8 October 2019

LANDPRO
Make the most of your land

Otago Regional Council
70 Stafford Street
Private Bag 1954
Dunedin 9054

Attention: Natasha Pritchard

Dear Natasha,

Re: Application by Queensbury Ridges Limited to Replace Deemed Permits

Please find enclosed the above consent application for your consideration.

The $1000 consent processing deposit will be paid via internet banking.

If you have any questions in relation to this application, please don't hesitate to contact me directly (details below).

Yours Sincerely,

Will Nicolson

Resource Management Planner

13 Pinot Noir Drive | PO Box 302 | Cromwell 9342
P 03 445 9905
will@landpro.co.nz | www.landpro.co.nz

1 Resource Consent Application

Otago Regional Council

This application is made under Section 88 of the Resource Management Act 1991.

(For Office Use Only)
Deposit Paid: $

Charges / Deposits

A deposit **must** accompany the application (see page **8** for amounts). The applicant will be invoiced for all costs incurred in processing this application that exceed the deposit.

Council can accept electronic lodgement of applications if sent to consents.applications@orc.govt.nz. Include "consent application" in the subject line.

Please complete the application in pen. For questions marked with an * you will find notes on page 4

1.* Applicant(s) Details

Applicant(s) name(s) in full: _____

_____

_____

_____

OR Company Name (in full) Queensbury Ridges Limited

OR Names of Trustees (in full) if Applicant is a Trust _____

_____

or Name of Incorporation _____

Postal Address PO Box 22

_____

Wanaka Post Code 9305

Street Address _____

(not a P O box number) _____

_____ Post Code _____

Phone Number Business _____ Private _____

Mobile 027 210 0685 Fax _____

Email Address rsomerville@xtra.co.nz

Please provide a valid and clear email address. Otago Regional Council is moving to a paperless consenting process – therefore any correspondence including decision documents and consent (if granted) will be sent via email, unless you request a paper copy.

If you do not prefer contact by electronic means, please tick ☐

1(a). Key Contact for Applicant Details

If the applicant consists of multiple parties (e.g. multiple consent holders, Trust etc) please outline who the key contact for the consent will be, if granted.

Key contact name(s) in full: _____

_____

_____

_____

Postal Address _____

_____

_____ Post Code _____

Street Address _____

(not a P O box number) _____

_____ Post Code _____

Phone Number Business _____ Private _____

Mobile _____ Fax _____

Email Address _____

Please provide a valid and clear email address. Otago Regional Council is moving to a paperless consenting process – therefore any correspondence including decision documents and consent (if granted) will be sent via email, unless you request a paper copy.

If you do not prefer contact by electronic means, please tick ☐

2.* Consultant/Contact Details (if not applicant)

Name of Consultant/ Contact Person: Will Nicolson - Landpro Ltd

Postal Address PO Box 302

_____

Cromwell Post Code 9342

Phone Number Business _____ Private _____

Mobile 027 459 8090 Fax _____

Email Address will@landpro.co.nz

Please provide a valid and clear email address. Otago Regional Council is moving to a paperless consenting process – therefore any correspondence including decision documents and consent (if granted) will be sent via email, unless you request a paper copy.

If you do not prefer contact by electronic means, please tick ☐

3. On Site Supervisor/Manager Contact Details (if applicable)

Name of On Site Supervisor/Manager Person:

Postal Address _____

_____

_____ Post Code _____

Phone Number Business _____ Private _____

Mobile _____ Fax _____

Email Address _____

Please provide a valid and clear email address. Otago Regional Council is moving to a paperless consenting process – therefore any correspondence including decision documents and consent (if granted) will be sent via email, unless you request a paper copy.

If you do not prefer contact by electronic means, please tick ☐

4.* a) Are there any current or expired resource consents relating to this proposal?

☐ Yes ☐ No

If yes, give Consent Number(s) and Description: 2002.348.V1, 2002.349.V1, 2002.351.V1, 2002.352.V1, 2002.353.V1, 2002.354.V1, 2003.591.V2

_____

b) Do you agree to your current consent automatically being surrendered should a replacement consent be issued.

☐ Yes ☒ No

c) Has there been a previous application for this activity that was returned as incomplete?

☐ Yes ☒ No

If yes, give Consent Number(s) and Description: _____

_____

_____

d) Have you a pre-application lodged with Council for this activity?

☐ Yes ☒ No

If yes, give pre-application Number(s) and Description: _____

_____

_____

e) Have you spoken to a Council staff member about this application prior to lodging this application?

☒ Yes ☐ No If yes, please state name of staff member Natasha Pritchard

5. The applicant is (tick one): ☒ owner ☐ leasee ☐ prospective purchaser **of the land on which the activity occurs.**

6*. Who is the owner of the land on which the activity occurs/is to occur? (only complete if applicant is not the landowner)

Name of landowner: _____

Postal Address _____

_____

_____ Post Code _____

Phone Number Business _____ Private _____

Mobile _____ Fax _____

Email Address _____

7*. Who is the occupier of the land on which the activity occurs/is to occur? (only complete if the applicant is not the land occupier)

Name of land occupier _____

Postal Address _____

_____

_____ Post Code _____

Phone Number Business _____ Private _____

Mobile _____ Fax _____

Email Address _____

8*. Who leases the land on which the activity occurs/is to occur? (only complete if land is leased and it is not leased to the applicant)

Name of land leasee _____

Postal Address _____

_____

_____ Post Code _____

Phone Number Business _____ Private _____

Mobile _____ Fax _____

Email Address _____

9. Tick the consents required in relation to this proposal:

Water

☐ Take Surface Water ☐ Divert

☐ Take Groundwater ☐ Dam (possibly - see AEE)

Discharge onto or into:

☐ Land ☐ Water ☐ Air

Land Use:

☐ Bore construction ☐ Bore alteration

☐ Activities in or on beds of lakes or rivers or floodbanks

☐ Disturbance of contaminated land

Coastal: ☐ Activities in the coastal marine area (i.e., below mean high water spring tide)?

Where you have indicated the type of consent that is required, you must complete the appropriate Application Form before your application can be processed. Application Forms can be found on the Council's website: www.orc.govt.nz.

10. What is the maximum term of consent you are seeking? 25 years

11.Territorial Local Authority in which activity is situated?

☐ Dunedin City Council ☐ Queenstown Lakes District Council

☐ Clutha District Council ☐ Waitaki District Council

☐ Central Otago District Council

12*. Do you require any other resource consent from any local authority for this activity?

☐ Yes ☐ No

If Yes, please list: _____

Have these consents been applied for/issued? ☐ Yes ☐ No If Yes

If Yes, please give the date applied for or issued: _____

Notes on Application Form Details

1. **Applicant(s) Details**

A resource consent can only be held by a legal organisation or fully named individual(s). A legal organisation includes a limited company, incorporated group or registered trust. If the application is for a trust the full names of all trustees are required. If the application is not for a limited company, incorporated group or trust, then you must use fully named individual(s).

2. **Consultant/Contact Details**

If you are using a consultant/agent for this application put their details here. If you are not, leave question 2 blank.

4 Previous Consent

Do you currently have a resource consent to do the activity that you are applying to renew with this application? If so, please enter the permit number if known and a brief description including the date of issue and the expiry date.

6-8 **Landowner, occupier and leasee**

If you are not the landowner, land occupier or leasee of the land where the activity will be undertaken, you may be required to obtain their unconditional written approval to your application. On pg 6 there is a form that can be used.

12. **Additional Consents**

If you are carrying out earthworks or building work you may need other consents from either the ORC or your Territorial Local Authority.

Declaration

Before signing the declaration below, in order to provide a complete application have you remembered to:

Fully completed this Form 1 and the necessary Application Forms ☐

Attached the required deposit.(or pay on line) (see page 8 for deposit that is payable) ☐
Cheques payable to Otago Regional Council

Please note: your deposit may not cover the entire cost of processing your application. At the end of the application process you will be invoiced for any costs that exceed the deposit. Interim invoices may be sent out for applications, where appropriate.
If the required deposit does not accompany your application, staff will contact you on the phone number provided on this form to request payment, and after 3 working days your application will returned if no payment is made for the required deposit.

I/we hereby certify that to the best of my/our knowledge and belief, the information given in this application is true and correct.

I/we undertake to pay all actual and reasonable application processing costs incurred by the Otago Regional Council.

Name/s WILL NICOLSON (on behalf of Queensbury Ridges Limited)
(BLOCK CAPITALS)

Signature/s _____
(or person authorised to sign on behalf of applicant)

Designation Consultant Date 8/10/2019
(e.g., owner, manager, consultant)

Otago Regional Council Postal Address: 70 Stafford St, Private Bag 1954, Dunedin 9054

Consultation

– (consultation is not compulsory, but it can make a process easier and reduce costs).

Under Section 95E of the Resource Management Act 1991 (the Act) the Council will identify affected parties to an application and if the application is to be processed on a non-notified basis the unconditional written approval of affected parties will be required. Consultation with potentially affected parties and interested parties can be commenced prior to lodging the application.

Consultation may be required with the appropriate Tangata Whenua for the area. The address of the local Iwi office is: Aukaha, 258 Stuart Street, P O Box 446, Dunedin, Fax (03)477-0072, Phone (03) 477-0071, email: info@aukaha.co.nz. If you require further advice please contact the Otago Regional Council.

Good consultation practices include:

- Giving people sufficient information to understand your proposal and the likely effects it may have on them
- Allowing sufficient time for them to assess and respond to the information
- Considering and taking into account their responses

Written approval forms are appended to this form on Page 9.

Information Requirements

In order for any consent application to be processed efficiently in the minimum time and at minimum cost, it is critical that as much relevant information as possible is included with the application**. Where an application is significantly incomplete, the Consent Authority may decide not to accept the application for processing.**

Resource Management Act 1991
FOURTH SCHEDULE—ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

(Below are the provisions of the 4th schedule of the Act, which describes what must be in an application for resource consent, as amended in 2015.)

1 Information must be specified in sufficient detail

Any information required by this schedule, including an assessment under clause 2(1)(f) or (g), must be specified in sufficient detail to satisfy the purpose for which it is required.

2 Information required in all applications

(1) An application for a resource consent for an activity (the **activity**) must include the following:

(a) a description of the activity:

(b) a description of the site at which the activity is to occur:

(c) the full name and address of each owner or occupier of the site:

(d) a description of any other activities that are part of the proposal to which the application relates:

(e) a description of any other resource consents required for the proposal to which the application relates:

(f) an assessment of the activity against the matters set out in Part 2:

(g) an assessment of the activity against any relevant provisions of a document referred to in section 104(1)(b). *("document" includes regional & district plans, regulations*, *national policy statements, iwi plans*)

(2) The assessment under subclause (1)(g) must include an assessment of the activity against—

(a) any relevant objectives, policies, or rules in a document; and

(b) any relevant requirements, conditions, or permissions in any rules in a document; and

(c) any other relevant requirements in a document (for example, in a national environmental standard or other regulations).

(3) An application must also include an assessment of the activity's effects on the environment that—

(a) includes the information required by clause 6; and

(b) addresses the matters specified in clause 7; and

(c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

3 Additional information required in some applications

An application must also include any of the following that apply:

(a) if any permitted activity is part of the proposal to which the application relates, a description of the permitted activity that demonstrates that it complies with the requirements, conditions, and permissions for the permitted activity (so that a resource consent is not required for that activity under section 87A(1)):

(b) if the application is affected by section 124 or 165ZH(1)(c) (which relate to existing resource consents), an assessment of the value of the investment of the existing consent holder (for the purposes of section 104(2A)):"(c) if the activity is to occur in an area within the scope of a planning document prepared by a customary marine title group under section 85 of the Marine and Coastal Area (Takutai Moana) Act 2011, an assessment of the activity against any resource management matters set out in that planning document (for the purposes of section 104(2B)

4 (relates to subdivisions- *not included here as subdivisions not ORC jurisdiction.)*

5 Additional information required in application for reclamation

An application for a resource consent for reclamation must also include information to show the area to be reclaimed, including the following:

(a) the location of the area:

(b) if practicable, the position of all new boundaries:

(c) any part of the area to be set aside as an esplanade reserve or esplanade strip.

Assessment of environmental effects

6 Information required in assessment of environmental effects

(1) An assessment of the activity's effects on the environment must include the following information:

(a) if it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity:

(b) an assessment of the actual or potential effect on the environment of the activity:

(c) if the activity includes the use of hazardous substances and installations, an assessment of any risks to the environment that are likely to arise from such use:

(d) if the activity includes the discharge of any contaminant, a description of—

(i) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and

(ii) any possible alternative methods of discharge, including discharge into any other receiving environment:

(e) a description of the mitigation measures (including safeguards and contingency plans where relevant) to be undertaken to help prevent or reduce the actual or potential effect:

(f) identification of the persons affected by the activity, any consultation undertaken, and any response to the views of any person consulted:

(g) if the scale and significance of the activity's effects are such that monitoring is required, a description of how and by whom the effects will be monitored if the activity is approved:

(h) if the activity will, or is likely to, have adverse effects that are more than minor on the exercise of a protected customary right, a description of possible alternative locations or methods for the exercise of the activity (unless written approval for the activity is given by the protected customary rights group).

(2) A requirement to include information in the assessment of environmental effects is subject to the provisions of any policy statement or plan.

(3) To avoid doubt, subclause (1)(f) obliges an applicant to report as to the persons identified as being affected by the proposal, but does not—

(a) oblige the applicant to consult any person; or

(b) create any ground for expecting that the applicant will consult any person.

7 Matters that must be addressed by assessment of environmental effects

(1) An assessment of the activity's effects on the environment must address the following matters:

(a) any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects:

(b) any physical effect on the locality, including any landscape and visual effects:

(c) any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity:

(d) any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations:

(e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants:

(f) any risk to the neighbourhood, the wider community, or the environment through natural hazards or the use of hazardous substances or hazardous installations.

(2) The requirement to address a matter in the assessment of environmental effects is subject to the provisions of any policy statement or plan.

Set out below are details of the amounts payable for those activities to be funded by fees and charges, as authorised by s36(1) of the Resource Management Act 1991.

Resource Consent Application Fees (from 1 July 2018)

Note that the fees shown below are a **deposit** to be paid on lodgement of a consent application and applications for exemptions in respect of water metering devices. This deposit will not usually cover the full cost of processing the application, and further costs are incurred at the rate shown in the scale of charges. GST is included in all fees and charges.

If you wish to make a payment via internet banking, or on line, the details are below. Please note the applicants name and "consent application" should be used as reference when paying the deposit -

For on line payments go to www.orc.govt.nz and go to Home/ Rates/ Way to Pay and follow prompts

Publicly Notified Applications: [3]	**$**
First application	5,000.00
Concurrent applications	225.00

Non Notified Applications and Limited Notified Applications: [3]	**$**
First application (except those below)	1,000.00
Concurrent applications [1]	50.00
Variation to conditions – s127	1,000.00
Administrative variation – s127	500.00
Exemptions from water measuring Regulations	200.00
Bores	500.00
Gravel	500.00

Hearings	Per Note 2 below
Payment for Commissioner request – s100A	Per Note 4 below

Objections	
Payment for Commissioner request – s357AB	Per Note 4 below

Transfers and Certificates Deposits:	**$**
Transfer of permits and consents	100.00
Priority Table	100.00
Section 417 Certificate	200.00
Certificate of Compliance	200.00
Section 125 – Extension of lapse date	100.00
All Other Costs	As per Scale of Charges

Scale of Charges:	**From 1 July 2018 $**
Staff time per hour:	
* Executive staff	235.00
* Senior Technical/Scientist	170.00
* Technical/Scientist	125.00
* Field Staff	100.00
* Administration	85.00
Disbursements	Actual
Additional site notice	Actual
Advertisements	Actual
Vehicle use per kilometre	0.70
Travel and accommodation	Actual
Testing charges	Actual
Consultants	Actual
Commissioners	Actual
Photocopying and printing	Actual
Councillor hearing fees per hour	
*Chairperson	100
*Member	80
*Expenses	Actual

Notes

1. For additional permits in respect of the same site, activity, applicant, time of application, and closely related effect as the first application.

2. The deposit payable shall be 90% of the cost of a hearing as calculated by Council in accordance with information contained in the application file and using the scale of charges. The amount payable will be due at least 10 working days before the commencement of the hearing. If the amount is not paid by the due date, then the Otago Regional Council reserves the right under S36 (7) of the Resource Management Act to stop processing the application. This may include cancellation of the hearing.

Should a hearing be cancelled or postponed due to the non payment of the charge, the applicant will be invoiced for any costs that arise from that cancellation or postponement.

Following completion of the hearing process, any shortfall in the recovery of hearing costs will be invoiced, or any over recovery will be refunded to the applicant.

Under Section 100A of the RMA, one or more submitters may make a request to have a resource consent application heard by one or more hearing commissioners who are not members of Council. In this case the applicant will pay the amount that Council estimates it would cost for the application to be heard had the request not been made, and the submitter(s) who made the request will pay, in equal shares, the cost of the application being heard that exceeds that amount payable by the applicant.

Further, the applicant may request to have a resource consent application heard by one or more hearing commissioners who are not members of Council. In this case, the applicant will pay the full costs.

3. Where actual and reasonable costs are less than the deposit paid, a refund will be given.

4. Where an applicant requests under s100A (for a consent hearing) or under s357AB (for the hearing of an objection) an independent commissioner(s); the applicant will be required to pay any increase in cost of having the commissioner(s).

   Where a submitter(s) requests under s100A an independent commissioner(s) any increase in costs that is in addition to what the applicant would have paid shall be paid by the submitter. If there is more than one submitter who has made such request the costs shall be evenly shared.

Administrative Charges
The following one-off administration charges shall apply to all resource consent applications received:

Publicly Notified and Limited Notified Applications	**$**
First application	100.00
Concurrent applications	50.00

Non-Notified Applications	**$**
First application	50.00
Concurrent applications	25.00

Other	**$**
Certificate of Compliance	25.00
Section 417 Certificate	25.00
Exemptions from water metering regulations	25.00

Review of Consent Conditions
Following the granting of a consent, a subsequent review of consent conditions may be carried out at either request of the consent holder, or, as authorised under Section 128, as a requirement of Council. Costs incurred in undertaking such reviews will be payable by the consent holder at the rates shown in the Scale of Charges above.

Reviews initiated by Council will not be charged to consent holders.

Compliance Monitoring Charges (from 1 July 2017)

1. Performance Monitoring
The following charges will apply to the review of performance monitoring reports for all consent holders, except those listed in section 1.6 below. The charges shown are annual fixed fees per performance monitoring report or plan, and are inclusive of GST.

		From 1 July 2017
1.1 Discharge to Air Consent		***$***
Measurement of contaminants from a Stack report		86.00
Ambient air quality measurement of contaminants report		100.00
Management plans and maintenance records		33.50
Annual Assessment report		66.50
1.2 Discharge to Water, Land and Coast		***$***
• Effluent Systems	Environmental Quality report	46.50
	Installation producer statements	60.00
	Return of flow/discharge records	60.00
• Active Landfills	Environmental Quality report	58.00
	Management Plans	130.00
• Industrial Discharges	Effluent quality report	42.00
	Environmental report	92.50
	Return of flow/discharge records	60.00
Annual Assessment report		50.00
Management Plans – minor environmental effects		130.00
Management Plans – major environmental effects		260.00
Maintenance records		30.00

1.3 Water Takes

Verification reports	60.00
Annual assessment report	50.00
Manual return of data per take	80.00
Datalogger return of data per take sent to the ORC	50.00
Telemetry data per consent	35.00
Administration fee – water regulations	100.00
Low flow monitoring charge*	
- Kakanui at McCones	327.00
- Unnamed Stream at Gemmels	1,431.00

*Charge for monitoring sites established by the ORC specifically to monitor consented activities in relation to river flows.

1.4 Structures

Inspection reports for small dams	130.00
Inspection reports for large dams	260.00
Structure integrity reports	80.00

1.5 Photographs

Provision of photos	60.00

1.6 Set Fees for Specific Consent Holders

Performance monitoring fees will be charges as 75% of actual costs for the following consent holders

Dunedin City Council
Central Otago District Council
Clutha District Council
Queenstown Lakes District Council
Waitaki District Council
Ravensdown
Contact Energy
Trustpower
Pioneer Generation

Additional charges may be incurred for new consents granted during the year.

2. Audit

Audit work will be charged at half of the actual cost incurred, with the actual costs being calculated using the Scale of Charges.

3. Non-Compliance, Incidents and Complaints

Enforcement work on consent conditions, and remedying negative effects from permitted activities – Scale of Charges.

Gravel Inspection and Management

Gravel extraction fee – $0.66 per cubic metre (incl. GST). Where more than 10,000 cubic metres of gravel is extracted within a prior notified continuous two month period, the actual inspection and management costs will be charged, as approved by the Director Corporate Services.

Written Approvals of Persons Likely to be Adversely Affected

I/We (Please print full name/s)_____ _____

of (Address) _____

I /we have read the full application for the proposal by (Applicant)

_____

for a Resource Consent (Number) _____ to _____

_____
and give my/our written approval to the proposed activity/activities.

In signing this written approval I/we understand that:

- The consent authority must decide that I/we am/are no longer an affected person, and disregard adverse effects on me/us
- That /we I may withdraw my/our written approval in writing before the hearing, or if no hearing before a decision is made on the application.

Signature/s_____ Date _____
(or person authorised to sign on behalf of affected party/parties)

Phone _____ Fax _____ Email _____

Please note: If this application is subsequently notified the above approval does not constitute a submission as required under Section 96 of the Resource Management Act 1991.

Written Approvals of Persons Likely to be Adversely Affected

I/We (Please print full name/s)_____ _____

of (Address) _____

I /we have read the full application for the proposal by (Applicant)

_____

for a Resource Consent (Number) _____ to _____

_____
and give my/our written approval to the proposed activity/activities.

In signing this written approval I/we understand that:

- The consent authority must decide that I/we am/are no longer an affected person, and disregard adverse effects on me/us
- That /we I may withdraw my/our written approval in writing before the hearing, or if no hearing before a decision is made on the application.

Signature/s_____ Date _____
(or person authorised to sign on behalf of affected party/parties)

Phone _____ Fax _____ Email _____

Please note: If this application is subsequently notified the above approval does not constitute a submission as required under Section 96 of the Resource Management Act 1991.

2 Application To Dam Water

Otago Regional Council

This form is to be used for applications seeking to dam water within a watercourse, or outside a watercourse where natural runoff will be captured.

(For Office Use Only)

Consent No.: _____

Job No: _____

PLEASE READ THIS PAGE BEFORE COMPLETING THE APPLICATION FORM

A number of resource consents may be required for the construction of a dam and the impoundment of water behind it. This schedule addresses the requirements for a water permit to dam water only.

Depending on the location of your dam structure, and if the dam structure is existing or new, you may not need to fill out all parts of this schedule.

Please note that additional permits may be required when damming water. These include:

- a water permit to take surface water or groundwater, should the dam impound water for which no consent is held to be taken (see Schedule 4 or 5), and
- a water permit to divert water, if flows are to be diverted during construction (see Schedule 3).
- a discharge permit to discharge water from a dam (see Schedule 7),
- a land use consent to disturb the bed of a watercourse and erect a dam structure in the bed of a watercourse, should construction activities occur in the bed of a watercourse (see Schedule 10C), and
- a discharge permit to discharge contaminants to water during dam construction (see Schedule 7) and
- a building consent for the dam structure *Please note that dam structures and dam modifications require a building consent under the Building Act (2004). The Otago Regional Council currently issue building consents for dams. You will need to apply to Council directly for a building consent. Application Forms are available on our website under 'Dams, their safety and building consents'"*

In order for any consent application to be processed efficiently in the minimum time and at minimum cost, it is critical that as much relevant information as possible is included with the application.

Form 1 and Schedule 2, when properly completed, may provide an adequate "Assessment of Effects on the Environment" (AEE) where the adverse effects of the dam proposal are not significant. The required detail for an AEE should reflect the scale and significance of the potential adverse effects the proposed dam may have on the environment. If the size of the proposed dam or scale of its potential effects is significant, a report by a professional advisor in support of your application may be required.

Guidance to answering the questions appear at the end of this schedule: "Notes to provide Guidance on Completing Schedule 2". Details of the information required in an AEE are included in the Fourth Schedule of the Resource Management Act 1991 appended to Form 1: Resource Consent Application.

If all the necessary information is not supplied with the application then Otago Regional Council may return your application, request further information or decline your application. This will lead to delays in the processing of your application and may increase processing costs.

If the effects of your proposal are considered to be minor and written approvals are gained from all parties that may be adversely affected by it, then your application(s) will proceed under non-notified consent provisions. If you are unable to supply the necessary written approvals from the affected parties, or if the effects of the proposal are more than minor, then Council must limited notify or fully notify the application. Such applications take longer to be processed than non-notified applications and may incur additional processing costs. Details of consultation required are presented in this document.

PART A: Description of the Proposed Damming and Associated Activities

A.1 Is the application to dam water:

☐ a new consent, or relates to a pre-existing weir on the Albert Burn (see AEE)

☐ to replace an existing consent? _____ (consent number)

A.2 Please Indicate what provisions of Permitted Activity Rule 12.3.2.1 of the Regional Plan: Water for Otago, cannot be met by the proposed damming activity:

☐ The size of the catchment upstream of the dam is greater than 50 hectares in area.

Size of catchment upstream of dam: well over 50 ha

☐ The water immediately upstream of the dam is more than 3 metres deep.

Maximum water depth behind dam: _____

☐ The volume stored by the dam is more than 20,000 cubic metres.

Maximum volume able to be stored behind dam: _____

☐ A lawful take will be adversely affected by the dam.

Name whose take will be affected, and water permit number if known: _____

☐ A wetland identified in schedule 9 of the Regional Plan: Water or any wetland higher than 800 metres above sea level will be adversely affected by the dam.

please name/describe wetland: _____

☐ The dam will cause either flooding, erosion, land instability, sedimentation or damage of another person's property.

Name which effect above, and whose property (if relevant): _____

A.3 Purpose for damming water: (Tick as appropriate)

☐ Irrigation

☐ Water harvesting / storage

☐ Stock water

☐ Domestic water supply

☐ Stormwater treatment

☐ Hydro-electric power generation

☐ Ornamental (specify): _____

☐ Other (specify): _____

A.4 Other Resource Consents required

A.4.1 (a) Do you hold a water permit or deemed permit / mining privilege to take the water that is dammed?

☐ Yes *(permit number):* 2002.348,349,351,352 *(go to Question A.4.2)*

☐ No *(go to question A.4.1(b))*

☐ Not applicable *(specify why):* _____

(b) Do you comply with the Permitted Activity Rules 12.1.2 or 12.2.2 of the Regional Plan: Water?

❑ Yes *(no resource consent to take water is required)*

❑ No *(a water permit may be required, see Schedule 4 or 5)*

A.4.2 **(a) Do you intend on discharging water from the dam into water (i.e. not to a pipe or race, but into a natural watercourse).**

❑ Yes *(please specify how):* see attached AEE *(go to Question A.4.2(b))*

❑ No *(go to Question A.4.3)*

❑ Not applicable *(specify why):* _____

(b) Do you hold a Discharge Permit to discharge water to water from the dam?

❑ Yes *(permit number):* _____ *(go to Question A.4.3)*

❑ No *(go to Question A.4.3)*

A.4.3 **(a) Do you propose to construct a new dam in a watercourse?**

❑ Yes *(go to Question A.4.3(b))*

❑ No *(go to Part B)*

(b) For the associated bed disturbance, if consent to dam water is needed you will be unable to comply with the Permitted Activity Rules given in Section 13.5.1 of the Regional Plan: Water. As such a land use consent is required, please fill out Schedule 10C. For the associated discharge of contaminants (sediments, concrete, etc) during bed disturbance, a discharge permit is required, please fill out Schedule 7).

❑ *Please tick if Schedule 10C attached*

❑ *Please tick if Schedule 7 attached*

(c) For the erection/placement/alteration of the proposed dam structure within the bed of a lake or river, if consent to dam water is needed you will be unable to comply with the Permitted Activity Rules given in Section 13.2.1 and 13.3.1 of the Regional Plan: Water, and a land use consent is required, please fill out Schedule 10C).

❑ *Please tick if Schedule 10C attached*

(d) If you propose to divert the flow of the watercourse to construct a dam, are you able to comply with the Permitted Activity Rules given in Section 12.3.2 of the Regional Plan: Water?

❑ Yes (no resource consent to divert water is required)

❑ No (a *water permit for the diversion is required, see Schedule 3)*

PART B: Location of the Proposed Activity

B.1 Describe the property on which the proposed dam structure is to be located *(if the dam is located on Crown Riverbed, please note on (e) below)*

(a) Full name(s) of owner(s) see AEE

(b) Full name(s) of occupier(s)_____

(c) Address/Location _____

_____

(d) Legal Description(s) *(as shown on Certificate of Title)*

Lot _____ DP _____ Sec _____

Survey District (SD) _____

Area (Nearby town etc.)_____

Other (specify)_____

Council will obtain a Certificate of Title to confirm details, if necessary.

(e) Is the dam located on Crown Riverbed: Yes: ❑ No ❑

If Yes, give the legal description of the property adjacent to the point of take

_____

B.2 If land is to be inundated as a result of the proposed dam structure, please describe the property(s) to be inundated

(a) Full name(s) of owner(s)_____

(b) Full name(s) of occupier(s)_____

(c) Address/Location _____

_____

(d) Legal Description(s) *(as shown on Certificate of Title)*

Lot _____ DP _____ Sec _____

Survey District (SD) _____

Area (Nearby town etc.)_____

Other (specify)_____

B.3 Map reference of the proposed dam structure in NZTM 2000:

NZTM 2000: E 1308761 N 5028101

B.4 If your proposed dam to be located within a watercourse, please provide the name of the watercourse:

the weir is technically outside the bed of the watercourse (Albert Burn)

(If the water body is unnamed then note this and give the name of the water body to which it flows into)

B.5 Please provide a plan (A4 or A3 size) with this application that shows the following:

(a) The location of the proposed dam.

(b) Natural ground contours.

(c) The pattern of land inundation that will occur when the proposed dam is full.

(d) The legal boundaries of all property(s) that will be affected by the proposal, including the names of the owners and/or occupiers of those properties.

(e) The location of any spillway or overflow.
(f) The flow-path of any watercourse(s) *(please indicate the direction of flow with an arrow).*
(g) Any other relevant features that will allow identification of the location of the dam, such as roads, bridges, dwellings, historic or waahi tapu sites, or other landmarks.
(h) Overflow / flood paths *(include buildings and infrastructure that may be within the flood path)*.
(i) Any upstream or downstream water users *(include name(s) and distance(s) if known).*
(j) A north symbol; and
(k) A scale

PART C: Description of the Water Resource/Catchment

C.1 If the proposed dam is located in a watercourse:

(a) Is the watercourse:

Perennial (flows all year round) : ❑

Ephemeral (flows intermittently or when there is rain) : ❑

(b) Mean flow of watercourse *(if known)*:_____(l/s or m^3/s)

(c) Mean annual low flow of watercourse (MALF) *(if known)*: _____(l/s or m^3/s)

(d) Describe frequency and duration of flows if ephemeral *(if known)*_____

_____

_____

(e) Flow for 50 year return period flood *(if known)*_____(l/s or m^3/s)

(f) Flow for 100 year return period flood *(if known)*_____(l/s or m^3/s)

(g) Flow for 100 year plus/super design event *(if known)*_____(l/s or m^3/s)

(h) Please describe the gradient of the watercourse or land on which the dam is to be located:_____

_____

_____

(i) Please describe composition of the bed of the watercourse on which the dam is to be located:_____

_____

(j) Please describe any aquatic life present in the watercourse (i.e. fish, invertebrates, aquatic vegetation and riparian vegetation):

_____

_____

_____

_____

(k) Aquatic waterfowl associated with the watercourse?

_____

_____

_____

C.2 If the proposed dam is located outside of a watercourse:

(a) Does the dam receive any natural runoff from the surrounding catchment?

❑ Yes (please describe): _____

☐ No

(b) What is the surrounding land used for immediately downstream of the proposed dam? *(please ensure that land use downstream is described to a distance appropriate to the scale of possible downstream effects in the event of dam failure)*

pasture (sheep and low density beef)

C.3 Have you identified any fault zones, flood zones, landslip areas or other flood hazards that may impact on the dam structure?

☐ Yes (please describe):

Pisa Fault is perhaps 1 km to the southeast of the weir

☐ No

PART D: Dam Design Details

D.1 Design and Construction Methodology

(a) Have you employed a professional advisor to design the dam?

☐ Yes (give details):

☐ No

(b) Have the New Zealand Society on Large Dams (NZSOLD) Guidelines (2000) been considered for this dam?

☐ Yes

☐ No (describe why not): The water pooled behind the weir is estimated at around 50 m3, with an average depth of 0.75 m

(c) What is the estimated start date of dam construction:

(d) What is the estimated completion date of dam construction:

(e) When will initial filling of the reservoir commence:

(f) When will initial filling of the reservoir finish:

(g) Give a description of site conditions and construction methodology, including (but not limited to)

- Foundation conditions, including any bore logs, results of shear strength testing etc.
- Excavation and key requirements
- Compaction requirements
- Proposed construction

Pre-existing

(please note that for all larger dams of greater than "low" risk (as defined by NZSOLD), a professional engineering report will be required):

_____

_____

(h) Please enclose labelled photographs of the site with this application, including

(i) Proposed dam site, or ❑

(ii) If an existing structure, the upstream batter, downstream batter, abutments, spillway, outflow pipe, dam crest, overflow path; and ❑

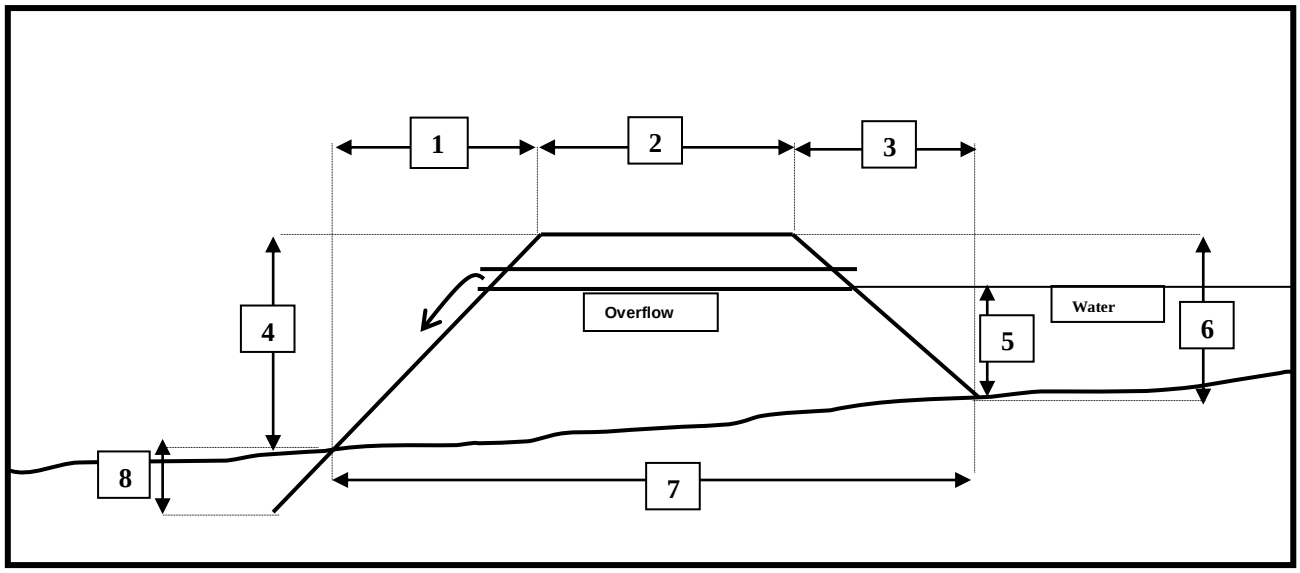
(iii) View upstream of the dam site ❑

(iv) View downstream of the dam site ❑

(v) Other (anything else of relevance) ❑

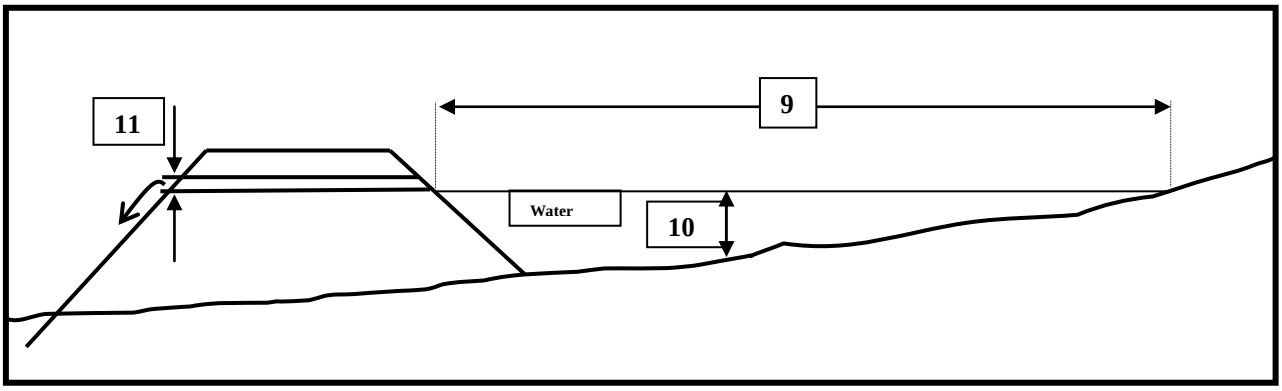
D.2 Dam Design and Dimensions

D.2.1 Please fill in the dimensions shown on the diagrams in the lists below (if the dam design is different from that shown below, please include a diagram showing all dimensions).



1. Downstream batter width _____ m
2. Crest width _____ m
3. Upstream batter _____ m
4. Downstream batter height _____ m
5. Overflow pipe height or spillway crest _____ m
6. Upstream batter height _____ m
7. Dam base width _____ m
8. Depth dam is to be keyed into existing ground _____ m

pertinent details are provided in the attached AEE



9. Length of pond behind dam _____ m
10. Maximum depth of reservoir _____ m
11. Diameter of overflow pipe _____ m

Other dimensions not shown on diagrams

12. Crest length: _____ m
13. Spillway width: _____ m
14. Spillway depth: _____ m
15. Spillway inlet height: _____ m
16. Spillway gradient: _____
17. Spillway surface material: _____
18. Material used for erosion protection of dam faces:
    _____
19. Surface area of reservoir behind dam (when water level at overflow pipe or spillway level):
    Normal level _____ m
    Low level _____ m
    Flood level _____ m
20. Volume of water retained by dam (when water level at overflow pipe or spillway level):
    Normal level _____ m
    Low level _____ m
    Flood level _____ m

21. Describe in detail the junction between the shoulders and the dam: _____

_____

_____

_____

_____

D.2.2. What material/materials is the dam made out of (or to be made of)?

concrete

_____

_____

D.2.3. What are the design flow capacities of the spillway?

unknown - however there is no spillway per se, only a weir

D.2.4. Details of any proposed or current mitigation measures, including low flow outlets/bypasses and fish passes:

The natural channel of the Albert Burn is unaffected, so at higher flows water continues to flow down that channel.

D.2.5 For dams for the creation of stormwater treatment ponds, please provide details of the ways in which the dam will be operated to allow for appropriate stormwater detention or treatment.

D.2.6. Supply accurate design drawings of the dam, including:

- Profile / elevation showing embankment cross section, design of foundations / key, conduits and drainage, service outlet and flood spillway design, and erosion protection.
- Location and design of any proposed mitigation measures, including low flow outlets / bypasses and fish passes.

D.3 Dam Safety

D.3.1 What is the potential hazard category for the dam in accordance with the NZSOLD Guidelines 2000?

- ☐ High potential impact structure
- ☐ Medium potential impact structure
- ☐ Low potential impact structure
- ☐ Very low potential impact structure

D.3.2 What is the design life of the dam:

unknown

D.3.3 What maximum flood event is the dam designed to pass? _____

unknown, but note again that the dam is not located in a watercourse

(note that all dams should be able to pass a probable maximum flood (PMF) event)

Estimated flow rate of design flood event: _____m^3/s

Any other comments:_____

D.3.4 Will the public and/or stock be prevented from accessing the dam structure and its banks?

❑ Yes (please describe): yes, via fencing

❑ No (detail why):_____

D.3.5 Will a Dam Safety Review, in accordance with the NZSOLD Guidelines (2000) be undertaken for the dam at regular intervals?

❑ Yes (please describe, including frequency of review, or the circumstances when review will be initiated, and how the review will occur):_____

❑ No (detail why): N/A

D.3.6 Has an Emergency Action Plan been prepared for the dam, in accordance with the NZSOLD Guidelines (2000)?

❑ Yes (please attach a copy to the application

❑ No (detail why): N/A, as not a dam per se

D.4 Dam Operation and Management *(applicable to dams with a risk greater than "low", as defined by NZSOLD)*

Describe the operating regime of the dam on a separate page (or include an up-to-date copy of your operations and maintenance manual), including:

- Management of water levels.
- Management of discharges, including low flows/flow releases and flows over fish passes.
- If the dam will be used for water supply, demonstrate that the dam will provide sufficient storage to meet the projected demand, whilst providing for any proposed flow discharges.
- Maintenance and inspection of the dam embankment and spillways.
- Maintenance of reservoir including water quality control and removal of sediment and aquatic vegetation.

D.5 Dam Break Risk Assessment

D.5.1 Please provide a risk assessment report on downstream impacts in the event of dam failure. This report should be prepared by a suitably qualified person, such as an engineer. For dams with a risk greater than "low", inundation maps should be supplied. Please ensure that the location of any dams or infrastructure is shown. N/A as not technically a dam

D.5.2 Do you propose to hold public liability insurance for the dam in event of dam failure?

☐ Yes (please describe, including to what value the insurance is held for): _____

_____

_____

_____

_____

☐ No (please describe why not): _____

_____

_____

_____

_____

PART E: Assessment of Environmental Effects of the Proposed Dam

An assessment of effects should be proportional to the scale and significance of the proposed activity. Where your proposed take could have a significant effect on water body flow or levels a detailed environmental assessment is required.

E.1 Effects of the proposed damming of water on the surface water resource:

(a) Please list any known water users that your proposed dam may affect: see AEE

_____

(b) Will the damming of water have an effect on water availability to neighbouring properties?

☐ Yes ☐ No ☐ Unknown

If yes, please explain the effect

_____

_____

(c) Are there any of the following present within 500 metres of the proposed dam:

(i) Obvious signs or known aquatic biota?	☐ Yes	☐ No	☐ Unknown
(ii) Areas where food is gathered from the water body?	☐ Yes	☐ No	☐ Unknown
(iii) Natural Wetlands?	☐ Yes	☐ No	☐ Unknown
(iv) Waste discharges (e.g., dairy sheds, industrial, sewage)?	☐ Yes	☐ No	☐ Unknown
(v) Recreational activities (e.g., swimming, fishing, canoeing?)	☐ Yes	☐ No	☐ Unknown
(vi) Areas of special aesthetic value (e.g. waterfalls)?	☐ Yes	☐ No	☐ Unknown
(vii) Areas or aspects of significance to Iwi?	☐ Yes	☐ No	☐ Unknown
(viii) Other water takes?	☐ Yes	☐ No	☐ Unknown

If you have answered "Yes" to any of the above, describe what adverse effects your dam may have and the steps you propose to take to minimise (i.e. mitigate) these effects:

previous fish surveys have identified brown trout in vicinity of weir in the Albert Burn

_____

_____

_____

E.2 Will the proposed damming of water affect any other individuals or organisations that may have an interest in that water?

