manawatu River

NAME	DESCRIPTION
Ahiaruhe	Kainga
Ahimate	Pa
Ake Ake	Kainga
Animate (Ahimate)	Kainga
Aramari	Kainga
Aratangata	Stream
Atiki	Kainga
Awatapu	Lagoon
Haumahangi	Occupied location
Haumiaroa	Kainga
Heiomarama	Occupied location
Hekinui	Occupied location
Hikaretu	Kainga
Hokonui	Occupied location
Hokorawa	Kainga
Hokowhitu	Kainga
Hokowhitu	Ceremonial site
Hokowhitu	Reserve
Hotaneiti	Cultivation
Iwi Te Kai	Reserve
Iwihi	Papa kainga

NAME	DESCRIPTION
Kari Kari	Occupied location
Kari kari	Site river
Kimi-Mai-I-Tawhiti	Kainga
Kopuanui	Pa
Kopu-Toroa	Kainga
Kopu-Toroa	Stream
Koterara	Kainga
Kotoura	Kainga
Koturua	Occupied location
Koutu Roa	Pa
Kupenga	Kainga
Kuti Kuti	Occupied location
Kutikuti-Rau	Kainga
Mahoe	Kainga
Mako Makonui	Kainga
Manawa Kai Hiekie	Kainga
Manawatu	River
Mangaone	Kainga
Manuwaru	Bush
Marae Tarata	Pa
Mararatapa	Pa

NAME	DESCRIPTION
Kahikatea	Kainga
Kahutara	Papa kainga
Kaimuapi	Occupied location
Kaingapipa	Kainga
Kai-Wahie	Kainga
Karamuremu	Kainga
Karanga Hiku	Kainga
Karatangiatu	Kainga
Karere	Kainga
Karere	Urupa
Karere	Lagoon
One-Poto	Kainga
Opaekete	Kainga
Opiki	Kainga
Oriko	Stream
Orua-rongo	Kainga
Otane	Kainga
Otangaki	Pa
Otangaki	Clearing
Otatara	Kainga
O-Tawhiti	Kainga
Otekura	Stream
Otini	Kainga
Pahiaroa	Kainga
Paiaka	Kainga
Pane-Iri	Pa
Papa Kino	Occupied location
Parahaki	Kainga
Paretao	Kainga
Pikau-Tahi	Pa
Pohue-Tangi	Kainga
Pokapoka	Kainga
Puka Puka	Occupied location
Tau Waka	Waka mooring
Taumata-O-Te-Poki	Site
Tauponga	Kainga
Tawa	Kainga
Te Ahitara	Pa
Te Aotahuna	Kainga
Te Apiti	Site
Te Apu	Kainga
Te Au Nui O Tonga	Site
Te Au Rere A Te Tonga	Site
Te Kairanga	Kainga
Te Kairanga	Pa
Te Kairanga	Papa kainga
Te Kapa-A-Haka	Kainga
Te Karaka	Kainga
Te Karaka	Occupied Location

NAME	DESCRIPTION
Marotira	Church
Mata Karapa	Pa
Mata-Ara	Kainga
Mikihi	Stream
Moengareha	Kainga
Mokomoko	Papa Kainga
Morotira	Kainga
Motua	Occupied location
Motuere	Occupied location
Moutoa	Post office location
Nga Totara	Fossil forest
Nga Wakahiamoe	Waka mooring
Nga Whakaraua	Pa
Ngataiawatea	Kainga
O-Hine-Kake-Ao	Area
Ohineninipeka	Ara Kiore
Okatia	Beach
Okehu	Kainga
Pukemahau	Kainga
Puketotara	Pa
Puketotara	Papa Kainga
Puru-rarauha	Kainga
Rameke	Whare
Rangi Po	Cultivation
Rongo-Karaka	Urupa
Roto Ngarara	Lagoon
Rotopiko	Lagoon
Ruahine	Range
Rua-Poho	Kainga
Tahitiki	Kainga
Tahumataroa	Kainga
Tai I Mate	Pa
Tai I Tahi	Kainga
Taioka	Kainga
Taita	Pa
Taita	Lagoon
Takupu	Kainga
Taringa Kurahaupo	Occupied location
Te Awa Kararoa	Occupied location
Te Awahou	Kainga
Te Awahou	Kainga
Te Awahou	Kainga
Te Awahuri	Kainga
Te Horo	Clearing
Te Kahihoe	Occupied location
Te Wi	Papa Kainga
Tiakitahuna	Pa
Tika Na Roa	Site River
Whirokino	Kainga