(a)	Other water users	❑	Yes	❑	No	❑	Not Applicable
(b)	Recreational water users	❑	Yes	❑	No	❑	Not Applicable
(c)	Fish and Game Council	❑	Yes	❑	No	❑	Not Applicable
(d)	Iwi	❑	Yes	❑	No	❑	Not Applicable
(e)	Neighbouring landowners	❑	Yes	❑	No	❑	Not Applicable
(f)	Department of Conservation	❑	Yes	❑	No	❑	Not Applicable
(g)	Other *(e.g. Forest & Bird, LINZ)*	❑	Yes	❑	No	❑	Not Applicable

whether the others will be affected is TBD by Council - see AEE

If you have answered "yes" to any of the above, please explain how they may be affected by your proposed dam:

_____

_____

_____

_____

_____

If you have answered "no" to any of the above, please explain why they will not be affected by your proposed dam:

see AEE

_____

_____

_____

_____

*If you have answered "yes" to any of the above, you may need that individual or organisation's written approval for your application to proceed under non-notified consent procedures. This is discussed further in Part G.

E.3 What are the positive effects of your proposed dam?

see AEE

_____

_____

_____

E.4 What monitoring, if any, do you propose to carry out to measure any effects of your proposed dam on the environment?

see AEE

_____

_____

_____

_____

E.5 Please tick if you are adopting any of the following measures to ensure that any adverse effects will be avoided, remedied or mitigated:

- ☐ Release of flushing flows
- ☐ Flood attenuation
- ☐ Provision of passage for migratory fish i.e. fish pass, diversion, climbing surface.
- ☐ Wetland creation
- ☐ Fencing of reservoir and riparian planting around the edges of the reservoir
- ☐ Other (Please specify)_____

Explanation:

As explained earlier, during higher flows (winter, spring), fish passage is unimpeded as the Albert Burn can flow down its natural channel. The applicant has plans for riparian planting around and above the reservoir.

PART F: Alternative Locations and Methods

F.1 Does your property have alternative locations for the dam *(*such as off stream locations, or stream of lower environmental value).

- ☐ No
- ☐ Yes *(please detail why your chosen location is considered the best option for you)*

PART G: Consultation

G.1 Please comment on any consultation undertaken with those persons/parties who may be interested in or potentially affected by your proposal to dam water (e.g., other water users, Department of Conservation, Fish and Game Council, Iwi, Transit New Zealand etc).

see AEE

F.2 Please provide any written approvals to the activity using Council's standard Form 1 - Resource Consent Application

PART H: Is Your Application Complete?

H.1 In order to provide a complete application have you remembered to:

(a) Fully complete this schedule and Form 1 (Resource Consent Application) ☐

(b) Include a location / site plan? ☐

(c) Include photographs of the proposed/existing dam structure? ☐

(d) Enclose a Certificate of Title? ☐

(e) Attach any appropriate additional information? ❑

Including:

(i) An emergency action plan? ❑

(ii) The dam maintenance and operations manual? ❑

(f) Complete and attach any additional schedules for associated resource consents?

Schedule 3 (to divert water) ❑

Schedule 4 or 5 (to take surface water or groundwater) ❑

Schedule 7 (to discharge contaminants or water to water) ❑

Schedule 10C (to disturb the bed of a watercourse and erect a structure) ❑

Notes to provide guidance on completing Schedule 2

Part A: Description of the Proposed Damming and Associated Activities

Question A.1
If you are unsure whether there is an existing or expired resource consent check with Otago Regional Council. If you know your expiring consent number, or if you are applying to transfer your currently consented dam to another location, please supply the consent number.

Question A.2
The purpose of this question is to determine why the application for consent is required. Section 12.3 of the Regional Plan: Water for Otago outlines the rules relating to the damming of water. Please tick the relevant boxes and refer to the full Permitted Activity Rule 12.3.2.1 in the Regional Plan: Water for a full description of the Rule. Maps identifying wetland areas are identified on Map series F of the Regional Plan: Water for Otago. Please contact Council if you require any assistance.

Question A.3
Tick the boxes that indicate the purpose of your proposed dam.

Question A.4
Additional consents may be required from Council in relation to the damming of surface water depending on the nature of the proposal. These include permits for works in the bed of a river, the discharge of water to water and for the taking of surface water. Staff at the Otago Regional Council will be able to advise you whether your proposal meets the conditions of the Permitted Activity Rules or whether any additional consents are required.

Part B: Location of the Proposed Activity

Questions B.1 and B.2
Please provide the name and address of the owner and occupier (if different to landowner) of the land where the water will be dammed, and the land that will be inundated, or, if owned by the Crown (i.e. Crown riverbed), the land adjacent to the dam. A copy of your certificate of title may be obtained from Land Information New Zealand (www.linz.govt.nz). LINZ may also require a licence for you to occupy the bed of the water body with your intake structure (please contact LINZ directly).

*If the dam is on the bed of a large river (particularly “navigable rivers”) the bed will likely be owned by the Crown. The beds of smaller watercourses are sometimes owned by the adjacent landowner(s).

Question B.3
NZTM 2000 maps are generally available from Public Libraries or may be purchased from Government Book Shops.

Question B.4
If you are unsure of the name of the water body, and your application is a replacement of an existing consent, the easiest way to find out the name of the water body from which you are seeking to dam is by checking your existing resource consent. If you are unsure of the name of the water body and the application is for a new dam, please contact an Otago Regional Council staff member who will be able to assist you. In many instances tributaries to larger water bodies do not have official (or legally recognised) names. If this is the case describe the water body as "an unnamed tributary of …….". If the water body has an unofficial local name you could continue to write "… locally known as……." . You can determine if a name is legally recognised by seeing if it is written on published topographic maps (see question B.3), or if any road bridges crossing it state the name of the water body (i.e. Transit or Automobile Association signs).

Question B.5
A general site plan showing as much detail of the location of your proposed dam and surrounding land as possible should be provided. This will assist Council's assessment of your application and may reduce processing time and costs.

Part C: Description of the Water Resource/Catchment

This section covers the characteristics of the water resource that you are proposing to dam. Tick the appropriate boxes and answer the appropriate questions in both either **B.1 or B.2,** as applicable.

Question C.1
Describe the watercourse which is to be dammed. For question (a) - a watercourse can be perennial (flows all year around) or ephemeral (flows intermittently or when there is rain). For questions (b) – (g): It is recommended that you engage a hydrologist to calculate the hydrological regime of the watercourse if you are unable to obtain this information yourself. Flows in your river may be measured at certain locations by Council or other organisations (e.g. NIWA). For question (j), the bed composition may be mud, silt, sand, gravel or rock, or a combination of these.

Questions (j) and (k) - The Otago Fish and Game Council and the Department of Conservation should be able to assist you in identifying the aquatic flora and fauna, and the aquatic waterfowl associated with the watercourse.

Question C.2
Describe the area outside of a watercourse which is to be dammed. Please estimate how much natural runoff the dam is likely to intercept. To what watercourse would the runoff have discharged to if the dam was not present? What is the predominant land use of the catchment of the dam?

Question C.3
Describe any faults or landslips that may be present at the dam site or in the greater area around the dam. Is the dam site within a flood zone? Are there any other hazards present that may impact on the dam structure?

Part D: Dam Design Details

Question D.1
(a) and (b) You should engage a chartered professional engineer to undertake an assessment of dam safety, if the risk posed by the dam is greater than "low". An assessment of dam safety should be undertaken with reference to the NZSOLD Dam Safety Guidelines (Technical Publication 109, June 2000). For (c) – (f), what are the estimated dates of start and finish of construction, and dam filling, should consent be granted. For (g), describe the geotechnical conditions of the land where the dam is to be built, and the construction requirements. For (h), the photographs requested will allow Otago Regional Council staff to make an assessment of the dam / proposed dam, and will allow determination of whether a site visit is necessary.

Question D.2
Please give the dimensions of your dam, and the details of the flows it is designed to contain and pass, and any design details to allow for fish passage. Details of the dam design, including plans, calculations and the results of on-site tests should be provided in a separate report accompanying this application form. For D.2.5 you should engage a chartered professional engineer experienced in the design and construction of dams to provide a plan of your proposed dam. The level of detail you provide should be appropriate for the scale of your proposal (that is, the larger the scale, the more detailed the plans should be). In addition, for stormwater ponds you should provide details of the ways in which the dam will be operated for stormwater detention or treatment.

Question D.3

You should provide a description of the ways in which the dam will be maintained to provide for its safe operation. You should include detail of any methods as recommended by the NZSOLD Guidelines (2000), including if a dam safety review will be undertaken, and whether an emergency action plan will be prepared.

Question D.4
If your dam has a risk greater than "low", you should provide a description of the ways in which the dam will be operated and maintained to provide for its safe operation.

Question D.5
Please provide a report detailing all the potential impacts and adverse effects that could occur downstream of the dam in the event of its failure. This will help Council assess the potential risks of the proposed structure. In addition, provide comment as to whether public liability insurance will be held, or is held, to cover any damage likely in the event of dam failure.

Part E: Assessment of Effects on the Environment

In this section you need to consider what the effects of your proposed take will have on the environment. You **must** provide an answer to all questions from **E.1 – E.6**.

Question E.1
(a) & (b) You need to consider whether your proposed dam will have any effect on the availability of water for other users. This will depend on the volume of water you propose to dam relative to the size of the water body and the distance downstream to the next inflow of water (i.e. where the next stream or tributary joins the water body you propose to dam).

(c) The items listed in this question are those that are commonly affected by dams. You need to consider if any of these are present in the vicinity of your proposed dam and if they are, then you will need to discuss how your proposed dam will affect them. Dams can lower the water levels of the water body (e.g. the dam may reduce the depth of water downstream of the point of the dam). This will depend on the type of water body which you are damming and the amount of water you are proposing to dam.

Question E.2
What other individuals or organisations who use this water body, or for whom the water body supports natural or cultural values, may be affected by your proposed dam? How might your dam affect them? For example, in a creek used for trout and salmon spawning, your take may affect their habitat by lowering the water level, thus Fish and Game may be an affected party. If the water body has significance to Iwi the effect of the dam may be more difficult for you to ascertain, as the values of the water body to them may be less tangible (if in doubt, it may be beneficial to consult Iwi).

Question E.3
There are a number of possible "positive" effects that dams can result in. These can include economic benefits to the community, secure water supplies for irrigation, and many others.

Question E.4
The amount of monitoring likely to be required will depend on a number of factors such as the quantity of water you are proposing to dam, the size of the water resource, and the pressure on the resource. A consent holder will commonly be required to measure the quantity of water they take on a daily basis and submit "water use records". In other cases, downstream flow measurement recording, water quality and/or biological monitoring may be required. In addition, the NZSOLD Guidelines (2000) require ongoing monitoring for the safe operation of a dam.

Question E.5
Please tick any relevant boxes and explain how any proposed methods will avoid, remedy or mitigate any actual or potential effects on the environment.

Part F: Alternative Locations and Methods

Question F.1
Please identify any alternative methods or locations of damming, as well as any other alternative water sources available to you. Please provide reason(s) why have you not chosen any of these alternative methods, locations or water sources.

Part G: Consultation

Questions G.1 and G.2
Council can advise you of those parties considered to be potentially adversely affected by your proposed activity and can also instruct you regarding Iwi consultation. In some instances it may be appropriate for you to submit your application and let Council determine who they think may be adversely affected by your proposal. Because Council charges time on an hourly basis, you may choose to consult these parties and seek their written approval to your application yourself, or you may choose for Council to pursue this for you. However, if an application is submitted without written approvals of potentially affected parties, the application goes "on hold" until these written approvals have been received. Failure to obtain written approvals within a reasonable timeframe can result in your application being notified.

Part H: Is Your Application Complete?

Question H.1
A complete application will assist Otago Regional Council in efficiently processing your application. If information is missing or inadequate your application may be returned to you or declined. Please ensure that you have fully completed the application form and included the items listed from (a) – (f). You will also need to complete Form 1, and any other relevant schedules for activities associated with the damming. Applications that are incomplete or do not provide sufficient information will be delayed and will cost more.

If you have any queries relating to information requirements, please contact the Otago Regional Council Offices:

Dunedin Office
70 Stafford St
Private Bag 1954
Dunedin
Phone 03 474 0827
Fax 03 479 0015

Alexandra Office
Dunorling St
PO Box 44
Alexandra
Phone 03 448 8063
Fax 03 448 6112

Queenstown Office
Cnr Shotover & Camp St
PO Box 958
Queenstown
Phone 03 442 5681
Fax 03 442 5682

Freephone: 0800 474 082

Website: www.orc.govt.nz

Resource Consent Application Form 4

To take and use surface water

This application is made under Section 88 of the Resource Management Act 1991.

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1. Note to applicants

The purpose of this form is to provide applicants with guidance on information that is required for your application under the Resource Management Act 1991. This form acts as a guide only and Otago Regional Council reserves the right to request additional information.

Please ensure that you fully complete this form **as well as** a fully completed resource consent application form (form 1) in support of your application, **and** preparation of an **Assessment of Environmental Effects** in terms of the Fourth Schedule of the Resource Management Act 1991. Failure to do so may result in Council rejecting your application, requesting further information, or publicly notifying your application, leading to delays in the processing of your application and potential increases in processing costs.

Acceptance of your application for processing does not constitute a guarantee that water allocation is available.

2. General

2.1 This application is for (please tick any applicable box):

☐ A new surface water take

☑ An application to replace a current Water Permit
Water permit number: 2003.591.V2 *Expiry date:* 1 October 2021

☑ An application to replace a Deemed Permit / Mining Privilege
Deemed permit number: Various - see AEE *Expiry date:* 1 October 2021

2.2 A lapse period of 5 years is sought. Provide reasons in application attached.

Note: This is the timeframe within which the consent must be given effect to. The default timeframe is 5 years after the date of commencement of the consent unless stated otherwise.

2.3 A consent term of 25 years is sought. Provide reasons in application attached.

Note: This is the timeframe from the date of commencement of the consent which the consent will expire.

2.4 Provide a map or coloured aerial photograph which outlines the following details (as applicable):

- [x] The location of the existing and proposed point(s) of take and all associated infrastructure
- [x] The location of the water measuring device(s) or system(s)
- [x] The total property area boundary
- [x] The area(s) to be irrigated (if relevant) by water applied for under this application
- [ ] The area of the community supply (if relevant)
- [ ] Distances to any discharge activities
- [x] Other surface water bodies and wetlands, and distances from the point of take(s) to them
- [ ] The coastline and the distance to it (if relevant)
- [ ] The location of any dairy shed(s)
- [ ] The location of any known recreational activities, other water takes, areas of significance to iwi and areas where food is obtained from the water body.

3. Volume and rates of take applied for

3.1 Quantity and rate of take

Note: 1,000 litres = 1 cubic metre

a. Maximum rate of take: Various - see AEE litres per second

b. Maximum monthly volume: 696,015 cubic metres per month

c. Maximum annual volume: 3,648,348 cubic metres per year

*Note: Some deemed permits refer to hourly/weekly rates. Water permits are issued in litres per second, m^3 per month and m^3 per year. Should you wish to seek hourly or weekly rates **in addition** to those listed on the form, please provide this information including justification for any variances.*

3.2 Frequency of take

Note both the maximum and estimated average take.

	Average	Maximum
How many hours per day?	24	24
How many days per week?	7	7
How many weeks per month?	4	4

3.2.1 In your application describe the timing of your take, including which months of the year you expect to take water in both an average year and a dry year, and what part of day the water take will generally occur.

3.2.2 In your application describe whether the take is from re-charge or is an augmented take, along with whether your activity provides re-charge back into the catchment.

3.3 Storage

3.3.1 Do you intend to store your water before subsequent use?

☑ Yes

☐ No

3.3.2 If yes, what/how much storage will be provided?

Various - see AEE m^3

3.3.3 In your application outline the type of storage facilities that are proposed.

Note: You may need a building consent and/or additional resource consents for the construction of storage facilities. If the reservoir is in a water body or captures catchment runoff, you may require resource consents for damming and associated activities.

4. Point(s) of take description

4.1 What are the GPS coordinates of the point(s) you propose to take water from?

Note: if there are more than two points of take, please provide these details on a separate sheet.

Point 1: NZTM 2000 E: Various - see AEE N:

Point 2: NZTM 2000 E: N:

4.2 Please provide photographs of the proposed point(s) of take ⊡

4.3 What is the name of the water body/ies from which the proposed take(s) is/are to occur? Albert Burn, Schoolhouse Creek, Clutha River

Note: if the water body is unnamed please note this and note the water body it flows into.

4.4 If the take is from a river, stream, spring, drain or modified water body, in your application please provide a full description of the water course, including:

- ☐ The average channel width and depth at various locations including at the point of take and upstream and downstream of the point of take.
- ☐ Average flow water velocity including source of flow data and any changes to flow velocity above and below the point of take.
- ☑ Any flow gauging of the water body. A flow gauging report with photographs of the site and methodology to be attached.
- ☑ Bed of the water body at the point of take and upstream and downstream of the point of take.

Please also answer the following:

4.4.1 What type of water body will the take/s occur from?

- ☑ River
- ☑ Stream
- ☐ Modified water body
- ☐ Spring
- ☐ Drain

4.4.2 Is the water course perennial (flows all year round) or ephemeral?

- ☑ Perennial
- ☑ Ephemeral

4.5 If the take is from a lake, pond or wetland please answer the following:

- ☐ Lake
- ☐ Pond
- ☐ Wetland

4.5.1 If the take is from a wetland, is the wetland classed as a Regionally Significant Wetland identified in Schedule 9 of the Regional Plan: Water for Otago?

- ☐ Yes (list the name and provide an assessment of effects on the wetland)
- ☐ No

4.5.2 Has the wetland been formed by artificial means?

- ☐ Artificial
- ☐ Natural

4.5.3 What is the surface area of the lake/pond/wetland?

4.5.4 How deep is the lake/pond/wetland?

4.5.5 Does the lake/pond/wetland have an outlet? i.e. does water flow out of it?

- ☐ Yes
- ☐ No

4.5.6 What is the main source of water that fills the lake/pond/wetland?

- ☐ Groundwater
- ☐ Springs
- ☐ Runoff from surrounding land
- ☐ Direct rainfall
- ☐ Stream/river (list name)
- ☐ Other (provide details)

5. Historical water use

5.1 Water abstracted over at least the last 5 years

Note: if you are applying to replace an existing water permit for primary allocation, or an existing deemed permit or mining privilege you must provide evidence of the amount of water abstracted under that permit for at least the last five years.

The following usage evidence is provided in support of this application:

- ☑ Water metering records, attached to this application with historical water use summarised and assessed
- ☐ Water metering records sent to Council electronically or recorded on file by Council with historical water use summarised and assessed
- ☐ Detail on alternative water use information, attached to this application

5.2 In your application please analyse and assess the historical volumes and pattern of water use based on the water use evidence.

5.3 Provide a summary of your analysis below:

a. Maximum rate of take: Various - see AEE litres per second

b. Maximum monthly volume: cubic metres per month

c. Maximum annual volume: cubic metres per year

5.4 For which years have these rates and volumes been recorded?

6. Water use and management

6.1 For what purpose(s) will the water be used?

- [x] Stock water and/or dairy shed use
- [x] Irrigation (provide detail of irrigation use in your application attached)
- [ ] Community supply
- [ ] Commercial/industrial
- [x] Other frost fighting

6.2 Will the water take be managed as part of an existing water allocation committee or water management group?

- [ ] Yes (name of committee of group):
- [x] No

6.3 If yes, have you described how the allocation committee/management group operates in your application?

- [ ] Yes
- [ ] No

6.4 In your application describe any water rationing regime that operates in the catchment.

6.5 Will the take applied for be operated in accordance with the rationing regime you have described in question 6.4?

- [ ] Yes
- [ ] No

6.6 Will you or others "re-take" water from your take (i.e. via a water race)? If yes, please provide details of such re-takes in your application.

- [ ] Yes
- [x] No

7. Measuring and reporting

7.1 In your application describe the type of water metering system that is installed or proposed to be installed.

Note: If currently installed provide proof of installation or note below if proof has already been provided to Council.

7.2 Provide information in your application demonstrating that the installation of the measuring device or system shall be undertaken in accordance with Council guidelines.

Note: If the installation is not able to meet these guidelines, you need to fill out and attach to this application form a Non-Standard Installation Form for Water Measuring Devices, available on our website or through the environmental services unit of the Council.

☑ Tick if completed

☐ Tick if completing a Non-Standard Installation Form for Water Measuring Devices

7.3 Is your water measuring device or system installed or proposed to be installed at the point(s) of take?

Note: The council considers the point of take to be within a 100 metre radius of the physical take point. If your answer is No, you need to apply for a Water Measuring Exemption (WEX) by filling out Application Form 24 – Application for Exemption to use a device or system near the location from which water is taken. A fully completed Form 24 should be lodged at the same time as this application to enable dual processing.

☑ Yes

☑ No – complete an Application Form 24 – Application for Exemption

8. Location and Efficiency of Water Use

8.1 Provide details of point/area of use (include legal description(s) and grid references.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

8.2 Provide a description of any existing works/infrastructure in place, including value, in your application.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

8.3 Provide a description of proposed works/infrastructure to give effect to consent sought, including value of investment, in your application.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

8.4 Provide an assessment of the proposed use against the Aqualinc report for reasonable water requirements[1].

☑ Completed

☐ Not Completed (provide details of alternative assessment and justification for that)

8.5 If you propose to use water to irrigate land, please outline:

a. How many hectares of land will be irrigated? See AEE for details

b. What is the soil type(s) of the land being irrigated?

c. What will you be irrigating (i.e. crop, pasture etc in ha)?

d. What is the target application rate (mm/day and mm/year)?

8.6 What type of irrigation system is proposed to be used or is currently being used?

☑ K-line

☑ Centre pivot

☐ Travelling irrigator

☐ Border-dyke/flood irrigation

☐ Other – provide details

8.7 Do you have any water distribution infrastructure in place (for example pipes, storage tanks, open races etc.)?

☑ Yes

☐ No

If yes, in your application please describe the type of infrastructure in place and how you intend to ensure that it is maintained in good working order (e.g. do you intend to have a

[1] *"Guidelines for reasonable irrigation water requirements in the Otago Region", Aqualinc, 2017. Note that while this document provides a basis for assessing efficiency of use, other matters may be applicable.*

maintenance or leak detection programme, will the scheme be managed by an external company).

Note: For deemed permits please ensure you have the right to convey water under s417 of the Resource Management Act if that conveyance crosses another party's property, prior to the expiry of the deemed permit.

8.8 Do you intend to install any water distribution infrastructure (for example pipes, storage tanks, open races etc.)?

☑ Yes

☐ No

If yes, in your application please describe the type of infrastructure to be installed and how you intend to ensure that it is maintained in good working order (e.g. do you intend to have a maintenance or leak detection programme, will the scheme be managed by an external company).

Note: For deemed permits please ensure you have the right to convey water under s417 of the Resource Management Act if that conveyance crosses another party's property, prior to the expiry of the deemed permit.

8.9 If you propose to use water for stock and/or dairy shed use – please answer the following:

Note: The Council considers the following values as efficient use of water for stock:

Sheep	*5 litres per day per head*
Beef cattle	*45 litres per day per head*
Dairy cows	*70 litres per day per head*
Deer	*15 litres per day per head*
Dairy shed use	*50 litres per day per head*

8.9.1 What type of animal and numbers of stock will be supplied with water for drinking?

Sheep

Number: See AEE Water required: litres/head/day

Beef cattle

Number: Water required: litres/head/day

Dairy cows

Number: Water required: litres/head/day

Other

Number: Water required: litres/head/day

8.9.2 How much water do you require for your dairy shed?

litres/head/day

8.9.3 If you are seeking more water for stock and/or dairy shed use than that recommended by the Council please state why this is in your application.

Note: please provide the source of any data provided. Also include details of stock water transportation if relevant.

8.10 If you propose to use water for industrial use – in your application state what type of industry will be using the water and how will the water be used.

8.11 If you propose to use water for community/domestic supply – please answer the following:

a. For households, the number of households to be supplied:

b. For camping grounds, the maximum number of visitors and staff per year:

c. For schools, the maximum number of students and staff per year:

d. For motel units, the number and expected occupancy:

e. Other uses (please describe):

8.12 For all uses, demonstrate in your application how have you calculated the amount of water you need?

Note: Please note that the Council will only grant volumes that have been assessed as efficient, and will assess the volumes sought for efficiency, taking into consideration the local climate, soils, and crop type.

☑ Tick if completed.

8.13 In your application please describe any other sources of water available for the property. How much water is available and what it is used for.

8.14 In your application please describe any measures you are proposing to minimise wastage of water and maximise its efficient use.

9. Assessment of Environmental Effects

Note: Pursuant to Schedule 4 of the Resource Management Act, 1991, there are a number of matters that must be addressed by an assessment of environmental effects. These matters are listed in Form 1, with additional or specific matters relating to water permits are listed below.

9.4 Provide an independent ecological assessment/instream assessment of the water body. It is recommended that all takes not from the main stem of a catchment have this assessment carried out.

☐ Yes (attached to application)

☑ No (please outline reasons why an independent ecological assessment has not been undertaken in your application)

9.5 Outline any physical effect on the locality, including any landscape and visual effect.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

9.6 Outline any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity of the point of take.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

9.7 Does the taking of water from the water body cause it to dry up during summer or does the water body naturally dry up downstream of the take?

☑ Yes

☐ No

If Yes, your application should explain approximately how far downstream from your this occurs and in approximately which month in a wet year, average year and dry year this happens.

Note: Please discuss and attach any evidence to the application (e.g. photographs of water body downstream):

9.8 Assess effects on cultural values.

☑ Yes (attached to application)

☐ No (please outline reasons why this has not been provided)

9.8 Assess any effect on other water users or other human use values.

- [x] Yes (attached to application)
- [ ] No (please outline reasons why this has not been provided)

9.9 Describe any positive effects from the take.

- [x] Yes (attached to application)
- [ ] No (please outline reasons why this has not been provided)

9.10 Outline the mitigation you propose in your application. This should include a consideration of the following:

- [x] A residual flow
- [x] Fish screening on water intakes
- [x] Measures for management where there are low flows
- [ ] Flow sharing measures
- [x] Whether base flow is necessary to maintain the water race
- [x] Any other applicable measures

9.10 Outline if your instantaneous abstraction rate (litres per second) will be reduced by increasing the length of time over which water is taken.

- [ ] Yes (attached to application)
- [x] No

9.11 Provide a description of any possible alternative water sources or methods for undertaking the activity and why these alternatives have not been selected.

- [x] Yes (attached to application)
- [ ] No (please outline reasons why this has not been provided)

10. Consultation

10.1 Include evidence of any consultation undertaken for this application.

DoC has been consulted and have subsequently provided feedback (see AEE)

10.2 Identify persons affected by this application.

10.3 Which persons approval have been provided to the application (attach copies of approvals)?

*Note: This **may** include (but not be limited to) consultation with adjoining landowners, other consent holders in the immediate area such as downstream permit holders, iwi (e.g. Te Rūnanga O Ngāi Tahu, Aukaha, Te Ao Marama Inc.), government departments/ministries (e.g. DOC), territorial authorities and recreational associations. To reduce costs and processing times, we recommended that written approval is obtained and submitted with the application for parties which may be affected. Such approval must be unconditional to avoid notification.*

11. Statutory Assessment

Please note that in accordance with Schedule 4 of the RMA, you are also be required to provide an assessment against the relevant provisions of the following documents (if relevant):

- [✔] National Policy Statement for Freshwater Management.
- [ ] National Policy Statement for Renewable Electricity Generation.
- [✔] Resource Management (Measurement and Reporting of Water Takes) Regulations 2010.
- [ ] National Environmental Standard for Sources of Human Drinking Water.
- [ ] New Zealand Coastal Policy Statement.
- [✔] Operative Regional Policy Statement 1998, Proposed Regional Policy Statement and Partially Operative Regional Policy Statement 2019.
- [✔] Regional Plan: Water for Otago (including description of permitted activities and compliance with permitted activity standards).
- [✔] Kai Tahu ki Otago Natural Resource Management Plan 2005.
- [✔] Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008 (for takes from the south side of the Clutha River/Mata-Au)
- [ ] Any other relevant plan, proposed plan and any other relevant regulations.

Resource Consent

Application Form 24

Application for exemption to use a water measuring device or system installed near (instead of at) the location from which water is taken

This application is made under the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010

Otago Regional Council

70 Stafford St
Private Bag 1954
Dunedin 9054

0800 474 082

www.orc.govt.nz

Important notes to the applicant

You must complete this Application Form 24 in full as this is a stand-alone document.
The Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 require that a water permit holder must use a water measuring device or system that is installed at the location from which water is taken. Exemption from this is possible under Regulation 10 where an alternative location is specified and approved in writing by the Otago Regional Council. The alternative location must be as near as practicable to the location from which water is taken.

A deposit of $200 towards the total application costs is required at lodgement. It is crucial that you provide as much relevant information as possible with your application and in an understandable way. This will help ORC staff process it efficiently, and at the minimum cost.

If all the necessary information is not supplied with the application, ORC may **return it** or request further information, particularly if this exemption is being applied for in conjunction with a Water Permit as the two applications will be processed jointly.

Part A: Applicant's details

A.1 Applicant(s) name(s) in full *(include middle names)*
This is the person(s), company name, names of trustees (if the applicant is a trust) or the name of the incorporated society who currently hold the consent.

Queensbury Ridges Limited

Applicant's postal address

PO Box 22

Wanaka Post code: 9305

Applicant's street address (not a PO Box number)

Post code:

Applicant's contact numbers:

Home phone: Work phone:

Email: rsomerville@xtra.co.nz Mobile: 027 210 0685

Part A: Applicant's details (continued)

A.2 Name of contact person (If different from A.1)

Will Nicolson - Landpro Ltd

Applicant's postal address

PO Box 302

Cromwell Post code: 9342

Contact persons contact numbers:

Home phone: Work phone:

Email: will@landpro.co.nz Mobile: 027 459 8090

Part B: Existing water permit information

This part only applies to exemption applications for existing Deemed Permit/Water Permits. If you do not have an existing Deemed Permit/Water Permit, go to Part C.

If you have more than one permit you will need to add additional information on separate paper.

B.1 What is the Deemed Permit/Water Permit Number(s) that this application for exemption relates to?

2002.348.V1, 2002.349.V1, 2002.351.V1,

2002.352.V1

(two separate meters, as detailed in AEE)

B.2 What is the expiry date of the Deemed Permit/Water Permit that this application relates to?

1 October 2021

B.3 Provide the map reference(s) or location description for the current consented location of the point(s) of take that this application for exemption relates to (as specified on the consent)

see AEE

Part C: Water measuring device and point of take information

C.1 Is the water measuring device:

☐ Proposed to be installed

☐ Already installed

C.2 What type of water measuring device is proposed to be used? (i.e. mechanical, v-notch)

pipe, model/type TBD

What type of data transfer do you intend to have? ☐ **Datalogger** ☒ **Telemetry**

C.3 What is the name of the water course you are to measure?

Albert Burn

C.4 What is your maximum consented rate of take?

237.5 Litres per second

Part C: Water measuring device and point of take information (continued)

C.5 Provide the GPS location (map co-ordinates) in NZTM (New Zealand Transverse Mercator projection) 2000 for the proposed, or installed, location of the water measuring device

E currently unknown N

C.6 How many points of take contribute to the total volume and rate of water taken, to be measured by the device or system?

1

C.7 What are the GPS locations (map co-ordinates) in NZTM 2000 for each of the points of take?

Point 1	E	see AEE	N	1
Point 2	E		N	
Point 3	E		N	
Point 4	E		N	
Point 5	E		N	
Point 6	E		N	

If you have more than 6 points of take, please provide their information on a separate sheet of paper.

C.8 What is the distance between each point of take and the proposed site of the water measuring device?

Point of Take 1	350-400	Metres
Point of Take 2		Metres
Point of Take 3		Metres
Point of Take 4		Metres
Point of Take 5		Metres
Point of Take 6		Metres

If you have more than 6 points of take, please provide their information on a separate sheet of paper.

C.9 Please describe the location of the water measuring device from each point of take

For example: Approximately 50 metres downhill to the southwest before the diversion of water for the dairy shed.

There are two pipes that convey water from the take point - a 200 mm pipe and a 300 mm pipe. Both are metered in roughly the same location, approx. 350-400 metres downstream from the take point, just above the applicant's tank farm.

C.10 Are there any diversions of water, or other water takes between the point of take and the water measuring device?

- [x] No
- [ ] Yes, describe the diversions

C.11 Are there any other sources of water that add to this consented take between the point of take and the water measuring device?

- [x] No
- [ ] Yes, describe the other sources

C.12 Please describe condition of the water race or water conveyance system (i.e.: pipes, etc) and what maintenance regime, if any, is in place

Consultant

C.13 Why do you need to install or use your water measuring device at a location that is not at the point(s) of take? Note: Your answer here will be used in determining whether or not approval will be granted, so adequate justification is required.

The meters have been located at the closest practicable location where electricity can be provided. This is a lot more cost effective, has a lower risk of the meters being washed out in flooding, and is easier for maintenance. Because the water is piped, it should make no difference whether the meters are at the point of take or a short distance away.

C.14 Has anyone specifically advised you that installation at the point of take is not feasible for the above stated reason?

- [x] No
- [ ] Yes, please detail…

Who:

Company:

Part D: Location information

D.1 Please indicate on a map or aerial photograph, all of the following details:

- Each point of take, or proposed point of take;
- The location, or proposed location, of the water measuring device;
- The location of pipes and infrastructure between the two locations; and
- Roads and other landmarks.

D.2 Provide clear, identifiable photos for all of the following:

- Each point of take;
- The location, or proposed location, of the water measuring device; and
- The location of pipes and infrastructure between the two locations.

Part E: Installation information

The Otago Regional Council has standard installation specifications for water meters in piped takes.
The standard installation specification of a water meter (for piped takes) is:

The water meter shall be installed in a straight length of pipe, before any diversion of water occurs. The straight length of pipe shall be part of the pump outlet plumbing, easily accessible, have no fittings and obstructions in it.
The water meter shall be installed at least 10 times the diameter of the pipe from the pump and at least 5 times the diameter of the pipe.

E.1 Are you proposing to install your Water Meter in accordance with the Otago Regional Council standard installation specifications outlined in the paragraph above?
Yes ☒ No ☐ My water take is not piped ☐

If your answer is NO, you need to fill out and attach to this application form a ***Non-standard installation form*** for water measuring devices. This is available from www.orc.govt.nz or the council's Environmental Services unit.

Part F: Declaration

I/we hereby certify that to the best of my/our knowledge and belief, that the information given in this application is true and correct and I/we agree to pay all actual and reasonable processing costs incurred by the ORC.

Name(s) *(BLOCK CAPITALS)*

WILL NICOLSON (on behalf of Queensbury Ridges Ltd)

will@landpro.co.nz

Digitally signed by will@landpro.co.nz
DN: cn=will@landpro.co.nz
Reason: I am the author of this document
Location:
Date: 2019-10-08 16:23+13:00

Signature (or authorised person)

Designation *(e.g. consent holder, manager, consultant)*

Consultant

Date

8/10/2019

Part G: Checklist

To minimise consent processing costs check that you have completed all the sections below before you lodge your application with the Otago Regional Council.

Have you … *(please tick)*

- ☒ Answered all relevant questions on this form?
- ☒ Provided an annotated map or aerial photograph as per question D1?
- ☒ Provided clear, identifiable photos as per question D2?
- ☒ Signed and dated the declaration?
- ☐ Attached a non-standard installation form? (if required)
- ☐ Included the deposit of $200?

Print Form Email Form

LANDPRO

Make the most of your land

Resource Consent Application to Otago Regional Council to Replace Various Deemed Permits

Prepared for Queensbury Ridges Ltd

October 2019

Prepared For
Queensbury Ridges Limited

Prepared By
Landpro Ltd
13 Pinot Noir Drive
PO Box 302
Cromwell

Tel +64 3 445 9905

QUALITY INFORMATION

Reference: L:\18365 - Queensbury Ridges Ltd - Deemed Permit Replacement\Docs\Lodgement package\Final lodgement\20190611_18365_Queensbury Ridges Ltd AEE_Final.docx

Date: 8 October 2019

Prepared by: Will Nicolson

Reviewed by: Claire Perkins

Client Review: Richard Somerville

Version Number: Final

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1. INTRODUCTION

1.1 Overview of Proposal

The applicant, Queensbury Ridges Limited (QRL), holds a total of 7 permits to take water from the Albert Burn, Schoolhouse Creek and the main trunk of the Clutha River. Table 1, below, provides an overview of these permits along with their current take limits and any additional pertinent information.

Table 1: Queensbury Ridges Ltd deemed permits to be replaced

Deemed Permit No.	Water body	Take limit (L/s)	Location (NZMS 260)	Location (NZTM)	Additional notes
2002.348.V1	Albert Burn	83.3	G41:187-898	1308743E 5028081N	
2002.349.V1	Albert Burn	14.2	G41:187-898	1308743E 5028081N	
2002.351.V1	Albert Burn	27.8	G41:191-897	1309143E 5027982N	Point of take 1
		55.6	G41:187-898	1308743E 5028081N	Point of take 2
2002.352.V1	Albert Burn	28.3	G41:192-897	1309243E 5027982N	Point of take 1
		28.3	G41:188-898	1308843E 5028081N	Point of take 2
2002.353.V1	Clutha River	83.3	G41:207-895	1310745E 5027783N	
2002.354.V1	Schoolhouse Creek	55.6	G41:186-890	1308644E 5027281N	
2003.591.V2 (water permit)	Clutha River	190	G41:207-893	1310745E 5027583N	

According to ORC's consents database, the applicant is the only consented water user on both the Albert Burn and Schoolhouse Creek. Where different deemed permits feature water takes in the same or similar locations, the applicant proposes to combine these into a single permit with a combined rate of take (as discussed later in the document).

All permits expire on 1 October 2021 and subsequent replacement water permits are sought. A consent term of 25 years is sought for the replacement permits. The applicant also requires water metering exemptions (WEX's) for the Albert Burn telemeters, which are situated downhill from the take point (discussed later). All replacement permits sought are to provide water for irrigation, frost fighting, and stock drinking.

Note that the applicant holds various other consents, including groundwater permits RM10.439.01, RM14.047.01 and RM16.043.01, however these are not subject to this application.

This application is being made more than 6 months before the expiry of the current consents and so the applicant may continue to operate under the existing consents per s124 of the RMA until the new consents are granted.

1.2 The Applicant

Applicant Address: Queensbury Ridges Limited
PO Box 22
Wanaka 9305

Address for Service: C/- Landpro Limited
PO Box 302
Cromwell 9342

1.3 Purpose of Documentation

Pursuant to Section 88 of the Resource Management Act 1991 (the RMA), this report provides an assessment of the activities effects on the environment as required by Schedule 4 of the RMA.

2. DETAILS OF PROPOSAL

2.1 Scheme overview

Figure 1 provides an overview of the applicant's consented water abstractions, along with the tank farm, Schoolhouse race and ponds which the Schoolhouse race feeds into. The permits shown in Figure 1 partially irrigate the command area identified in Figure 2 that is comprised of QRL pasture irrigation and a number of private blocks comprising vineyards, cherry orchards, and pasture (see Appendix A for full-size images of Figures 1 and 2). Figure 3 is a schematic of the three surface water abstraction locations and provides an overview of the system as further described below.

It should be noted that the Albert Burn take locations specified on the permits and shown on Figure 1 show abstractions occurring at several locations on the creek, however in actuality there is only a single abstraction point on the Albert Burn, at approximately NZTM2000 1308734E 5028107N (uppermost consented point of take).

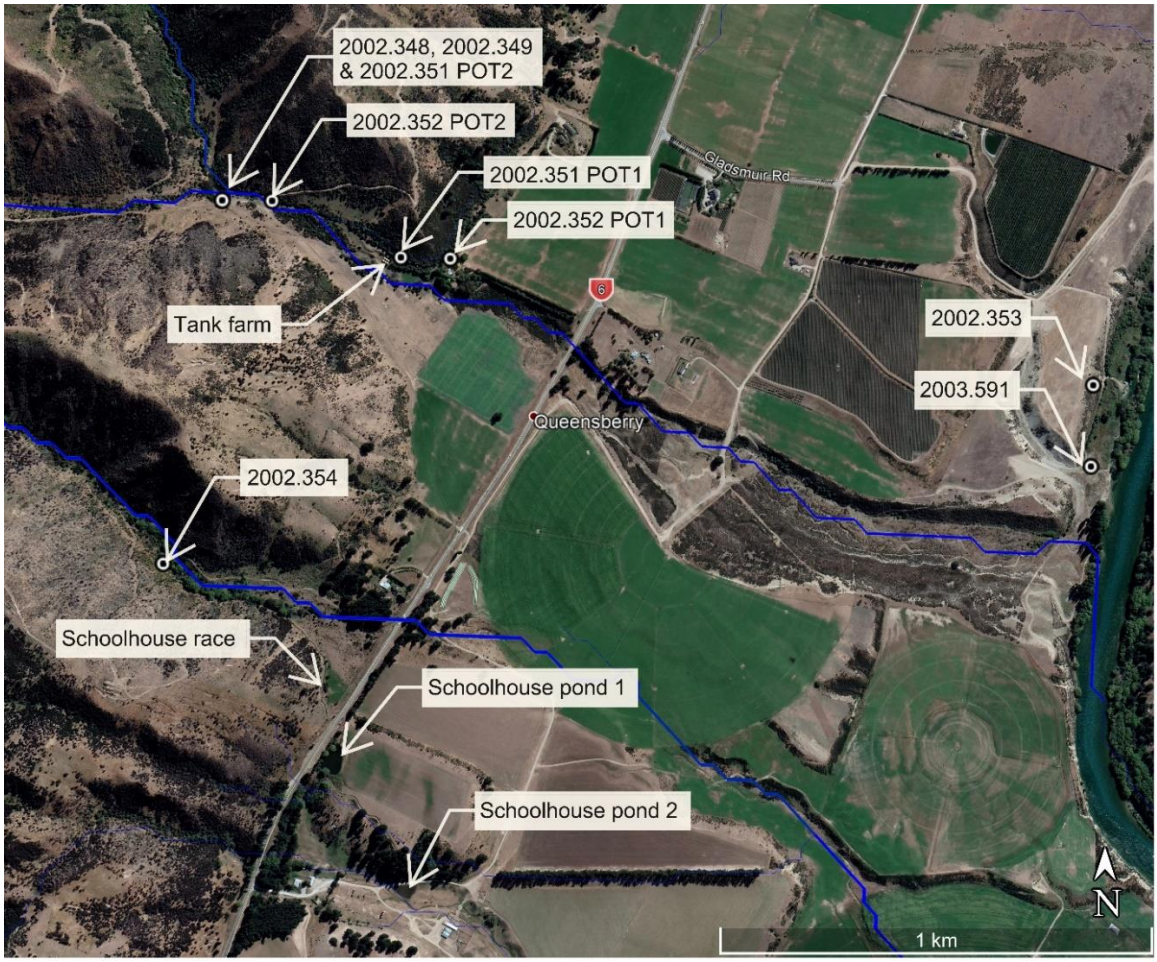


Figure 1: Overview of existing QRL consented water take locations (POT = point of take).