NAME	DESCRIPTION
Te Karaka	Cultivation
Te Karekare	Pa
Te Karihari	Papa Kainga
Te Kuri Kautete	Kainga
Te Kuripaka	Pa
Te Maire	Kainga
Te Maire	Lagoon
Te Matai	Pa
Te Motu a Poutoa	Pa
Te Ngaioroa	Kainga
Te Oranga-Tuturu	Kainga
Te Paiaka Kainga	Kainga
Te Papa Ngaio	Pa
Te Pehu	Site river
Te Raka	Site
Te Rerenga-o-hau	Kainga
Te Rewarewa	Area
Te Waka Puni	Waka mooring
Te Weka	Clearing
Te Weki	Clearing
Te Wharangi	Pa
Wharaoere	Occupied location

NAME	DESCRIPTION
Tikitiki	Kainga
Titiuha	Kainga
Toita	Occupied location
Tokitoki	Kainga
Tokomaru	Kainga
Tuapaka	Kainga
Tuapu	Occupied location
Turitea	Pa
Tutunanui Kainga	Kainga
Tuturima	Kainga
Upoko-poutu	Kainga
Waitamata	Kainga
Waiteikai	Occupied location
Whakapohepohe	Occupied location
Whakaripa	Kainga
Whakatanguru	Kainga
Whakatero	Kainga
Whakatero	Kainga
Whakatutu	Kainga
Whakawaewae	Mound
Whakawehi	Kainga

As Rangitāne o Manawatu develop their capacity they look forward to the future and the time when they are fully engaged in upholding the principle of kaitiaki over the Manawatu River.

Appendix G

STORAGE PLANNING ASSESSMENT

STORAGE FACILITY CONSTRUCTION & OPERATION

While there are multiple ways in which the required storage volume can be provided, it is likely that this will be achieved by construction of storage pond on the Innesmoor Farm property. If this is the case, construction and operation of the storage pond will require the following resource consents:

- Land Use Consent from Palmerston North City Council as a Discretionary Activity under Rule R9.8.2 of the District Plan in relation to a ' rural industry' located within a Rural Zone.
- Land Use Consent from Palmerston North City Council as a Non-Complying Activity under Rule R6.3.8.1 for the District Plan in relation to earthworks for construction.
- Land Use Consent from Horizons Regional Council as a Controlled Activity under Rule 13-2 of the One Plan for large scale land disturbance for construction.
- Discharge to Air Consent from Horizons Regional Council as a Discretionary Activity under Rule 15-17 for any discharge of odour or other contaminants from the storage facility.

The above consents do not form part of this application and as noted Fonterra will seek resource consent for the above activities as a separate application. The reasons for this are that the effects of the storage facility are limited in both time (construction effects) and location given any effects from the storage facility will be limited to the subject and adjacent properties. For completeness, the following identifies the consents required for a pond storage option and provides an assessment of the applicant's ability to obtain the necessary consents.

Land Use Consent for `Rural Industrial Activity and Earthworks Under the PNCC District Plan

Innesmoor Farm is zoned Rural under the Operative District Plan (being the Palmerston North City Council's City Plan). There is a flood prone area overlay in the District Plan over a portion of the property. The storage facility is to be located outside of the flood prone area overlay.