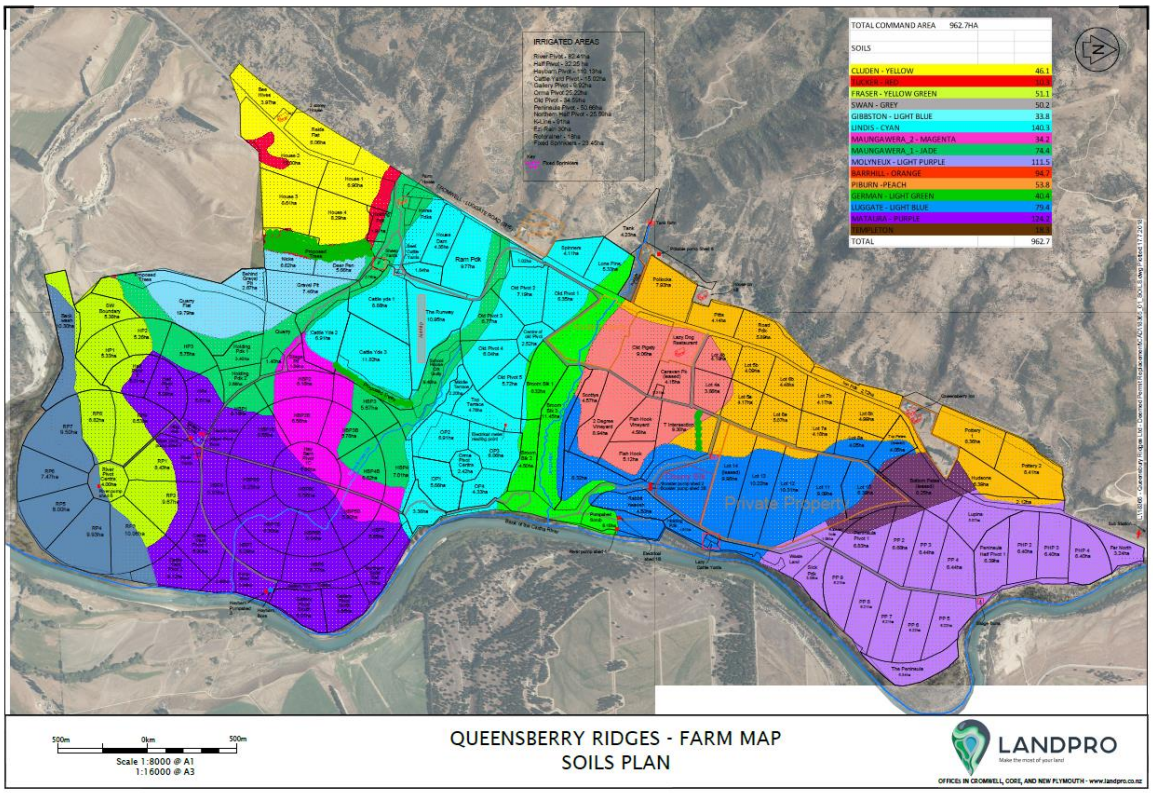


Figure 2: Overview of QRL irrigation command area.

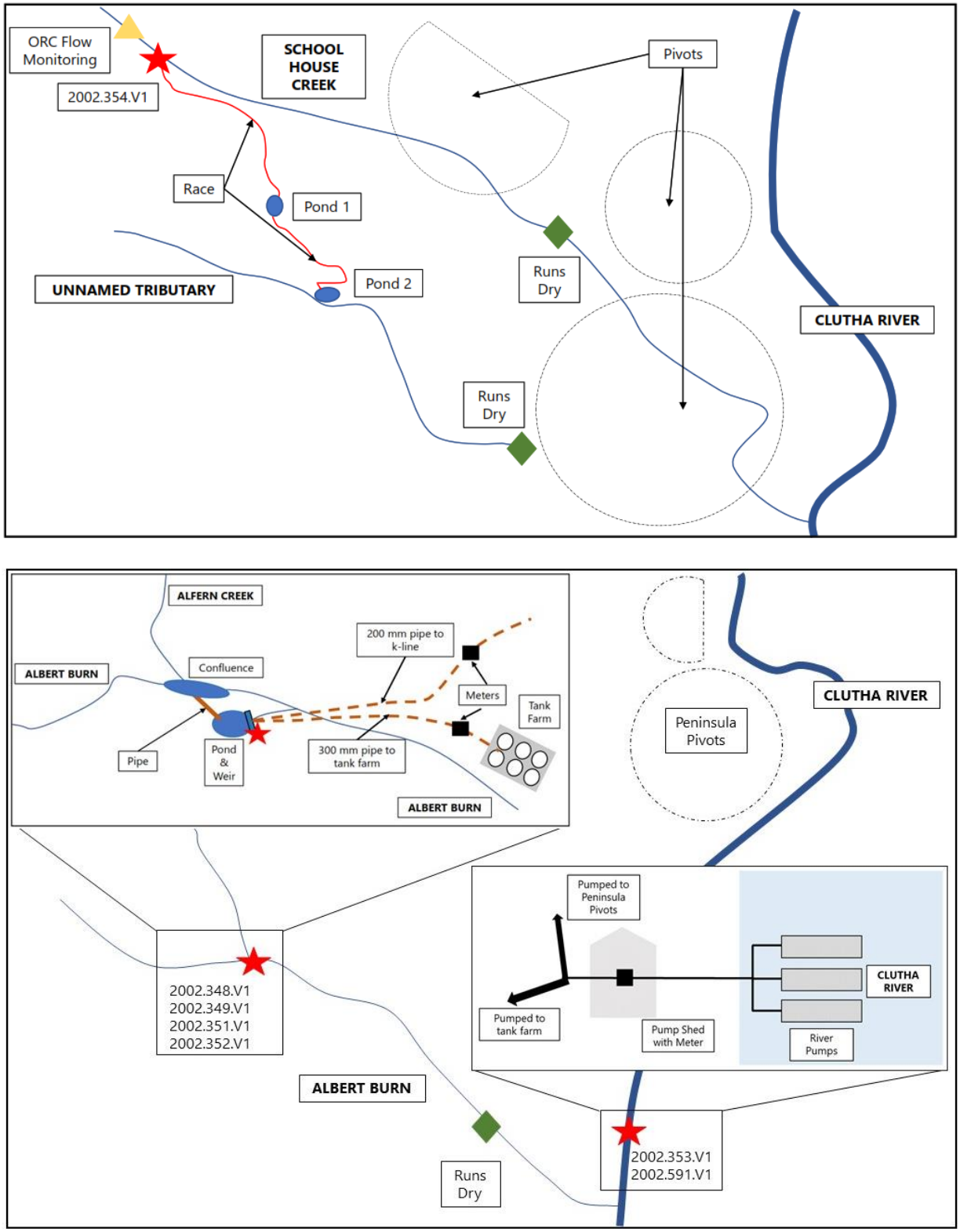


Figure 3: Schematics showing irrigation infrastructure for Schoolhouse Creek (top) and the Albert Burn and Clutha River (bottom).

2.1.1 Albert Burn

The water abstracted from the Albert Burn is collected via a pipe (Figure 4) and conveyed to a separate pond and weir located outside of the natural bed (Figure 5). Water is abstracted from the weir at the outflow of the pond. At the weir a 200mm pipe takes water to irrigate land on the top side of the State

Highway (metered near the tank farm), and a 300mm pipe carries water from the weir to the tank farm and is metered at the tank farm (Figure 6). Both pipe intakes are covered by a grate to prevent the ingress of debris and fish, and to limit the amount of water abstracted. The weir does not fully detain Albert Burn water, with the natural creek bed allowing higher flows (typically from April through to November, and during rain events) to bypass the intake pipe and pond (Figure 4 and 7); overflow from the pond is via the weir and returns diverted water to the Albert Burn (Figure 7). In addition, the applicant has the ability to plug the intake pipe to the pond outside of the irrigation season to ensure that all Albert Burn flows bypass the pond and follow the natural channel.

Both the 200mm pipe and 300mm pipe are metered individually and measured as a combined take against a combined consented maximum. 50 mm black pipes seen in Figures 4 and 7 provide stock drinking water, taking water from the Albert Burn upstream of the pond inlet pipe (approx. NZTM 1308758E 5028106N).

Key details relating to the applicant's Albert Burn pond are as follows:

- Inlet location: NZTM 1308749E 5028096N (approx.)
- Outlet location: NZTM 1308761E 5028101N (approx.)
- Pond dimensions (approx.): average width 7 m, average length 9.5 m, average depth 0.75 m (estimated volume 50 m^3)

Figure 4: View downstream to the end wall of dam showing pipe to pond, and overflow to Albert Burn (January 2019).

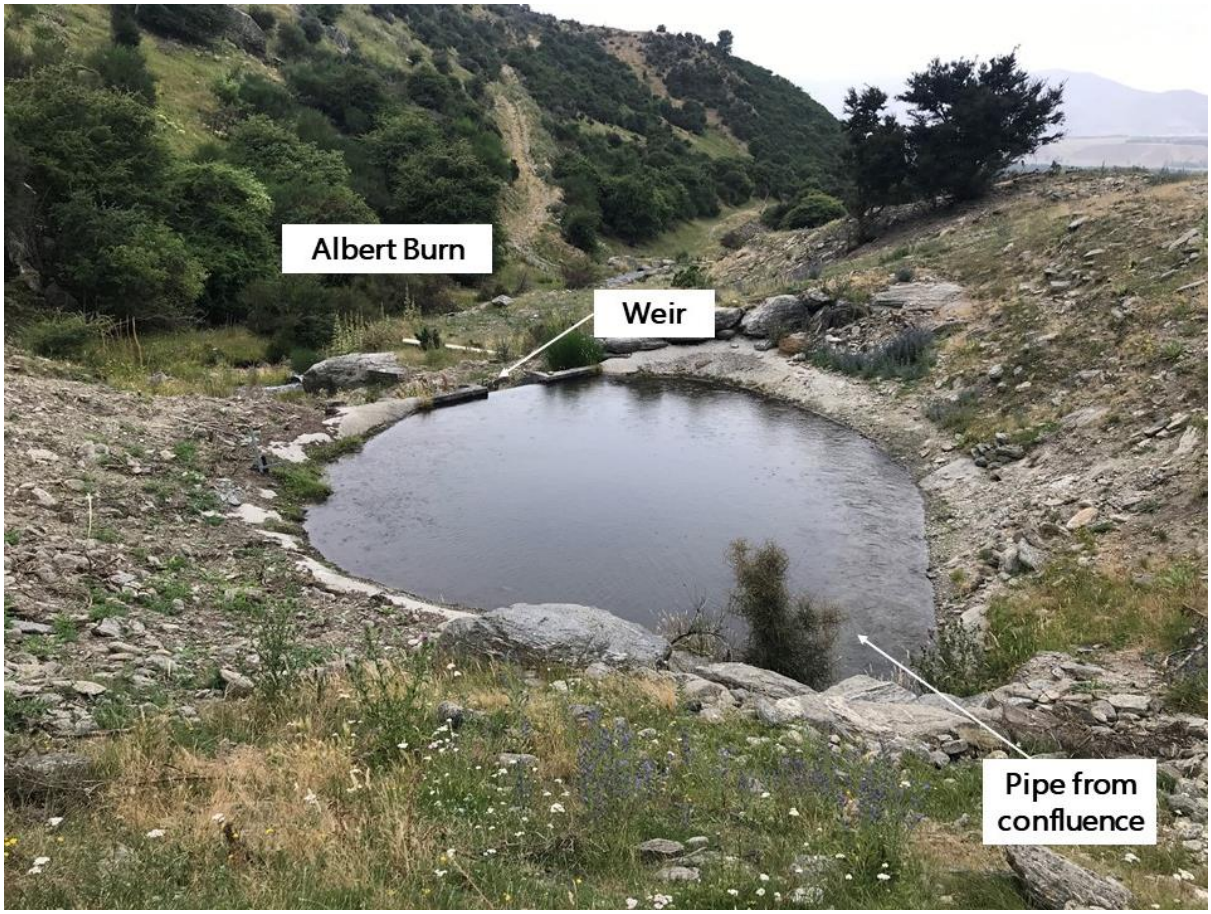


Figure 5: Pond where abstracted Albert Burn water is diverted to. Water flows back to the Albert Burn via the weir (January 2019).

Figure 6: Tank farm where Albert Burn water is stored, and Clutha water can be stored if required (October 2018).

Figure 7: Left, weir at end of pond where diverted water flows back to the Albert Burn; right, view looking downstream from dam crest where the natural Albert Burn channel and overflow from pond converge (Left: January 2019, Right: June 2019).

2.1.2 Clutha River

Abstraction from the Clutha River occurs on a small side channel off the main trunk, where three pumps set as an array (Figure 8) abstract water from the Clutha River. All Clutha River water is metered at this location before some of the water is diverted to the northern property boundary, supplying two pivots. Water not sent directly to the pivots is pumped to the tank farm on an as-required basis, and services much of the property when Albert Burn water is not available (i.e. mid to late summer).

Note, the Albert Burn and Clutha River abstractions work as an integrated system to ensure water use efficiency. In spring, when flows in the Albert Burn are high, the applicant utilises this water to fill the storage tanks and irrigate all available land via gravity feed – with the exception of the two northern pivots (known as the Peninsula area) that are always fed by water from the Clutha River. In summer, when flows in the Albert Burn substantially decrease and the water stored in the tank farm declines, the Clutha River abstraction increases in order to replace the water shortfall at the tank farm. When the tank farm reaches capacity the Clutha River abstraction is automatically curtailed.

Figure 8: Three pumps installed in the small channel of the Clutha River that pump water to the Peninsula pivots and the tank farm (October 2018).

2.1.3 Schoolhouse Creek

Water from Schoolhouse Creek is taken from the main stem of the creek via a race (Figure 9) that traverses the hillside and is piped under the State Highway and delivered to a pond that stores the abstracted water (Figure 10). This abstracted water has historically not been metered, but during the 2018/2019 season monthly gauging on the race was carried out to satisfy an agreement between the Otago Regional Council (ORC) and the applicant to provide a record of use for the season. Overflow from this pond is to a race that carries water to an additional pond (Figure 11). Water is piped from the first pond and used in farm activities, and for stock drinking water, and is also a key source of water for the planned future developments.

Key details relating to the applicant's two schoolhouse ponds are as follows:

- Pond 1 inlet: NZTM 1309049E 5026888N (approx.)
- Pond 1 outlet: NZTM 1309031E 5026817N (approx.)
- Pond 1 dimensions (approx.): average width 40 m, average length 68 m, average depth 2 m (estimated volume 5,500 m^3).
- Pond 2 inlet: NZTM 1309193E 5026571N (approx.)
- Pond 2 outlet: N/A (there is no designated spillway, with excess water from the pond seeping out in a diffuse manner along the southeast perimeter of the pond. Some of this water may enter an unnamed tributary of the Clutha River, however the vast majority of the time there is no overflow.)
- Pond 2 dimensions: average width 25 m, average length 40 m, average depth 1 m (estimated volume 1000 m^3)

Figure 9: Schoolhouse Creek diversion to race with current infrastructure of a flume with staff gauge.

Figure 10: Left, Schoolhouse Creek race below the State Highway looking downstream towards Pond (1). Right, Pond (1) collects and stores Schoolhouse Creek water (October 2018).

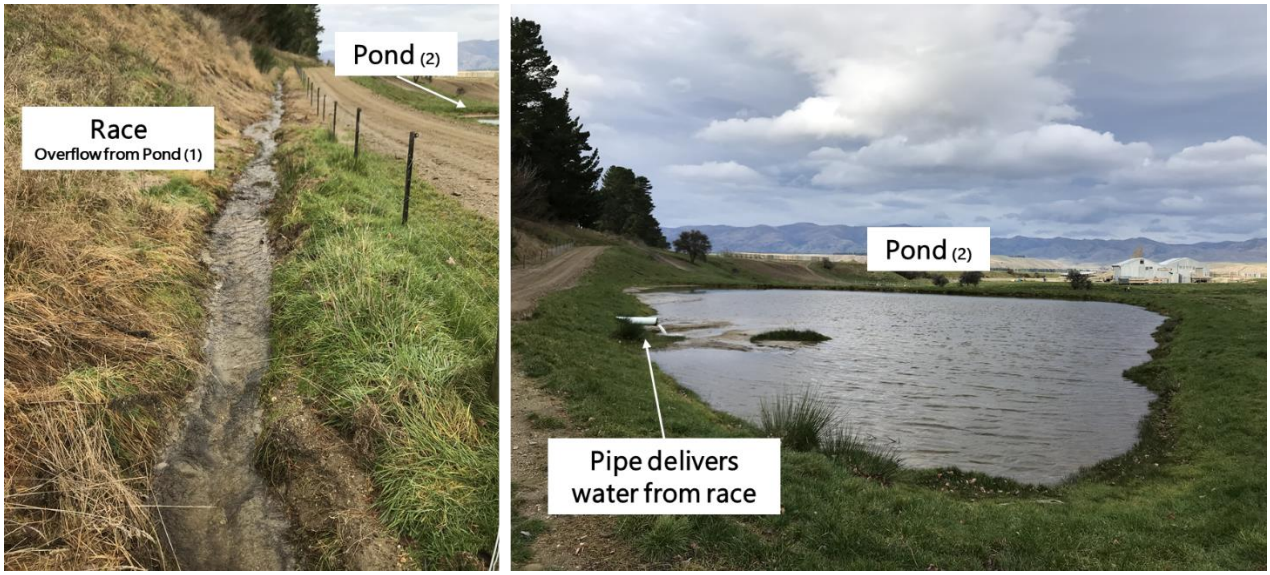


Figure 11: Left, race that carries overflow from Pond (1). Right, pond that collects and stores Pond (1) overflow (July 2019).

2.1.4 Records of Title

The scheme command area encompasses numerous land parcels, a list of which is provided in the below table. Those parcels within which water take infrastructure is located are noted and corresponding Records of Title appended, along with those properties within the command area that are not owned by the applicant.

Table 2: Legal parcels located within the scheme command area

Owner	Appellation	Water infrastructure	Record of Title appended?
Queensbury Ridges Ltd	Section 37 BLK IX Tarras SD	Irrigation & conveyance	N
	Section 45 BLK IX Tarras SD	Irrigation & conveyance	N
	Section 46 BLK IX Tarras SD	Irrigation & conveyance	N
	Lot 1 Deposited Plan 347117	Irrigation & conveyance	N
	Lot 1 Deposited Plan 511969	Irrigation, conveyance & water take (Clutha River pump house)	Y
	Lot 3 Deposited Plan 22096	Irrigation & conveyance	N
	Section 1 Survey Office Plan 300501	Water takes (Albert Burn & Schoolhouse Creek)	Y
	Lot 1 Deposited Plan 516051	Irrigation, conveyance & water storage (Schoolhouse ponds)	Y
	Lot 2 Deposited Plan 516051	Irrigation & conveyance	N
	Lot 4 Deposited Plan 466903	Irrigation & conveyance	N
	Lot 1 Deposited Plan 22096	Irrigation & conveyance	N

Owner	Appellation	Water infrastructure	Record of Title appended?
	Lot 4 Deposited Plan 368189	Irrigation & conveyance	N
	Lot 2 Deposited Plan 532869	Irrigation & conveyance	N
	Lot 1 Deposited Plan 532869	Irrigation & conveyance	N
	Lot 4 Deposited Plan 358051	Irrigation & conveyance	N
	Lot 5 Deposited Plan 358051	Irrigation & conveyance	N
	Lot 6 Deposited Plan 358051	Irrigation & conveyance	N
	Lot 7 Deposited Plan 358051	Irrigation & conveyance	N
	Lot 8 Deposited Plan 358051	Irrigation & conveyance	N
Treescapes Trustees Ltd	Lot 3 Deposited Plan 368189	Irrigation & conveyance	Y
	Lot 1 Deposited Plan 368189	Irrigation & conveyance	Y
Hasler family	Lot 1 Deposited Plan 22567	Irrigation & conveyance	Y
Jacqueline Diane McDonald Steven Carlisle McDonald Anderson Lloyd Trustee Company (2013) Limited	Lot 2 Deposited Plan 358051	Irrigation & conveyance	Y
Richard John Somerville	Lot 18 Deposited Plan 358051	Irrigation & conveyance	Y
Fish Hook Limited	Lot 17 Deposited Plan 358051	Irrigation & conveyance	Y
Christine Sybil Pacey Paul Edgar Alexander Pacey	Lot 2 Deposited Plan 439756	Irrigation & conveyance	Y
Queensberry Gardens Limited	Lot 1 Deposited Plan 439756	Irrigation & conveyance	Y
Jacqueline Diane McDonald Steven Carlisle McDonald Anderson Lloyd Trustee Company (2013) Limited	Lot 1 Deposited Plan 525499	Irrigation & conveyance	Y
Pongs Creek Trading Ltd	Lot 15 Deposited Plan 358051	Irrigation & conveyance	Y
	Lot 6 Deposited Plan 511969	Irrigation & conveyance	Y
MJ & MJ Noonan Limited	Lot 14 Deposited Plan 358051	Irrigation & conveyance	Y

Owner	Appellation	Water infrastructure	Record of Title appended?
	Lot 5 Deposited Plan 511969	Irrigation & conveyance	Y
Greah Jade Crawford Thomas Philip Day	Lot 13 Deposited Plan 358051	Irrigation & conveyance	Y
	Lot 4 Deposited Plan 511969	Irrigation & conveyance	Y
Jacqueline Catrina Connor John Craig Connor Marcus Jeremy Lester Stephanie Anne Lester	Lot 12 Deposited Plan 358051	Irrigation & conveyance	Y
	Lot 3 Deposited Plan 511969	Irrigation & conveyance	Y
John Craig Connor	Lot 11 Deposited Plan 358051	Irrigation & conveyance	Y
	Lot 2 Deposited Plan 511969	Irrigation & conveyance	Y
Benjamin John van Gool	Lot 8 Deposited Plan 511969	Irrigation & conveyance	Y
L & P Farms Limited	Lot 9 Deposited Plan 358051	Irrigation & conveyance	Y

2.2 Historic use and allocation sought

All former mining rights related to the applicant's abstraction from the Albert Burn, Schoolhouse Creek, and the Clutha River were given deemed permit status in 2002. These permits are 2732A and 336A with associated race licences WR2321Cr, WR1661Cr, WR3469Cr, and WR1677Cr. These water rights were initially granted 1904 – 1914. The former mining privilege for the Clutha River abstraction is permit 3337A with the associated race licence WR10173Cr, initially granted in 1966. The second Clutha River abstraction is authorised under 2003.591, which is not a deemed permit but still expires in October 2021. The Schoolhouse Creek permit is associated with the former mining privilege permit 2781A and race licence WR6999Cr.

Since attaining deemed permit status the water has been used for irrigation purposes. As discussed earlier, the purpose of the replacement permits sought is to provide water for irrigation (predominantly pasture, cherries and grapes), frost fighting and stock water. As the system is fully integrated, all water sources (i.e. Albert Burn, Schoolhouse Creek, Clutha River) will provide water for all of the listed purposes, however Schoolhouse Creek will also provide water for general farm use (e.g. wool shed, making up sprays etc). Irrigation is mostly in the form of pivots and k-line for pasture, and drip or under-tree micro spray for orchards and vineyards. Frost fighting water is used via overhead sprinklers.

2.2.1 Albert Burn

Metering on the Albert Burn has occurred since December 2012 and shows that the combined abstraction (Figure 12) from permits 2002.348.V1, 2002.349.V1, 2002.351.V1, and 2002.352.V1 never meets the current combined consented maximum (237.5 L/s). Abstraction generally only occurs between October and April and tapers off in May, with no abstraction over winter (Figure 13). Note that data for the 2018/2019 irrigation season has been pulled directly from the service provider. For the 2012/2013 and 2013/2014 irrigation seasons the applicants were not irrigating at the full extent of the irrigable area, explaining why less water was abstracted than what has occurred in more recent seasons. No water

was abstracted in the 2014/2015 season because of infrastructure upgrades and conversion of the hard wire system to telemetry.

Based on the 6 years of flow data, maximum instantaneous and totalised take volumes are as follows:

- Max rate of take: 103 l/s
- Max daily volume: 8,925 m^3
- Max monthly volume: 215,885 m^3
- Max annual volume: 1,183,765 m^3

QRL are the only water users on the Albert Burn, and therefore the abstraction record provides a fair representation of the available flow in the creek during peak irrigation demand but does not provide an indication of winter flows or flows during rain events.

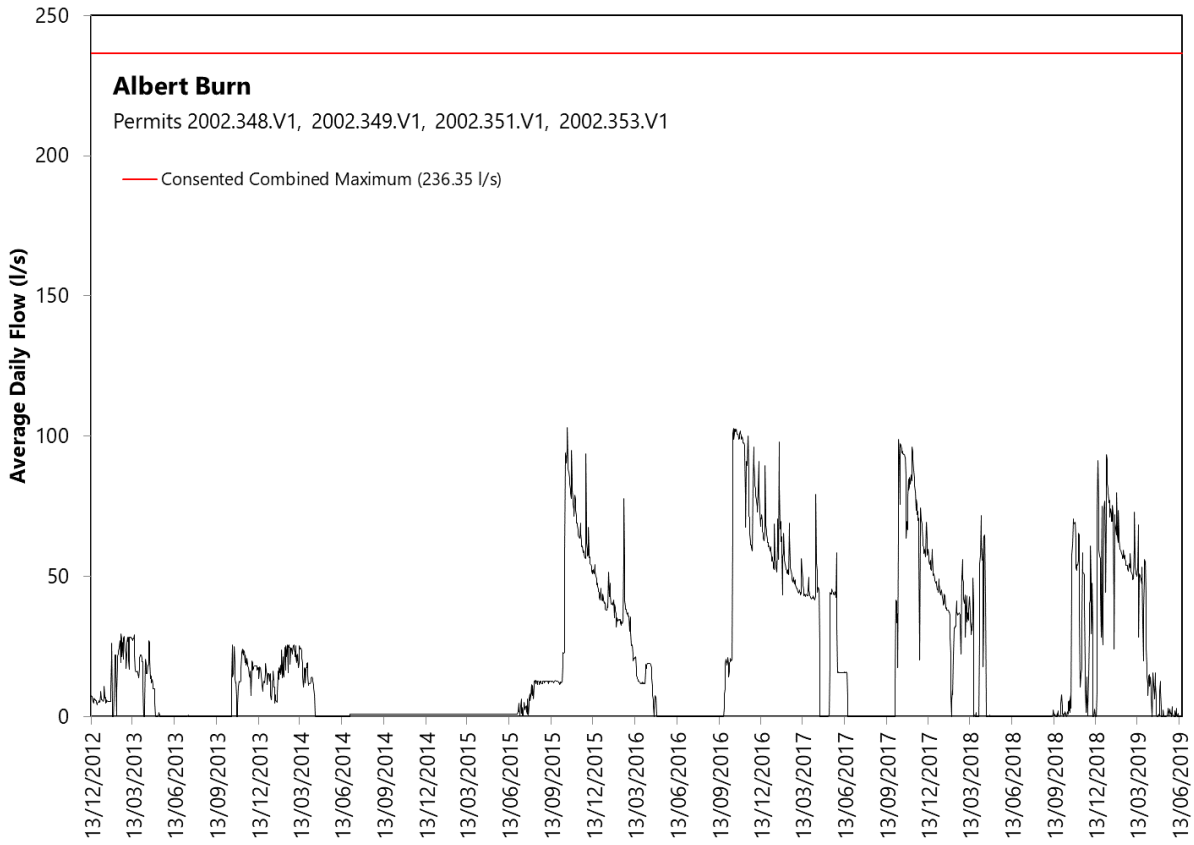


Figure 12: Daily average abstraction rate for Albert Burn permits (2002.348.V1, 2002.349.V1, 2002.351.V1, and 2002.352.V1), December 2012 – June 2019 (Source: ORC, 2019).

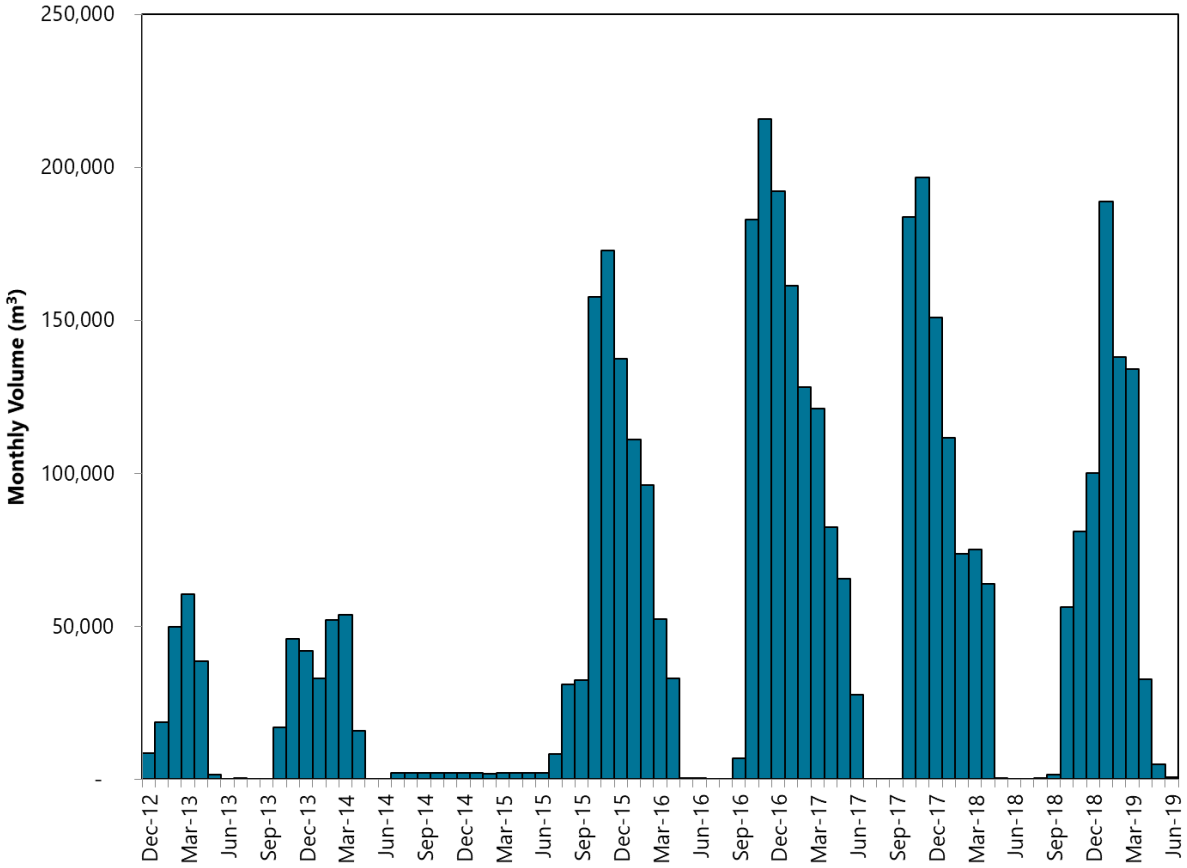


Figure 13: Monthly abstraction volumes for Albert Burn permits (2002.348.V1, 2002.349.V1, 2002.351.V1, and 2002.352.V1), December 2012 – June 2019 (Source: ORC, 2019).

2.2.2 Clutha River

Metering on the Clutha River abstraction has occurred since December 2012, and shows that the combined abstraction (Figure 14) from permits 2002.353 and 2003.591 has historically fallen short of the current consented maximum. Abstraction generally only occurs between October and April with no abstraction over winter which is outside the irrigation season (Figure 15). For the 2012/2013 and 2013/2014 irrigation seasons the applicants were not irrigating the full extent of the irrigable area and explains why less water was abstracted than what has occurred in more recent seasons. The record shows that no water was abstracted during the 2015/2016 irrigation season. This is due to a full infrastructure upgrade and conversion of the hard wire system to telemetry.

Based on the 7 years of flow data, maximum instantaneous and totalised take volumes are as follows:

- Max rate of take: 153 l/s
- Max daily volume: 13,234 m^3
- Max monthly volume: 331,946 m^3
- Max annual volume: 1,273,935 m^3

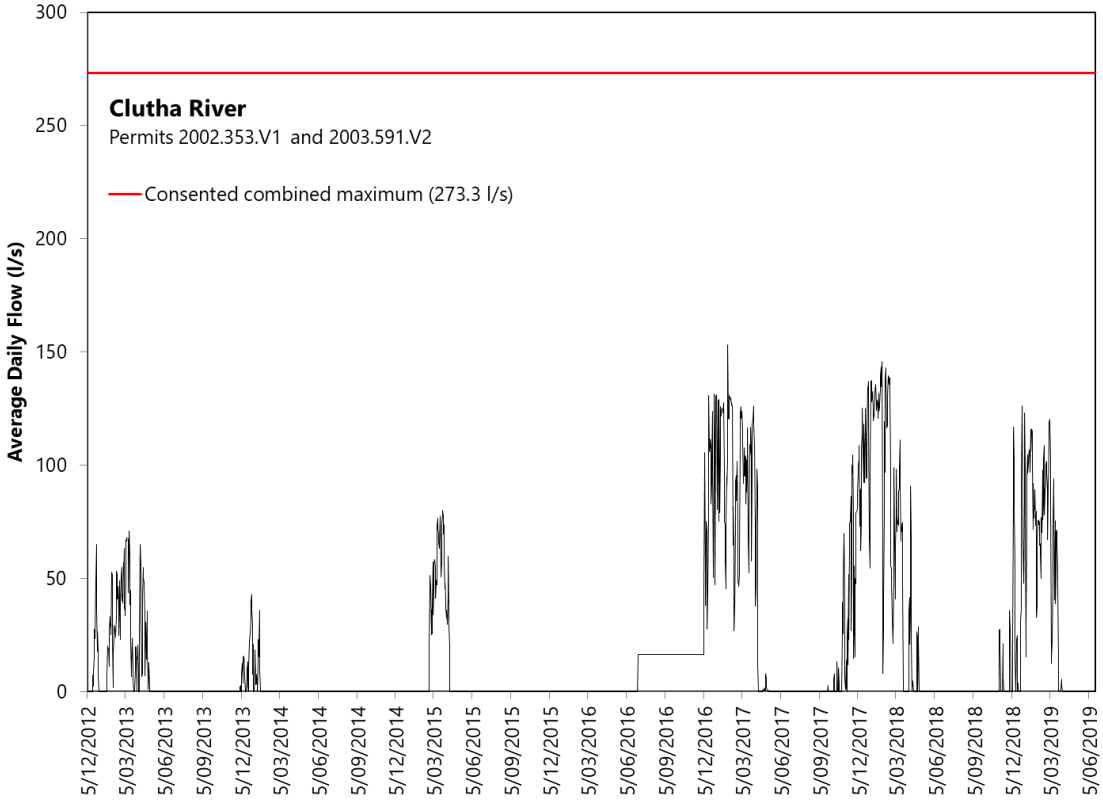


Figure 14: Combined daily average abstraction rate for Clutha River permits (2002.353.V1, 2003.591.V1), December 2012 – June 2019 (Source: ORC, 2019).

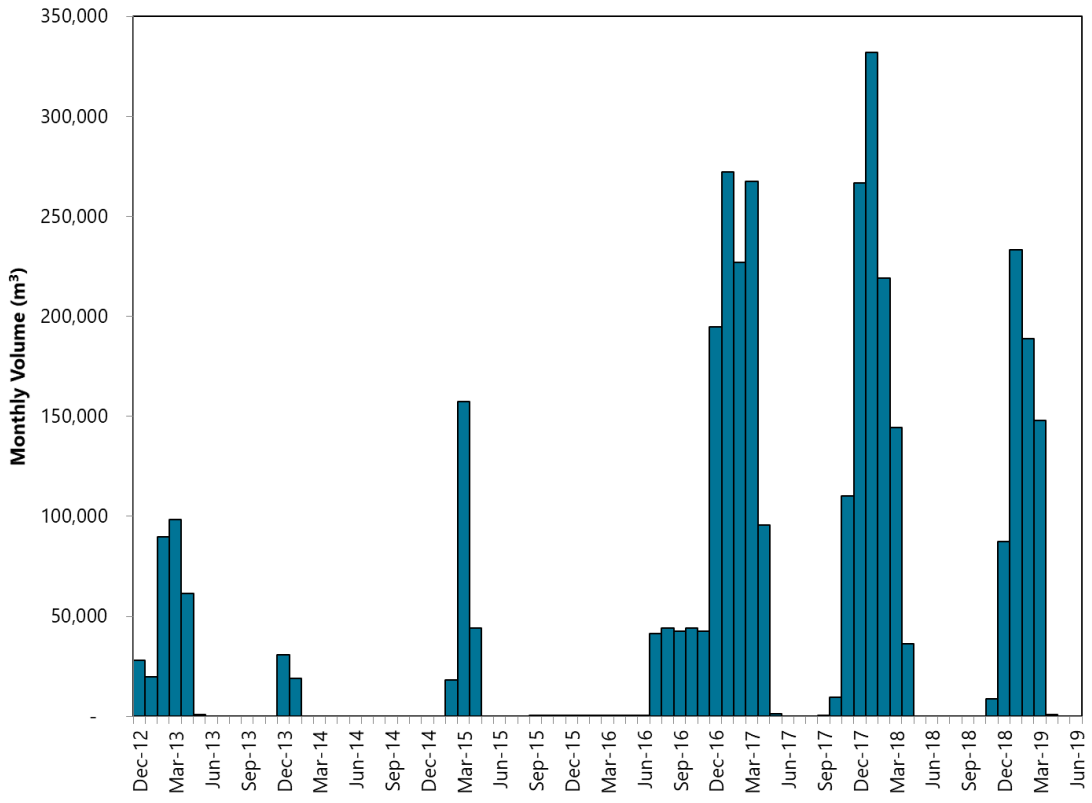


Figure 15: Monthly abstraction volumes for Clutha River permits (2002.353.V1, 2003.591.V1), December 2012 – June 2019 (Source: ORC, 2019).

2.2.3 Schoolhouse Creek

There has historically been no metering of permit 2002.354.V1 on Schoolhouse Creek. As the race intake essentially acts as an open diversion, water levels in the race are ultimately determined by the amount of water naturally present in the creek. The first section of the race (see SCH1 in Table 2) has higher flows than further down-race (SCH2), due to a large leak approximately 40 m from the intake returning water to Schoolhouse Creek.

Abstraction has historically occurred year-round, and water stored in two ponds. For the 2018/2019 irrigation season, monthly gauging was carried out on the race to understand the likely abstracted volumes and carrying capacity of the race. The gauging record measured flow in the race immediately downstream from the abstraction point and suggests that 14 – 32 l/s was abstracted during the 2018/2019 season (Table 2). Gaugings completed further downstream below the major leak from the race indicated flows in the race ranged from 11 – 20 l/s; suggesting that between 2 and 12 L/s are typically returned to Schoolhouse Creek around 40 m downstream of the take. The average abstraction rate across the 2018/2019 season was 18 l/s.

In order to ensure more efficient water use, the applicant plans to upgrade the Schoolhouse Creek intake and conveyance infrastructure in the future. This may include installing pipework instead of racing the water, however the details of the upgrades are yet to be finalised. An appropriate water meter would also be installed at or near the intake.

Table 3: Measured flow for the Schoolhouse Creek race during the 2018/19 irrigation season

Site Name	Date	Measured flow (L/sec)	Gauging uncertainty flow range (L/sec)
SCH1	20/12/18	31.5	30.6 – 32.4
	23/01/19	13.7	13.2 – 14.2
	13/02/19	15.2	14.7 – 15.7
	06/03/19	13.6	13.2 - 14
	10/04/19	15.7	15.2 – 16.2
SCH2	20/12/18	10.6	10 – 11.2
	23/01/19	11.1	10.3 – 11.9
	13/02/19	13	12.6 – 13.4
	06/03/19	17.9	17.4 – 18.4
	10/04/19	20.2	19.5 – 20.9

2.2.4 Allocation Sought

The allocation sought for the Albert Burn is based on historic use records. Historically, the applicant's abstraction from the Albert Burn has been limited by the internal diameters of the intake pipes; they now plan on increasing the intake capacity to take up to 150 L/s if it is available in the creek, which

would typically only occur during times of high flow such as during the late spring or rainfall events. This is still considerably less than the current paper allocation for the Albert Burn (237.5 L/s). As such, the applicant also seeks supplementary allocation from the Albert Burn to enable harvesting of additional water above primary allocation levels during times of high flow. This would likely require the installation of a flow meter above the abstraction point to determine when the applicant can initiate abstraction under their supplementary allocation. A proposed consent condition addresses this consideration in Section 6.12. Note that MfE data indicates the Albert Burn at the point of take has a mean flow of 121 L/s. As the applicant is seeking 103 L/s primary allocation, abstraction under supplementary allocation could occur with flows over 224 L/s.

Because Schoolhouse Creek abstractions have not historically been recorded, the maximum rate of take based on the gaugings presented in Table 2 has been used to determine the allocation sought. Once again, the allocation sought in the replacement permit is significantly lower than the existing paper allocation, and it is recognised that the applicant will not be able to take continuously at this rate due to efficient water use restrictions discussed in Section 6.6. A higher instantaneous rate of take will enable the applicant to take more water during times of high creek flows, meaning storage ponds can be replenished, and placing less demand on the creek during times of low flow.

The applicant is seeking to take at the same rate from the Clutha River as is currently authorised, as these abstractions act as an important secondary source of water for irrigation and stock drinking when flows in the Albert Burn and Schoolhouse Creek begin to dry up in mid to late summer. Note that while the applicant's take record indicates only a maximum of 153 L/s has historically been abstracted under the two Clutha permits, 273 L/s is being sought to provide for future irrigable area expansion. This is not considered excessive use of water, given that Aqualinc calculations (see Section 6.6) suggest that a minimum of 273 L/s, in conjunction with the Schoolhouse and Albert Burn rates sought, is required to efficiently irrigate the command area.

Daily, monthly and annual volumes sought are discussed later in this report. Note that the allocation sought is based on both existing use and projected future demand for water within the command area.

Table 4: Allocation sought by Queensbury Ridges Ltd.

River	Primary allocation (l/s)	Supplementary allocation (l/s)
Clutha River	273	
Albert Burn	103	Can occur with Albert Burn flows >224 L/s.
Schoolhouse Creek	31.5	

3. DESCRIPTION OF EXISTING ENVIRONMENT

3.1 Surface water hydrology and ecology

3.1.1 Albert Burn

3.1.1.1 Hydrology

The headwaters of the Albert Burn originate close to the point where the Pisa Range Ridge Track and the Locharburn track meet, at an elevation of around 1395 m above sea level (masl) towards the northern end of the Pisa Range. The Burn picks up several small tributaries (including Alfern Creek) as it descends the steep eastern face of the Pisa Range, after which the channel widens and gradient flattens

out upon reaching the Queensberry terraces. After flowing through the terraces for approximately 2 km, the Albert Burn discharges into the Clutha River.