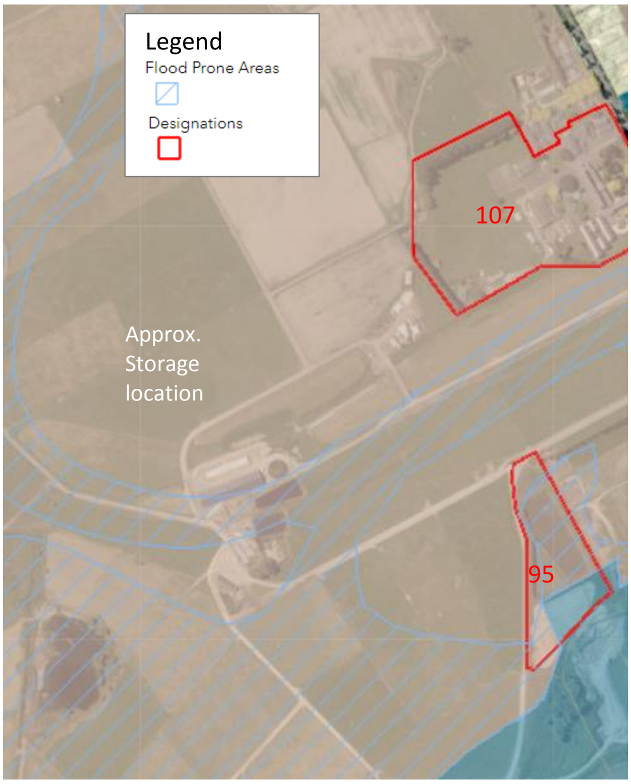

Figure H1: Storage Facility Location & District Plan Zoning[14]

14 *Designations (Red lines) shown in Figure H1 are as follows:*
- Designation 95; for Water and Waste Services; Requiring Authority is Palmerston North City Council
- Designation 107; for Educational Purposes; Requiring Authority is the Minister of Education. This site is the Longburn Adventist College.

The Rural Zone rules provide primarily for rural activities to be undertaken within the zone. The proposed storage facility, while being of a similar nature to a rural activity such as a (albeit very large) effluent storage pond, is classified under the District Plan as a Rural Industry, with Rural Industry being defined as (emphasis added):

> *"Rural Industry means land and/or buildings used for* ***industry which involves the processing of primary products*** *and/or is better located in the rural area because of the need to achieve a separation from other activities; an land/or buildings used by rural contracting businesses to provide services related to the primary production sector, including but not limited to agriculture, aerial topdressing, forestry, earthmoving and construction, and transport."*

Under Rule R9.8.2 of the District Plan, 'sawmills and rural industries' are Discretionary Activities. Therefore, a **Land Use Consent for a Discretionary Activity** is required to be able to establish and use the storage facility.

Further, earthworks would be required in order to construct a pond. The scale of the earthworks is such that the permitted activity criteria of Rule R6.3.6.1 will be exceeded[15]. As the **earthworks** do not meet the permitted activity criteria, they would fall to be a **Non-Complying Activity** under Rule 6.3.8.1 as follows:

> **R6.3.8.1 Non-Complying Activities**
>
> Any earthworks that do not comply with the Permitted Activity Performance Condition R6.3.6.1(e)(ii) or Condition R6.3.6.1(e)(iii) or condition R6.3.6.1(a)(ia) shall be Non-Complying Activities.

A detailed Land Use Consent application and Assessment of Environmental Effects will be submitted to the Palmerston North City Council in order to seek these, or any other necessary, consents. The application will be determined against the relevant assessment criteria which are specified in the District Plan as follows:

Assessment Criteria relating to Rule 9.8.2 – Sawmills & Rural Industries in Rural Zone

The application will be assessed against the following criteria:

> *a. The extent to which adverse visual impacts of any proposed building, structure or storage areas for products and waste, on the surrounding rural environment, and on the landscape values of adjoining areas are avoided, remedied or mitigated.*

A detailed visual effects assessment will be undertaken. A pond will be similar in nature to a large scale dairy effluent pond and mitigation measures are available such as boundary plantings and landscaping. The pond itself is a relatively low structure, being approximately 2.5 m in height above the natural ground. It is therefore considered that any potential landscape or visual effects will be able to be appropriately mitigated.

> *b. The extent to which the effects of noise, dust and other environmental disturbance, on the amenity of the surrounding area are avoided, remedied or mitigated.*

The storage facility will not create any noise, dust or other environmental disturbance that will affect the amenity of the area. Some pumps are proposed but will not breach any noise standards and any noise generated will be consistent with the rural nature of the environment.