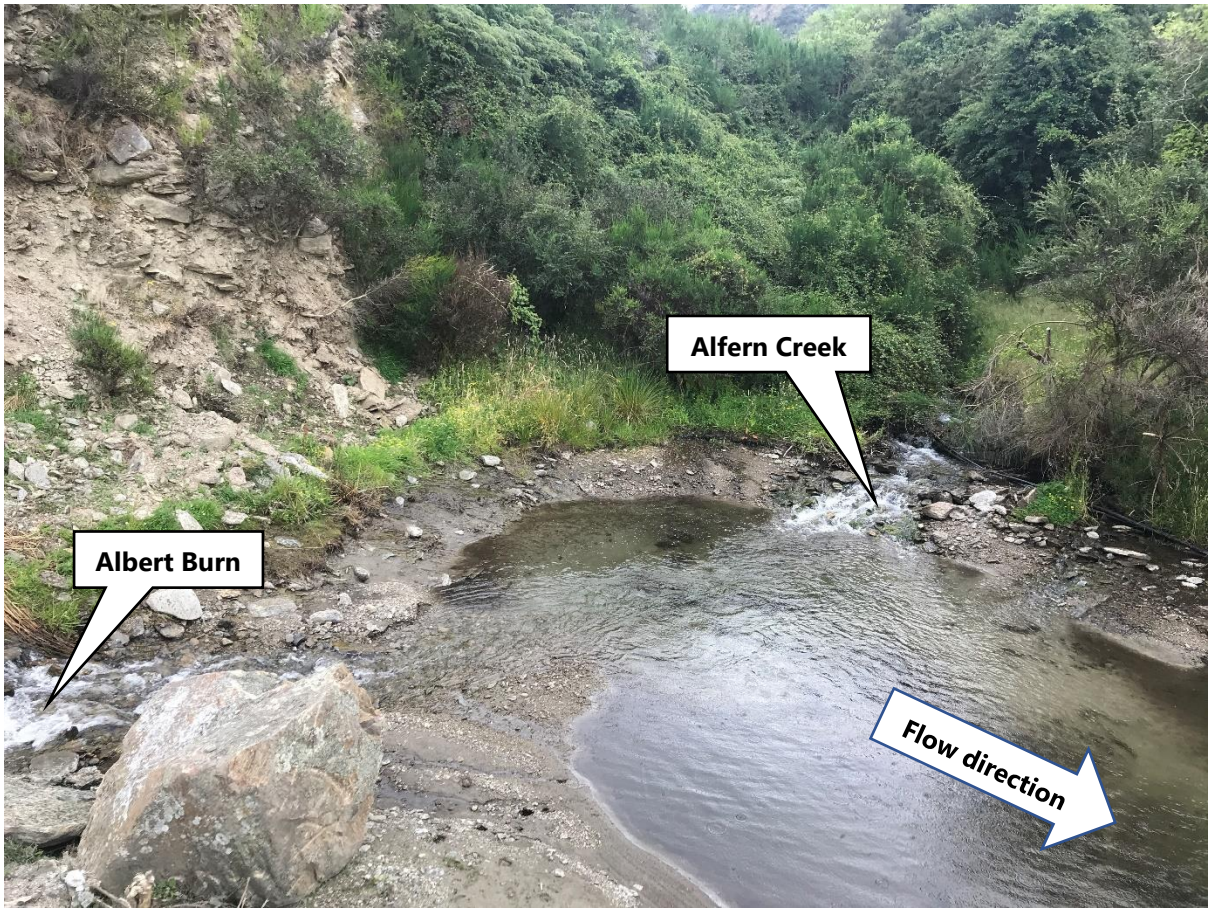


Figure 16: Albert Burn and Alfern Creek confluence (January 2019)

Figure 17: Albert Burn downstream of uppermost gauging location (January 2019)

No flow monitoring data exists for the Albert Burn, therefore any determination of historic flows is based on MfE flow modelling data. MfE river flow modelling estimates Albert Burn mean flows, just downstream of the Alfern Creek confluence and in the vicinity of the point of take, to be 133 L/s. Modelling data estimates a mean annual low flow (MALF) of 34 L/s at this same location.

Stream gauging conducted by Landpro Ltd in January, 2019, indicates that the lower reach of the Albert Burn naturally dries up in the summer (see Appendix B). As part of the gauging, the applicant was asked to cease all abstraction from the Albert Burn 24 hours prior to data capture. Figure 18, taken from the appended report, has been included below to show the variations in flow throughout the lower reaches of the Albert Burn.

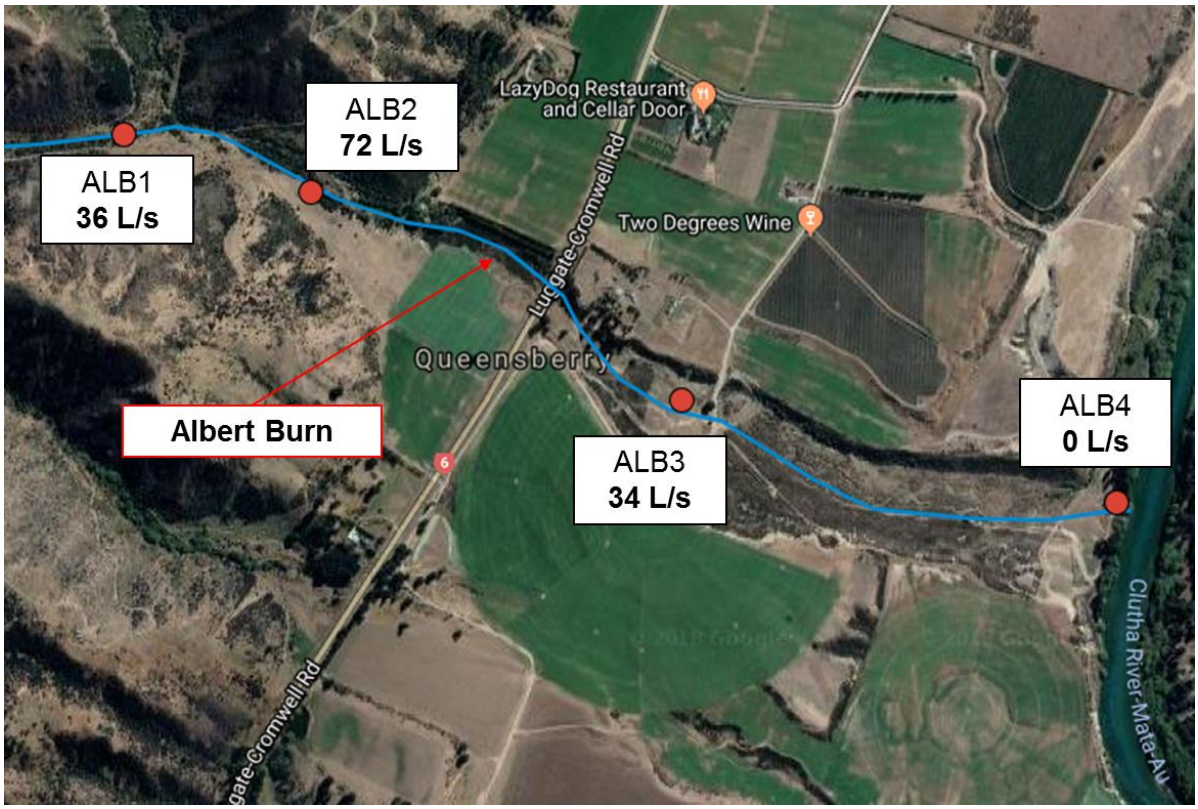


Figure 18: January 2019 Albert Burn flow gauging sites and measured flows

As can be seen in the figure, flows in the Albert Burn prior to the Alfern Creek confluence were relatively low, at around 36 L/s. After picking up Alfern Creek water, flows in the Burn effectively doubled, before halving again midway down the terraces and flows completely disappearing below-ground well-prior to the Clutha River (Figure 19). This suggests that even were the applicant to discontinue taking water from the Albert Burn during the mid- to late-summer months, the Albert Burn would still go to ground prior to the channel's confluence with the Clutha River.

Figure 19: Dry Albert Burn bed, looking up-channel towards Pisa Range (January 2019)

It is worth noting that this gauging was undertaken during a particularly wet season, meaning it is fair to assume that during more typical drier summers the Albert Burn would usually run dry even further upstream. It is also worth noting that the flow measured in the Albert Burn downstream of the Alfern Creek confluence (72 L/s) is more than double the modelled MALF for that same reach, suggesting that the Albert Burn would be even more likely to run dry as flows draw closer to MALF.

Figure 20: Albert Burn just upstream of Clutha River confluence, with no abstraction yet occurring due to a particularly wet spring (October 2018)

The preferentially losing nature of the lower Albert Burn is a common feature amongst the smaller streams draining the eastern face of the Pisa Range. The terraces adjoining the western banks of the Clutha River and Lake Dunstan in this area tend to be comprised of deep alluvial deposits from both the historic movements of the Clutha River itself and from the large alluvial fans created by the aforementioned streams. As these streams flow out of their highly incised bedrock channels on the mountain face and onto this gently-sloping alluvial substrate, the highly porous underlying media often absorbs water faster than it can be recharged via surface flows. This means that, while the Albert Burn and similar streams may be providing inputs to the Clutha River via subsurface flows, there is often no surface connection to the Clutha during drier months.

The substrate of the Albert Burn in the vicinity of the applicant's take points is composed primarily of boulders and course gravels.

3.1.1.2 Aquatic ecology

Recent fish surveys of the Albert Burn are notably lacking, with the most recent survey undertaken by Ross Dungey in 2001. At this time, Ross surveyed a section of the creek just upstream of SH6, downstream of the applicant's points of take. The survey did not identify any fish present, and noted the presence of a downstream barrier.

The only other recorded fish survey in the Albert Burn took place in 1995, approximately 400 m upstream of the applicant's uppermost point of take. This survey recorded a "rare" abundance of brown trout, with no further details as to the number of fish caught or their characteristics. Mayflies were identified as the predominant invertebrate.

In the same year, another fish survey was conducted in Alfern Creek approximately 200 metres upstream of the Albert Burn confluence. It was noted in the survey that brown trout were "abundant", but once again there were no further details provided.

3.1.1.3 Schedule 1 values

The Albert Burn is not listed in Schedule 1 of the Regional Plan: Water for Otago (RPW).

3.1.2 Schoolhouse Creek

3.1.2.1 Hydrology

Schoolhouse Creek is relatively similar in nature to the Albert Burn, although it drains a smaller catchment. The headwaters of the creek originate at approx. 1220 masl, with the channel winding down the steep eastern face of the Pisa Range before opening out onto an unconfined channel on the Queensberry terraces. After passing under SH6, Schoolhouse Creek is piped under a centre pivot then flows over an area of farmland before meeting with the Clutha River.

Figure 21: Schoolhouse Creek upstream of the abstraction point (October 2018)

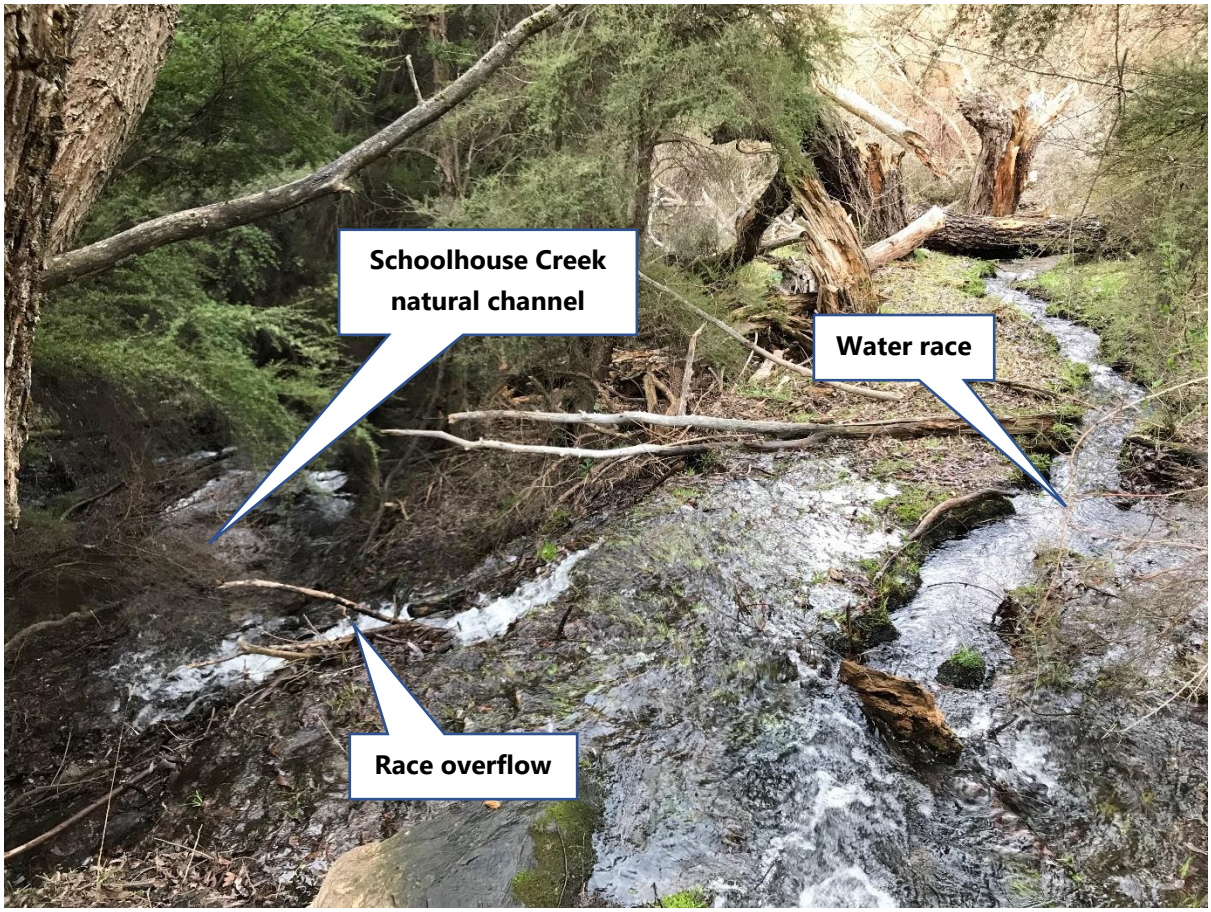


Figure 22: Schoolhouse race overflowing back into Schoolhouse Creek channel approx. 40 m downstream of intake (June, 2019)

Figure 23: Applicant's Schoolhouse water race in the foreground with Schoolhouse Creek in the background (October 2018)

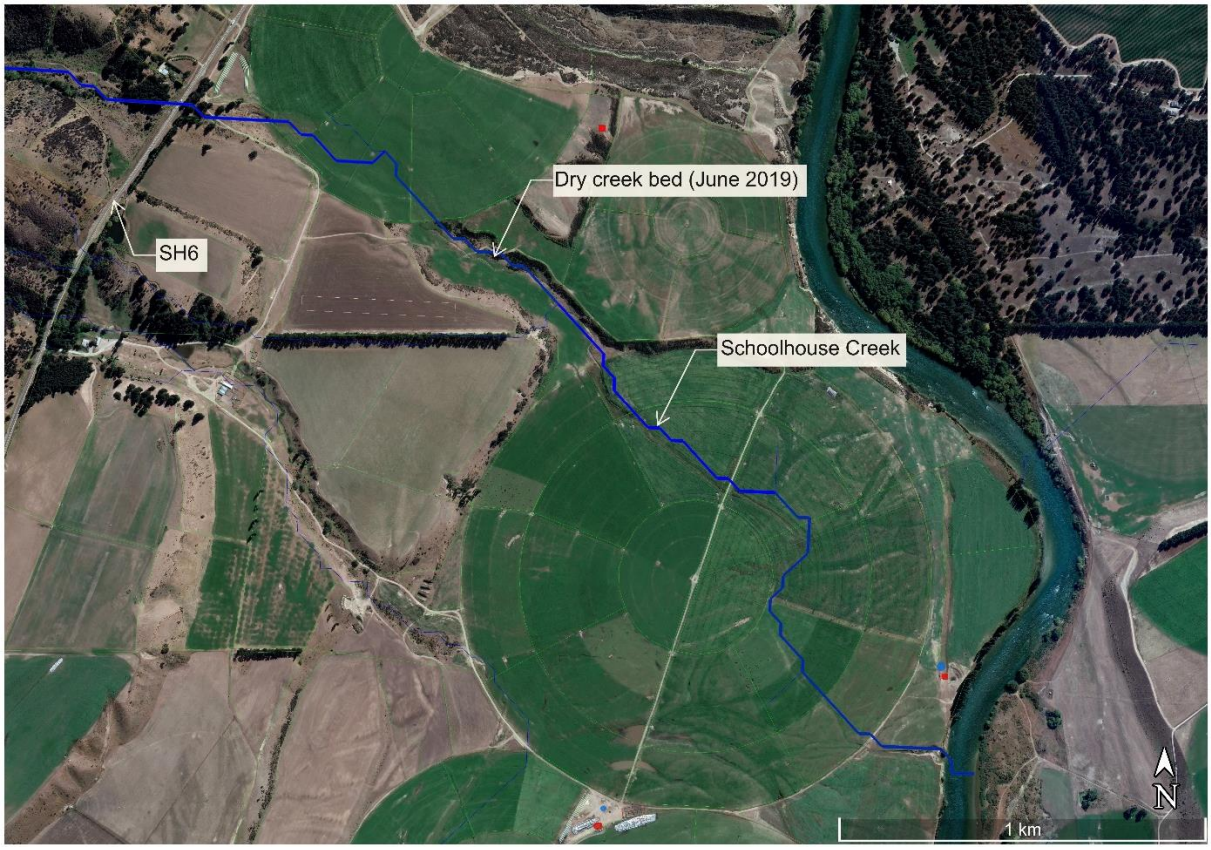


Figure 24: Schoolhouse Creek overview

MfE river flow modelling estimates the mean flow of Schoolhouse Creek in the vicinity of the abstraction point to be 53 L/s, with a MALF of 12 L/s. In addition to MfE modelling, ORC has also maintained a flow meter in Schoolhouse Creek above the point of take since November 2013. As Figure 25 shows, there is a strong seasonal pattern to flows in the creek, with the highest flows experienced July-December, and a notable drop in flows in the new year. Based on the ORC's flow data for Schoolhouse Creek, the mean annual flow is 37.6 L/s and the 7-day MALF is 12.1 L/s, which is not significantly different to the MfE modelling estimates.

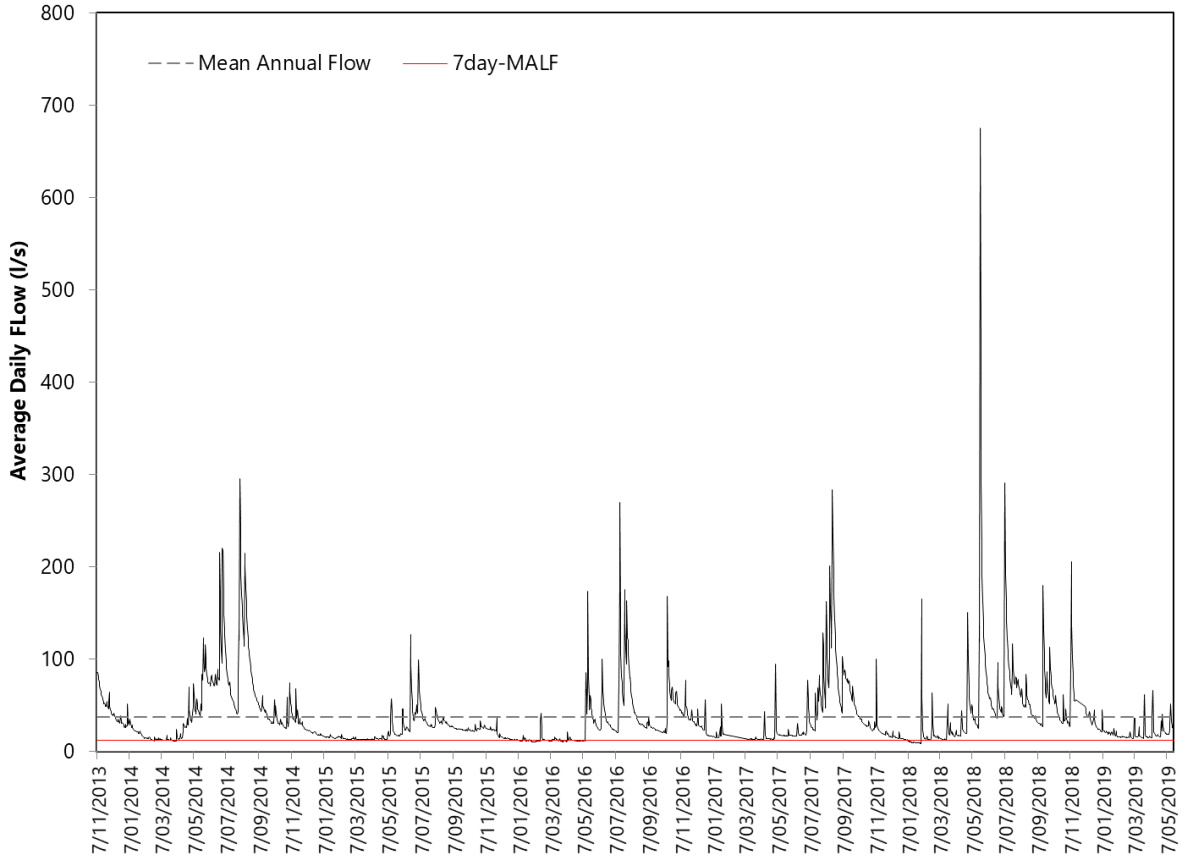


Figure 25: Schoolhouse Creek flows metered approx. 150 m upstream of abstraction point (Source: ORC, 2019)

The hydrology of Schoolhouse Creek below SH6 is highly modified, with the creek bed essentially converted to a grassed farm ditch as it passes through the two centre pivots. During a site visit in July, 2019, when creek flows were high and no abstraction taking place, the creek was found to go-to-ground approximately 1.8 km upstream of its Clutha River confluence. This coincides with the approximate point where the underlying loess substrate gives way to an alluvium substrate (see Figure 12 of the attached hydrological assessment). In the summertime, it is fair to assume that the creek runs dry considerably further up-channel, towards SH6.

Figure 26: Schoolhouse Creek culvert under SH6 (July, 2019)

Figure 27: Schoolhouse Creek approximately 2 km (left) and 1.8 km (right) upstream of Clutha River confluence (July, 2019)

The Schoolhouse Creek substrate in the vicinity of the abstraction point is largely composed of boulders, cobbles and coarse gravels.

3.1.2.2 Aquatic ecology

Unlike the Albert Burn, Schoolhouse Creek has been the subject of over 20 fish surveys from 1995 through to 2010, all of which were conducted by the Department of Conservation (DoC). Virtually all of the surveys took place above (but still within 400 m) the applicant's point of take, and show that there are both Clutha flathead galaxias and brown trout present in the upper reaches of the creek. Clutha flathead galaxias have tended to be relatively abundant across the various surveys, with 74 individuals recorded in 2007, and length generally ranging between 30 and 130 mm (see Appendix C).

Brown trout were recorded on 6 occasions between 1995 and 2010, on the months of March, April, June and October. Abundance ranged from 12 to 18, and lengths range from 70-235 mm. Given the relatively static population of trout over the years and the small size class, it may be that the individuals surveyed represent an isolated resident population cut off from the Clutha River fishery.

Given the abundance of Clutha flathead galaxia, a nationally critical indigenous species, the upper reaches of Schoolhouse Creek are clearly an important habitat for native fish. A lack of connection between the upper reaches of the creek and the Clutha River would therefore be beneficial to one of New Zealand's most endangered fish species, preventing the up-migration and spawning of predatory sportfish in the creek. In fact, even the presence of the small brown trout population in the upper reaches of the creek poses a significant threat to the resident galaxiids.

3.1.2.3 Schedule 1 values

Schoolhouse Creek is listed in Schedule 1A as an important habitat for rare fish and is notably absent of aquatic pest plants. The schedule lists Schoolhouse Creek as "significant habitat for flathead galaxiid".

3.1.3 Clutha River / Mata-Au

3.1.3.1 Hydrology

The closest ORC flow monitoring station on the Clutha River is located just downstream of the Cardrona River confluence, approximately 30 km upstream of the applicant's 2002.353/2003.591 take point. Flow at this location over the past 7 months has ranged from less than 200 m^3/s in December last year to almost 500 m^3/s in early June. MALF for the Clutha River below the Cardrona River confluence is listed as 121 m^3/s on the ORC's website.

The applicant's take is located on a small side channel off the main trunk of the Clutha River, as shown in the below figure (Figure 28). Flows in this location are comparatively sluggish.

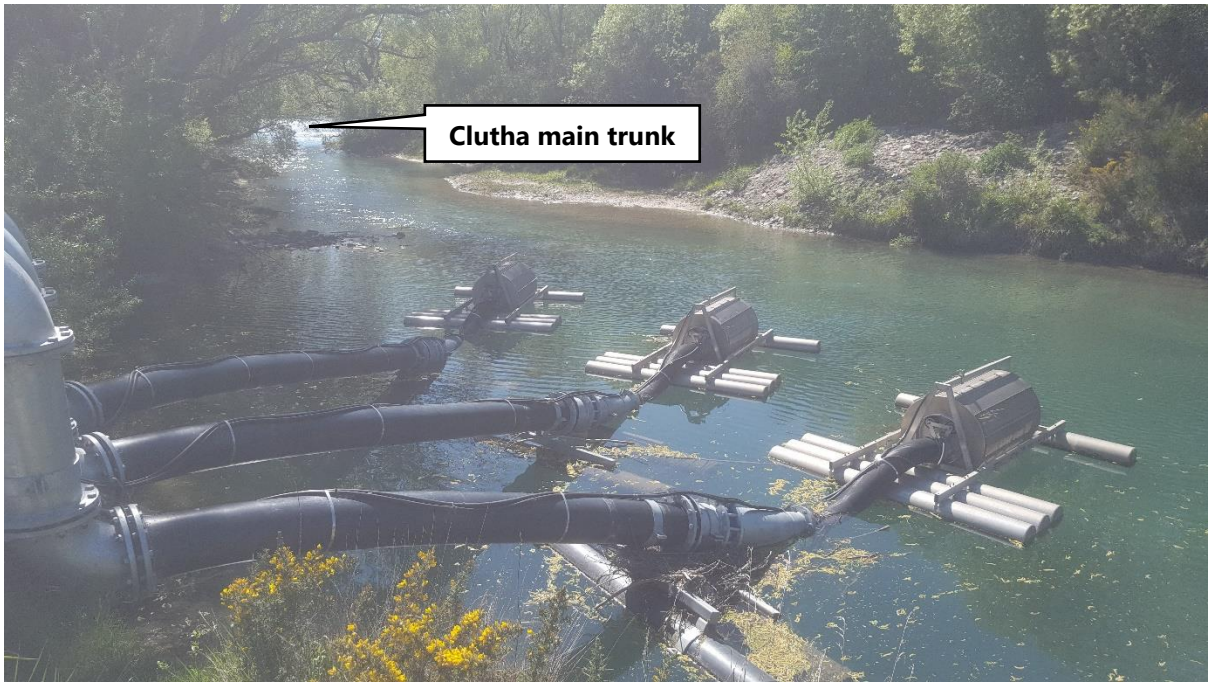


Figure 28: Location of Clutha River intake

3.1.3.2 Aquatic ecology

Numerous fish surveys are listed in NIWA's freshwater fish database (NZFFD), however only a select few have been undertaken in the vicinity of the applicant's point of take. These indicate presence of brown trout, upland bully, common bully and longfin eel. The presence of rainbow trout and salmon is also assumed in this section of the Clutha River.

3.1.3.3 Schedule 1 values

The Clutha River between Alexandra and Lake Wanaka is listed in Schedule 1A of the RPW for the following ecosystem values:

- Large water body supporting high numbers of particular species, or habitat variety, which can provide for diverse life cycle requirements of a particular species, or a range of species.
- Notable rock and gravel bed composition for resident biota.
- Significant fish spawning areas for trout and salmon.
- Significant areas for development of juvenile trout and salmon.
- Presence of riparian vegetation of significance to aquatic habitats.
- Significant presence of trout, eel, and salmon.
- Presence of indigenous fish species threatened with extinction.
- Presence of a significant range of indigenous waterfowl.

The Clutha River between Alexandra and Lake Wanaka is also listed in Schedule 1D of the RPW for the following Kai Tahu values:

- MA1 (Kaitiakitanga – the exercise of guardianship by Kai Tahu in accordance with tikanga Maori in relation to Otago's natural and physical resources; and includes the ethic of stewardship)
- MA2 (Mauri – life force; for example the mauri of a river is most recognisable when there is abundance of water flow and the associated ecosystems are healthy and plentiful; a most important element in the relationship that Kai Tahu have with the water bodies of Otago)
- MA3 (Waahi tapu and/or Waiwhakaheke – sacred places; sites, areas and values associated with water bodies that hold spiritual values of importance to Kai Tahu.)
- MA4 (Waahi taoka – treasured resource; values, sites and resources that are valued and reinforce the special relationship Kai Tahu have with Otago's water resources.)
- MB1 (Mahika kai – places where food is procured or produced. Examples in the case of waterborne mahika kai include eels, whitebait, kanakana (lamprey), kokopu (galaxiid species), koura (fresh water crayfish), fresh water mussels, indigenous waterfowl, watercress and raupo)
- MB2 (Kohanga – important nursery/spawning areas for native fisheries and/or breeding grounds for birds.)
- MB3 (Trails – sites and water bodies which formed part of traditional routes, including tauraka waka (landing place for canoes))
- MB4 (Cultural materials – water bodies that are sources of traditional weaving materials (such as raupo and paru) and rongoa (medicines)).

3.1.4 Regionally significant wetlands

There are no regionally significant wetlands in proximity to the study area, with the closest case being the Bendigo Wetland, approximately 5.5 km to the southwest.

3.2 Land Use and Climate

The Queensbury Ridges command area encompasses approximately 963 hectares of the terraces between the flanks of the Pisa Range and the Clutha River, with an additional 1500 ha (approx.) of the applicant's land given over to high country farming activities above SH6 (outside the irrigation command area). Land within the command area is generally gently sloping towards the Clutha River, ranging from 300 masl to approximately 200 masl.

Much of the command area is classified in the New Zealand Land Cover Database as high producing exotic grassland with smaller areas of low producing grassland. Most of the irrigable subject land has been cleared of native vegetation, however pockets of matagouri, coprosma spp. and kanuka/manuka persist in inaccessible area like ridges, depressions and dry creek beds. Above SH6, kanuka/manuka is the predominant vegetation type, interspersed with rosehip and matagouri and with some willow growth in the lower riparian reaches.

The Queensberry area is subject to characteristically hot dry summers and cold winters. MAR for the irrigable land areas is estimated at 550 mm/year, based on ORC's GIS viewer.

Frosts are frequent during the middle of each year, but typically only impact cherry and grape growing in the early part of the growing season (i.e. spring). Some harvests of late-season wine crops like Pinot Noir may be affected by frosts in late April or May, however the likelihood of this occurring is much

lower than in spring. GrowOtago data indicate a median of ~9-10 spring frosts per year (September-November). This is comparable to NIWA data for air frosts at Alexandra (mean 9.5 frosts September-November each year, with up to a mean of 7 frosts in September alone) and Wanaka Airport (11).

3.3 Soils and geology

SMap-designated soils (Landcare Research/Manaaki Whenua, 2019) within the QRL command area are summarised in Figure 2 earlier in this document, a full-size copy of which is provided in Appendix A.

The GNS Science New Zealand Geology Web Map indicates that virtually all of the land within the irrigation command area is underlain by Late Quaternary glacial outwash deposits, described as "muddy to sandy gravel." Much of the land within the Clutha River valley is designated with this geological unit, while the geology of the Pisa Range to the west of the command area is classified as much older Wanaka lithologic association TZIV schist.

4. ACTIVITY CLASSIFICATION

This application seeks to replace existing water permits that have primary allocation status. Replacement of the 5 deemed permits from the Albert Burn and Schoolhouse Creek as part of the proposal is authorised by Rule 12.1.4.5 of the RPW:

Rule 12.1.4.5

Taking and use of surface water as primary allocation applied for prior to 28 February 1998 in catchments not listed in Schedule 2A:

- *(i) This rule applies to the taking of surface water, as primary allocation, in catchment areas not listed in Schedule 2A, if the taking was the subject of a resource consent or other authority:*
  - *(a) Granted before 28 February 1998; or*
  - *(b) Granted after 28 February 1998, but was applied for prior to 28 February 1998; or.*
  - *(c) Granted to replace a resource consent or authority of the kind referred to in paragraph (a) or (b).*
- *(ii) Unless covered by Rule 12.1.1A.1, the taking and use of surface water to which this rule applies is a **restricted discretionary** activity. The matters to which the Otago Regional Council has restricted the exercise of its discretion are set out in Rule 12.1.4.8.*
- *(iii) Unless covered by Rule 12.1.1A.1, the taking and use of surface water in the Waitaki catchment to which this rule applies is a restricted discretionary activity provided that by itself or in combination with any other take, use, dam, or diversions, the sum of the annual volumes authorised by resource consent, does not exceed the allocation to activities set out in Table 12.1.4.2. The matters to which the Otago Regional Council has restricted the exercise of its discretion are set out in Rule 12.1.4.8.*
- *(iv) Takes to which this rule applies will not be subject to a minimum flow condition until the minimum flow has been determined by investigation and added to Schedule 2A by a plan change. Note: If a minimum flow has been determined for a catchment previously not listed in Schedule 2A, and that minimum flow has been set by a plan change, the catchment will then be listed in Schedule 2A and Rule 12.1.4.2 or Rule 12.1.4.4 will apply.*

Rule 12.1.4.8 Restricted discretionary activity considerations

In considering any resource consent for the taking and use of water in terms of Rules 12.1.4.2 to 12.1.4.7 and 12.2.3.1A, the Otago Regional Council will restrict the exercise of its discretion to the following:

- *(i) The primary and supplementary allocation limits for the catchment; and*
- *(ii) Whether the proposed take is primary or supplementary allocation for the catchment; and*
- *(iii) The rate, volume, timing and frequency of water to be taken and used; and*
- *(iv) The proposed methods of take, delivery and application of the water taken; and*
- *(v) The source of water available to be taken; and*
- *(vi) The location of the use of the water, when it will be taken out of a local catchment; and*
- *(vii) Competing lawful local demand for that water; and*
- *(viii) The minimum flow to be applied to the take of water, if consent is granted; and*
- *(ix) Where the minimum flow is to be measured, if consent is granted; and*
- *(x) The consent being exercised or suspended in accordance with any Council approved rationing regime; and*
- *(xi) Any need for a residual flow at the point of take; and*
- *(xii) Any need to prevent fish entering the intake and to locate new points of take to avoid adverse effects on fish spawning sites; and*
- *(xiii) Any effect on any Regionally Significant Wetland or on any regionally significant wetland value; and*
- *(xiv) Any financial contribution for regionally significant wetland values or Regionally Significant Wetlands that are adversely affected; and*
- *(xv) Any actual or potential effects on any groundwater body; and*
- *(xvi) Any adverse effect on any lawful take of water, if consent is granted, including potential bore interference; and*
- *(xvii) Whether the taking of water under a water permit should be restricted to allow the exercise of another water permit; and*
- *(xviii) Any arrangement for cooperation with other takers or users; and*
- *(xix) Any water storage facility available for the water taken, and its capacity; and*
- *(xx) The duration of the resource consent; and*
- *(xxi) The information, monitoring and metering requirements; and*
- *(xxii) Any bond; and*
- *(xxiii) The review of conditions of the resource consent; and*
- *(xxiv) For resource consents in the Waitaki catchment the matters in (i) to (xxiii) above, as well as matters in Policies 6.6A.1 to 6.6A.6.*

<u>Notification and written approvals</u>

(a) For applications for resource consent to which this Rule applies, to take and use water from a river, the Consent Authority is precluded from giving public notification, if the application is to take and use water from:

- *(i) A river for which a minimum flow has been set by or under this Plan; or*
- *(ii) A river for which it is not necessary for the Council to consider whether, if consent is granted, the taking should be subject to a condition requiring a residual flow to remain in the river at the point of take, or a condition requiring other provision for native fish, other than a condition requiring fish screening.*

Other applications for resource consent to take and use water from a river may be considered without notification as allowed by the Resource Management Act.

(b) For applications for resource consent to which this rule applies, to take and use water from a water body other than a river, the Consent Authority is precluded from giving public notification.

All water sought as replacement for the applicant's deemed permits (2002.348-349, 2002.351, 2002.352 & 2002.354) is the same or less than that applied for prior to 28 February 1998, as per Rule 12.1.4.5(i)(a). None of the catchments are listed in Schedule 2A of the RPW. This means these deemed permit replacements are **restricted discretionary** activities.

The applicant is also seeking supplementary allocation from the Albert Burn to enable water harvesting during times of high flow, which would be considered a restricted discretionary activity under Rule 12.1.4.7(iii) of the RPW:

12.1.4.7 Taking and use of surface water as supplementary allocation in any catchment other than a Schedule 2B catchment:

> *(iii) The taking of surface water as supplementary allocation for any catchment is subject to a minimum flow which is not less than either:*
>
> > *(a) 50% of the natural flow at the point of take, or, if a resource consent so provides, not less than 50% of the natural flow at a point specified in the resource consent; or*
> >
> > *(b) The natural mean flow at the point of take, or, if a resource consent so provides, not less than the natural mean flow at a point specified in the resource consent*
>
> *(iv) Unless covered by Rule 12.1.1A.1, the taking and use of surface water to which this rule applies is a **restricted discretionary** activity, and is subject to Rule 12.1.4.9. The matters to which the Otago Regional Council has restricted the exercise of its discretion are set out in Rule 12.1.4.8.*

In addition, the application is seeking to replace Deemed Permit 2002.353 and Water Permit 2003.591, both of which authorise the take and use of Clutha River water. Policy 6.4.1 of the RPW notes that the allocation quantities set by Chapter 6 policies do not apply to surface water takes from the main stem of the Clutha River:

Policy 6.4.1
To enable the taking of surface water, by:

(a) Defined allocation quantities; and

(b) Provision for water body levels and flows, except when:

> *(i) The taking is from Lakes Dunstan, Hawea, Roxburgh, Wanaka or Wakatipu, or the main stem of the Clutha River/Mata-Au or Kawarau Rivers.*

The RPW notes that "takes from these seven water bodies…are full **discretionary** activities."

The weir structure at the Albert Burn point of take may also breach Rule 12.3.2.1, due to the fact that the catchment upstream of the weir is more than 50 hectares in area:

Rule 12.3.2.1
Unless prohibited by Rules 12.3.1.1 to 12.3.1.4, the damming or diversion of water is a permitted activity, providing:

(a) The size of the catchment upstream of the dam, weir or diversion is no more than 50 hectares in area.

As such, Rule 12.3.4.1 likely applies:

Rule 12.3.4.1

*(i) Except as provided for by Rules 12.3.1.1 to 12.3.3.1 and except in the Waitaki catchment, the damming or diversion of water is a **discretionary** activity.*

Overall, the proposed activities are classified as **discretionary**.

4.1 Other activities

The applicant may, at times, need to conduct maintenance to the Albert Burn intake infrastructure. This will involve instream works, and is a permitted activity under Rule 13.5.1 of the RPW:

*The disturbance of any lake or river…and any resulting discharge or deposition of bed material associated with: (iii) The maintenance or reinstatement of a water intake, in order to enable the exercise of a lawful take of water…is a **permitted activity.***

All conditions of this rule will be adhered to, including the advance notification of DoC and Fish and Game (F&G) in advance of any instream works between 1 May and 30 September.

Some disturbance to the bed of Schoolhouse Creek may also be required to facilitate the potential upgrades to existing water take and conveyance infrastructure (design TBD). This activity would also be permitted under Rule 13.5.1:

*The disturbance of any lake or river…and any resulting discharge or deposition of bed material associated with: (i) The erection, placement, extension, alteration, replacement, reconstruction, repair, maintenance, demolition or removal, of any structure that is fixed in, on, under or over the bed of any lake or river…is a **permitted activity**.*

As part of these upgrades, there would be no increase in the scale of the existing structure and appropriate notification would be given to DoC and F&G. All other conditions of this rule would also be adhered to.

The applicant also operates stock water takes from the Albert Burn, in addition to stock water takes from the Schoolhouse Creek storage ponds and from groundwater sources. These takes are in accordance with the provisions of Section 14 of the RMA, permitting the take and use of water for the reasonable needs of an individual's animals for drinking water.

Finally, discharges of water to water occur from the Albert Burn intake pond (via the weir and back into the Albert Burn) and (very occasionally) from Schoolhouse pond 2 to an unnamed tributary of the Clutha River. These are both permitted activities under Rule 12.C.1.1 of the RPW:

The discharge of water or any contaminant to water, or onto or into land in circumstances which may result in a contaminant entering water, is a permitted activity.

None of the provisions that might confound the permitted status of these activities (i.e. causing flooding, discharge between catchments, etc.) are triggered by the two discharges.

5. NON-NOTIFICATION & CONSULTATION

A consent authority has the discretion whether to publicly notify an application unless a rule or National Environmental Standard (NES) precludes public notification (in which case the consent authority must not publicly notify) or section 95A(2) applies.

The effects of the activities will be no more than minor, the applicants do not request public notification and there are no rules or NES' which require the public notification of the application. In addition, there are no special circumstances relating to the application. As such, notification of the application is not necessary.

Clause 6(1)(f) of Schedule 4 of the RMA requires the identification of, and any consultation undertaken with, persons affected by the activity. Given that there are no other legal water takes on either the Albert Burn or Schoolhouse Creek other than those held by the applicant, and considering that the applicant owns or manages most of the land encompassing these two catchments, it is reasonable to conclude that no persons will be adversely affected by the proposal (per Section 6 below). The applicant's takes from the Clutha River would not be considered a significant volume (273 L/s combined), and are not likely to adversely affect anyone.

F&G may have some interest in the proposal, given the temporary connectivity between the Albert Burn and Schoolhouse Creek and the Clutha River outside of summer. The identification of brown trout in both creeks suggests that they may provide trout spawning and rearing habitat, however it is unlikely that the applicant's water take activities would adversely impact sportfish on account of both creeks naturally running dry during the summer months. An appropriate visual connection residual flow condition on the Albert Burn replacement permit, along with suitable fish screening on all takes, may be sufficient to satisfy F&G concerns, and it can be argued that the presence of galaxia in the Schoolhouse catchment and the potential presence of galaxia in the Albert Burn supersedes any concerns that F&G might have.

DoC will likely also be considered an affected party, considering the presence of Clutha flathead galaxias in the upper reaches of Schoolhouse Creek. It should be noted that only one fish survey was undertaken downstream of the applicant's point of take on Schoolhouse Creek, and no species were identified at this location. It can therefore be assumed that the reach of concern is upstream of the abstraction point. Consultation has been initiated with DoC (Trudy Anderson), and while they are generally happy with the proposal they have asked the applicant to provide additional ecological data relating to the Albert Burn take. As such, additional ecological work is scheduled for October/November 2019 to supplement the data already on hand.

Aukaha may also be considered an affected party to the proposal, as representatives of iwi's interests in surface water abstractions.

The owner of the property on which the applicant's Clutha River intakes (and part of the associated pump shed) is unknown, however this is likely either fixed marginal strip land (managed by DoC and established under s24(3) of the Conservation Act) or Crown land managed by Land Information New Zealand (see below figure). Given the location and the nature of the parcel in question, it is probable that this is DoC-managed land, and as such written approval and/or easements from this authority for the intake structures may be required. Note that the Albert Burn intake is also located within fixed marginal strip centred on the watercourse.

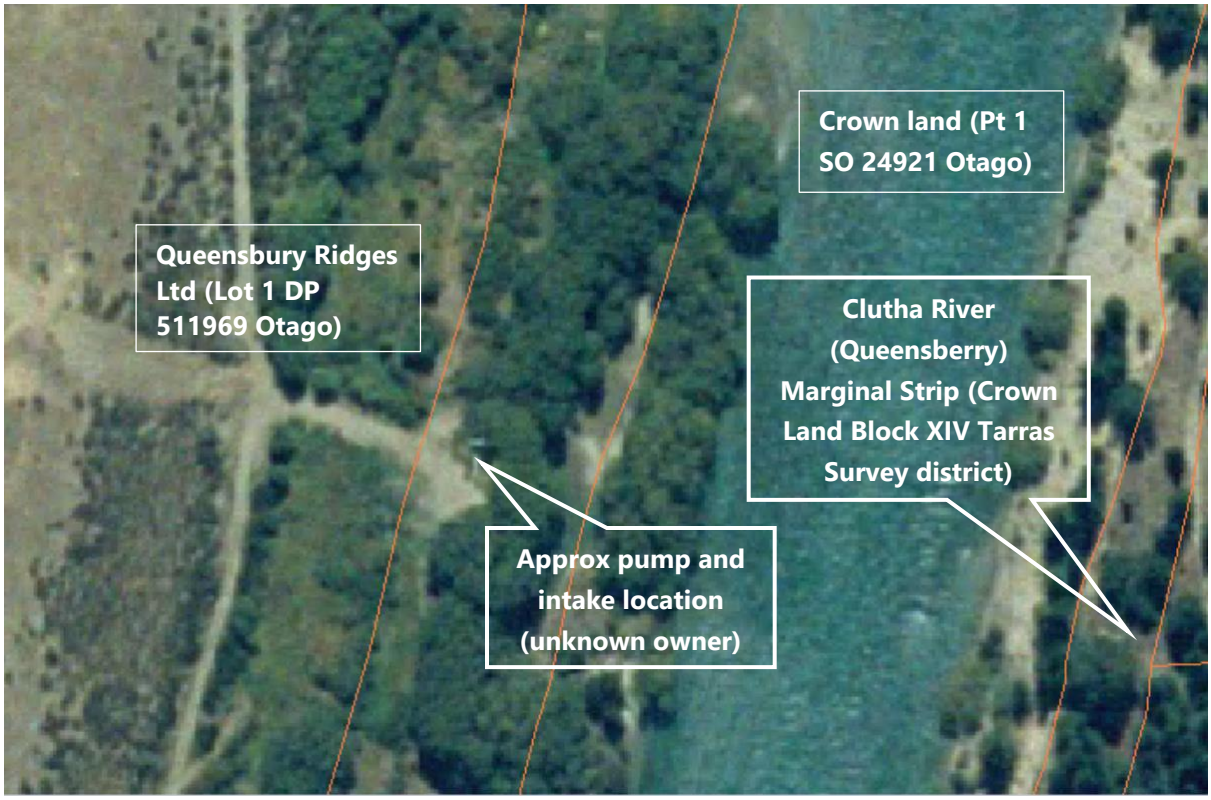


Figure 29: Property details in the vicinity of the applicant's Clutha River intake structures

6. ASSESSMENT OF ENVIRONMENTAL EFFECTS

In addition to the application being made in the prescribed forms and manner, Section 88 of the RMA also requires that every application for consent includes an assessment of the effects of the activity on the environment as set-out in Schedule 4 of the RMA.

6.1 Assessment of Alternatives

Alternative sources of water within the study area include the Clutha River and groundwater, both of which are already being utilised by the applicant. At present, the applicant is authorised to take up to 273 L/s from the Clutha River and up to 150 L/s groundwater from two bores within the command area. In order to fully replace surface water takes from both the Albert Burn and Schoolhouse Creek, the applicant would need to invest large sums of money into:

- Drilling new bores;
- Developing new production wells;
- Obtaining new groundwater consent;
- Overhauling or upgrading the existing intake structure on the Clutha River;
- Increasing the size of the tank farm for storage; and
- Increasing the size and frequency of pumping from the Clutha up to the tank farm: a distance of close to 2 km and an elevation gain of almost 100 metres.

In contrast, the existing water takes from the Albert Burn and Schoolhouse Creek are long-established and considerable investment has already been made implementing, maintaining and upgrading these

abstractions and associated infrastructure over the years. These represent the most practical means of taking water for the command area, given that they are above the irrigable areas and so can be gravity fed to where water is needed without pumping or electrical requirements.

6.2 Effects on stream ecology and hydrology

6.2.1 Albert Burn

As discussed in Section 3.1.1, there has been a notable lack of fish surveys undertaken in the Albert Burn. Of the two surveys undertaken in the creek, one found no fish and the other found a rare incidence of brown trout. Another survey undertaken in Alfern Creek, which drains into the Albert Burn, reported that brown trout were abundant in the creek. It is fair to assume, then, that the Albert Burn provides some habitat for brown trout, however it would not be considered a significant fishery based on the fact that it naturally dries up each summer and the relatively low flows.

Nonetheless, the Albert Burn may provide spawning and rearing habitat for both brown and rainbow trout, suggesting that any water takes early in the irrigation season from the Burn have the potential to adversely impact sportfish. A residual flow condition that requires the applicant to maintain a visual connection between the Albert Burn and the Clutha River in the early irrigation season (September-November) should ensure that spawning trout are given plenty of time to out-migrate to the Clutha River. Juvenile trout would be able to subsist in the reaches above the point of take, as prior surveys suggest may have been taking place. There is already a fish screen on the intake point below the weir, as shown in the below figure.

The applicant has recently fenced off the Albert Burn intake and weir to prevent livestock access, and plans to establish native plantings to improve water quality and enhance native fish habitat.

Figure 30: Albert Burn intake point behind fine-mesh screen (June, 2019)

Without a continuous flow metering record, it is difficult to determine how the applicant's water take activities have and continue to impact the hydrology of the Albert Burn. However, as the applicant doesn't take all of the flow from the Albert Burn, it is assumed that the creek retains its natural variability and therefore it's hydrological character.

6.2.2 Schoolhouse Creek

Unlike the Albert Burn, there is a wealth of knowledge regarding aquatic ecology in the upper reaches of Schoolhouse Creek. Successive surveys between 1995 and 2010 have confirmed the presence of endangered Clutha flathead galaxia, along with brown trout. As the below figure shows, only two fish surveys have taken place below the applicant's abstraction point, and both did not identify any fish present.

Figure 31: Schoolhouse Creek fish surveys (points may denote multiple surveys at the same location) (Source: NZFFD, 2019)

Given the highly modified nature of Schoolhouse Creek below SH6, and considering that the creek goes to ground each summer, the creek is arguably more critical as habitat for Clutha flathead galaxiids than it is for sportfish, particularly given the threatened status of the former. Furthermore, surveys seem to indicate that the most suitable galaxiid habitat is upstream of the point of take, and it is therefore unlikely that the applicant's abstraction activities would have any adverse impact on upstream habitat. In fact, the abstraction may help to protect native fish by isolating the upper reaches of the creek from the Clutha River earlier in the season.

To avoid ingress of fish into the Schoolhouse water race, the applicant proposes to install a suitably designed fish screen once consent has been granted and a replacement intake and metering system are installed (see proposed consent conditions below).

With regards to hydrology, monthly flow gauging of the Schoolhouse Creek race between December and April 2018 shows that the race is only able to carry a maximum of approximately 32 L/s, with flows across the 5 months averaging approximately 18 L/s. Furthermore, the race intake essentially acts as a small diversion channel from the creek, leaving most of the flow in the creek itself and hence maintaining the natural hydrological cycles of the creek.

6.2.3 Clutha River

As discussed earlier, the Clutha River in the vicinity of the applicant's abstraction point provides habitat for a range of native fish and exotic sportfish. Due to considerable flows in the river year-round, it is unlikely that the abstraction of up to 273 L/s (0.2% of the Clutha River MALF below the Cardrona River

confluence) will have any noticeable effect on fish or aquatic ecology in general. The same is true for the hydrology of the river.

The applicant's pump intakes on the Clutha River all feature fish screens to prevent the ingress of small fish.

6.3 Residual flow

Policy 6.4.7 of the RPW states:

> *The need to maintain a residual flow at the point of take will be considered with respect to any take of water, in order to provide for the aquatic ecosystem and natural character of the source water body.*

When considering a residual flow, the importance of both the Albert Burn and Schoolhouse Creek as habitat for the Nationally Critical Clutha flathead galaxiid needs to be given due consideration. The water take on Schoolhouse Creek is located below confirmed habitat for Clutha flathead, and it is assumed that the same is true for the Albert Burn (while this species has not been found here, there is a strong likelihood that they are present). Currently, these takes essentially help to isolate Clutha flathead populations by lowering downstream water levels and causing the creeks to go-to-ground sooner than they might naturally – thereby cutting the upper reaches of the creeks off from the Clutha River.

This loss of connectivity is thought to typically occur after spawning season for brown and rainbow trout (April-October/November[1]), and any effects of the water takes on sportfish migrations would therefore be minimal. Conversely, the isolation of the upper creek reaches would likely provide considerable benefit to Clutha flathead populations, helping to reduce the number of predatory sportfish pushing up into their habitat. It should be noted that the spread of trout, which eat galaxiids, is the key cause of the decline of this native species.

For this reason, it can be argued that maintaining a residual flow past the Schoolhouse Creek take would not provide any significant value, and in fact would run the risk of compromising endangered galaxiid populations. Not imposing a residual flow on Schoolhouse Creek could also be considered to be more in line with Schedule 1A values, which identify the creek as significant habitat for Clutha flathead.

While the Albert Burn is likely also viable habitat for Clutha flathead, the applicant also recognises the importance of maintaining natural connectivity between the upper reaches of the Burn and the Clutha River during the wetter months, particularly as spawning habitat for brown trout. For this reason, it is proposed that a visual surface water connection between the Albert Burn and the Clutha River be maintained up until mid-November, to ensure any spawning trout can out-migrate before the Burn naturally dries up. Due to the nature of the underlying gravels in the lower reaches of the Albert Burn, a significant in-channel flow is needed to maintain that connection, therefore a simple visual residual flow condition is considered sufficient to maintain fish passage during the spawning period.

Given that the applicant's Clutha River takes represent less than 0.2% of the Clutha MALF, it is not considered necessary to impose a residual flow restriction on those takes.

[1] Based on conversations with Fish & Game and MPI Freshwater Fish Spawning and Migration Periods (2015). Note that research produced by MPI shows that the spawning season for brown and rainbow trout in Otago typically only extends from March to September.

6.4 Effects on other water users

As discussed earlier, there are no other known water users on the Albert Burn or Schoolhouse Creek. The Clutha River supports many water users along its length, but as the applicant's takes on this stretch of the river represent such a tiny fraction of flows, there are no known effects on these users due to the activity. In addition, the Clutha River takes are located on a small branch of the Clutha River that is accessible only by boat, and the scale and position of the intakes are unlikely to compromise the ability of recreational boaters or fishers to enjoy the river.

Given the small size, steep topography and inaccessibility of the Albert Burn and Schoolhouse Creek, it is unlikely that there will be any adverse effects on recreational users of these watercourses due to the proposal.

6.5 Available water allocation

Policy 6.4.2 of the RPW defines the primary allocation limit for each catchment:

> *To define the primary allocation limit for each catchment, from which surface water takes and connected groundwater takes may be granted, as the greater of:*
>
> *(a) That specified in Schedule 2A, but where no limit is specified in Schedule 2A, 50% of the 7-day mean annual low flow; or*
>
> *(b)* ***The sum of consented maximum instantaneous, or consented 7-day, takes of:***
>
> *(i)* ***Surface water as at:***
>
> *(1) 19 February 2005 in the Welcome Creek catchment; or*
>
> *(2) 7 July 2000 in the Waianakarua catchment; or*
>
> *(3)* ***28 February 1998 in any other catchment****; and*
>
> *(ii) Connected groundwater as at 10 April 2010,*
>
> *less any quantity in a consent where:*
>
> *(1) In a catchment in Schedule 2A, the consent has a minimum flow that was set higher than that required by Schedule 2A.*
>
> *(2) All of the water taken is immediately returned to the source water body.*
>
> *(3) All of the water being taken had been delivered to the source water body for the purpose of that subsequent take.*
>
> *(4) The consent has been surrendered or has expired (except for the quantity granted to the existing consent holder in a new consent).*
>
> *(5) The consent has been cancelled (except where the quantity has been transferred to a new consent under Section 136(5)).*
>
> *(6) The consent has lapsed.*

This proposal seeks to take water from the Albert Burn and Schoolhouse Creek that is within the allocation limit as defined by Policy 6.4.2(b)(i)(3), as no more water than was consented at 28 February 1998 is being sought for deemed permits 2002.348, 2002.349, 2002.351, 2002.352 and 2002.354. In fact, the amount of water being sought as replacement to these permits is significantly lower than the current paper allocation.

There are currently no allocation restrictions on takes from the Clutha River, and the applicant is not seeking more water than is currently consented as part of the proposal.

6.6 Efficiency of Use

An assessment of reasonable irrigation demand has been undertaken for the total command area of the scheme in accordance with Aqualinc 2017[2] guidelines, which involved determining soil types within the irrigated areas of the properties via Landcare Research's S-Map[3] online tool. The soil types encompassed within the command area are presented in Figure 2 of this report, a larger copy of which is provided in Appendix A. Aqualinc was then used in conjunction with ORC mean annual rainfall (MAR) data to determine the peak daily, monthly and annual irrigation demand.

Table 4 provides a summary of the Aqualinc outputs, with full calculations and explanations presented in Appendix D.

Table 5: Aqualinc modelled application requirements for existing and future irrigated areas of Queensbury Ridges Ltd, compared to total existing paper allocation from the Albert Burn, Schoolhouse Creek and the Clutha River

Volume	Daily (m^3)	Monthly (m^3)	Annual (m^3)
Required (per Aqualinc calcs)	24,027	606,973	3,337,953 (100% ile)
Current total paper allocation	48,929	N/A	N/A
Frost-fighting requirements[4]	12,000[5]	84,000	114,000
Stock drinking requirements	511	15,545	144,977
Baseflow required outside irrigation season	-	-	78,840
Volume sought	**35,037**	**696,015**	**3,648,348**

Aqualinc irrigation volumes are based on 3 primary land uses within the QRL command area: pasture, which comprises the largest land use, viticulture, and cherries. While the total QRL command area equates to approximately 963 ha, much of this is serviced by groundwater takes, with the remaining 393 ha supplied water from the Albert Burn, Schoolhouse Creek, and the Clutha River.

At present, the Schoolhouse Creek take primarily provides water for stock management (primarily stock drinking) while the Albert Burn and Clutha River takes provide the lion's share for irrigation. Going forward, however, the applicant has plans to increase the irrigable area to the southwest of the command area, and it is most practical to use Schoolhouse Creek water to do this. In addition, the applicant plans to source water for the Old Pivot (between Schoolhouse Creek and the Albert Burn) from their Schoolhouse Creek take.

The longest Aqualinc irrigation season relates to pasture (approx. 172 days – from around October to April), however water is required year-round to provide drinking water for 6480 sheep, 507 beef cattle and 3820 dairy cows (see Appendix D), along with a nominal baseflow of 5 L/s left in the Schoolhouse Creek race outside of the irrigation season to prevent the race channel from drying out and cracking.

[2] McIndoe I, Brown P, Rajanayaka C, KC. B, 2017. Guidelines for Reasonable Irrigation Water Requirements in the Otago Region. Otago Regional Council, 2. Aqualinc Research Limited.

[3] https://smap.landcareresearch.co.nz/app

[4] Based on ORC-recommended Bay of Plenty guidelines, which recommend a max application of 30 m^3/ha for a max of 10 hours per frost event, considering 40 hectares total of vineyard and cherries within the scheme command area. A breakdown of historic frost event averages for the region is provided in Section 3.2.

[5] It is assumed that no irrigation water is required during frost-fighting events, therefore irrigation requirements of frost-fighting zones has been removed from the daily, monthly and annual volumes.

Additional water for frost fighting of approx. 40 ha of vineyard and cherries has also been sought, with details relating to these calculations provided in Appendix D.

With regards to current paper allocation, of the 7 surface water permits held by the applicant, 6 do not specify monthly or annual limits while one (2003.591) specifies 492,480 m^3/month and 2,547,000 m^3/year alone. Using the daily maxima provided on all 7 permits, annual paper allocation would be assumed to exceed 7.5 million m^3. Thus the monthly and annual volumes sought will see a dramatic reduction in allocated water within the catchments.

Note that a daily volume has been provided in the above table for information purposes only; a daily volumetric limit is not being sought by the applicant.

6.7 Effects on groundwater resources

There are no designated aquifers within the study area, with the closest nearby designated aquifer being the Lindis Alluvial Ribbon Aquifer, located approximately 4.5 km to the southeast of the Albert Burn take, 3.8 km to the southeast of the Schoolhouse Creek take, and 3.5 km to the south of the Clutha River takes. The distance of the Albert Burn and Schoolhouse Creek takes from this aquifer is such that no effects are likely from the activity, while the Clutha River takes are so minor when compared to Clutha River flows that they are unlikely to significantly impact the state of the Lindis aquifer.

The closest neighbouring bores to the respective takes are as follows:

- Schoolhouse Creek take: closest active groundwater take estimated at 2.4 km away (2004.317)
- Albert Burn take: closest active groundwater take estimated at 2.5 km away (2004.317)
- Clutha River takes: closest active groundwater take estimated at 800 m away (2004.317). Note that this bore is located on the opposite side of the Clutha River.

None of the proposed takes are likely to affect any neighbouring bores, primarily due to their lack of proximity, but also due to the fact that any aquifers in the area are likely recharged by the Clutha River. As discussed above, the applicant's relatively low rate of take from the Clutha is unlikely to impact nearby bores.

No adverse effects on underlying groundwater resources, such as aquifer compaction or degraded groundwater quality, are expected as a result of the proposal.

6.8 Cultural values

The watercourses are within the Statutory Acknowledgement Area of Te Wairere (Lake Dunstan) under the Ngai Tahu Claims Settlement Act 1998. Cultural values are considered later in this document.

6.9 Monitoring

The Albert Burn and Clutha River takes will continue to be metered as per the current arrangement, while the applicant will install an ORC-approved telemeter on the Schoolhouse Creek take prior to exercise of the replacement permit. All take data will be provided to ORC within the required frequency.

6.10 Effects relating to proposed supplementary rate of take (Albert Burn)

As discussed in Section 2.24, the applicant proposes to upgrade their Albert Burn intake pipes to allow for a greater volume of water to be taken (150 L/s) than what has previously been possible (≤103 L/s).

As such, the applicant proposes a supplementary rate of take from the Albert Burn of up to 150 L/s, which would require the installation of a water meter at or upstream of the point of take to determine naturalised flows. This may present environmental impacts to the creek and wider catchment that have not been encompassed within the above AEE, which is based on the abstraction status quo. As such, an additional assessment of effects as it relates to the proposed supplementary take of up to 150 L/s is provided below.

6.10.1 Effects on stream ecology and hydrology

Taking an additional ~50 L/s from the Albert Burn would likely only have minor effects on the ecology of the creek, due to the fact that this would generally only be during the spring snowmelt or rainfall events. During these events, up-stream fish passage would likely be difficult due to the higher velocities. Furthermore, as proposed in Sections 6.3 and 6.12, a visual residual flow condition would apply up until mid-November, ensuring connectivity between the Clutha River and the upper reaches of the Albert Burn and allowing any up-migrations of sportfish to occur.

No additional effects on native fish (if present) are anticipated as it is assumed that any native fish that may be present would be upstream of the abstraction point.

Some effects to the downstream hydrology of the Albert Burn would be possible due to the greater rate of take, however it should again be noted that this would likely only occur during shorter duration rainfall or snowmelt events, and the 150 L/s cap would ensure that the natural hydrograph of the creek would remain largely unchanged.

6.10.2 Effects on other water users

As discussed earlier, there are no other water users on the Albert Burn, and the catchment is largely unsuitable for recreation.

6.10.3 Available water allocation

The Albert Burn is not subject to either Schedule 2A or 2B of the RPW, meaning as long as the mean flow or 50% of the natural flow at the point of take is maintained, supplementary allocation is available. It is worth noting that if the applicant had upgraded their Albert Burn intake infrastructure prior to submitting this application, their maximum historic rate of take would have been closer to 150 L/s, the replacement of which would still have been in accordance with Policy 6.4.2(b)(i)(3), as no more water than was consented on 28 February 1998 would have been sought.

6.10.4 Efficiency of use

No additional monthly or annual water is being sought above what has been calculated to be efficient in Section 6.6.

6.11 Positive effects

As discussed in other sections of this document, the positive effects of the activity are numerous, and include:

- Ongoing operation of an extensive and productive sheep and beef farm that contributes to both the local and regional economy. Much of this operation would not be possible without a secure source of water.

- Ongoing operation of various smaller but equally productive land uses, including viticulture, horticulture, and bee keeping. Viticulture and horticulture in particular would be virtually impossible without this water.

- In the case of the Albert Burn and Schoolhouse Creek takes – diminished energy consumption. Because the water take systems and irrigations systems from these sources are gravity fed, energy consumption can be kept to a minimum. This places less pressure on the national grid, and ensures the operation is more sustainable.

- Much of the applicant's property above the State Highway is given over to low-density sheep grazing, a practice that tends to be far less destructive to native and aquatic habitats than many other land uses. The Schoolhouse Creek catchment, for example, supports healthy stands of kanuka that might not persist when subjected to other land uses. In turn, this kanuka and other native vegetation provides a riparian buffer for Schoolhouse Creek and its tributaries, thereby supporting local Clutha flathead galaxiid populations.

The applicant has also indicated that they are willing to enter into discussions around further protection of galaxiid habitat in the upper Schoolhouse Creek, which would be a very positive step in helping to preserve one of New Zealand's most endangered species.

6.12 Proposed consent conditions

The following consent conditions are proposed to ensure that any potential adverse effects from the activity are appropriately managed:

Albert Burn replacement permit

- Purpose: to take water as primary and supplementary allocation from the Albert Burn for irrigation, frost fighting and stock drinking.

- Location: Albert Burn, approximately 800 metres upstream of the Luggate-Cromwell Road, State Highway 6.

- Legal description of land at point of take: Section 1 SO 300501

- Map reference: NZTM2000 1308734E 5028107N

- This permit shall not commence until Deemed Permits 2002.348, 2002.349, 2002.351 and 2002.352 have expired or been surrendered.

- The primary rate of take shall not exceed 103 L/s.

- The supplementary rate of take shall not exceed 150 L/s.

- The supplementary rate of take shall only occur when the naturalised flow exceeds 224 L/s at the point of take and will not cause the flow in the stream to fall below this level. Prior to the exercise of any supplementary takes, the consent holder shall install a water meter at or immediately above the point of take to accurately determine naturalised flows. This meter shall be installed as per Condition (**below water meter condition**), with water take data provided to the Consent Authority as per the same condition.

- The combined volume of water taken under this consent, [replacement to permit 2002.354] and [replacement to permits 2002.353, 2003.591] shall not exceed:
    - 696,015 m^3/month
    - 3,648,348 m^3/year
- The consent holder shall ensure that a visual surface water connection is maintained in the Albert Burn from immediately below the point of take to the Clutha River from April 1 through to November 15.
- The consent holder shall continue to maintain the intake grate/fish screen on the weir to prevent the ingress of fish.
- The consent holder shall maintain a water meter to record the water take, at or close to the point of take, within an error accuracy of +/- 5% over the meter's nominal flow range, and a telemetry compatible datalogger with at least 24 months data storage and a telemetry unit to record the rate and volume of take, and the date and time this water was taken. The datalogger shall record the date, time and flow in L/s. Data shall be provided to the Consent Authority by means of telemetry. The consent holder shall ensure data compatibility with the Consent Authority's time-series database. The water meter shall be installed according to the manufacturer's specifications and instructions. There shall be enough space in the pipe/flume to allow for verification of the accuracy of the meter under Condition (X).
- The Consent Holder shall ensure the full operation of the water meter, data logger and telemetry unit at all times during the exercise of this consent. All malfunctions of the water meter and/or datalogger during the exercise of this consent shall be reported to the Consent Authority within 5 working days of observation and appropriate repairs shall be performed within 5 working days. Once the malfunction has been remedied, a Water Measuring Device Verification Form completed with photographic evidence must be submitted to the Consent Authority within 5 working days of the completion of repairs.
- If a mechanical insert water meter is installed it shall be verified for accuracy each and every year from the first exercise of this consent. An electromagnetic or ultrasonic flow meter shall be verified for accuracy every 5 years from the first exercise of this consent. Each verification shall be undertaken by a Consent Authority approved operator and a Water Measuring Device Verification Form shall be provided to the Consent Authority within 5 days of the verification being performed, and at any time upon request.
- The consent holder shall take all practicable steps to ensure that:
    - There is no leakage from pipes and structures;
    - The use of water is confined to the target areas;
    - There is no runoff of irrigation water in irrigated areas either on site or off site.
- The Consent Authority may, in accordance with Sections 128 and 129 of the RMA 1991, serve notice on the consent holder of its intention to review the conditions of this consent within 3 months of each anniversary of the commencement of this consent for the purpose of:
    - Adjusting the consented rate or volume of water under Conditions X and X, should monitoring under Condition X or future changes in water use indicate that the consented rate or volume is not able to be fully utilised; or

- Determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or
- Ensuring the conditions of this consent are consistent with any NES, relevant plans and/or the Otago RPS; or
- Adjusting or altering the method of water take data recording and transmission.

Note that to streamline consent compliance and monitoring, the applicant proposes to merge all of the Albert Burn permits into one water permit. Also note that the proposed map reference is different to those entered on the existing permits, however this new reference reflects the actual ground-truthed take location.

Schoolhouse Creek replacement permit

- Purpose: to take water as primary allocation from Schoolhouse Creek for irrigation and stock drinking purposes.
- Location: Schoolhouse Creek, approximately 550 metres upstream of the Luggate-Cromwell Road, State Highway 6.
- Legal description of land at point of take: Section 1 SO 300501
- Map reference: NZTM2000 1308644E 5027281N
- This permit shall not commence until Deemed Permit 2002.354 has expired or been surrendered.
- The rate of take shall not exceed 31.5 L/s.
- The combined volume of water taken under this consent, [replacement to permits 2002.348, 2002.349, 2002.351, 2002.352] and [replacement to permits 2002.353, 2003.591] shall not exceed:
    - 696,015 m^3/month
    - 3,648,348 m^3/year
- Prior to first exercise of this consent, the consent holder shall install a fish screen on, or just down-race of, the intake to prevent the ingress of fish.
- The consent holder shall maintain a water meter to record the water take, at or close to the point of take, within an error accuracy of +/- 5% over the meter's nominal flow range, and a telemetry compatible datalogger with at least 24 months data storage and a telemetry unit to record the rate and volume of take, and the date and time this water was taken. The datalogger shall record the date, time and flow in L/s. Data shall be provided to the Consent Authority by means of telemetry. The consent holder shall ensure data compatibility with the Consent Authority's time-series database. The water meter shall be installed according to the manufacturer's specifications and instructions. There shall be enough space in the pipe/flume to allow for verification of the accuracy of the meter under Condition (X).

- The Consent Holder shall ensure the full operation of the water meter, data logger and telemetry unit at all times during the exercise of this consent. All malfunctions of the water meter and/or datalogger during the exercise of this consent shall be reported to the Consent Authority within 5 working days of observation and appropriate repairs shall be performed within 5 working days. Once the malfunction has been remedied, a Water Measuring Device Verification Form completed with photographic evidence must be submitted to the Consent Authority within 5 working days of the completion of repairs.

- If a mechanical insert water meter is installed it shall be verified for accuracy each and every year from the first exercise of this consent. An electromagnetic or ultrasonic flow meter shall be verified for accuracy every 5 years from the first exercise of this consent. Each verification shall be undertaken by a Consent Authority approved operator and a Water Measuring Device Verification Form shall be provided to the Consent Authority within 5 days of the verification being performed, and at any time upon request.

- The consent holder shall take all practicable steps to ensure that:
    - There is no leakage from pipes and structures;
    - The use of water is confined to the target areas;
    - There is no runoff of irrigation water in irrigated areas either on site or off site.

- The Consent Authority may, in accordance with Sections 128 and 129 of the RMA 1991, serve notice on the consent holder of its intention to review the conditions of this consent within 3 months of each anniversary of the commencement of this consent for the purpose of:
    - Adjusting the consented rate or volume of water under Conditions X and X, should monitoring under Condition X or future changes in water use indicate that the consented rate or volume is not able to be fully utilised; or
    - Determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or
    - Ensuring the conditions of this consent are consistent with any NES, relevant plans and/or the Otago RPS; or
    - Adjusting or altering the method of water take data recording and transmission.

Clutha River replacement permit

- Purpose: to take water as primary allocation from the Clutha River for irrigation, frost fighting and stock drinking.

- Location: Clutha River, approximately 400 metres upstream of the Albert Burn confluence.

- Legal description of land at point of take: [unknown – formerly marginal strip, however this appears to have changed in recent years. No data available.]

- Map reference: NZTM2000 1310827E 5027786N

- This permit shall not commence until Deemed Permit 2002.353 and Water Permit 2003.591 have expired or been surrendered.

- The rate of take shall not exceed 273 L/s.

- The combined volume of water taken under this consent, [replacement to permits 2002.348, 2002.349, 2002.351, 2002.352] and [replacement to permit 2002.354] shall not exceed:
    - 696,015 m^3/month
    - 3,648,348 m^3/year
- The consent holder shall continue to maintain fish screens on the pump intakes to prevent the ingress of fish.
- The consent holder shall maintain a water meter to record the water take, at or close to the point of take, within an error accuracy of +/- 5% over the meter's nominal flow range, and a telemetry compatible datalogger with at least 24 months data storage and a telemetry unit to record the rate and volume of take, and the date and time this water was taken. The datalogger shall record the date, time and flow in L/s. Data shall be provided to the Consent Authority by means of telemetry. The consent holder shall ensure data compatibility with the Consent Authority's time-series database. The water meter shall be installed according to the manufacturer's specifications and instructions. There shall be enough space in the pipe/flume to allow for verification of the accuracy of the meter under Condition (X).
- The Consent Holder shall ensure the full operation of the water meter, data logger and telemetry unit at all times during the exercise of this consent. All malfunctions of the water meter and/or datalogger during the exercise of this consent shall be reported to the Consent Authority within 5 working days of observation and appropriate repairs shall be performed within 5 working days. Once the malfunction has been remedied, a Water Measuring Device Verification Form completed with photographic evidence must be submitted to the Consent Authority within 5 working days of the completion of repairs.
- If a mechanical insert water meter is installed it shall be verified for accuracy each and every year from the first exercise of this consent. An electromagnetic or ultrasonic flow meter shall be verified for accuracy every 5 years from the first exercise of this consent. Each verification shall be undertaken by a Consent Authority approved operator and a Water Measuring Device Verification Form shall be provided to the Consent Authority within 5 days of the verification being performed, and at any time upon request.
- The consent holder shall take all practicable steps to ensure that:
    - There is no leakage from pipes and structures;
    - The use of water is confined to the target areas;
    - There is no runoff of irrigation water in irrigated areas either on site or off site.
- The Consent Authority may, in accordance with Sections 128 and 129 of the RMA 1991, serve notice on the consent holder of its intention to review the conditions of this consent within 3 months of each anniversary of the commencement of this consent for the purpose of:
    - Adjusting the consented rate or volume of water under Conditions X and X, should monitoring under Condition X or future changes in water use indicate that the consented rate or volume is not able to be fully utilised; or
    - Determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or

- Ensuring the conditions of this consent are consistent with any NES, relevant plans and/or the Otago RPS; or
- Adjusting or altering the method of water take data recording and transmission.

7. STATUTORY CONSIDERATIONS

Schedule 4 of the RMA requires that an assessment of the activity against the matters set out in Part 2 and any relevant provisions of a document referred to in Section 104 of the RMA is provided when applying for a resource consent for any activity. These matters are assessed as follows.

7.1 Part 2 of the RMA

The proposal is consistent with the purpose and principles of the RMA. The proposal will have a less than minor effect on the ability of the three watercourses to meet the reasonably foreseeable needs of future generations, or on the life-supporting capacity of the watercourses and any ecosystems associated with them. The proposal ensures that adverse effects on the environment are avoided, remedied or mitigated.

There are no matters of national importance under Section 6 of the RMA that will be affected by the proposal. The proposal is also consistent with the requirements of Section 7 of the RMA, with particular regard given to the efficient use of natural resources, intrinsic values of ecosystems, and the maintenance and enhancement of the quality of the environment. Regarding Section 8, the proposed activity is not inconsistent with the principles of the Treaty of Waitangi.

Overall, the activity is considered to be consistent with Part 2 of the RMA, given the minor nature of the activities and the proposed mitigation.

7.2 Section 104(1)(b) of the RMA

In accordance with Schedule 4 of the RMA, an assessment of the activity against the relevant provisions of a document referred to in 104(1)(b) of the RMA must be included in an application for resource consent. Documentation in this section are noted as being:

(i) National Policy Statement for Freshwater Management, 2014
(ii) Resource Management (Measurement and Reporting of Water Takes) Regulations, 2010
(iii) Kāi Tahu ki Otago Natural Resource Management Plan, 2005
(iv) Partially Operative Regional Policy Statement for Otago, 2019
(v) Partially Operative Regional Policy Statement for Otago, 1998
(vi) Proposed Regional Policy Statement for Otago, 2015
(vii) Regional Plan: Water for Otago, 2004

Under the RMA, regional plans need to give effect to NPSs, NESs and RPSs. For an application of this scale, an assessment of the application against the regional plans is adequate as these plans ultimately give effect to the higher order statutory instruments. In 2015, however, ORC released the Proposed Regional Policy Statement for Otago and have subsequently released the Partially Operative Regional Policy Statement for Otago earlier this year. As the RPW does not reflect these latest versions of the RPS, consideration of these two documents has been considered below.

Additionally, for the sake of completeness, the national policy statement and Resource Management (Measurement and Reporting of Water Takes) Regulations have also been considered below.

7.2.1 National Policy Statement for Freshwater Management

The National Policy Statement for Freshwater Management 2014 (NPSFM) sets objectives and policies for the management of freshwater quality and quantity, emphasising the need for safeguarding of the values of freshwater, avoiding over-allocation, improving efficiency and providing reasonable opportunity for Iwi and hapū involvement in overall freshwater management including planning and decision-making. The following policies, which give effect to the NPS's objectives, are of most relevance to this application for resource consent.

Policy B5
By every regional council ensuring that no decision will likely result in future over-allocation – including managing fresh water so that the aggregate of all amounts of fresh water in a freshwater management unit that are authorised to be taken, used, dammed or diverted does not over-allocate the water in the freshwater management unit.

Policy B6
By every regional council setting a defined timeframe and methods in regional plans by which overallocation must be phased out, including by reviewing water permits and consents to help ensure the total amount of water allocated in the freshwater management unit is reduced to the level set to give effect to Policy B1.

Policy B8
By every regional council considering, when giving effect to this national policy statement, how to enable communities to provide for their economic well-being, including productive economic opportunities, while managing within limits.

With regards to Policies B5 and B6, the proposal sees a significant reduction in the current level of allocation for the Albert Burn and Schoolhouse Creek, from an instantaneous, daily, monthly and annual standpoint. The water sought from both creeks is within the allocation limits defined by Policy 6.4.2 of the RPW, while the water sought from the Clutha River is only a small fraction of the MALF and is exempt from RPW Chapter 6 policies.

With regards to Policy B8, the proposal will enable the numerous orchards, vineyards, cheesemakers and farming operations to continue operating at optimum levels. All of these land uses are fundamental aspects of the local and regional economies, and the proposal therefore supports the continued economic well-being of the people who work this land and of the local community in general.

Council considers that the current and proposed policies in the RPS and RPW generally meet the requirements of the NPS. Consideration of these documents in light of the activities proposed is given below.

7.2.2 Resource Management (Measurement and Reporting of Water Takes) Regulations

Section 4(1) of the Regulations states that "These regulations apply only to a water permit that allows fresh water to be taken at a rate of 5 litres/second or more." Because the proposed takes are greater

than 5 L/s, the activity must be in accordance with the Regulations. Specifically, the Regulations require the following:

- That the permit holder "keep records that provide a continuous measurement of the water taken under a water permit, including water taken in excess of what the permit allows." As a minimum, this typically means taking measurements of the volume of water taken each day.
- The water measurement device must be verified as accurate by a suitably qualified person:
    - Before the end of a permit's first water year; and
    - Every 5 years thereafter.
- The permit holder must provide records that cover each water year of the permit to the regional council that granted the permit, no later than 1 month after the end of the water year.
- The regional council that granted a water permit may, at its discretion, grant approval to the permit holder to keep records using a device or system that is installed as near as practicable to the location from which water is taken under the permit (instead of at that location).

The proposal is consistent with the requirements of the Regulations, with the applicant's abstraction record indicating ongoing adherence to the Regulations with no proposed change to this system of water measurement and reporting. An exception to this is the Schoolhouse Creek take, which has not yet had a meter established in accordance with the Regulations. As part of the deemed permit replacement process, however, the applicant proposes to install a meter in line with the Regulations prior to exercise of the new (replacement) permit.

A notice of exemption (WEX) will be required for the Albert Burn takes (200 mm and 300 mm lines) which have meters installed closer to the tank farm at a more practical measuring location, approximately 350 m downstream from the actual point of take.

7.2.3 Partially Operative Regional Policy Statement for Otago

The following policies from the 2019 Partially Operative Regional Policy Statement are relevant to this application. Policies in this version of the plan (January 2019, updated March 2019) that have not yet been made operative have been omitted.

Table 6: Relevant policies from the Partially Operative Regional Policy Statement for Otago, 2019

Policy		Comments
2.2.1	*Manage the natural environment to support Kāi Tahu wellbeing by all of the following:* *a) Recognising and providing for their customary uses and cultural values in Schedules 1A and B; and* *b) Safe-guarding the life-supporting capacity of natural resources.*	The proposal will see a reduction in allocated water from the Albert Burn, thereby significantly improving the life-supporting capacity of this creek. The take from the Clutha River/Mata-Au is relatively minor and therefore unlikely to adversely impact Kāi Tahu values as they relate to this river. Potential future upgrades to Schoolhouse Creek should ensure water is used more efficiently, while the proposed lack of residual flow

		should ensure that native fish values are protected (see Section 6.3). In general, it is envisaged that Kāi Tahu values, as detailed in Schedule 1A, will be protected and potentially enhanced as a result of the proposal. No Schedule 1B sites are located within the study area.
2.2.2	*Recognise and provide for the protection of wāhi tūpuna, by all of the following:* *a) Avoiding significant adverse effects on those values that contribute to the identified wāhi tūpuna being significant;* *b) Avoiding, remedying, or mitigating other adverse effects on the identified wāhi tūpuna;* *c) Managing the identified wāhi tūpuna sites in a culturally appropriate manner.*	Consideration has been given to Schedule 1C sites of cultural significance (wāhi tupuna). No specific wāhi tupuna sites are known within the study area, however all three watercourses (the Clutha/Mata-Au in particular) likely have significance in terms of Wāhi Mahika kai (food and natural material gathering sites), Taumanu (fishing sites) and Wāi māori (important freshwater areas).
3.1.1	*Safeguard the life-supporting capacity of fresh water and manage fresh water to:* *a) Maintain good quality water and enhance water quality where it is degraded, including for:* *i. Important recreation values, including contact recreation; and, ii. Existing drinking and stock water supplies;* *b) Maintain or enhance aquatic:* *i. Ecosystem health;* *ii. Indigenous habitats; and,* *iii. Indigenous species and their migratory patterns.* *c) Avoid aquifer compaction and seawater intrusion;* *d) Maintain or enhance, as far as practicable:* *i. Natural functioning of rivers, lakes, and wetlands, their riparian margins, and aquifers;* *ii. Coastal values supported by fresh water;* *iii. The habitat of trout and salmon unless detrimental to indigenous biological diversity; and* *iv. Amenity and landscape values of rivers, lakes, and wetlands;* *e) Control the adverse effects of pest species, prevent their introduction and reduce their spread;* *f) Avoid, remedy or mitigate the adverse effects of natural hazards, including flooding and erosion; and,* *g) Avoid, remedy or mitigate adverse effects on existing infrastructure that is reliant on fresh water.*	The ecological and hydrological features of the Albert Burn, Schoolhouse Creek and the Clutha River are discussed in Section 3.1, while the potential effects on these features, and subsequent mitigation proposed, are discussed in Sections 6.2 and 6.3, respectively. Water quality is unlikely to be affected by the activities. Kāi Tahu and other cultural values have been assessed above and in Section 7.2.6 of this document. Recreational values are addressed in Section 6.4, aesthetic and landscape values will be unaffected by the proposal, and no flooding, erosion, or other natural hazards will be caused or exacerbated by the activities.

3.1.2	*Manage the beds of rivers, lakes, wetlands, their margins, and riparian vegetation to:* *a) Safeguard the life supporting capacity of fresh water;* *b) Maintain good quality water, or enhance it where it has been degraded;* *c) Maintain or enhance bank stability;* *d)Maintain or enhance ecosystem health and indigenous biological diversity;* *e) Maintain or enhance, as far as practicable:* *i. Their natural functioning and character; and* *ii. Amenity values;* *f) Control the adverse effects of pest species, prevent their introduction and reduce their spread; and,* *g) Avoid, remedy or mitigate the adverse effects of natural hazards, including flooding and erosion.*	See response to 3.1.1 above.
3.1.3	*Manage the allocation and use of fresh water by undertaking all of the following:* *a) Recognising and providing for the social and economic benefits of sustainable water use;* *b) Avoiding over-allocation, and phasing out existing over-allocation, resulting from takes and discharges;* *c) Ensuring the efficient allocation and use of water by:* *i) Requiring that the water allocated does not exceed what is necessary for its efficient use;* *ii) Encouraging the development or upgrade of infrastructure that increases use efficiency;* *iii. Providing for temporary dewatering activities necessary for construction or maintenance.*	An evaluation of efficient water use in relation to the proposal is provided in Section 6.6. As discussed earlier, the applicant intends to upgrade the Schoolhouse Creek infrastructure following granting of replacement consent to improve water use efficiency.
3.1.4	*Manage for water shortage by undertaking all of the following:* *a) Encouraging land management that improves moisture capture, infiltration, and soil moisture holding capacity.* *b) Encouraging collective coordination and rationing of the take and use of water when river flows or aquifer levels are lowering, to avoid breaching any minimum flow or aquifer level restriction to optimise use of water available for taking;* *c) Providing for water harvesting and storage, subject to allocation limits and flow management, to reduce demand on water bodies during periods of low flows.*	An evaluation of efficient water use in relation to the proposal is provided in Section 6.6. As abstractions from all three watercourses operate as an integrated system, water use is coordinated and prioritised to those sources which are more capable of providing water – meaning allocation limits should never be breached. Water harvesting and storage takes place within the command area in the form of a tank farm (in the case of Albert Burn and Clutha River takes) and storage ponds (in the case of Schoolhouse Creek).