> *c. To avoid, remedy or mitigate the risk of contamination posed by hazardous substances.*

There are no hazardous substances associated with the proposal.

> *d. The extent to which the adverse effects on the safe and efficient operation of the roading network from the traffic movements generated by activities are avoided remedied or mitigated.*

The operation of the storage facility does not generate any traffic movements and therefore there will be no adverse effects on the roading network.

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15 *The Permitted Activity criteria of Rule 6.3.6.1 include a maximum volume of 1,000 m^3 in any 12-month period. As the storage to be constructed will result in a total storage volume of 63,700 - 95,000 m^3 it is clear that this threshold will be exceeded.*

e. *To ensure the provision of adequate on-site parking, loading, manoeuvring and access space to avoid this taking place on roads.*

The operation of the storage facility does not create any additional demand for on-site parking, loading, manoeuvring and access, and will be sited in the centre of a large land holding where there is adequate space for any such activities. There will be no effects on the road network.

f. *The extent to which there is a functional need for the industrial activity to locate in a rural area.*

The storage facility is associated with the discharge of wastewater on land which is consented for that purpose. There is a functional need for the storage facility to be located on the Innesmoor farm.

g. *The extent to which the proposal retains the productive capability of rural land, especially the productive use of versatile Class 1 and Class 2 soils*

Soil mapping of the wastewater farms has been carried out to support the wastewater to land assessment included in Appendix C2. The soil mapping found that the soils of the Innesmoor farm are comprised mainly of Manawatū and Kairanga soils and fall between Land Use Classes II and III. The storage facility is also located on a farm which is managed first and foremost for wastewater treatment. The storage facility therefore will not have any adverse effect the productive capacity of rural land.

Earthworks Considerations

In relation to the earthworks provisions, the District Plan seeks to control earthworks in order to manage landscape and visual effects; impacts on amenity values on neighbouring properties; effects on land stability and impacts of flooding; construction impacts including dust and noise; effects on runoff and sedimentation; and effect on the national grid. The proposed storage facility will be designed with appropriate landscape and visual mitigation, is sited at least 200 m from the nearest dwelling, and is located on flat land outside of the flood prone area hazard overlay. There are no national grid assets in close proximity to the site. The earthworks that would be required are a standard earthworks activity and able to be undertaken using standard construction methodologies to mitigate dust, noise, runoff and sedimentation effects. Therefore, while earthworks to create a storage pond will fall to be considered as a Non-Complying activity under the District Plan, it is considered that any relevant effects will be less than minor.

Without pre-judging the determination of consent applications to be lodged with the Palmerston North City Council for the construction and use of a storage pond or other facility, it is considered that the design and mitigation will be such that all relevant effects will be considered to be less than minor and consistent with the relevant objectives and policies of the District Plan.

Land Use Consent for Large Scale Land Disturbance Under the Regional Plan

Earthworks to construct a storage pond will also require resource consent as a controlled activity under Rule 13-2 of the One Plan.