3.1.13	*Encourage, facilitate and support activities that contribute to the resilience and enhancement of the natural environment, by one or more of the following where applicable:* *a) Improving water quality and quantity;* *b) Protecting or restoring habitat for indigenous species;* *c) Regenerating indigenous species;* *d) Mitigating natural hazards;* *e) Protecting or restoring wetlands;* *f) Improving the health and resilience of:* *i. Ecosystems supporting indigenous biological diversity;* *ii. Important ecosystem services, including pollination;* *g) Improving access to rivers, lakes, wetlands and their margins, and the coast;* *h) Buffering or linking ecosystems, habitats and areas of significance that contribute to ecological corridors;* *i) Controlling pest species.*	It can be argued that the applicant's take on Schoolhouse Creek is helping to protect an indigenous species (Clutha flathead galaxiid) by preventing the up-migration of predatory sportfish. The applicant has also indicated that they are open to taking additional regenerative steps for this species in Schoolhouse Creek, which may include riparian plantings or fencing where practicable.
4.1.4	*Assess activities for natural hazard risk to people, property and communities, by considering all of the following:* *a) The natural hazard risk identified, including residual risk; and* *b) Any measures to avoid, remedy or mitigate those risks, including relocation and recovery methods; and* *c) The long term viability and affordability of those measures; and* *d) Flow-on effects of the risk to other activities, individuals and communities; and* *e) The availability of, and ability to provide, lifeline utilities, and essential and emergency services, during and after a natural hazard event.*	No known hazard risk is associated with the proposal. The applicant's various storage ponds are not classified as large dams and are not located above any settlements or subdivisions.
4.2.2	*Ensure Otago's people and communities are able to mitigate and adapt to the effects of climate change, over no less than 100 years, by all of the following:* *a) Taking into account the effects of climate change, including by using the best relevant climate change data; and* *b) Applying a precautionary approach when assessing and managing the effects of climate change where there is scientific uncertainty and potentially significant or irreversible effects; and* *c) Encouraging activities that assist to reduce or mitigate the effects of climate* *change; and*	The uncertainty of the effects of climate change are such that providing future water security to the applicant, both in terms of sufficient volume and duration, is critical to the ongoing operation of the various farms, orchards, vineyards and other high-value land uses within the command area.

	d) Encouraging system resilience.	
5.2.1	*Recognise all of the following elements as characteristic or important to Otago's historic heritage:* *a) Residential and commercial buildings;* *b) Māori cultural and heritage values;* *c) 19th and early 20th century pastoral sites;* *d) Early surveying, communications and transport, including roads, bridges and routes;* *e) Early industrial historic heritage, including mills and brickworks;* *f) Gold and other mining systems and settlements;* *g) Dredge and ship wrecks;* *h) Coastal historic heritage, particularly takata whenua occupation sites and those associated with early European activity such as whaling;* *i) Memorials;* *j) Trees and vegetation.*	As the Schoolhouse Creek and Albert Burn deemed permits are based on historic mining privileges and water race licences, they may have some heritage value as remnants of Central Otago's gold mining heritage. This application outlines how the races and infrastructure associated with these heritage values will be managed in the future, with continued operation under the status quo helping to preserve these features.
5.3.1	*Manage activities in rural areas, to support the region's economy and communities, by:* *a) Enabling primary production and other rural activities that support the rural economy; and* *b) Providing for mineral exploration, extraction and processing; and* *c) Minimising the loss of significant soils; and* *d) Restricting the establishment of activities in rural areas that may lead to reverse sensitivity effects; and* *e) Minimising the subdivision of productive rural land into smaller lots that may result in rural residential activities; and* *f) Providing for other activities that have a functional need to locate in rural areas, including tourism and recreational activities that are of a nature and scale compatible with rural activities.*	Replacement of the applicant's deemed and water permits with sufficient instantaneous and volumetric rates of take will ensure the farming and other rural activities that take place within the command area can continue into the future. This will also help to minimise any chance of future subdivision of productive rural land. Water use is already via efficient means within the scheme (k-line, pivot, spray, drip irrigation etc.), meaning the proposal does not pose any risk to soil health.
5.4.3	*Apply a precautionary approach to activities where adverse effects may be uncertain, not able to be determined, or poorly understood but are potentially significant or irreversible.*	Due to reliable historic abstraction records and a long history of use, much of the potential adverse effects associated with the proposal will have been captured within Section 6 of this document. Where information gaps occur, Council has the ability to review consent conditions and adjust methods or approaches to better manage adverse effects.

7.2.4 Proposed Regional Policy Statement for Otago

The following policies from the 2015 Proposed Regional Policy Statement are relevant to this application for consent replacements. Only those policies that have not been directly superseded by operative policies have been included.

Table 7: Relevant policies from the Proposed Regional Policy Statement for Otago, 2015

Policy		Comments
1.1.2	*Ensure that local authorities exercise their functions and powers, to:* *a) Accord Kāi Tahu a status distinct from that of interest groups and members of the public, consistent with their position as a Treaty partner; and,* *b) Involve Kāi Tahu in resource management decision-making processes and implementation; and* *c) Take into account Kāi Tahu views in resource management decision-making processes and implementation, particularly regarding the relationship of their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taoka; and* *d) Ensure Kāi Tahu have the prerogative to:* *i. Identify their relationship with their ancestral lands, water, sites, wāhi tapu, and other taoka; and* *ii. Determine how best to express that relationship; and* *e) Ensure Kāi Tahu are able to exercise kaitiakitaka; and* *f) Ensure that district and regional plans:* *i. Give effect to the Ngāi Tahu Claims Settlement Act 1998; and* *ii. Recognise and provide for statutory acknowledgement areas, as detailed in Schedule 2; and* *iii. Provide for other areas in Otago that are recognised as significant to Kāi Tahu in a manner similar to that prescribed for statutory acknowledgement areas.*	Kāi Tahu have been given due consideration as a stakeholder in Section 5. Applicable provisions of the Kāi Tahu ki Otago Natural Resource Management Plan as they relate to this application have also been considered below.
2.1.1	*Recognise freshwater values, and manage freshwater, to:* *a) Support healthy ecosystems in all Otago aquifers, and rivers, lakes, wetlands, and* *their margins; and* *b) Retain the range and extent of habitats provided by freshwater; and* *c) Protect outstanding water bodies and wetlands; and* *d) Protect migratory patterns of freshwater species, unless detrimental to indigenous biodiversity; and* *e) Avoid aquifer compaction, and seawater intrusion in aquifers; and*	The ecological and hydrological features of the Albert Burn, Schoolhouse Creek and the Clutha River are discussed in Section 3.1, while the potential effects on these features, and subsequent mitigation proposed, are discussed in Sections 6.2 and 6.3, respectively. Water quality is unlikely to be affected by the activities. Kāi Tahu and other cultural values have been assessed above and in Section 7.2.6 of this document. Recreational values are addressed in Section 6.4, aesthetic and landscape values will be

	f) Maintain good water quality, including in the coastal marine area, or enhance it where it has been degraded; and *g) Maintain or enhance coastal values supported by freshwater values; and* *h) Maintain or enhance the natural functioning of rivers, lakes, and wetlands, their riparian margins, and aquifers; and* *i) Retain the quality and reliability of existing drinking water supplies; and* *j) Protect Kāi Tahu values; and* *k) Provide for other cultural values; and* *l) Protect important recreation values; and* *m) Maintain the aesthetic and landscape values of rivers, lakes, and wetlands; and* *n) Avoid the adverse effects of pest species, prevent their introduction and reduce their spread; and* *o) Mitigate the adverse effects of natural hazards, including flooding and erosion; and* *p) Maintain the ability of existing infrastructure to operate within their design parameters.*	unaffected by the proposal, and no flooding, erosion, or other natural hazards will be caused or exacerbated by the activities. Replacement of the applicant's permits will enable them to continue operating their existing infrastructure within their design parameters.
2.1.2	*Recognise the values of beds of rivers and lakes, wetlands, and their margins, and manage them to:* *a) Protect or restore their natural functioning; and* *b) Protect outstanding water bodies and wetlands; and* *c) Maintain good water quality, or enhance it where it has been degraded; and* *d) Maintain ecosystem health and indigenous biodiversity; and* *e) Retain the range and extent of habitats supported; and* *f) Maintain or enhance natural character; and* *g) Protect Kāi Tahu values; and* *h) Provide for other cultural values; and* *i) Maintain their aesthetic and amenity values; and* *j) Avoid the adverse effects of pest species, prevent their introduction and reduce their spread; and* *k) Mitigate the adverse effects of natural hazards, including flooding and erosion; and* *l) Maintain bank stability.*	Much of this policy is also reflected in Policy 2.1.1, which is discussed above.
2.1.6	*Recognise the values of ecosystems and indigenous biodiversity, and manage ecosystems and indigenous biodiversity, to:*	The ecosystem values of the Albert Burn, Schoolhouse Creek and Clutha River are discussed in Section 3.1, while the potential

	a) Maintain or enhance ecosystem health and indigenous biodiversity; and *b) Maintain or enhance areas of predominantly indigenous vegetation; and* *c) Buffer or link existing ecosystems; and* *d) Protect important hydrological services, including the services provided by tussock grassland; and* *e) Protect natural resources and processes that support indigenous biodiversity; and* *f) Maintain habitats of indigenous species that are important for recreational, commercial, cultural or customary purposes; and* *g) Protect biodiversity significant to Kāi Tahu; and* *h) Avoid the adverse effects of pest species, prevent their introduction and reduce their spread.*	effects on these values and subsequent mitigation measures proposed are provided in Sections 6.2 and 6.3, respectively. Particular regard has been given to native fish in Schoolhouse Creek and – potentially – the Albert Burn.
2.1.7	*Recognise the values of natural features, landscapes, seascapes and the coastal environment are derived from the following attributes, as detailed in Schedule 4:* *a) Biophysical attributes, including:* *i. Natural science factors;* *ii. The presence of water;* *iii. Vegetation (indigenous and introduced);* *iv. The natural darkness of the night sky;* *b) Sensory attributes, including:* *i. Legibility or expressiveness;* *ii. Aesthetic values;* *iii. Transient values, including nature's sounds;* *iv. Wild or scenic values;* *c) Associative attributes, including:* *i. Whether the values are shared and recognised;* *ii. Cultural and spiritual values for Kāi Tahu;* *iii. Historical and heritage associations.*	The values of applicable natural features potentially affected by the proposal (namely the watercourses) have been recognised in Section 3.1.
2.2.1	*Identify areas and values of significant indigenous vegetation and significant habitats of indigenous fauna, using the attributes detailed in Schedule 5.*	Schoolhouse Creek has been identified as significant habitat for the nationally critical Clutha flathead galaxiid, and provisions have been made for this throughout the application.
2.2.2	*Protect and enhance the values of areas of significant indigenous vegetation and significant habitats of indigenous fauna, by:* *a) Avoiding adverse effects on those values which contribute to the area or habitat being significant; and* *b) Avoiding significant adverse effects on other values of the area or habitat; and*	See above. The application seeks to protect Clutha flathead via proposed fish screens and by proposing that no residual flow be applied to the take, thereby isolating Clutha flathead populations from predatory

	c) Assessing the significance of adverse effects on those values, as detailed in Schedule 3; and *d) Remediating, when adverse effects cannot be avoided; and* *e) Mitigating where adverse effects cannot be avoided or remediated; and* *f) Encouraging enhancement of those areas and values.*	sportfish. The applicant has indicated that they are willing to consider further measures proposed to protect or enhance this species in Schoolhouse Creek.
2.2.12	*Identify outstanding water bodies and wetlands and their values, using the following criteria:* *a) A high degree of naturalness;* *b) Outstanding aesthetic or landscape values;* *c) Significant takata whenua cultural values;* *d) Significant recreational values;* *e) Significant ecological values;* *f) Significant hydrological values.*	Outstanding water bodies are largely determined through the regional plan framework, with the RPW listing the Clutha River in Schedule 1A for a range of ecological values (discussed earlier) and Schoolhouse Creek for it's notable absence of pest plants and significant native fish habitat. Effects on these features have all been assessed in Section 6 of this document.
2.2.13	*Protect the values of outstanding water bodies and wetlands by:* *a) Avoiding significant adverse effects, including cumulative effects, on those values which contribute to the water body or wetland being outstanding; and* *b) Avoiding, remedying or mitigating other adverse effects on the water body or wetland's values; and* *c) Assessing the significance of adverse effects on values, as detailed in Schedule 3; and* *d) Controlling the adverse effects of pest species, preventing their introduction and* *reducing their spread; and* *e) Encouraging enhancement of outstanding water bodies and wetlands.*	See above.
3.1.1	*Recognise the natural and physical environmental constraints of an area, the effects of those constraints on activities, and the effects of those activities on those constraints, including:* *a) The availability of natural resources necessary to sustain the activity; and* *b) The ecosystem services the activity is dependent on; and* *c) The sensitivity of the natural and physical resources to adverse effects from the proposed activity/land use; and* *d) Exposure of the activity to natural and technological hazard risks; and*	The existing natural environment as it relates to the proposal is examined in Section 3 of this document, while the effects of the activities on the natural environment are assessed in Section 6. Based on ORC's GIS mapping, no flood risk to the activities are likely, aside from potential washout of the Clutha River intakes, while the Pisa Fault runs through the middle of the

	e) The functional necessity for the activity to be located where there are significant constraints.	command area, to the southeast of the Schoolhouse and Albert Burn take points.

7.2.5 Regional Plan: Water for Otago

The following policies, which give effect to the plan's objectives, are relevant to this application for resource consent.

Table 8: Assessment of RPW policies

Policy	Comments
5.4.1 To identify the following natural and human use values supported by Otago's lakes and rivers, as expressed in Schedule 1: *(a) Outstanding natural features and landscapes;* *(b) Areas with a high degree of naturalness;* *(c) Areas of significant indigenous vegetation, significant habitats of indigenous fauna, and significant habitats of trout and salmon;* *(d) Ecosystem values;* *(e) Water supply values;* *(f) Registered historic places; and* *(g) Spiritual and cultural beliefs, values and uses of significance to Kai Tahu.*	As discussed in Section 3.1, both Schoolhouse Creek and the Clutha River are listed in Schedule 1A for their ecosystem values and significant native fish habitat (the latter in the case of Schoolhouse Creek). The Clutha River between Alexandra and Lake Wanaka is also listed in Schedule 1D for a range of Kai Tahu values. No other Schedule 1 values directly relate to the activity.
5.4.2 In the management of any activity involving surface water, groundwater or the bed or margin of any lake or river, to give priority to avoiding, in preference to remedying or mitigating: *(1) Adverse effects on:* *(a) Natural values identified in Schedule 1A;* *(b) Water supply values identified in Schedule 1B;* *(c) Registered historic places identified in Schedule 1C, or archaeological sites in, on, under or over the bed or margin of a lake or river;*	As discussed in Section 6, the primary Schedule 1 value of concern relates to the confirmed presence of Nationally Critical Clutha flathead galaxia in Schoolhouse Creek, and the potential of the Albert Burn as Clutha flathead habitat. It has been argued that the best way to protect this species in the aforementioned watercourses is to not impose a residual flow on the takes, which would help to restrict predatory trout migrations into flathead habitat during the late spring and summer months. Nonetheless, it has been

Policy	Comments
(d) Spiritual and cultural beliefs, values and uses of significance to Kai Tahu identified in Schedule 1D; *(e) The natural character of any lake or river, or its margins;* *(f) Amenity values supported by any water body; and* *(2) Causing or exacerbating flooding, erosion, land instability, sedimentation or property damage.*	proposed that a visual connection be maintained between the Albert Burn and the Clutha River between the months of September and mid-November to protect out-migrating sportfish. The applicant has also indicated that they are happy to assist with other proposed mitigation to protect Clutha flathead galaxia. This may include additional upstream fencing and/or riparian planting, but is to be determined following discussions with DoC and other stakeholders. Due consideration has also been given to Kai Tahu beliefs and values identified in Schedule 1D for the Clutha River. Particular regard has been given to MA2, relating to the Mauri of the Clutha River, and MB2, relating to the importance of both Schoolhouse Creek and the Albert Burn (as tributaries of the Clutha/Mata-Au) as habitat for native fisheries.
5.4.3 In the management of any activity involving surface water, groundwater or the bed or margin of any lake or river, to give priority to avoiding adverse effects on: *(a) Existing lawful uses; and* *(b) Existing lawful priorities for the use, of lakes and rivers and their margins.*	There are no other existing lawful users of Albert Burn or Schoolhouse Creek water. The take from the Clutha River will not adversely affect any other water users.
5.4.4 To recognise Kai Tahu's interests in Otago's lakes and rivers by promoting opportunities for their involvement in resource consent processing.	The Kai Tahu ki Otago Natural Resource Management Plan (NRMP) is considered later in this report.
5.4.8 To have particular regard to the following features of lakes and rivers, and their margins, when considering adverse effects on their natural character *(a) The topography, including the setting and bed form of the lake or river;* *(b) The natural flow characteristics of the river;* *(c) The natural water level of the lake and its fluctuation;* *(d) The natural water colour and clarity in the lake or river;* *(e) The ecology of the lake or river and its margins; and*	The natural flow characteristics of the three watercourses are discussed earlier in this report. The abstraction of water will undeniably have some influence on the natural flow regime of the Albert Burn and Schoolhouse Creek, however, adverse effects from the activity will be avoided or mitigated by the proposed residual flow condition with regards to the Albert Burn, and virtually all of the Schoolhouse Creek values are concentrated above the point of take. It should be noted that the Albert Burn takes have been occurring for over a century, while

Policy	Comments
(f) The extent of use or development within the catchment, including the extent to which that use and development has influenced matters (a) to (e) above.	the Schoolhouse Creek take has been occurring for over 70 years. As such, the largely un-maintained Schoolhouse race has morphed into what is essentially a natural watercourse, providing year-round habitat for fish and invertebrates and forming part of the natural landscape.
5.4.9 To have particular regard to the following qualities or characteristics of lakes and rivers, and their margins, when considering adverse effects on amenity values: *(a) Aesthetic values associated with the lake or river; and* *(b) Recreational opportunities provided by the lake or river, or its margins.*	Considering the long history of water takes from the Albert Burn and Schoolhouse Creek, it could be argued that the aesthetic values of the creeks are intrinsically tied to long-established abstractions. Furthermore, virtually all of both creeks are located on private land and are unsupportive of recreation, with the small size of the creeks unsupportive of angling. The applicant's Clutha River takes are unlikely to adversely impact any recreational opportunities of the river, and the intake is located on a small side-channel of the Clutha River that is largely hidden from view from the public.
5.4.12 To promote the establishment of, and support, appropriate water user groups to assist in the management of water resources.	Given that the applicant is the only legal water user on both the Albert Burn and Schoolhouse Creek, there is no need to establish a water user group. Furthermore, water sharing on the Clutha River is not considered necessary given the ample water available for abstraction.
6.4.0 To recognise the hydrological characteristics of Otago's water resources, including behaviour and trends in: *(a) The levels and flows of surface water bodies; and* *(b) The levels and volumes of groundwater; and* *(c) Any interrelationships between adjoining bodies of water, when managing the taking of water.*	The hydrological regime of all waterways potentially impacted by the activity is discussed earlier in this report.
6.4.0A To ensure that the quantity of water granted to take is no more than that required for the purpose of use taking into account: *(a) How local climate, soil, crop or pasture type and water availability affect the quantity of water required; and*	The proposed irrigation volumes have been calculated in accordance with guidelines which ORC accepts as representing reasonable water requirements for irrigation of pasture, cherries and vineyards. The irrigation volumes account for all factors

Policy	Comments
(b) The efficiency of the proposed water transport, storage and application system.	mentioned in the policy (climate, crop, efficiency of use, etc.). Much of the scheme utilises piped water conveyance, which is a more efficient means of moving water over large distances. All water application systems utilise efficient, modern means such as drip, k-line or pivot.
6.4.0B To promote and support shared use and management of water that: *(a) Allows water users the flexibility to work together, with their own supply arrangements; or* *(b) Utilises shared water infrastructure which is fit for its purpose.*	N/A – see 5.4.12 above.
6.4.0C To promote and give preference, as between alternative sources, to the take and use of water from the nearest practicable source.	The proposal seeks to enable the continued taking of water from the nearest practicable source.
6.4.1 To enable the taking of surface water, by: *(a) Defined allocation quantities; and* *(b) Provision for water body levels and flows,* *except when:* *(i) The taking is from Lakes Dunstan, Hawea, Roxburgh, Wanaka or Wakatipu, or the main stem of the Clutha River/Mata-Au or Kawarau Rivers.* *(ii) All of the surface water or connected groundwater taken is immediately returned to the source water body.* *(iii) Water is being taken which has been delivered to the source water body for the purpose of that subsequent take.*	The proposal seeks to take water that is within the current primary allocation limits for Schoolhouse Creek and the Albert Burn. The Clutha River takes are exempt from this policy as there are no defined allocation quantities for the river and it is exempted from 6.4.1b.

Policy	Comments
6.4.2 To define the primary allocation limit for each catchment, from which surface water takes and connected groundwater takes may be granted, as the greater of: *(a) That specified in Schedule 2A, but where no limit is specified in Schedule 2A, 50% of the 7-day mean annual low flow; or* ***(b) The sum of consented maximum instantaneous, or consented 7-day, takes of:*** ***(i) Surface water as at:*** *(1) 19 February 2005 in the Welcome Creek catchment; or* *(2) 7 July 2000 in the Waianakarua catchment; or* ***(3) 28 February 1998 in any other catchment**; and* *(ii) Connected groundwater as at 10 April 2010,* *less any quantity in a consent where:* *(1) In a catchment in Schedule 2A, the consent has a minimum flow that was set higher than that required by Schedule 2A.* *(2) All of the water taken is immediately returned to the source water body.* *(3) All of the water being taken had been delivered to the source water body for the purpose of that subsequent take.* *(4) The consent has been surrendered or has expired (except for the quantity granted to the existing consent holder in a new consent).* *(5) The consent has been cancelled (except where the quantity has been transferred to a new consent under Section 136(5)).* *(6) The consent has lapsed.*	The proposal seeks to take water that is within the current primary allocation limits for Schoolhouse Creek and the Albert Burn. One of the Clutha River takes (2002.353) is subject to 6.4.2(b)(3), while the other take (2003.591) is subject to 6.4.2(a) – 50% of the 7-day mean annual low flow, which would amount to 60.5 m^3/s as measured below the Cardrona River confluence.
6.4.2A Where an application is received to take water and Policy 6.4.2(b) applies to the catchment, to grant from within primary allocation no more water than has been taken under the existing consent in at least the preceding five years, except in the case of a registered community drinking water supply where an allowance may be made for growth that is reasonably anticipated.	The rate of take sought is no more than what has been taken under the existing consents.

Policy	Comments
6.4.4 For existing takes outside Schedule 2A catchments, minimum flows, for the purpose of restricting primary allocation takes of water, will be determined after investigations have established the appropriate minimum flows in accordance with Method 15.9.1.3. The new minimum flows will be added to Schedule 2A by a plan change and subsequently will be applied to existing takes in accordance with Policy 6.4.5(d). *For new takes in a catchment outside Schedule 2A, until the minimum flow has been set by a plan change, the minimum flow conditions of any primary allocation consents will provide for the maintenance of aquatic ecosystems and the natural character of the source water body.*	Stream flows and primary allocation minimum flows are discussed earlier.
6.4.7 The need to maintain a residual flow at the point of take will be considered with respect to any take of water, in order to provide for the aquatic ecosystem and natural character of the source water body.	Residual flows are considered earlier in this report (Section 6.3).
6.4.16 In granting resource consents to take water, or in any review of the conditions of a resource consent to take water, to require the volume and rate of take to be measured in a manner satisfactory to the Council unless it is impractical or unnecessary to do so.	The Clutha and Albert Burn takes will continue to be metered in accordance with the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010. The applicant will install a water meter in accordance with the Regulations on the Schoolhouse Creek take prior to exercising the replacement consent.
6.4.19 When setting the duration of a resource consent to take and use water, to consider: *(a) The duration of the purpose of use;* *(b) The presence of a catchment minimum flow or aquifer restriction level;* *(c) Climatic variability and consequent changes in local demand for water;* *(d) The extent to which the risk of potentially significant, adverse effects arising from the activity may be adequately managed through review conditions;* *(e) Conditions that allow for adaptive management of the take and use of water;* *(f) The value of the investment in infrastructure; and* *(g) Use of industry best practice.*	These matters are discussed in Section 8.

Policy	Comments
6.6.0 To promote and support development of shared water infrastructure.	The applicant already operates a water scheme whereby multiple users are supplied water for irrigation and stock drinking via shared water infrastructure.

7.2.6 Cultural policies assessment

Iwi planning documents are not statutory instruments, but they do have statutory weight under the RMA in relation to the plan preparation process. The RPS must take into account any relevant planning document recognised by an iwi authority, however, iwi management plans retain their ability to address concepts from a Maori paradigm without constraint of the RMA.

7.2.6.1 Te Runanga o Ngai Tahu Freshwater Policy Statement

The Ngai Tahu Freshwater Policy Statement has status as an iwi management plan, to complement and be read alongside the Kai Tahu Ki Otago Natural Resource Management Plan (NRMP).

In terms of integrated management, whilst this document is mostly directed at the organizational level, the policy statement confirms that catchment management planning is the preferred approach. This includes catchment-specific strategies as providing a better basis for achieving integrated sustainable management of natural and physical resources.

Where Ngai Tahu values have been identified, they should be maintained as a minimum, but preferably enhanced. Particular consideration of the mauri (life force) of the three watercourses has been given throughout the application, exemplified in reduced monthly and annual allocations, future improvements to water infrastructure to increase water use efficiencies, potential riparian enhancement, and fish screen provisions.

7.2.6.2 Kāi Tahu ki Otago NRMP

The policies within the Kāi Tahu ki Otago NRMP that are considered particularly relevant to this application are presented in the below table. The proposal is considered generally consistent with these policies, as discussed in the table.

Table 9: Relevant policies of the Kai Tahu ki Otago NRMP

Policy	Comments
To require an assessment of instream values for all activities affecting water.	Values of the Albert Burn, Schoolhouse Creek and the Clutha River are considered in Section 3.1.
To require that resource consent applicants seek only the amount of water actually required for the purpose specified in the application.	The proposed water take volumes are considered to be reasonable for the proposed uses, based on the specific characteristics of the site and recognised reasonable water use guidelines for irrigation (see Section 6.6).

Policy	Comments
To require that all water takes are metered and reported on, and information be made available upon request to Kāi Tahu ki Otago.	The Clutha and Albert Burn water takes will continue to be metered as detailed in Section 6.9, while the Schoolhouse take will be appropriately metered and reported prior to exercising the replacement consent. Metering data will be made available to ORC, and Aukaha can request this data either from ORC or from the applicant, if desired.
To oppose the granting of water take consents for 35 years. Consistent with a precautionary approach, either a review clause or a reduced term may be sought.	A 25-year term is sought.
To require that fish passage is provided for at all times, both upstream and downstream.	As discussed in Section 6.3, residual flow conditions on the Albert Burn and Schoolhouse Creek takes would have the potential to negatively impact native fish populations (Clutha flathead) in Schoolhouse Creek and potentially in the Albert Burn. For this reason, only a late spring residual flow condition has been proposed for the Albert Burn to allow spawning sportfish to out-migrate to the Clutha/Mata-Au. Schoolhouse Creek Clutha flathead populations would likely benefit from the applicant's water take, in that it is more likely to isolate the upper reaches of the creek from the Clutha River, thereby protecting these galaxia from predation by up-migrating sportfish.
To require that fish screens be fitted to all pumps and race intakes.	A proposed consent condition requires that the applicant install a fish screen at the Schoolhouse Creek intake or down-race of the intake. Both the Albert Burn and Clutha River/Mata-Au takes already feature fish screens.
To encourage those that extract water for irrigation to use the most efficient method of application. *Flood irrigation, border dyke and contour techniques are less likely to be supported than spray irrigation techniques.*	Farm irrigation within the command area utilises a mix of k-line, pivot and hard nose sprinklers. Smaller private land uses within the command area use drippers and spray – all of which are considered an efficient means of irrigation.
To encourage irrigation to occur at times when winds are light and evaporation low.	Irrigation at the most efficient times is in the applicant's best interest as well, although it is noted that it will not be practical to avoid irrigation in adverse conditions 100 % of the time.

8. CONSENT DURATION, REVIEW AND LAPSE

A consent term of 25 years is sought. In accordance with Section 123 of the RMA, a term of up to 35 years may be granted for a resource consent to take and use water. A shorter term is requested solely due to the policies of the Kāi Tahu ki Otago NRMP, as discussed above. This consent duration satisfies the criteria set out in Policy 6.4.19 of the RPW due to the following:

- The use of the water for irrigation supply is very likely to be in effect for a duration of at least 25 years, given the suitability of the properties within the scheme for farming, viticulture and cherry orchards. It is also worth noting that the proposed takes are to supply water to activities that are already in place, with some recognition of future expansion.

- There is close to 6 years of flow data for the Albert Burn, and over 30 years of flow data for the Clutha River upstream of the applicant's takes, meaning the hydrological characteristics of these two watercourses are well understood. This makes understanding the ongoing effects of takes from these watercourses a lot easier, and can ensure informed decision making. While the Albert Burn has not been continuously monitored, there is close to 7 years of abstraction records which may provide a fair approximation (in conjunction with recent stream gauging completed by Landpro) of the hydrological nature of the creek.

- For both the Schoolhouse and Albert Burn, in-stream values are arguably concentrated above the points of take, and focus around the presence (or possible presence, in the case of the Albert Burn) of the nationally critical Clutha flathead galaxiid. In many respects (and as discussed above), the applicant's continued abstraction from these two creeks may help to protect those values. In the case of the Clutha River takes, the scale of the abstractions is such that there is unlikely to be any unforeseen effects not already encompassed within Section 6 of this AEE.

- With the exception of 2003.591, the applicant's takes from all three watercourses have a long history of use – ranging back to 1904 for the Albert Burn, 1943 for Schoolhouse Creek, and 1966 for the Clutha River (2002.353). This long take history makes it easier to foresee future effects on natural and cultural values due to the continuing operation of the activities.

- The local climate is likely to become more variable and less predictable in the coming decades due to climate change, based on the climate change projections for the Otago region prepared by the Ministry for the Environment in 2018 and available on their website. In particular, temperatures (and therefore evapotranspiration) are expected to increase, and while precipitation may also increase, changes in the timing (largest increases in Winter and Spring) and form (more rain and less snow) may reduce water security in the region. More frequent droughts are predicted. Securing reliable water rights to the Albert Burn, Schoolhouse Creek and the Clutha River, while preserving and/or enhancing the values of the watercourses will enable the farms, orchards and vineyards serviced by QRL to continue operating at their fullest potential into the future.

- This report and the supporting documents demonstrate that the activities will have no more than minor actual or potential adverse environmental effects. The probability that this assessment and proposed mitigation measures have not addressed all actual or potential adverse effects is low and the scope of remaining unforeseen adverse effects is limited. Review conditions can adequately manage unforeseen adverse effects if required.

- The existing water distribution infrastructure and irrigation systems represent a significant investment. To date, close to $4 million has been spent on on-farm infrastructure, including water conveyance infrastructure (pipes and races), water storage (tanks and ponds), pivots and irrigation systems, pump equipment and maintenance, fencing and general land improvements (further details can be provided on request). The applicant also recently bought over 500 ha of new land from Contact Energy for $3 million, and has since invested considerable sums into converting this dilapidated land into productive farmland. Further investment will be required for ongoing maintenance of the infrastructure, and for future works. Possible installation of a mainline pipe from the Schoolhouse Creek abstraction point to the first pond will cost an estimated $39,000, while associated construction of an intake structure may cost up to $50,000. The request for a 25-year consent duration gives the applicants the security to make ongoing investment decisions based on the returns from their operation over this duration.

A standard lapse period of 5 years within which the replacement consents are given effect to is considered acceptable.

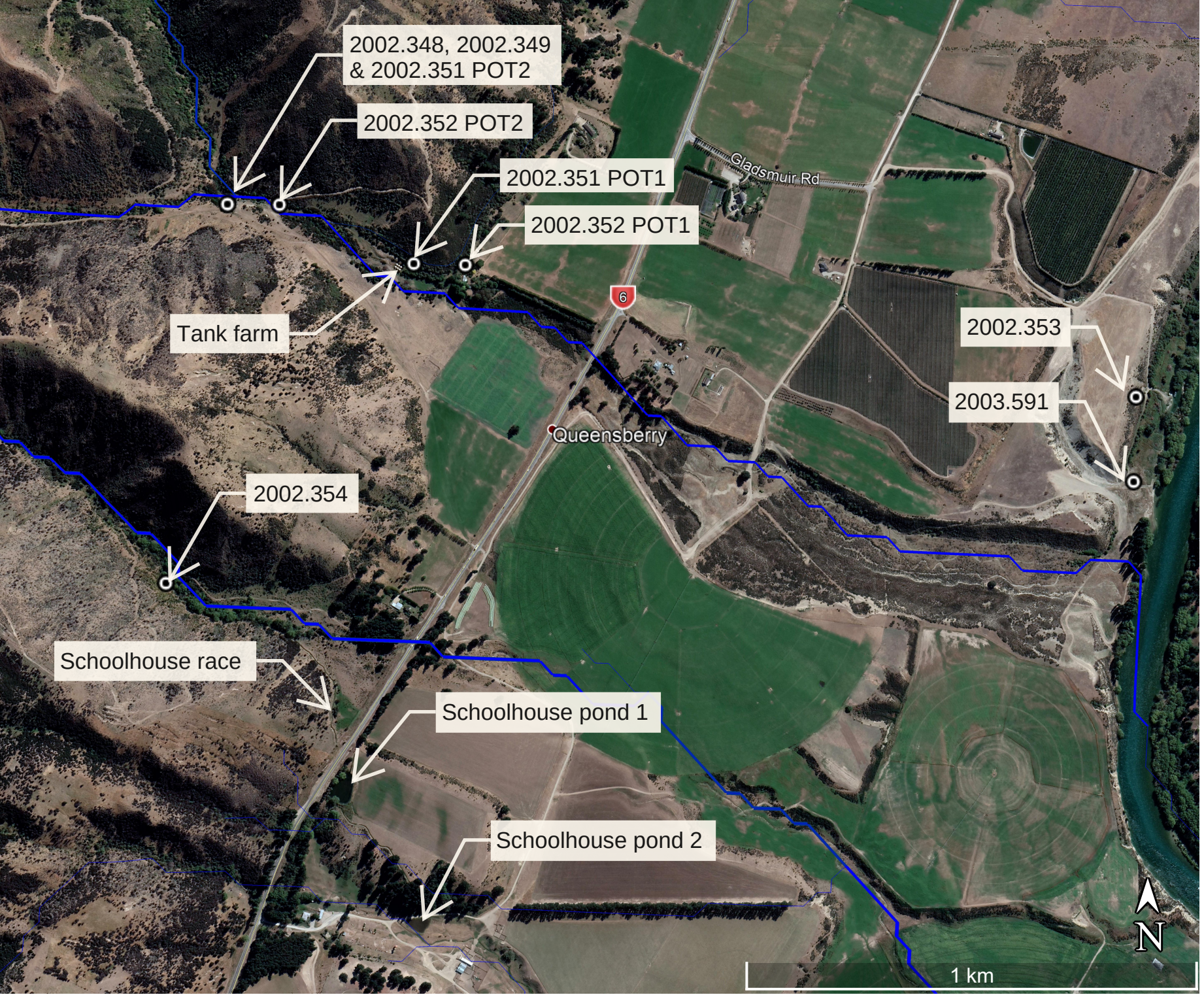
9. CONCLUSION

A decision to grant consent pursuant to Section 104B under delegated authority can be made on the basis that:

a) It is expected that the adverse effects on the environment will be minor or less;
b) The proposal meets the non-notification requirements of Section 95A of the RMA; and
c) The proposal is consistent with the requirements of the RMA, Council policy and other relevant matters.

Granting of the consents will be consistent with the purpose of the RMA for the reasons explained within this report. The proposed activities are not expected to result in any significant adverse ecological or hydrological impacts, and potential adverse effects will be avoided, remedied or mitigated as far as practicable.

Appendix A: Water take overview and scheme command area


2002.348, 2002.349
& 2002.351 POT2
2002.352 POT2
2002.351 POT1
2002.352 POT1
Tank farm
Gladsmuir Rd
6
Queensberry
2002.353
2003.591
2002.354
Schoolhouse race
Schoolhouse pond 1
Schoolhouse pond 2
N
1 km

IRRIGATED AREAS

River Pivot - 82.41ha
Half Pivot - 32.25 ha
Haybarn Pivot - 110.13ha
Cattle Yard Pivot - 15.02ha
Gallery Pivot - 9.92ha
Orma Pivot 25.22ha
Old Pivot - 34.59ha
Peninsula Pivot - 50.66ha
Northern Half Pivot - 25.59ha
K-Line - 91ha
Ezi Rain 30ha
Rotorainer - 18ha
Fixed Sprinklers - 23.45ha

Key
Fixed Sprinklers

TOTAL COMMAND AREA	962.7HA
SOILS	
CLUDEN - YELLOW	46.1
TUCKER - RED	10.3
FRASER - YELLOW GREEN	51.1
SWAN - GREY	50.2
GIBBSTON - LIGHT BLUE	33.8
LINDIS - CYAN	140.3
MAUNGAWERA_2 - MAGENTA	34.2
MAUNGAWERA_1 - JADE	74.4
MOLYNEUX - LIGHT PURPLE	111.5
BARRHILL - ORANGE	94.7
PIBURN -PEACH	53.8
GERMAN - LIGHT GREEN	40.4
LUGGATE - LIGHT BLUE	79.4
MATAURA - PURPLE	124.2
TEMPLETON	18.3
TOTAL	962.7

N

Bee Hives 3.97ha
2 storey House
Reids Flat 6.06ha
House 2 10.30ha
House 1 6.90ha
House 3 8.61ha
House 4 8.29ha
Farm House
CROMWELL - LUGGATE ROAD (SH8)
Holding Pdk 1.91ha
Horse Pdks
House Dam 4.35ha
Sheep Yards
Beef Cattle Yards
Ram Pdk 9.77ha
Tank 4.23ha
Tank farm
Potable pump Shed 6
Spinners 4.11ha
Lone Pine 5.33ha
House on hill
Pollocks 7.93ha
Pitts 4.14ha
Road Pdk 5.69ha
Proposed Trees
Nicks 6.62ha
Deer Pen 5.66ha
Behind Gravel Pit 2.67ha
Gravel Pit 7.46ha
Quarry Flat 19.79ha
Cattle yds 1 8.88ha
Old Pivot 2 7.19ha
Old Pivot 1 6.35ha
Old Pivot 3 6.77ha
The Runway 10.95ha
Airstrip
Back wash 0.30ha
SW Boundary 5.38ha
HP2 5.26ha
HP1 5.33ha
HP3 5.75ha
Holding Pdk 1 3.40ha
Quarry
Cattle Yds 2 6.91ha
Cattle Yds 3 11.82ha
Silage Pit 1.59ha
Centre of old Pivot 2.52ha
Old Pivot 4 6.04ha
Old Pivot 5 5.72ha
Old Pigsty 9.06ha
Lazy Dog Restaurant
Caravan Pk (leased) 4.15ha
Lot 4b 4.19ha
Lot 5b 4.09ha
Lot 6b 4.48ha
Lot 4a 3.88ha
Lot 5a 4.17ha
Lot 6a 5.07ha
Lot 7b 4.17ha
Lot 8b 4.99ha
Lot 7a 4.18ha
Lot 8a 4.05ha
Inn Pdk 2.72ha
Queensberry Inn
Pottery 1 8.36ha
Pottery 2 8.41ha
Top Petes (leased) 4.05ha
Bottom Petes (leased) 8.25ha
Hudsons 6.39ha
2.12ha
Lupins 5.57ha
Sub Station
Far North 3.24ha
Half Pivot 6 5.01ha
Half Pivot 5 5.09ha
HP4 5.81ha
Holding Pdk 2 2.68ha
1.40ha
HBP2 6.16ha
Proposed Trees
HBP3 5.67ha
School House Crk Gully 9.44ha
Middle Terrace 2.20ha
Top Terrace 4.78ha
Broom Blk 1 6.32ha
Broom Blk 3 11.45ha
Broom Blk 2 4.50ha
Scottys 4.57ha
2 Degree Vineyard 8.94ha
Fish Hook Vineyard 4.58ha
T Intersection 9.30ha
Fish Hook 5.12ha
Cherry Blk
Booster pump shed 2
Booster pump shed 2B
Lot 14 (leased) 9.98ha
Lot 13 10.22ha
Lot 12 10.31ha
Lot 11 9.09ha
Lot 10 6.39ha
Private Property
RP7 9.50ha
RP8 6.82ha
RP9 8.53ha
Hide Pdk
Gallery Pump
Tractor Shed
Wiper pivot pump shed 4
Wiper Pivot Bore
HBP1 6.19ha
HBP1B 6.55ha
HBP2B 6.56ha
Hay Barn Pivot 1C 5.88ha
HBP3B 5.78ha
HBP4B 6.62ha
HBP4 7.01ha
OP2 6.91ha
Electrical meter reading point
OP3 6.06ha
Orma Pivot Centre 2.42ha
OP1 5.68ha
OP4 4.33ha
3.38ha
RP6 7.47ha
River Pivot Centre 4.00ha
River pump shed 5
RP1 8.43ha
River Yards
RP2 9.67ha
HBP8 5.95ha
HBP8B 6.25ha
HBP8C 5.56ha
HBP5B 5.90ha
RP5 8.00ha
RP4 9.93ha
RP3 10.06ha
HBP7B 6.30ha
HBP6B 6.04ha
HBP5 5.65ha
Cattle Yard Pivot 1 5.90ha
HBP7 6.29ha
Cattle Yard Pivot 2 9.12ha
HBP6 5.77ha
Northern Solid Set 4.76ha
2.40ha
Pump Shed 3.49ha
Gallery Top 2.06ha
Haybarn Pumpshed 3
Haybarn Bore
Gallery Pivot South 5.07ha
Gallery Pivot North 4.85ha
Bank of the Clutha River
Pumpshed Scrub 5.10ha
Rabbit heaven 4.50ha
Holding Pdk 1.91ha
River pump shed 1
Electrical shed 1B
Lazy Cattle Yards
Rubbish hole 1.58ha
Waste Land
Sick Pdk 3.38ha
Peninsula Pivot 1 6.83ha
PP 2 6.68ha
PP 3 6.44ha
PP 4 6.44ha
PP 9 6.21ha
PP 8 6.21ha
PP 7 6.21ha
PP 6 6.22ha
PP 5 6.22ha
Peninsula Half Pivot 1 6.39ha
PHP 2 6.40ha
PHP 3 6.40ha
PHP 4 6.40ha
Silage Buns
The Peninsula 5.34ha

500m 0km 500m

Scale 1:8000 @ A1
1:16000 @ A3

QUEENSBERRY RIDGES - FARM MAP
SOILS PLAN

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LT18365 - Queensbury Ridges Ltd - Deemed Permit Replacement\CAD\18365_01_SOILS.dwg Plotted:17.7.2018

Appendix B: Hydrological assessment technical comment

TECHNICAL COMMENT

Date: 4 September 2019 Our Ref: 18365

To: Will Nicolson, Planner, Landpro Ltd

From: Christina Bright, Environmental Scientist, Landpro Ltd

Subject: Hydrological assessment of the Albert Burn and Schoolhouse Creek for Queensbury Ridges Ltd.

1. Background

Queensbury Ridges Ltd wishes to obtain resource consent from the Otago Regional Council to continue abstracting water from the Albert Burn and Schoolhouse Creek for pasture irrigation, frost fighting and stock drinking. The consent numbers relevant to this assessment are deemed permits 2002.348.V1, 2002.349.V1, 2002.351.V1, 2002.352.V1 and 2002.354.V1. A summary of these consents is provided in Table 1.

The purpose of this report is to provide a hydrological assessment of the Albert Burn and Schoolhouse Creek. Specifically, to:

- Estimate the natural losses and gains of a preidentified reach of the Albert Burn; and
- Determine the flow in a race diverting water from Schoolhouse Creek at monthly intervals over the 2018/2019 irrigation season.

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Table 1: Summary of Queensberry Ridges Ltd permits for Schoolhouse Creek and the Albert Burn.

Permit	Permit holder	Creek	Consented Rate of take/volume	Location of intake (NZTM 2000)
2002.348.V1	Queensbury Ridges Ltd	Albert Burn	83.3 L/s	1308743E 5028081N
2002.349.V1	Queensbury Ridges Ltd	Albert Burn	14.15 L/s	1308743E 5028081N
2002.351.V1	Queensbury Ridges Ltd	Albert Burn	Combined 83.3 L/s	1308743E 5028081N 1309143E 5027982N
2002.352.V1	Queensbury Ridges Ltd	Albert Burn	Combined 56.6 L/s	1308843E 5028081N 1309243E 5027982N
2002.354.V1	Queensbury Ridges Ltd	Schoolhouse Creek	55.6 L/s	1308645E 5027282N

Figure 1 shows the location of the creeks in relation to Queensbury Ridges Ltd and significant watercourses in the vicinity, namely the Clutha River.

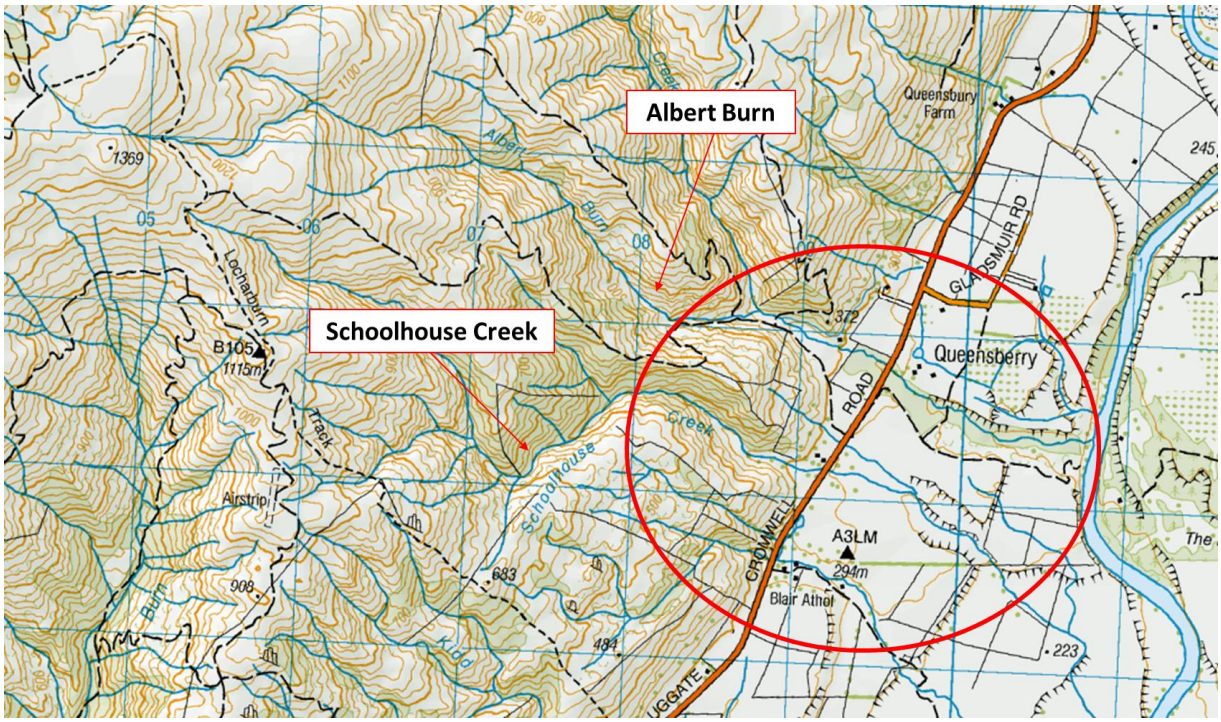

Figure 1: Site location map in relation to surface water bodies and general location of property (red circle). **[Source: NZ topo map]**

2. Catchment Description

The properties are located in the Clutha River catchment which is located in Central Otago and flows in a general north to south direction with a catchment area of 21,022 km^2. The catchment drains a significant area of the Otago region with its headwaters characteristically mountainous, bordering the Southern Alps in the far north-west, gradually becoming more rolling through the midsections and in contrast the lower reaches of the catchment are dominated by alluvial plains and lowland. The Albert Burn catchment and Schoolhouse Creek are situated in the northern Upper Clutha Catchment and drain directly to Lake Dunstan, an artificial lake constructed as the result of damming the Clutha River at Clyde. The area receives a mean annual rainfall of approximately 430 mm. Both waterways have historically had dry creek beds in summer.

The Clutha River is the second longest river in New Zealand and the longest in the South Island, stretching 338 kilometers. The Clutha has a mean annual flow of 575 m3/s of which around 75% is derived from the main lake catchments in the north of the catchment, including lakes Hawea, Wanaka and Wakatipu. Flow rates range between 120 m^3s^{-1} (minimum) and 1,250 m^3s^{-1} (maximum) throughout the year. There are approximately 24 natural and artificial lakes within the Clutha Catchment, and therefore flow rates vary significantly.

2.1 Localised hydrology

The applicants own an area of land northwest of the Clutha River along the Pisa Range. The Albert Burn flows from the northwest to the southeast terminating at the Clutha River. Schoolhouse Creek flows in a general north west to southeast direction terminating at the Clutha River, but does flow northeast for a portion as the creek curves around through the gully. Both streams traverse steep land in the headwaters of the Pisa Range and drop quickly through gorges, falling onto relatively flat to rolling land at the foothills of the range.

The Albert Burn and Schoolhouse Creek are fed primarily by runoff from the surrounding Pisa Range, and in winter and spring runoff is snow melt driven. The Albert Burn originates high up in a gully approximately 1,400 meters above mean sea level (mamsl) where it drains down to 240 mamsl at its confluence with the Clutha River, Schoolhouse Creek originates in a gully at 1,200 mamsl and drains down to 220mamsl terminating at the Clutha River.

Since November 2013, a continuous flow monitoring site has been maintained by the Otago Regional Council on Schoolhouse Creek above the upper most point of take. This continuous record (Figure 2)

shows the creek follows the typical behavior of steep headwater streams, with fast to respond event specific hydrographs. Based on this record, basic flow statistics have been determined (Table 2).

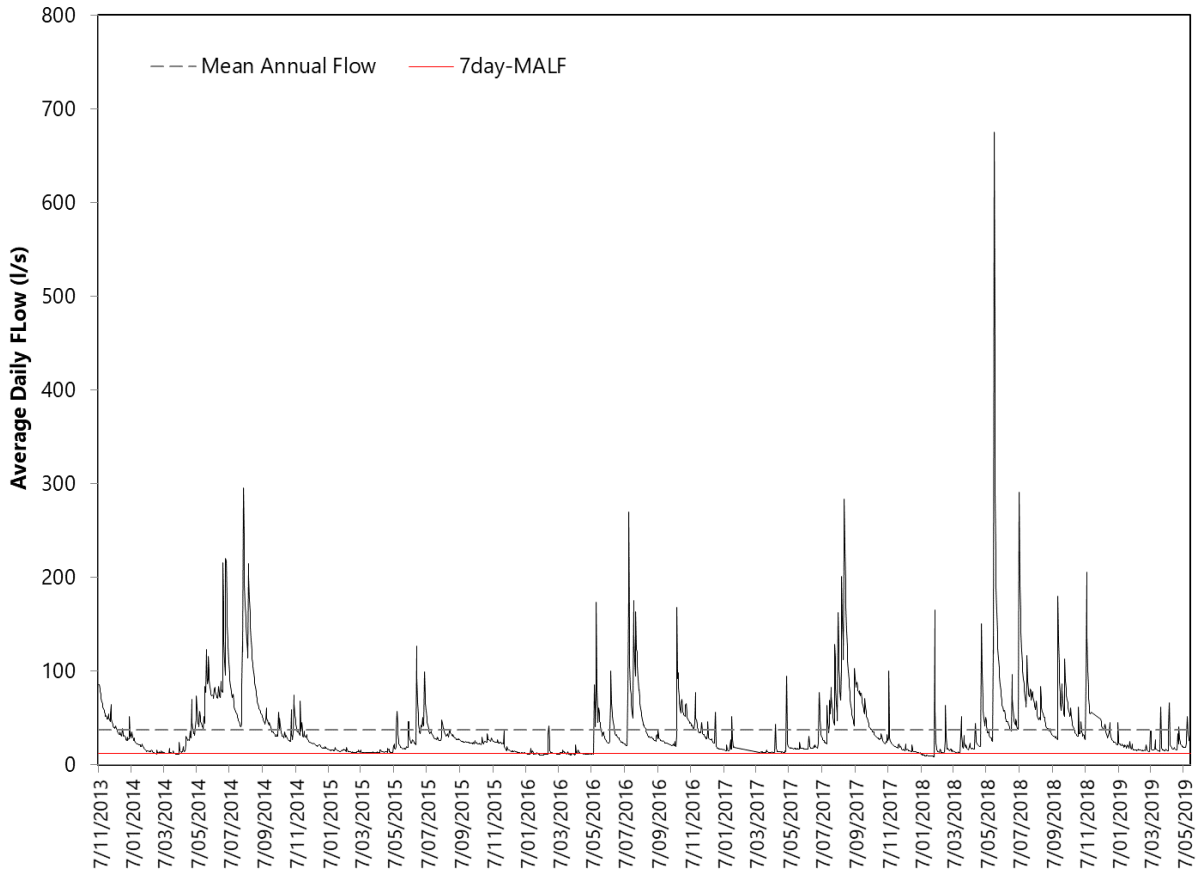

Figure 2: Daily flow (Nov 2013 – May2019) for Schoolhouse Creek monitoring site located in upper reaches of the catchment, unaffected by abstraction (ORC, 2019).

The Otago Regional Council also maintain a flow monitoring site on the Amisfield Burn that is unaffected by abstraction actives, located nearby on the Pisa Range (outside of the study area). The flow statistics for the Amisfield Burn are also shown in Table 2.

Table 2: Flow statistics for Schoolhouse Creek, and Amisfield Burn. [Source: ORC, data records]

Site Name	7-day mean annual low flow (L/s)	Mean annual flow (L/s)
Schoolhouse Creek (upstream of all abstraction)	12	38
Amisfield Burn (upstream of all abstraction)	65	162

3. Data Collection and Results

3.1 Site flow assessments

A series of flow gaugings were undertaken on the 23 January 2019 by Landpro Limited to determine the quantity of water flowing at various sites throughout the Albert Burn. A total of four reaches were selected. These were located upstream from the upper most water take, through the middle reaches of the Albert Burn, and lower in the catchment on the lowland alluvial gravels. For the duration of the survey and for 24hours prior the applicant ceased taking water from the Albert Burn, this enabled the Albert Burn survey to identify where in the catchment losses of water to the sub-surface zone were naturally occurring.

Additionally, flow assessments were carried out on the race diverting water from Schoolhouse Creek between December 2018 and April 2019.

The data was collected in accordance with the National Environmental Monitoring Standard: Open Channel Flow Measurement. This data, included in the appendices, has been used on an as-is basis.

3.2 Albert Burn Stream Flow Losses and Gains

3.2.1 Gauging sites

ALB1: Albert Burn upstream of point of take

Flow gauging site approximately 140 meters upstream from point of take. Both the true left and right sides of the creek are predominantly grass with low lying vegetation. Bed consisted of cobble sized rocks largely covered in algae.

ALB2: Albert Burn downstream of point of take

Flow gauging site approximately 300 meters downstream from point of take. The true left bank is steep with exposed soil and rock with minimal vegetation, true left low-lying grass. River bed comprises boulders with cobbles.

ALB3: Albert Burn middle reach

Flow gauging site mid-way down Albert Burn, approximately 1km downstream from previous gauging location. True left and right banks are grassy with tall weeds, the creek is incised with well-defined soil banks. Stream bed composed of pebbles and cobbles.

ALB4: Albert Burn upstream of confluence with Clutha River

True right and left bank are low lying predominantly grassy; stream channel is wider than upstream site with alluvial bed material. Creek is dry.

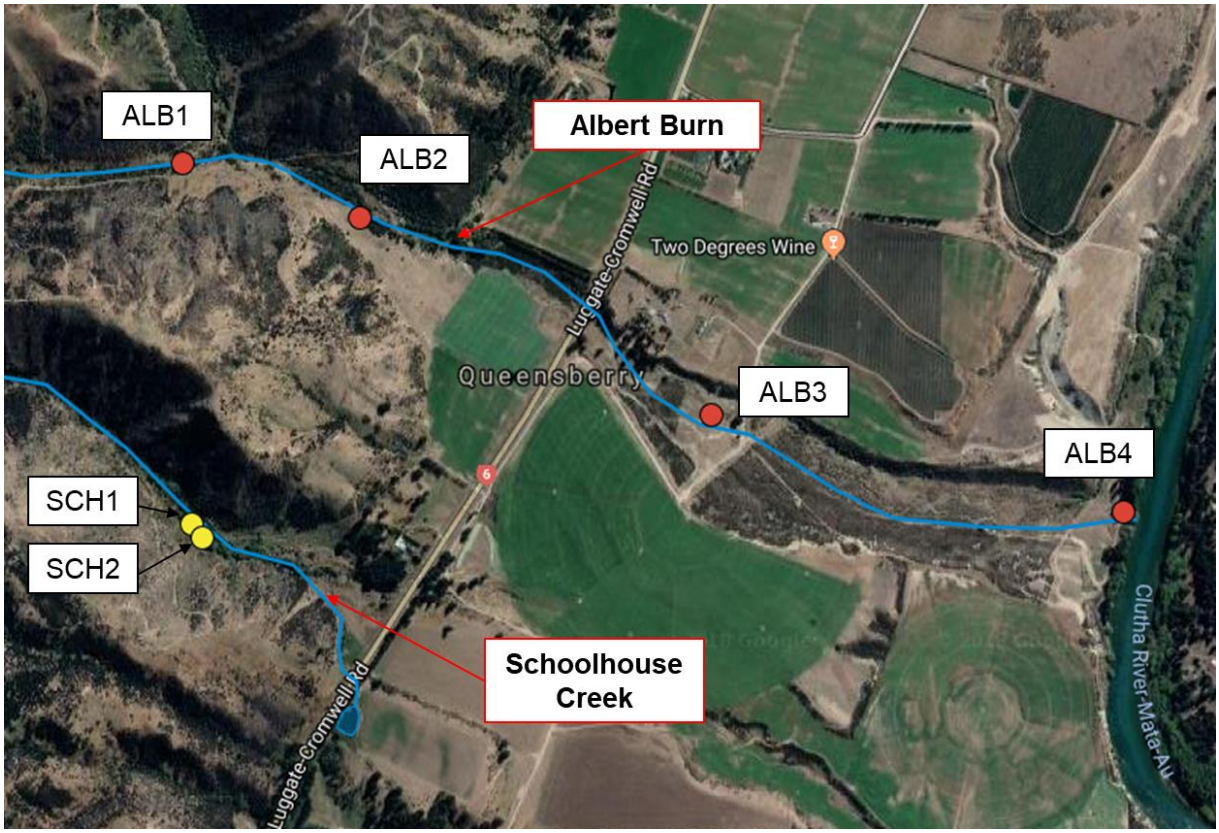

Figure 3: Location of flow gauging sites in the Albert Burn and Schoolhouse Creek Catchments.

3.2.2 Site Photos

Figure 4: Albert Burn upstream of upper point of take (ALB1), left: looking upstream and right: looking downstream.

Figure 5: Albert Burn downstream of upper point of take, below dam structure (ALB2), left: looking upstream and right: looking downstream.

Figure 6: Albert Burn downstream of State Highway (ALB3), left: looking upstream and right: looking downstream.

Figure 7: Albert Burn upstream of confluence with Clutha River (ALB4), left: looking upstream and right: looking downstream with Clutha River in background.

3.2.3 Measured Flow

Table 2: Field measurements for Albert Burn.

Easting (NZTM 2000)	Northing (NZTM 2000)	Measured flow (L/sec)	†Gauging uncertainty flow range (L/sec)	Site Name
1308609	5028084	36	34.8 – 37.2	ALB1
1309009	5027979	71.9	69.7 – 74.1	ALB2
1309818	5027576	33	32.1 – 33.9	ALB3
1310750	5027402	0 L/s	-	ALB4

†As with many flow measurements there is a degree of uncertainty and New Zealand Standards use ISO5168:2005 and ISO748:2007 to report on the accuracy of gaugings.

3.3 Schoolhouse Creek Race Flows

3.3.1 Gauging sites

SCH1: Schoolhouse Creek downstream point of take diversion (1308666E 5027282N)

Flow gauging site on race approximately 30 meters downstream from point of take. Both the true left and right sides of the race are predominantly grassy, with taller woody vegetation overhanging. Bed consisted of pebbles and sand.

SCH2: Schoolhouse Creek downstream of race overflow (1308691E 5027253N)

Flow gauging site on race approximately 70 meters downstream from point of take. Both the true left and right sides of the race are predominantly grassy, with taller woody vegetation overhanging. Bed consisted of pebbles and cobbles.

3.3.2 Site Photos

SCH1: Schoolhouse Creek downstream point of take diversion

Figure 8: Schoolhouse Creek race downstream from point of take (SCH1 site).

SCH2: Schoolhouse Creek downstream of race overflow

Figure 9: Schoolhouse Creek race downstream from race overflows (SCH2 site).

3.3.3 Measured Flow

Table 2: Field measurements for Schoolhouse Creek over three consecutive field assessments.

Site Name	Date	Measured flow (L/sec)	†Gauging uncertainty flow range (L/sec)
SCH1	20/12/18	31.5	30.6 – 32.4
	23/01/19	13.7	13.2 – 14.2
	13/02/19	15.2	14.7 – 15.7
	06/03/19	13.6	13.2 - 14
	10/04/19	15.7	15.2 – 16.2
SCH2	20/12/18	10.6	10 – 11.2
	23/01/19	11.1	10.3 – 11.9
	13/02/19	13	12.6 – 13.4
	06/03/19	17.9	17.4 – 18.4
	10/04/19	20.2	19.5 – 20.9

†As with many flow measurements there is a degree of uncertainty and New Zealand Standards use ISO5168:2005 and ISO748:2007 to report on the accuracy of gaugings.

4. Hydrological Assessment

4.1 Albert Burn Flow Losses and Gains Assessment

At the time of the site visit (23 January 2019) flow at the nearest rated flow site which is located in Schoolhouse Creek was approximately 18 L/s. This flow is approximately equal to the 7day-mean annual low (7day-MALF) for Schoolhouse Creek (7day-MALF 12 l/s; Table 2) indicating the assessment was carried out during a period of low flow conditions.

To identify potentially losing/gaining reaches of the Albert Burn, flow measurements were collected longitudinal down the Albert Burn main stem. A differential gauging approach was used to identify differences in flow that related to either a gain or loss of water.

A losing or gaining reach as identified in this assessment refers to the assumption that flow is interacting with the hyporheic zone (sub-surface zone) due to factors such as topography, geology, and geomorphology that control the movement of water, including flow and wetted perimeter. The

assessment assumes that this hyporheic water may or may not be specifically linked to groundwater as groundwater level data is not available or not included as part of this assessment. This zone of sub-surface and surface water exchange (hyporheic zone) is relatively active where water ways traverse steep gullies passing down to river valleys and alluvial lowlands. In these types of environments, the hyporheic zone can be more substantial, and the typically porous alluvial media may extend for a larger depth, creating more space for underflow into the sub-surface environment to occur. Under hot dry weather conditions, this water rarely returns to the surface due to intense evaporation processes that occur as water comes to the surface.

Results of the flow gauging undertaken on the Albert Burn suggest that flow in the lower reaches of the Albert Burn interacts with the hyporheic zone and fine loose alluvial gravels, and that this provides a mechanism for water loss to the sub-surface zone. The survey identified a net loss of 72 L/s between the dam structure on the Albert Burn and the confluence with the Clutha River, as summarized in Figure 3.

General survey findings:

- Gauging was carried out above the upper point of take in the Albert Burn Catchment and measured flow was 36 L/s. Flow increased to 72 L/s below the point of take and dam structure. This was an expected gain in flow due to inflow from Alfern. As abstraction was not occurring on the day of the survey, the dam was releasing all water from the Albert Burn and Alfern Creek combined, essentially a doubling in flow.
- From the point of take and dam structure, the creek travels through a gorge like area with steep incised sides, and a gravel alluvial creek bed (Figure 10) (based on upstream creek bed and observation from above gorge) until the creek passes under the state highway where rolling to flat land dominates the topography. As the creek traversed the less steep terrain a loss of water was measured between the foothills and the state highway.
- Flow measured below the State Highway 6 crossing was 34 L/s and substantially lower than the measured flow upstream; a measured loss of 38 L/s was recorded. The creek at this location was incised in soil with a rock stream bed (Figure 6), whereas a short distance downstream at a ford the creek blows out onto alluvial gravels with a larger wetted perimeter.
- A further 1km downstream flow in the Albert Burn ceased, and the 34L/s measured upstream was reduced to dryness upstream of the confluence with Lake Dunstan (Figure 7). The surface area of the wider alluvial channel at this location and further downstream increases the potential for water to be lost to the sub-surface zone.

Figure 10: Albert Burn middles reaches above the State Highway where creek is confined to a gorge-like area with dense vegetation, and steep banks (January 2019).

Although the nearby Schoolhouse Creek flows were indicative of low flow conditions, the measured flow in the Albert Burn upstream of all abstraction was measured as 36 l/s and comparatively similar to the mean annual flow estimated by SHINY[1] (SHINY mean flow = 40L/s; MALF = 9.8L/s). Due to the substantial rainfall experienced in December that is unusual for this area of Central Otago, flows in the catchment were higher than usual. It is likely that the gauging completed upstream of all activity is indictive of mean annual flows. Given the survey was completed under average flow conditions and showed the potential for flow losses greater than the estimated MALF, careful consideration of flow losses must be included in residual flow discussions. Under drier conditions, like typically experienced in this area, it can be assumed that any available flow would go to ground leaving a dry creek bed. This phenomenon would also likely occur further upstream than observed during the survey.

[1] SHINY is a model developed by NIWA and a tool utilized by the Otago Regional Council for modelling flow statistics in catchments where little hydrological information is available, as well as other relevant ecological variables (Booker & Whitehead, 2017).

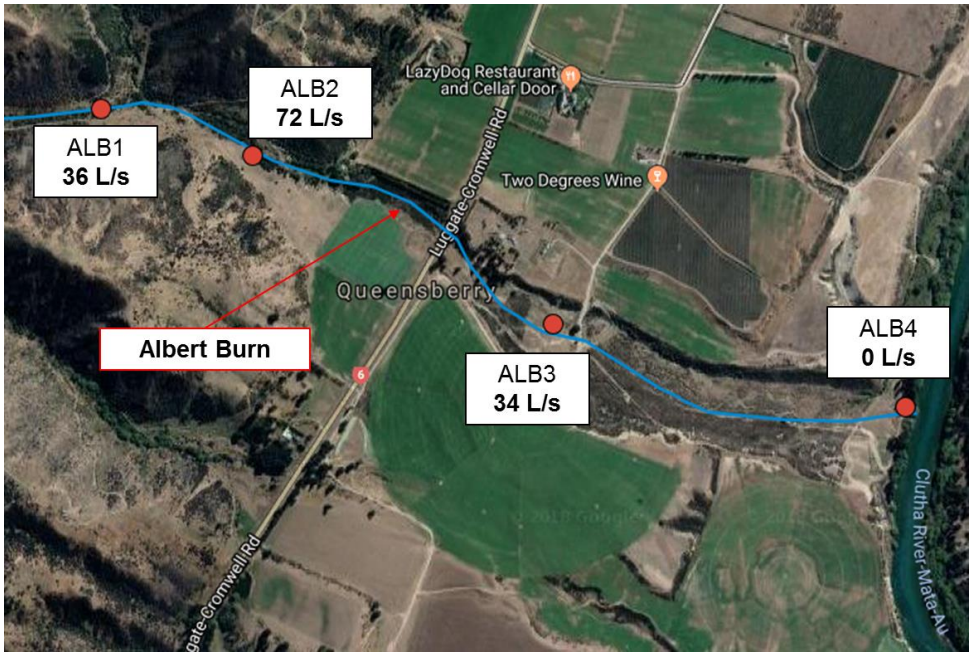

Figure 11: Flow gauging sites with measured flows.

The geology of the catchment is variable, with schist geology in the upper headwaters, and loess and alluvium in the lower reaches (Figure 12). Loess and fine alluvial gravels are typically quite porous and therefore can leak surface water to the sub-surface zone or groundwater zone, and therefore likely promote the interaction of surface water with the sub-surface zone in the Albert Burn Catchment in the lower reaches, explaining the observed water losses.

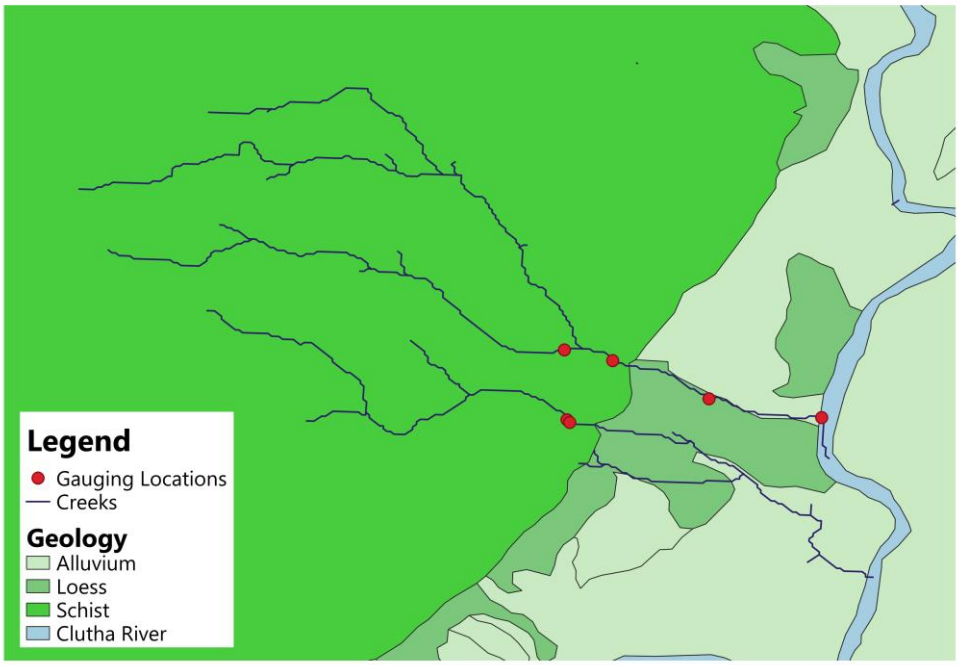

Figure 12: Geology of the Albert Burn and Schoolhouse Creek catchments.

4.2 Temperature Records

Temperature is often used as a tracer for groundwater surface water interactions, as temperature can be used to identify locations of exchange between surface water and groundwater. Air temperature is commonly used as a comparison to identify the thermal behavior of a stream. Flow affects water temperature due to the difference in the thermal capacity of water and air, and therefore a larger volume of water, deeper water, and faster moving water will dampen the effects of the surrounding air temperature and incoming solar radiation. Likewise, rainfall patterns can help understand the thermal behavior of streams.

A series of water temperature records exists for the Amisfield Burn Catchment, a neighboring catchment that is topographically and geologically similar to the Albert Burn. An in-depth investigation of the Amisfield Burn temperature records was carried by Landpro Ltd in 2019 to assess the validity of using temperature monitoring data as a proxy to determine when the streams along the Pisa Range are likely dry in their lower reaches and understand flow losses in catchments. It was expected that one or both of the daily maximum temperature or daily temperature range observed in the Amisfield Burn Catchment could be used to predict the absence of water in the lower reaches of the stream.

The investigation suggested that both the maximum daily temperature and the daily temperature range have potential as predictors of when the stream is dry downstream in the Amisfield Burn Catchment, and in summary:

- Absolute and daily temperature records are significantly higher downstream than upstream, particularly during summer and autumn;
- Higher temperatures would be expected downstream regardless of wet or dry conditions due to longer flow path, lower altitude and gravel bed, affecting the thermal regime of the stream in the lower reaches;
- Bimodal or multimodal behavior present in the 2013-14 record of daily max temperature and daily temperature range suggest the effect of dryness was more extreme in this season;
- Predicted dry spells occur primarily in late summer and early autumn, and coincide with periods of low upstream flows, low rainfall, and high air temperatures, also coinciding with a general trend of decreasing abstraction at this time of year; and
- Predicted dryness coincides with natural low flows in the upper reaches of the Amisfield Burn, and warmer upstream temperatures.

The Albert Burn likely behaves in a similar way to the Amisfield Burn based on similarities in topography and geology. This drying behavior is typically observed in the creeks draining the Pisa Range and

therefore when observations of dryness are made in the Amisfield Burn at times of low flow in the upper reaches of the catchment, dryness is likely in the Albert Burn.

4.3 Schoolhouse Creek Race Abstraction

The 5 gaugings carried out monthly on the Schoolhouse Creek race between December 2018 and April 2019 show that 75-100% of the flow in the creek is diverted through the race. This abstraction point in its current infrastructure set-up is passive, and therefore there is a strong relationship between creek flows, and race flow that is measured immediately downstream of the abstraction point. Race overflows were observed between the abstraction point and downstream along the race (approximately 40 meters) (Figure13 and 14). Although some significant race overflows occurred when creek flows were high (20 l/s when abstraction was greatest), these overflows were insignificant (0-2 l/s) when abstraction was at average conditions. Without knowing the conditions under which these overflows truly occur means it is difficult to parameterize the conditions in which overflows occur, therefore abstraction can occur up to 32 l/s over the irrigation season.

A synthetic abstraction record using the relationship between creek flows and measured race flows would look something like Figure 2 due to the passive nature of the abstraction, although abstracted flows are approx. 6% lower than that measured at the upstream flow monitoring site. This crude assessment of Schoolhouse Creek abstraction under permit 2002.354.V1 is based on the 6-year Schoolhouse Creek flow record; 94% of Schoolhouse Creek flow is assumed abstracted based on linear relationship.

Figure 13: Example of overflow from the Schoolhouse Creek Race in February and March 2019.

Figure 14: Example of overflow from the Schoolhouse Creek Race in March 2019, and April 2019 which was comparably drier with no overflow.

5. Conclusion and Recommendation

It is likely that there are natural flow losses in the Albert Burn Catchment. The stream gauging identified that when abstraction is not occurring in the catchment, the geomorphology of the river channel and alluvial bed morphology promotes flow losses to the subsurface zone. The flow lost during the assessment is proportional to flows upstream in the catchment and suggests that there is potential for substantial flow losses, greater than the 7day-MALF for the catchment, and therefore residual flow discussions must consider this.

The gauging on the Schoolhouse Creek Race for the 2018/2019 season indicates that a maximum of 31.7 l/s was abstracted, and an average of 19 l/s was abstracted. Although there are at times significant overflows in the race delivering water back to Schoolhouse Creek (as high as 20 l/s). The gauging record suggests that 75-100% of available flow in Schoolhouse Creek was taken on average over the 2018/2019 season.

6. Appendix - Gauging Raw Data

Albert Burn – ALB1

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190123_ALBERTUP.WAD
Start Date and Time	2019/01/22 11:24:45

Site Details	
Site Name	ALBERTUP
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P3911
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty		
Category	**ISO**	**Stats**
Accuracy	1.0%	1.0%
Depth	0.4%	3.6%
Velocity	0.9%	3.2%
Width	0.1%	0.1%
Method	1.9%	-
# Stations	2.2%	-
Overall	**3.2%**	**4.9%**

Summary			
Averaging Int.	40	# Stations	23
Start Edge	LEW	Total Width	2.100
Mean SNR	39.4 dB	Total Area	0.122
Mean Temp	14.75 °C	Mean Depth	0.058
Disch. Equation	Mean-Section	Mean Velocity	0.2961
		Total Discharge	**0.0360**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	11:24	0.00	None	0.000	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	*11:24*	*0.20*	*0.6*	*0.040*	*0.6*	*0.016*	*0.1659*	*1.00*	*0.0829*	*0.004*	*0.0003*	*0.9*
2	11:27	0.30	0.6	0.050	0.6	0.020	0.1220	1.00	0.1439	0.005	0.0006	1.8
3	11:28	0.40	0.6	0.050	0.6	0.020	0.4064	1.00	0.2642	0.005	0.0013	3.7
4	11:29	0.50	0.6	0.070	0.6	0.028	0.2557	1.00	0.3310	0.006	0.0020	5.5
5	11:30	0.60	0.6	0.060	0.6	0.024	0.3959	1.00	0.3258	0.007	0.0021	5.9
6	11:32	0.65	0.6	0.070	0.6	0.028	0.4378	1.00	0.4168	0.003	0.0014	3.8
7	11:33	0.70	0.6	0.080	0.6	0.032	0.4534	1.00	0.4456	0.004	0.0017	4.6
8	11:35	0.75	0.6	0.060	0.6	0.024	0.4118	1.00	0.4326	0.004	0.0015	4.2
9	11:36	0.80	0.6	0.060	0.6	0.024	0.3311	1.00	0.3714	0.003	0.0011	3.1
10	11:37	0.90	0.6	0.060	0.6	0.024	0.2925	1.00	0.3118	0.006	0.0019	5.2
11	11:39	1.00	0.6	0.060	0.6	0.024	0.0510	1.00	0.1717	0.006	0.0010	2.9
12	*11:40*	*1.10*	*0.6*	*0.070*	*0.6*	*0.028*	*0.0265*	*1.00*	*0.0387*	*0.007*	*0.0003*	*0.7*
13	*11:41*	*1.20*	*0.6*	*0.070*	*0.6*	*0.028*	*0.1250*	*1.00*	*0.0757*	*0.007*	*0.0005*	*1.5*
14	11:42	1.30	0.6	0.080	0.6	0.032	0.3527	1.00	0.2388	0.008	0.0018	5.0
15	11:43	1.40	0.6	0.060	0.6	0.024	0.2771	1.00	0.3149	0.007	0.0022	6.1
16	11:46	1.45	0.6	0.080	0.6	0.032	0.1155	1.00	0.1963	0.004	0.0007	1.9
17	*11:47*	*1.50*	*0.6*	*0.060*	*0.6*	*0.024*	*0.1428*	*1.00*	*0.1291*	*0.004*	*0.0005*	*1.3*
18	11:50	1.60	0.6	0.080	0.6	0.032	0.1421	1.00	0.1424	0.007	0.0010	2.8
19	*11:51*	*1.70*	*0.6*	*0.080*	*0.6*	*0.032*	*0.5228*	*1.00*	*0.3324*	*0.008*	*0.0027*	*7.4*
20	11:52	1.80	0.6	0.070	0.6	0.028	0.6844	1.00	0.6036	0.008	0.0045	12.6
21	11:55	1.90	0.6	0.060	0.6	0.024	0.7497	1.00	0.7170	0.007	0.0047	13.0
22	11:55	2.10	None	0.000	0.0	0.0	0.0000	0.00	0.3748	0.006	0.0022	6.3

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Albert Burn – ALB2

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190123_ALBMID1.WAD
Start Date and Time	2019/01/22 12:16:30

Site Details	
Site Name	ALBMID1
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P3911
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.3%	3.1%
Velocity	1.2%	3.4%
Width	0.1%	0.1%
Method	1.7%	-
# Stations	1.9%	-
Overall	**3.0%**	**4.7%**

Summary

Averaging Int.	40	# Stations	27
Start Edge	LEW	Total Width	2.200
Mean SNR	42.8 dB	Total Area	0.212
Mean Temp	15.02 °C	Mean Depth	0.096
Disch. Equation	Mean-Section	Mean Velocity	0.3399
		Total Discharge	**0.0719**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:16	0.00	None	0.000	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	12:16	0.10	0.6	0.060	0.6	0.024	-0.0199	1.00	-0.0099	0.003	0.0000	0.0
2	12:18	0.15	0.6	0.100	0.6	0.040	0.1427	1.00	0.0614	0.004	0.0002	0.3
3	*12:19*	*0.20*	*0.6*	*0.120*	*0.6*	*0.048*	*0.4511*	*1.00*	*0.2969*	*0.006*	*0.0016*	*2.3*
4	*12:21*	*0.25*	*0.6*	*0.120*	*0.6*	*0.048*	*0.0469*	*1.00*	*0.2490*	*0.006*	*0.0015*	*2.1*
5	12:23	0.30	0.6	0.130	0.6	0.052	0.3243	1.00	0.1856	0.006	0.0012	1.6
6	12:24	0.35	0.6	0.100	0.6	0.040	0.6469	1.00	0.4856	0.006	0.0028	3.9
7	12:25	0.40	0.6	0.090	0.6	0.036	0.6378	1.00	0.6423	0.005	0.0031	4.2
8	*12:27*	*0.45*	*0.6*	*0.120*	*0.6*	*0.048*	*0.5978*	*1.00*	*0.6178*	*0.005*	*0.0032*	*4.5*
9	*12:28*	*0.50*	*0.6*	*0.120*	*0.6*	*0.048*	*0.4860*	*1.00*	*0.5419*	*0.006*	*0.0033*	*4.5*
10	*12:29*	*0.60*	*0.6*	*0.100*	*0.6*	*0.040*	*0.2424*	*1.00*	*0.3642*	*0.011*	*0.0040*	*5.6*
11	*12:31*	*0.70*	*0.6*	*0.100*	*0.6*	*0.040*	*0.3792*	*1.00*	*0.3108*	*0.010*	*0.0031*	*4.3*
12	*12:32*	*0.80*	*0.6*	*0.100*	*0.6*	*0.040*	*0.4639*	*1.00*	*0.4215*	*0.010*	*0.0042*	*5.9*
13	*12:33*	*0.90*	*0.6*	*0.170*	*0.6*	*0.068*	*0.5218*	*1.00*	*0.4928*	*0.014*	*0.0067*	*9.3*
14	*12:36*	*1.00*	*0.6*	*0.130*	*0.6*	*0.052*	*0.3837*	*1.00*	*0.4527*	*0.015*	*0.0068*	*9.4*
15	*12:38*	*1.10*	*0.6*	*0.120*	*0.6*	*0.048*	*0.2661*	*1.00*	*0.3249*	*0.013*	*0.0041*	*5.6*
16	12:39	1.20	0.6	0.120	0.6	0.048	0.2261	1.00	0.2461	0.012	0.0030	4.1
17	*12:40*	*1.30*	*0.6*	*0.080*	*0.6*	*0.032*	*0.2363*	*1.00*	*0.2312*	*0.010*	*0.0023*	*3.2*
18	12:41	1.40	0.6	0.100	0.6	0.040	0.2742	1.00	0.2552	0.009	0.0023	3.2
19	12:42	1.50	0.6	0.120	0.6	0.048	0.3530	1.00	0.3136	0.011	0.0034	4.8
20	12:44	1.60	0.6	0.120	0.6	0.048	0.4024	1.00	0.3777	0.012	0.0045	6.3
21	12:45	1.70	0.6	0.100	0.6	0.040	0.4206	1.00	0.4115	0.011	0.0045	6.3
22	12:46	1.80	0.6	0.080	0.6	0.032	0.2816	1.00	0.3511	0.009	0.0032	4.4
23	12:48	1.90	0.6	0.060	0.6	0.024	0.1399	1.00	0.2107	0.007	0.0015	2.1
24	12:49	2.00	0.6	0.050	0.6	0.020	0.1170	1.00	0.1284	0.006	0.0007	1.0
25	12:50	2.10	0.6	0.040	0.6	0.016	0.1681	1.00	0.1425	0.005	0.0006	0.9
26	12:50	2.20	None	0.000	0.0	0.0	0.0000	0.00	0.0840	0.002	0.0002	0.2

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Albert Burn – ALB3

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190123_ALBMID2.WAD
Start Date and Time	2019/01/22 13:28:52

Site Details	
Site Name	ALBMID2
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P3911
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.3%	1.8%
Velocity	0.8%	2.0%
Width	0.1%	0.1%
Method	1.6%	-
# Stations	1.9%	-
Overall	**2.8%**	**2.9%**

Summary

Averaging Int.	40	# Stations	27
Start Edge	LEW	Total Width	1.500
Mean SNR	41.2 dB	Total Area	0.162
Mean Temp	16.37 °C	Mean Depth	0.108
Disch. Equation	Mean-Section	Mean Velocity	0.2045
		Total Discharge	**0.0330**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	13:28	0.00	None	0.000	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	13:31	0.20	0.6	0.050	0.6	0.020	0.0328	1.00	0.0164	0.005	0.0001	0.2
2	13:32	0.25	0.6	0.050	0.6	0.020	0.0347	1.00	0.0337	0.003	0.0001	0.3
3	13:34	0.30	0.6	0.050	0.6	0.020	0.2970	1.00	0.1658	0.003	0.0004	1.3
4	13:37	0.35	0.6	0.060	0.6	0.024	0.2812	1.00	0.2891	0.003	0.0008	2.4
5	13:38	0.40	0.6	0.060	0.6	0.024	0.2791	1.00	0.2801	0.003	0.0008	2.5
6	13:39	0.45	0.6	0.080	0.6	0.032	0.2748	1.00	0.2769	0.004	0.0010	2.9
7	13:41	0.50	0.6	0.080	0.6	0.032	0.1899	1.00	0.2323	0.004	0.0009	2.8
8	13:42	0.55	0.6	0.090	0.6	0.036	0.2371	1.00	0.2135	0.004	0.0009	2.7
9	13:43	0.60	0.6	0.140	0.6	0.056	0.0436	1.00	0.1403	0.006	0.0008	2.4
10	13:45	0.65	0.6	0.140	0.6	0.056	0.0956	1.00	0.0696	0.007	0.0005	1.5
11	13:46	0.70	0.6	0.140	0.6	0.056	0.1294	1.00	0.1125	0.007	0.0008	2.4
12	13:47	0.75	0.6	0.130	0.6	0.052	0.2646	1.00	0.1970	0.007	0.0013	4.0
13	13:48	0.80	0.6	0.140	0.6	0.056	0.3059	1.00	0.2852	0.007	0.0019	5.8
14	13:50	0.85	0.6	0.150	0.6	0.060	0.2741	1.00	0.2900	0.007	0.0021	6.4
15	13:51	0.90	0.6	0.160	0.6	0.064	0.2468	1.00	0.2604	0.008	0.0020	6.1
16	13:52	0.95	0.6	0.170	0.6	0.068	0.2512	1.00	0.2490	0.008	0.0021	6.2
17	13:53	1.00	0.6	0.190	0.6	0.076	0.2491	1.00	0.2501	0.009	0.0023	6.8
18	13:54	1.05	0.6	0.180	0.6	0.072	0.2524	1.00	0.2507	0.009	0.0023	7.0
19	13:56	1.10	0.6	0.170	0.6	0.068	0.2182	1.00	0.2353	0.009	0.0021	6.2
20	13:57	1.15	0.6	0.160	0.6	0.064	0.2514	1.00	0.2348	0.008	0.0019	5.9
21	13:58	1.20	0.6	0.120	0.6	0.048	0.2106	1.00	0.2310	0.007	0.0016	4.9
22	14:00	1.25	0.6	0.110	0.6	0.044	0.2286	1.00	0.2196	0.006	0.0013	3.8
23	14:01	1.30	0.6	0.110	0.6	0.044	0.2353	1.00	0.2319	0.006	0.0013	3.9
24	14:02	1.35	0.6	0.150	0.6	0.060	0.2134	1.00	0.2243	0.007	0.0015	4.4
25	14:04	1.40	0.6	0.110	0.6	0.044	0.1843	1.00	0.1988	0.007	0.0013	3.9
26	14:04	1.50	None	0.110	0.0	0.0	0.0000	0.00	0.0921	0.011	0.0010	3.1

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Schoolhouse Creek Race – SCH1 (note date of each set of data)

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20181220_SCHTER.WAD
Start Date and Time	2018/12/19 09:22:37

Site Details	
Site Name	SCHTER
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P3911
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.4%	1.5%
Velocity	0.7%	1.6%
Width	0.1%	0.1%
Method	1.8%	-
# Stations	2.1%	-
Overall	**3.0%**	**2.4%**