Rule	Activity	Classification	Conditions/Standards/Terms	Control/Discretion Non-Notification
13-2 **Large-scale *land disturbance**, including earthworks**	Except as regulated by Rules 13-6, 13-8 and 13-9, any *land disturbance** pursuant to s9(2) RMA of a total area greater than 2500 m^2 per *property** per 12-month period and any ancillary: (a) diversion of *water*^ pursuant to s14(2) RMA on the *land*^ where the *land disturbance** is undertaken, or (b) *discharge*^ of sediment into *water*^ pursuant to s15(1) RMA resulting from the *land disturbance**.	**Controlled**	(a) The activity must not take place on *land*^ that is within a *coastal foredune**. (b) The activity must be undertaken in accordance with an *Erosion and Sediment Control Plan**. (c) Any ancillary *discharge*^ of sediment into *water*^ must not, after reasonable mixing, cause the receiving *water body*^ to breach the water quality standards for visual clarity set out in Schedule E for that *water body*^. (d) The activity must not occur on *land*^ that is in, or within 5 m of: (i) the *bed*^ of a *river*^ that is permanently flowing, (ii) the *bed*^ of a *river*^ that is not permanently flowing -and has an *active bed** width greater than 1 m, (iii) the *bed*^ of a *lake*^. (e) The activity must not occur on *land*^ that is in, or within 10 m of: (i) A *wetland*^ as identified in Schedule F, (ii) Sites valued for Trout Spawning as identified in Schedule B, (iii) Sites of Significance - Aquatic as identified in Schedule B.	Control is reserved over: (a) the location, nature, scale, timing and duration of the activity (b) Additional content of and the standard to which the *Erosion and Sediment Control Plan** must be prepared, the implementation of the plan, and the timing of when it must be prepared and submitted (c) the *effects*^ of the activity and associated sediment run-off on soil conservation, surface *water** quality and aquatic ecology and the methods to be taken to avoid, remedy or mitigate them (d) the provision of greater setback distances from *water bodies*^ than those specified under conditions (d) and (e) to provide greater protection to a *water body*^ if required (e) duration of consent (f) review of consent *conditions*^ (g) compliance monitoring (h) the matters in Policy 14-9. *Resource consent*^ applications under this *rule*^ will not be notified and written approval of affected persons will not be required (notice of applications need not be *served*^ on affected persons).

The storage facility is not located within a coastal foredune, nor within 5 m of a waterbody, nor within 10 m of a wetland, trout spawning area or site of significance - aquatic. The activity will be undertaken in accordance with an Erosion and Sediment Control Plan which will ensure that there is no ancillary discharge of sediment into water which causes a breach of the water quality standards for visual clarity. Therefore, the earthworks will be able to be undertaken as a Controlled Activity under Rule 13-2 meaning that consent must be granted by the Regional Council and the consent application for the earthworks is to be processed on a non-notified basis without the need for affected party approvals. That is, there is certainty that the necessary consent for earthworks to construct the storage facility can be secured prior to construction.

Discharge to Air (Odour from the Storage Facility)

There is no rule in the One Plan which provides for the discharge of odour from a wastewater storage pond or similar facility. Therefore, it falls to be considered a **Discretionary Activity** under Rule 15-17 Other discharges.

Rule	Activity	Classification	Conditions/Standards/Terms	Control/Discretion, Non-Notification
15-17 **Other *discharges*^**	The *discharge*^ of *contaminants*^ into air pursuant to ss15(1) or 15(2A) RMA and any subsequent *discharge*^ of *contaminants*^ onto *land*^ from activities which either: (a) are located on *industrial or trade premises*^ and are not addressed by any other *rule*^ in this Plan, or (b) do not comply with one or more *conditions*^, standards or terms of a *permitted activity*^ *rule*^, but which are not expressly classified as a *controlled activity*^, *restricted discretionary activity*^, *discretionary activity*^, *non-complying activity*^ or *prohibited activity*^. *Discharges*^ that are covered by this *rule*^ under (a) include, but are not limited to, those activities listed in the *rule*^ guide following this *rule*^ table.	**Discretionary**		

An initial assessment of the storability of the permeate wastewater streams has been undertaken by Beca Ltd. The assessment determined that a storage pond will be able to operate without causing off-site adverse effects in terms of odour. Some mitigation such as the wastewater polisher is also available to ensure that any potential odour effects are appropriately managed. The facility is also proposed to be located at least 500 m from any adjoining residential boundary and the closest dwelling is at least 200 m from the storage facility site.

A separate application will be lodged with Regional Council for a resource consent to discharge contaminants to air under Rule 15-17.

NES-Contaminated Soils

The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES-CS) is relevant if the site of the proposed storage facility has, or is more likely than not to have had, an activity or industry occur on it which is listed on the Hazardous Activities and Industries List (HAIL). The extent of earthworks required to construct the storage facility will exceed the Permitted Activity criteria of Regulation 8(3) of the NES-CS and therefore if a HAIL activity has, or is more likely than not to have had, occurred on the site, land use consent under the NES-CS will be required.

The site is not known to be listed on any HAIL registers nor have any HAIL listed activities occurred on the site. Therefore, the site is a not a “piece of land” defined under Regulation 5(8) of the NES-CS and consent under the NES-CS is not required.

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