Summary

Averaging Int.	40	# Stations	24
Start Edge	LEW	Total Width	1.150
Mean SNR	39.4 dB	Total Area	0.145
Mean Temp	11.01 °C	Mean Depth	0.126
Disch. Equation	Mean-Section	Mean Velocity	0.2173
		Total Discharge	**0.0315**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	09:22	0.00	None	0.000	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	*09:22*	*0.05*	*0.6*	*0.155*	*0.6*	*0.062*	*0.0003*	*1.00*	*0.0001*	*0.004*	*0.0000*	*0.0*
2	*09:24*	*0.10*	*0.6*	*0.155*	*0.6*	*0.062*	*0.0079*	*1.00*	*0.0041*	*0.008*	*0.0000*	*0.1*
3	09:26	0.17	0.6	0.155	0.6	0.062	0.2070	1.00	0.1074	0.011	0.0012	3.7
4	09:29	0.20	0.6	0.175	0.6	0.070	0.1235	1.00	0.1652	0.005	0.0008	2.6
5	09:30	0.25	0.6	0.180	0.6	0.072	0.1179	1.00	0.1207	0.009	0.0011	3.4
6	09:32	0.30	0.6	0.175	0.6	0.070	0.2132	1.00	0.1655	0.009	0.0015	4.7
7	09:33	0.35	0.6	0.185	0.6	0.074	0.2698	1.00	0.2415	0.009	0.0022	6.9
8	09:34	0.40	0.6	0.160	0.6	0.064	0.2849	1.00	0.2773	0.009	0.0024	7.6
9	09:36	0.45	0.6	0.180	0.6	0.072	0.2826	1.00	0.2837	0.009	0.0024	7.7
10	09:38	0.50	0.6	0.160	0.6	0.064	0.2769	1.00	0.2797	0.009	0.0024	7.6
11	09:39	0.55	0.6	0.155	0.6	0.062	0.2726	1.00	0.2747	0.008	0.0022	6.9
12	09:41	0.60	0.6	0.130	0.6	0.052	0.2910	1.00	0.2818	0.007	0.0020	6.4
13	09:42	0.65	0.6	0.125	0.6	0.050	0.2843	1.00	0.2876	0.006	0.0018	5.8
14	09:44	0.70	0.6	0.110	0.6	0.044	0.2912	1.00	0.2877	0.006	0.0017	5.4
15	09:45	0.75	0.6	0.110	0.6	0.044	0.2821	1.00	0.2866	0.006	0.0016	5.0
16	09:47	0.80	0.6	0.100	0.6	0.040	0.2764	1.00	0.2792	0.005	0.0015	4.7
17	09:48	0.85	0.6	0.090	0.6	0.036	0.2689	1.00	0.2726	0.005	0.0013	4.1
18	09:50	0.90	0.6	0.080	0.6	0.032	0.2693	1.00	0.2691	0.004	0.0011	3.6
19	09:51	0.95	0.6	0.080	0.6	0.032	0.2681	1.00	0.2687	0.004	0.0011	3.4
20	09:52	1.00	0.6	0.080	0.6	0.032	0.2609	1.00	0.2645	0.004	0.0011	3.4
21	09:54	1.05	0.6	0.080	0.6	0.032	0.2594	1.00	0.2601	0.004	0.0010	3.3
22	09:56	1.10	0.6	0.080	0.6	0.032	0.2258	1.00	0.2426	0.004	0.0010	3.1
23	09:56	1.15	None	0.000	0.0	0.0	0.0000	0.00	0.1129	0.002	0.0002	0.7

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190123_SCH1.WAD
Start Date and Time	2019/01/22 15:17:32

Site Details	
Site Name	SCH1
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P3911
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.4%	1.7%
Velocity	0.6%	1.9%
Width	0.1%	0.1%
Method	1.8%	-
# Stations	2.5%	-
Overall	**3.4%**	**2.7%**

Summary

Averaging Int.	40	# Stations	20
Start Edge	LEW	Total Width	1.000
Mean SNR	32.4 dB	Total Area	0.095
Mean Temp	15.50 °C	Mean Depth	0.095
Disch. Equation	Mean-Section	Mean Velocity	0.1451
		Total Discharge	**0.0137**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	15:17	0.00	None	0.050	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	*15:17*	*0.05*	*0.6*	*0.120*	*0.6*	*0.048*	*0.0000*	*1.00*	*0.0000*	*0.004*	*0.0000*	*0.0*
2	*15:18*	*0.10*	*0.6*	*0.120*	*0.6*	*0.048*	*0.0840*	*1.00*	*0.0420*	*0.006*	*0.0003*	*1.8*
3	15:20	0.15	0.6	0.140	0.6	0.056	0.0905	1.00	0.0872	0.007	0.0006	4.1
4	15:21	0.20	0.6	0.140	0.6	0.056	0.0387	1.00	0.0646	0.007	0.0005	3.3
5	15:22	0.25	0.6	0.140	0.6	0.056	0.1626	1.00	0.1006	0.007	0.0007	5.1
6	15:24	0.30	0.6	0.140	0.6	0.056	0.1794	1.00	0.1710	0.007	0.0012	8.7
7	15:25	0.35	0.6	0.130	0.6	0.052	0.1787	1.00	0.1790	0.007	0.0012	8.8
8	15:26	0.40	0.6	0.120	0.6	0.048	0.1820	1.00	0.1803	0.006	0.0011	8.2
9	15:27	0.45	0.6	0.120	0.6	0.048	0.1795	1.00	0.1807	0.006	0.0011	7.9
10	15:32	0.50	0.6	0.110	0.6	0.044	0.1706	1.00	0.1750	0.006	0.0010	7.3
11	15:35	0.55	0.6	0.080	0.6	0.032	0.1865	1.00	0.1785	0.005	0.0008	6.2
12	15:36	0.60	0.6	0.080	0.6	0.032	0.1969	1.00	0.1917	0.004	0.0008	5.6
13	15:37	0.65	0.6	0.080	0.6	0.032	0.1986	1.00	0.1977	0.004	0.0008	5.8
14	15:39	0.70	0.6	0.060	0.6	0.024	0.2177	1.00	0.2081	0.004	0.0007	5.3
15	15:40	0.75	0.6	0.060	0.6	0.024	0.2363	1.00	0.2270	0.003	0.0007	5.0
16	15:42	0.80	0.6	0.050	0.6	0.020	0.2234	1.00	0.2298	0.003	0.0006	4.6
17	15:43	0.85	0.6	0.050	0.6	0.020	0.2198	1.00	0.2216	0.003	0.0006	4.0
18	15:44	0.90	0.6	0.050	0.6	0.020	0.2240	1.00	0.2219	0.003	0.0006	4.0
19	15:44	1.00	None	0.050	0.0	0.0	0.0000	0.00	0.1120	0.005	0.0006	4.1

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190213_SCH1.WAD
Start Date and Time	2019/02/13 11:17:24

Site Details	
Site Name	SCH1
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P2225
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.3%	1.5%
Velocity	0.5%	1.7%
Width	0.1%	0.1%
Method	1.7%	-
# Stations	2.5%	-
Overall	**3.3%**	**2.5%**

Summary

Averaging Int.	40	# Stations	20
Start Edge	LEW	Total Width	1.000
Mean SNR	29.9 dB	Total Area	0.091
Mean Temp	14.41 °C	Mean Depth	0.091
Disch. Equation	Mid-Section	Mean Velocity	0.1672
		Total Discharge	**0.0152**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	11:17	0.00	None	0.110	0.0	0.0	0.0000	1.00	0.1130	0.006	0.0006	4.1
1	11:18	0.10	0.6	0.150	0.6	0.060	0.1130	1.00	0.1130	0.011	0.0013	8.4
2	11:20	0.15	0.6	0.130	0.6	0.052	0.0777	1.00	0.0777	0.007	0.0005	3.3
3	11:21	0.20	0.6	0.140	0.6	0.056	0.1154	1.00	0.1154	0.007	0.0008	5.3
4	11:23	0.25	0.6	0.130	0.6	0.052	0.1734	1.00	0.1734	0.007	0.0011	7.4
5	11:24	0.30	0.6	0.120	0.6	0.048	0.1909	1.00	0.1909	0.006	0.0011	7.5
6	11:25	0.35	0.6	0.120	0.6	0.048	0.1854	1.00	0.1854	0.006	0.0011	7.3
7	11:26	0.40	0.6	0.100	0.6	0.040	0.1807	1.00	0.1807	0.005	0.0009	6.0
8	11:27	0.45	0.6	0.090	0.6	0.036	0.1810	1.00	0.1810	0.005	0.0008	5.4
9	11:28	0.50	0.6	0.080	0.6	0.032	0.1871	1.00	0.1871	0.004	0.0007	4.9
10	11:29	0.55	0.6	0.070	0.6	0.028	0.2192	1.00	0.2192	0.004	0.0008	5.1
11	11:30	0.60	0.6	0.070	0.6	0.028	0.2270	1.00	0.2270	0.004	0.0008	5.2
12	11:31	0.65	0.6	0.070	0.6	0.028	0.2217	1.00	0.2217	0.004	0.0008	5.1
13	11:32	0.70	0.6	0.070	0.6	0.028	0.2053	1.00	0.2053	0.004	0.0007	4.7
14	11:33	0.75	0.6	0.070	0.6	0.028	0.1928	1.00	0.1928	0.004	0.0007	4.4
15	11:35	0.80	0.6	0.060	0.6	0.024	0.2140	1.00	0.2140	0.003	0.0006	4.2
16	11:36	0.85	0.6	0.060	0.6	0.024	0.2410	1.00	0.2410	0.003	0.0007	4.8
17	11:37	0.90	0.6	0.040	0.6	0.016	0.2260	1.00	0.2260	0.002	0.0005	3.0
18	11:38	0.95	0.6	0.040	0.6	0.016	0.1906	1.00	0.1906	0.002	0.0004	2.5
19	11:38	1.00	None	0.040	0.0	0.0	0.0000	1.00	0.1906	0.001	0.0002	1.3

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190306_SHC1.WAD
Start Date and Time	2019/03/06 07:15:51

Site Details	
Site Name	SHC1
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P4396
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.3%	1.1%
Velocity	0.5%	1.5%
Width	0.1%	0.1%
Method	1.7%	-
# Stations	2.0%	-
Overall	**2.9%**	**2.1%**

Summary

Averaging Int.	40	# Stations	25
Start Edge	LEW	Total Width	0.980
Mean SNR	33.2 dB	Total Area	0.095
Mean Temp	14.10 °C	Mean Depth	0.097
Disch. Equation	Mean-Section	Mean Velocity	0.1437
		Total Discharge	**0.0136**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	07:15	0.00	None	0.120	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	*07:15*	*0.05*	*0.6*	*0.120*	*0.6*	*0.048*	*0.0000*	*1.00*	*0.0000*	*0.006*	*0.0000*	*0.0*
2	*07:17*	*0.10*	*0.6*	*0.130*	*0.6*	*0.052*	*0.0017*	*1.00*	*0.0008*	*0.006*	*0.0000*	*0.0*
3	07:18	0.14	0.6	0.140	0.6	0.056	0.1263	1.00	0.0640	0.005	0.0003	2.5
4	07:20	0.18	0.6	0.140	0.6	0.056	0.1277	1.00	0.1270	0.006	0.0007	5.2
5	07:21	0.22	0.6	0.140	0.6	0.056	0.0941	1.00	0.1109	0.006	0.0006	4.6
6	07:22	0.26	0.6	0.140	0.6	0.056	0.1428	1.00	0.1184	0.006	0.0007	4.9
7	07:23	0.30	0.6	0.130	0.6	0.052	0.1796	1.00	0.1612	0.005	0.0009	6.4
8	07:24	0.34	0.6	0.130	0.6	0.052	0.1801	1.00	0.1798	0.005	0.0009	6.9
9	07:25	0.38	0.6	0.120	0.6	0.048	0.1859	1.00	0.1830	0.005	0.0009	6.7
10	07:26	0.42	0.6	0.100	0.6	0.040	0.1909	1.00	0.1884	0.004	0.0008	6.1
11	07:27	0.46	0.6	0.100	0.6	0.040	0.1872	1.00	0.1890	0.004	0.0008	5.5
12	07:28	0.50	0.6	0.100	0.6	0.040	0.1915	1.00	0.1893	0.004	0.0008	5.6
13	07:29	0.54	0.6	0.080	0.6	0.032	0.1889	1.00	0.1902	0.004	0.0007	5.0
14	07:30	0.58	0.6	0.080	0.6	0.032	0.1898	1.00	0.1893	0.003	0.0006	4.4
15	07:32	0.62	0.6	0.080	0.6	0.032	0.1953	1.00	0.1925	0.003	0.0006	4.5
16	07:32	0.66	0.6	0.080	0.6	0.032	0.1891	1.00	0.1922	0.003	0.0006	4.5
17	07:34	0.70	0.6	0.060	0.6	0.024	0.1937	1.00	0.1914	0.003	0.0005	3.9
18	07:35	0.74	0.6	0.060	0.6	0.024	0.2008	1.00	0.1972	0.002	0.0005	3.5
19	07:36	0.78	0.6	0.060	0.6	0.024	0.2115	1.00	0.2061	0.002	0.0005	3.6
20	07:37	0.82	0.6	0.060	0.6	0.024	0.2115	1.00	0.2115	0.002	0.0005	3.7
21	07:38	0.86	0.6	0.060	0.6	0.024	0.2045	1.00	0.2080	0.002	0.0005	3.7
22	07:39	0.90	0.6	0.060	0.6	0.024	0.2078	1.00	0.2061	0.002	0.0005	3.6
23	07:40	0.94	0.6	0.060	0.6	0.024	0.2004	1.00	0.2041	0.002	0.0005	3.6
24	07:40	0.98	None	0.040	0.0	0.0	0.0000	0.00	0.1002	0.002	0.0002	1.5

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190410_SCH1.WAD
Start Date and Time	2019/04/10 08:51:49

Site Details	
Site Name	SCH1
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P4396
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty		
Category	**ISO**	**Stats**
Accuracy	1.0%	1.0%
Depth	0.3%	1.2%
Velocity	0.5%	1.7%
Width	0.1%	0.1%
Method	1.6%	-
# Stations	2.0%	-
Overall	**2.9%**	**2.3%**

Summary			
Averaging Int.	40	# Stations	25
Start Edge	LEW	Total Width	1.100
Mean SNR	34.1 dB	Total Area	0.100
Mean Temp	9.93 °C	Mean Depth	0.091
Disch. Equation	Mean-Section	Mean Velocity	0.1562
		Total Discharge	**0.0157**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	08:51	0.00	None	0.120	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	*08:53*	*0.05*	*0.6*	*0.120*	*0.6*	*0.048*	*-0.0002*	*1.00*	*-0.0001*	*0.006*	*0.0000*	*0.0*
2	*08:54*	*0.10*	*0.6*	*0.120*	*0.6*	*0.048*	*-0.0144*	*1.00*	*-0.0073*	*0.006*	*0.0000*	*-0.3*
3	08:56	0.14	0.6	0.130	0.6	0.052	0.0849	1.00	0.0352	0.005	0.0002	1.1
4	08:57	0.18	0.6	0.140	0.6	0.056	0.1756	1.00	0.1302	0.005	0.0007	4.5
5	08:58	0.22	0.6	0.140	0.6	0.056	0.1341	1.00	0.1548	0.006	0.0009	5.5
6	08:59	0.26	0.6	0.140	0.6	0.056	0.1010	1.00	0.1175	0.006	0.0007	4.2
7	09:00	0.30	0.6	0.130	0.6	0.052	0.1866	1.00	0.1438	0.005	0.0008	4.9
8	09:01	0.34	0.6	0.130	0.6	0.052	0.1934	1.00	0.1900	0.005	0.0010	6.3
9	09:02	0.38	0.6	0.120	0.6	0.048	0.1982	1.00	0.1958	0.005	0.0010	6.2
10	09:03	0.42	0.6	0.110	0.6	0.044	0.1955	1.00	0.1968	0.005	0.0009	5.8
11	09:05	0.46	0.6	0.110	0.6	0.044	0.2030	1.00	0.1992	0.004	0.0009	5.6
12	09:06	0.50	0.6	0.100	0.6	0.040	0.2143	1.00	0.2086	0.004	0.0009	5.6
13	09:07	0.54	0.6	0.100	0.6	0.040	0.2212	1.00	0.2177	0.004	0.0009	5.6
14	09:08	0.58	0.6	0.080	0.6	0.032	0.2266	1.00	0.2239	0.004	0.0008	5.1
15	09:09	0.62	0.6	0.080	0.6	0.032	0.2301	1.00	0.2283	0.003	0.0007	4.7
16	09:10	0.66	0.6	0.080	0.6	0.032	0.2287	1.00	0.2294	0.003	0.0007	4.7
17	09:11	0.70	0.6	0.060	0.6	0.024	0.2269	1.00	0.2278	0.003	0.0006	4.1
18	09:12	0.75	0.6	0.060	0.6	0.024	0.2286	1.00	0.2277	0.003	0.0007	4.4
19	09:13	0.80	0.6	0.060	0.6	0.024	0.2304	1.00	0.2295	0.003	0.0007	4.4
20	09:14	0.85	0.6	0.050	0.6	0.020	0.2317	1.00	0.2310	0.003	0.0006	4.0
21	09:15	0.90	0.6	0.050	0.6	0.020	0.2225	1.00	0.2271	0.003	0.0006	3.6
22	09:16	0.95	0.6	0.050	0.6	0.020	0.2009	1.00	0.2117	0.003	0.0005	3.4
23	09:17	1.00	0.6	0.050	0.6	0.020	0.2120	1.00	0.2064	0.003	0.0005	3.3
24	09:17	1.10	None	0.050	0.0	0.0	0.0000	0.00	0.1060	0.005	0.0005	3.4

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Schoolhouse Creek Race – SCH2 (note date of each set of data)

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20181220_SCHLWR.WAD
Start Date and Time	2018/12/19 10:13:20

Site Details	
Site Name	SHCLWR
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P3911
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.7%	3.9%
Velocity	2.5%	5.9%
Width	0.2%	0.2%
Method	3.4%	-
# Stations	3.3%	-
Overall	**5.5%**	**7.1%**

Summary

Averaging Int.	40	# Stations	15
Start Edge	LEW	Total Width	0.700
Mean SNR	38.6 dB	Total Area	0.060
Mean Temp	11.70 °C	Mean Depth	0.085
Disch. Equation	Mean-Section	Mean Velocity	0.1781
		Total Discharge	**0.0106**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	10:13	0.00	None	0.000	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	*10:13*	*0.05*	*0.6*	*0.000*	*0.6*	*0.000*	*-0.0001*	*1.00*	*0.0000*	*0.000*	*0.0000*	*0.0*
2	*10:17*	*0.10*	*0.6*	*0.060*	*0.6*	*0.024*	*-0.0241*	*1.00*	*-0.0121*	*0.002*	*0.0000*	*-0.2*
3	*10:18*	*0.15*	*0.6*	*0.070*	*0.6*	*0.028*	*-0.0614*	*1.00*	*-0.0427*	*0.003*	*-0.0001*	*-1.3*
4	*10:21*	*0.20*	*0.6*	*0.080*	*0.6*	*0.032*	*-0.0298*	*1.00*	*-0.0456*	*0.004*	*-0.0002*	*-1.6*
5	10:22	0.25	0.6	0.080	0.6	0.032	0.0111	1.00	-0.0093	0.004	0.0000	-0.4
6	*10:24*	*0.30*	*0.6*	*0.080*	*0.6*	*0.032*	*0.0732*	*1.00*	*0.0421*	*0.004*	*0.0002*	*1.6*
7	*10:25*	*0.35*	*0.6*	*0.110*	*0.6*	*0.044*	*0.0881*	*1.00*	*0.0806*	*0.005*	*0.0004*	*3.6*
8	10:27	0.40	0.6	0.120	0.6	0.048	0.3675	1.00	0.2278	0.006	0.0013	12.4
9	10:30	0.45	0.6	0.140	0.6	0.056	0.2787	1.00	0.3231	0.007	0.0021	19.8
10	10:31	0.50	0.6	0.120	0.6	0.048	0.6190	1.00	0.4488	0.007	0.0029	27.5
11	*10:33*	*0.55*	*0.6*	*0.110*	*0.6*	*0.044*	*0.2469*	*1.00*	*0.4329*	*0.006*	*0.0025*	*23.5*
12	10:34	0.60	0.6	0.120	0.6	0.048	0.1793	1.00	0.2131	0.006	0.0012	11.6
13	*10:36*	*0.65*	*0.6*	*0.100*	*0.6*	*0.040*	*-0.0312*	*1.00*	*0.0740*	*0.006*	*0.0004*	*3.8*
14	10:36	0.70	None	0.000	0.0	0.0	0.0000	0.00	-0.0156	0.003	0.0000	-0.4

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190123_SCH2.WAD
Start Date and Time	2019/01/22 16:02:53

Site Details	
Site Name	SCH2
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P3911
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.6%	1.9%
Velocity	2.9%	7.2%
Width	0.2%	0.2%
Method	3.0%	-
# Stations	2.6%	-
Overall	**5.1%**	**7.5%**

Summary

Averaging Int.	40	# Stations	19
Start Edge	LEW	Total Width	0.900
Mean SNR	42.4 dB	Total Area	0.085
Mean Temp	15.25 °C	Mean Depth	0.094
Disch. Equation	Mean-Section	Mean Velocity	0.1301
		Total Discharge	**0.0111**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	16:02	0.00	None	0.040	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	16:02	0.05	0.6	0.060	0.6	0.024	0.0035	1.00	0.0017	0.003	0.0000	0.0
2	*16:04*	*0.10*	*0.6*	*0.060*	*0.6*	*0.024*	*-0.0064*	*1.00*	*-0.0014*	*0.003*	*0.0000*	*0.0*
3	*16:05*	*0.15*	*0.6*	*0.060*	*0.6*	*0.024*	*-0.0038*	*1.00*	*-0.0051*	*0.003*	*0.0000*	*-0.1*
4	*16:07*	*0.20*	*0.6*	*0.070*	*0.6*	*0.028*	*-0.0572*	*1.00*	*-0.0305*	*0.003*	*-0.0001*	*-0.9*
5	*16:08*	*0.25*	*0.6*	*0.080*	*0.6*	*0.032*	*-0.0230*	*1.00*	*-0.0401*	*0.004*	*-0.0002*	*-1.4*
6	16:09	0.30	0.6	0.100	0.6	0.040	-0.0145	1.00	-0.0187	0.005	-0.0001	-0.8
7	16:11	0.35	0.6	0.100	0.6	0.040	0.0199	1.00	0.0027	0.005	0.0000	0.1
8	*16:13*	*0.40*	*0.6*	*0.120*	*0.6*	*0.048*	*0.0513*	*1.00*	*0.0356*	*0.006*	*0.0002*	*1.8*
9	16:15	0.45	0.6	0.130	0.6	0.052	0.2175	1.00	0.1344	0.006	0.0008	7.6
10	16:16	0.50	0.6	0.130	0.6	0.052	0.3263	1.00	0.2719	0.007	0.0018	16.0
11	16:17	0.55	0.6	0.130	0.6	0.052	0.1888	1.00	0.2575	0.007	0.0017	15.1
12	*16:18*	*0.60*	*0.6*	*0.130*	*0.6*	*0.052*	*0.2611*	*1.00*	*0.2249*	*0.007*	*0.0015*	*13.2*
13	16:19	0.65	0.6	0.110	0.6	0.044	0.5189	1.00	0.3900	0.006	0.0023	21.2
14	16:20	0.70	0.6	0.110	0.6	0.044	0.2343	1.00	0.3766	0.006	0.0021	18.7
15	16:21	0.75	0.6	0.090	0.6	0.036	0.1415	1.00	0.1879	0.005	0.0009	8.5
16	16:23	0.80	0.6	0.080	0.6	0.032	0.0075	1.00	0.0745	0.004	0.0003	2.9
17	*16:24*	*0.85*	*0.6*	*0.080*	*0.6*	*0.032*	*-0.0573*	*1.00*	*-0.0249*	*0.004*	*-0.0001*	*-0.9*
18	16:24	0.90	None	0.080	0.0	0.0	0.0000	0.00	-0.0286	0.004	-0.0001	-1.0

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190213_SHC2.WAD
Start Date and Time	2019/02/13 11:48:17

Site Details	
Site Name	SCH2
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P2225
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.3%	0.8%
Velocity	0.8%	6.6%
Width	0.1%	0.1%
Method	1.7%	-
# Stations	2.0%	-
Overall	**2.9%**	**6.8%**

Summary

Averaging Int.	40	# Stations	26
Start Edge	LEW	Total Width	0.750
Mean SNR	37.0 dB	Total Area	0.054
Mean Temp	14.99 °C	Mean Depth	0.072
Disch. Equation	Mid-Section	Mean Velocity	0.2406
		Total Discharge	**0.0130**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	11:48	0.00	None	0.040	0.0	0.0	0.0000	1.00	-0.0001	0.001	0.0000	0.0
1	*11:49*	*0.05*	*0.6*	*0.050*	*0.6*	*0.020*	*-0.0001*	*1.00*	*-0.0001*	*0.003*	*0.0000*	*0.0*
2	*11:50*	*0.10*	*0.6*	*0.050*	*0.6*	*0.020*	*0.0002*	*1.00*	*0.0002*	*0.003*	*0.0000*	*0.0*
3	*11:51*	*0.15*	*0.6*	*0.060*	*0.6*	*0.024*	*0.0000*	*1.00*	*0.0000*	*0.003*	*0.0000*	*0.0*
4	11:53	0.20	0.6	0.080	0.6	0.032	0.0015	1.00	0.0015	0.003	0.0000	0.0
5	11:55	0.22	0.6	0.080	0.6	0.032	0.2462	1.00	0.2462	0.002	0.0004	3.0
6	11:56	0.24	0.6	0.080	0.6	0.032	0.3081	1.00	0.3081	0.002	0.0005	3.8
7	11:57	0.26	0.6	0.080	0.6	0.032	0.3427	1.00	0.3427	0.002	0.0005	4.2
8	11:58	0.28	0.6	0.090	0.6	0.036	0.3275	1.00	0.3275	0.002	0.0006	4.5
9	11:59	0.30	0.6	0.080	0.6	0.032	0.4206	1.00	0.4206	0.002	0.0007	5.2
10	12:00	0.32	0.6	0.080	0.6	0.032	0.3955	1.00	0.3955	0.002	0.0006	4.9
11	*12:02*	*0.34*	*0.6*	*0.080*	*0.6*	*0.032*	*0.3749*	*1.00*	*0.3749*	*0.002*	*0.0006*	*4.6*
12	12:02	0.36	0.6	0.080	0.6	0.032	0.3729	1.00	0.3729	0.002	0.0006	4.6
13	12:03	0.38	0.6	0.080	0.6	0.032	0.4353	1.00	0.4353	0.002	0.0007	5.3
14	12:04	0.40	0.6	0.080	0.6	0.032	0.4809	1.00	0.4809	0.002	0.0008	5.9
15	12:05	0.42	0.6	0.080	0.6	0.032	0.5225	1.00	0.5225	0.002	0.0008	6.4
16	12:06	0.44	0.6	0.080	0.6	0.032	0.4926	1.00	0.4926	0.002	0.0008	6.0
17	12:07	0.46	0.6	0.080	0.6	0.032	0.1699	1.00	0.1699	0.002	0.0003	2.1
18	12:08	0.48	0.6	0.080	0.6	0.032	0.4600	1.00	0.4600	0.002	0.0007	5.6
19	12:09	0.50	0.6	0.080	0.6	0.032	0.3376	1.00	0.3376	0.002	0.0005	4.1
20	12:10	0.52	0.6	0.080	0.6	0.032	0.3214	1.00	0.3214	0.002	0.0006	4.9
21	12:11	0.55	0.6	0.080	0.6	0.032	0.2787	1.00	0.2787	0.003	0.0009	6.8
22	12:12	0.60	0.6	0.080	0.6	0.032	0.2324	1.00	0.2324	0.004	0.0009	7.1
23	12:13	0.65	0.6	0.080	0.6	0.032	0.1834	1.00	0.1834	0.004	0.0007	5.6
24	12:14	0.70	0.6	0.070	0.6	0.028	0.1349	1.00	0.1349	0.004	0.0005	3.6
25	12:14	0.75	None	0.060	0.0	0.0	0.0000	1.00	0.1349	0.002	0.0002	1.6

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190306_SHC2.WAD
Start Date and Time	2019/03/06 07:50:29

Site Details	
Site Name	SCH2
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P4396
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.4%	1.3%
Velocity	0.8%	0.7%
Width	0.1%	0.1%
Method	1.8%	-
# Stations	1.9%	-
Overall	**2.9%**	**1.8%**

Summary

Averaging Int.	40	# Stations	27
Start Edge	LEW	Total Width	0.750
Mean SNR	35.0 dB	Total Area	0.056
Mean Temp	14.12 °C	Mean Depth	0.074
Disch. Equation	Mean-Section	Mean Velocity	0.3212
		Total Discharge	**0.0179**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	07:50	0.00	None	0.040	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	*07:50*	*0.05*	*0.6*	*0.040*	*0.6*	*0.016*	*-0.0002*	*1.00*	*-0.0001*	*0.002*	*0.0000*	*0.0*
2	*07:51*	*0.10*	*0.6*	*0.040*	*0.6*	*0.016*	*0.0475*	*1.00*	*0.0236*	*0.002*	*0.0000*	*0.3*
3	*07:52*	*0.14*	*0.6*	*0.060*	*0.6*	*0.024*	*0.0884*	*1.00*	*0.0679*	*0.002*	*0.0001*	*0.8*
4	*07:53*	*0.18*	*0.6*	*0.060*	*0.6*	*0.024*	*0.2118*	*1.00*	*0.1501*	*0.002*	*0.0004*	*2.0*
5	*07:55*	*0.20*	*0.6*	*0.060*	*0.6*	*0.024*	*0.1882*	*1.00*	*0.2000*	*0.001*	*0.0002*	*1.3*
6	*07:56*	*0.22*	*0.6*	*0.060*	*0.6*	*0.024*	*0.2010*	*1.00*	*0.1946*	*0.001*	*0.0002*	*1.3*
7	*07:57*	*0.24*	*0.6*	*0.060*	*0.6*	*0.024*	*0.2666*	*1.00*	*0.2338*	*0.001*	*0.0003*	*1.6*
8	*07:58*	*0.26*	*0.6*	*0.060*	*0.6*	*0.024*	*0.2794*	*1.00*	*0.2730*	*0.001*	*0.0003*	*1.8*
9	07:59	0.28	0.6	0.070	0.6	0.028	0.3102	1.00	0.2948	0.001	0.0004	2.1
10	08:00	0.30	0.6	0.070	0.6	0.028	0.3356	1.00	0.3229	0.001	0.0005	2.5
11	08:01	0.32	0.6	0.080	0.6	0.032	0.3414	1.00	0.3385	0.002	0.0005	2.8
12	08:02	0.34	0.6	0.080	0.6	0.032	0.3268	1.00	0.3341	0.002	0.0005	3.0
13	08:03	0.36	0.6	0.090	0.6	0.036	0.3490	1.00	0.3379	0.002	0.0006	3.2
14	08:05	0.38	0.6	0.080	0.6	0.032	0.4496	1.00	0.3993	0.002	0.0007	3.8
15	08:06	0.40	0.6	0.100	0.6	0.040	0.4438	1.00	0.4467	0.002	0.0008	4.5
16	08:07	0.42	0.6	0.100	0.6	0.040	0.4824	1.00	0.4631	0.002	0.0009	5.2
17	08:08	0.44	0.6	0.100	0.6	0.040	0.5498	1.00	0.5161	0.002	0.0010	5.8
18	08:09	0.46	0.6	0.100	0.6	0.040	0.5913	1.00	0.5705	0.002	0.0011	6.4
19	08:10	0.48	0.6	0.100	0.6	0.040	0.5725	1.00	0.5819	0.002	0.0012	6.5
20	08:11	0.50	0.6	0.100	0.6	0.040	0.5552	1.00	0.5638	0.002	0.0011	6.3
21	08:12	0.54	0.6	0.100	0.6	0.040	0.4690	1.00	0.5121	0.004	0.0020	11.5
22	08:13	0.58	0.6	0.100	0.6	0.040	0.4017	1.00	0.4353	0.004	0.0017	9.8
23	08:14	0.62	0.6	0.090	0.6	0.036	0.3397	1.00	0.3707	0.004	0.0014	7.9
24	08:15	0.66	0.6	0.080	0.6	0.032	0.2016	1.00	0.2706	0.003	0.0009	5.2
25	08:17	0.70	0.6	0.080	0.6	0.032	0.1510	1.00	0.1763	0.003	0.0006	3.2
26	08:17	0.75	None	0.040	0.0	0.0	0.0000	0.00	0.0755	0.003	0.0002	1.3

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jul 4 2019

File Information	
File Name	20190410_SCH2.WAD
Start Date and Time	2019/04/10 09:26:27

Site Details	
Site Name	SCH2
Operator(s)	CEB

System Information	
Sensor Type	FlowTracker
Serial #	P4396
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units	(Metric Units)
Distance	m
Velocity	m/s
Area	m^2
Discharge	m^3/s

Discharge Uncertainty		
Category	**ISO**	**Stats**
Accuracy	1.0%	1.0%
Depth	0.4%	1.7%
Velocity	1.1%	1.1%
Width	0.1%	0.1%
Method	2.2%	-
# Stations	2.5%	-
Overall	**3.7%**	**2.2%**

Summary			
Averaging Int.	40	# Stations	20
Start Edge	LEW	Total Width	0.800
Mean SNR	36.5 dB	Total Area	0.054
Mean Temp	10.05 °C	Mean Depth	0.068
Disch. Equation	Mean-Section	Mean Velocity	0.3718
		Total Discharge	**0.0202**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	09:26	0.00	None	0.000	0.0	0.0	0.0000	0.00	0.0000	0.000	0.0000	0.0
1	*09:27*	*0.05*	*0.6*	*0.040*	*0.6*	*0.016*	*-0.0030*	*1.00*	*-0.0015*	*0.001*	*0.0000*	*0.0*
2	*09:28*	*0.10*	*0.6*	*0.040*	*0.6*	*0.016*	*0.0658*	*1.00*	*0.0314*	*0.002*	*0.0001*	*0.3*
3	09:30	0.14	0.6	0.040	0.6	0.016	0.1058	1.00	0.0858	0.002	0.0001	0.7
4	09:31	0.18	0.6	0.050	0.6	0.020	0.2004	1.00	0.1531	0.002	0.0003	1.4
5	09:32	0.22	0.6	0.050	0.6	0.020	0.2670	1.00	0.2337	0.002	0.0005	2.3
6	09:33	0.26	0.6	0.060	0.6	0.024	0.3207	1.00	0.2938	0.002	0.0006	3.2
7	09:34	0.30	0.6	0.060	0.6	0.024	0.3316	1.00	0.3261	0.002	0.0008	3.9
8	09:35	0.34	0.6	0.070	0.6	0.028	0.3107	1.00	0.3211	0.003	0.0008	4.1
9	09:36	0.38	0.6	0.070	0.6	0.028	0.3684	1.00	0.3395	0.003	0.0010	4.7
10	09:38	0.42	0.6	0.100	0.6	0.040	0.5561	1.00	0.4622	0.003	0.0016	7.8
11	*09:39*	*0.46*	*0.6*	*0.100*	*0.6*	*0.040*	*0.5922*	*1.00*	*0.5741*	*0.004*	*0.0023*	*11.4*
12	09:40	0.50	0.6	0.100	0.6	0.040	0.6214	1.00	0.6068	0.004	0.0024	12.0
13	*09:41*	*0.54*	*0.6*	*0.100*	*0.6*	*0.040*	*0.6346*	*1.00*	*0.6280*	*0.004*	*0.0025*	*12.5*
14	09:42	0.58	0.6	0.100	0.6	0.040	0.5306	1.00	0.5826	0.004	0.0023	11.6
15	09:43	0.62	0.6	0.090	0.6	0.036	0.4403	1.00	0.4854	0.004	0.0018	9.1
16	09:44	0.66	0.6	0.080	0.6	0.032	0.3845	1.00	0.4124	0.003	0.0014	7.0
17	09:45	0.70	0.6	0.070	0.6	0.028	0.2310	1.00	0.3077	0.003	0.0009	4.6
18	09:46	0.75	0.6	0.060	0.6	0.024	0.1057	1.00	0.1683	0.003	0.0005	2.7
19	09:46	0.80	None	0.060	0.0	0.0	0.0000	0.00	0.0528	0.003	0.0002	0.8

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Appendix C: NIWA NZ Freshwater Fish Database records for the Albert Burn, Schoolhouse Creek and the Clutha River in proximity to the applicant's takes

card	m	y	locality	time	org	map	east	north	altitude	penet	fishmeth	effort	pass	spcode	abund	number	minl	maxl	nzreach
9451	10	1995	Schoolhouse Creek	1100	doco	g41	2218400	5589300	400	224	efp		1	galspd		2			14019164
9451	10	1995	Schoolhouse Creek	1100	doco	g41	2218400	5589300	400	224	efp		1	saltru	a				14019164
25216	3	2001	Schoolhouse Creek	day	doco	g41	2218400	5589200	380	224	efp	64	1	saltru			70	109	14019164
25217	3	2001	Schoolhouse Creek	day	doco	g41	2219100	5588900	280	223	obs			nospec					14019164
26513	6	2005	Schoolhouse Creek	1045	doco	g41	2217286	5588765	660	225	efp	50	3	galspd		67	39	134	14019186
31869	10	2005	Schoolhouse Creek	1300	doco	F42	2187686	5547987	1130	249	efp	40	1	nospec					14037768
102446	3	2015	Schoolhouse Creek	1050	docc	G41	2218385	5589223	403	231	efp	8	3	galspd		24	44	116	14019186
106192	6	2005	Schoolhouse Creek	1400	doco	G41	2218511	5589119	403	231	efp	80	2	saltru		12	78	235	14019186
106193	3	2006	Schoolhouse Creek		doco	G41	2217286	5588765	609	234	efp	86	3	galspd		59	33	131	14019241
106194	3	2006	Schoolhouse Creek	950	doco	G41	2218327	5589266	403	231	efp	70	3	galspd		14	51	118	14019186
106195	3	2006	Schoolhouse Creek	855	doco	G41	2218511	5589119	403	231	efp	65	1	saltru		13	74	208	14019186
106196	4	2007	Schoolhouse Creek	1030	doco	G41	2217289	5588766	609	234	efp	66	4	galspd		74	35	131	14019241
106197	4	2007	Schoolhouse Creek	1530	doco	G41	2218327	5589266	403	231	efp	90	2	galspd		27	38	126	14019186
106198	4	2007	Schoolhouse Creek	1400	doco	G41	2218511	5589119	403	231	efp	69	1	saltru		18	113	214	14019186
106199	4	2008	Schoolhouse Creek	1345	doco	G41	2217289	5588766	609	234	efp	91	3	galspd		42	34	128	14019241
106200	4	2008	Schoolhouse Creek		doco	G41	2218327	5589266	403	231	efp	65	3	galspd		48	35	126	14019186
106201	4	2008	Schoolhouse Creek		doco	G41	2218511	5589119	403	231	efp	76	3	saltru		16	64	226	14019186
106202	4	2009	Schoolhouse Creek	915	doco	G41	2217289	5588766	609	234	efp		3	galspd		49	33	131	14019241
106203	4	2009	Schoolhouse Creek	1425	doco	G41	2218327	5589266	403	231	efp		3	galspd		16	37	112	14019186
106204	5	2010	Schoolhouse Creek	945	doco	G41	2218327	5589266	403	231	efp	71	3	galspd		59	40	136	14019186
106205	5	2010	Schoolhouse Creek	1320	doco	G41	2218327	5589266	403	231	efp	88	3	galspd		35	31	126	14019186

Appendix D: Aqualinc calculations and associated explanations

Site:	Queensbury Ridges Ltd	Sub-region	Central and Lakes District

	Land use	Soil type	Area (ha)	MAR Zone	Smaps PAW	Aqualinc PAW	peak daily demand (mm/day)	peak daily demand (m^3)	maximum monthly demand (mm/month)	maximum monthly demand (m^3)	90%ile annual demand (mm/year)	90%ile annual demand (m^3)	100%ile annual demand (mm/year)	100%ile annual demand (m^3)
0	Pasture	CLUDEN - YELLOW	37.40	550	70	60	5.1	1907.4	158	59,092	769	287,606	877	327998.00
0	Pasture	LINDIS - CYAN	117.90	550	56	60	5.1	6012.9	158	186,282	769	906,651	877	1033983.00
0	Pasture	MAUNGAWERA_1 - JADE	12.16	550	69	60	5.1	620.2	158	19,213	769	93,510	877	106643.20
0	Pasture	MOLYNEUX - LIGHT PURPLE	108.84	550	37	40	5.5	5986.2	171	186,116	785	854,394	875	952350.00
0	Pasture	BARRHILL - ORANGE	85.19	550	121	120	4.2	3578.0	130	110,747	672	572,477	777	661926.30
0	Pasture	PIBURN -PEACH	31.18	550	89	90	4.7	1465.5	146	45,523	729	227,302	818	255052.40
0	Vineyard	PIBURN -PEACH	23.14	550	107	120	2.4	560.0	73	16,892	164	37,950	198	45817.20
0	Pasture	GERMAN - LIGHT GREEN	10.55	550	75	90	4.7	495.9	146	15,403	729	76,910	818	86299.00
0	Stonefruit	LUGGATE - LIGHT BLUE	17.10	550	54	60	5.5	940.5	171	29,241	702	120,042	809	138339.00
0	Pasture	LUGGATE - LIGHT BLUE	31.88	550	41	40	5.5	1753.4	171	54,515	785	250,258	875	278950.00
0	Pasture	TEMPLETON	15.05	550	104	90	4.7	707.4	146	21,973	729	109,715	818	123109.00
		Total	**392.7**					***24,027***		***606,973***		***2,941,940***		***3,337,953***

Aqualinc calculations walkthrough

While the instantaneous rates applied for from each watercourse (Albert, Schoolhouse and Clutha) have been sought individually, Aqualinc reasonable irrigation demands have been calculated as a combined volume across the entire command area. The reason for this is in the adaptive nature of the irrigation system within the scheme: the tank farm captures and stores flows from the Albert Burn when sufficient water is present in the channel; typically during spring and early summer, and during rainfall events. When the Albert Burn abstractions begin to diminish, pumps on the Clutha River automatically ramp up and begin to pump water up to the tank farm to make up the Albert Burn water shortfall. Thus to break down Aqualinc volumes sought per watercourse would be impractical.

Aqualinc volumes were calculated using irrigated hectare summaries provided by the applicant, and include both existing irrigated areas and future areas intended for irrigation following the deemed permit replacement process. These land use breakdowns can be provided upon request, but it should be noted that less than half of the total command area is to be irrigated using surface water abstractions, with the remaining ~570 ha either serviced by groundwater takes, or left unirrigated.

Frost Fighting

With regards to frost fighting, ORC's resource consent application form 4 recommends a maximum of 3mm/hour (30 m^3/ha) and a maximum frost fighting duration of 10 hours per event. As discussed in the main body of this report, climate data for Central Otago suggests a mean of 9.5 frost events between September and November (the start of the cherry and grape growing seasons), therefore frost fighting volumes have been calculated and integrated into the total volumes sought as follows:

- 23 ha vineyard and 17 ha cherries within the command area = 40 ha total frost fighting area.
- Daily frost fighting maximum: 30*10*40 = 12,000 m^3. Daily total volume sought: 24,027m^3 (Aqualinc volume)+12,000m^3(frost fighting volume)-1500m3(volume of water not needed for irrigation based on 40 ha of cherries and grapes) = 34,527.
- Monthly and annual volumes sought were calculated similarly, but monthly volume was calculated assuming a maximum of 7 frost days (based on NIWA climate data) and annual volume was calculated assuming a maximum of 9.5 frost days.

As part of the calculations, it was assumed that no irrigation water is required on cherry or grape land during frost events.

Stock drinking requirements

Stock drinking requirements were calculated based on 2018 winter stock numbers, as outlined below:

Stock units/water use	ORC guidelines (per Form 4)	Water required (m^3/day)
3980 mixed age ewes	5 L/head/day	19.9
1000 hoggets		5
1500 ewe lambs		7.5
220 beef cows	40 L/head/day	8.8

Stock units/water use	ORC guidelines (per Form 4)	Water required (m^3/day)
287 steers and heifers		11.5
820 1 year old dairy heifers (winter only)	70 L/head/day (year-round)	57.4
700 2 year old dairy heifers (winter only)		49
2300 dairy cows (winter only)	70 L/head/day (May-August 15)	161
Total		**511.1**

Note that dairy cows are only present on the farm for the winter months (May through to mid-August), so water requirements for these stock have only been calculated for 107 days of the year.

Thus approximately 511 m^3/day of water is needed for stock drinking within the command area.

Appendix E: Applicable Records of Title