SOUTH WAIRARAPA DISTRICT COUNCIL
Kia Reretahi Tātau

WATER RACE SUBCOMMITTEE

Agenda

NOTICE OF MEETING

An ordinary meeting will be held in Kiwi Hall, 62 Bell Street, Featherston, on Wednesday 2 September 2020 at 6:30pm. The meeting will be held in public (except for any items specifically noted in the agenda as being for public exclusion).

MEMBERSHIP OF THE SUBCOMMITTEE

Colin Olds (Chair), Cr Rebecca Fox, Jim Hedley, Dennis Hodder, Justine Thorpe, Paul Harvey and Frank van Steensel and Mayor Alex Beijen.

Open Section

A1. Apologies

A2. Conflicts of interest

A3. Public participation

As per standing order 14.17 no debate or decisions will be made at the meeting on issues raised during the forum unless related to items already on the agenda.

A4. Actions from public participation

A5. Minutes for Confirmation: Pages 1-2

***Proposed Resolution**: That the minutes of the Water Race Subcommittee meeting held on 30 June 2020 are a true and correct record.*

A6. Extraordinary business

B. Decision Reports

B1. Water Race Realignments Report Pages 3-9

C. Information Reports

C1. Water Race Report Pages 10-110

SOUTH WAIRARAPA DISTRICT COUNCIL
Kia Reretahi Tātau

WATER RACE SUBCOMMITTEE
Minutes from 30 June 2020

Present:	Colin Olds (Chair), Paul Harvey, Jim Hedley, Frank van Steensel, Cr Rebecca Fox, Justine Thorpe, Dennis Hodder and Mayor Alex Beijen.
In Attendance:	Bill Sloan (Waters Project Officer) and Suzanne Clark (Committee Advisor) and for part only Euan Stitt (Group Manager Partnerships and Operations), Ian McSherry (Wellington Water), and Russell Hooper (Russell Hooper Consulting).
Conduct of Business:	The meeting was held in the Supper Room, Waihinga Centre, Texas Street, Martinborough and was conducted in public between 2:00pm and 2:50pm.

Open Section

A1. Apologies

There were no apologies.

A2. Conflicts of Interest

Justine Thorpe declared a conflict of interest as she works for Tu Ora Compass Health which had a subsidiary company that will hold the head lease on the Five Rivers Medical development. Water Race diversion had been granted to the Five Rivers development.

A3. Public Participation

There was no public participation.

A4. Actions from Public Participation

There were no actions from public participation.

A5. Minutes for Confirmation

WATER RACE SUBCOMMITTEE RESOLVED (WRS2020/08) that the minutes of the meeting held 13 February 2020 be confirmed as a true and correct record.

(Moved Mayor Beijen/Seconded Cr Fox) <u>*Carried*</u>

A6. Extraordinary Business

There was no extraordinary business.

B Decision Reports from Chief Executive and Staff

B1. Water Race Subcommittee Report

Mr Hooper provided an update on the Longwood Resource Consent application and answered members questions on costs, requirements and approach of a short term consent versus a long term consent application, ecological and hydrology findings to date, use of Ruamahanga Whaitua findings, and timeframes for a Greater Wellington Regional Council decision on whether to accept the application and whether it will be notified.

Members agreed that recommendation *(WRS2020/07)* be resubmitted to the Assets and Services Committee.

> *That the management of the Greytown stormwater system, which currently uses the Moroa Water Race network, needs to be considered by the Assets and Services Committee, and that any investigation towards that outcome is not funded by Moroa Water Race ratepayers.*

Members discussed the timeframe for handing over the Water Race management to Wellington Water and what measures were being put in place for a smooth transition. Officers undertook to provide regular updates on the transition.

Members discussed rating arrangements for beneficiaries of the historical Farley subdivision diversion.

WATER RACE SUBCOMMITTEE RESOVED (WRS2020/09) to receive the Water Race Reports.

(Moved Cr Fox/Seconded van Steensel) Carried

B2. Action Items Update Report

WATER RACE SUBCOMMITTEE RESOLVED (WRS2020/10) to receive the Water Race Subcommittee Appointment Report.

(Moved Thorpe/Seconded Cr Fox) Carried

Confirmed as a true and correct record

……………………………………….(Chair)

……………………………………….(Date)

WATER RACE SUBCOMMITTEE

2 SEPTEMBER 2020

AGENDA ITEM B1

WATER RACE REALIGNMENTS

Purpose of Report

To seek approval for a Moroa water race realignment and inform members of a Moroa water race realignment as approved by Council.

Recommendations

Officers recommend that the Subcommittee:

1. *Receive the Water Race Subcommittee Report.*
2. *To recommend to the Assets and Services Committee endorsement of the Fire and Emergency NZ application for Moroa Water Race to be realigned.*
3. *To note the committee's retrospective support and approval for a Moroa Water Race realignment at 78 Kuratawhiti, Greytown.*

1. Executive Summary

This report presents various items that should be considered by the Water Race Subcommittee for information and decision where appropriate. To be noted in particular are matters around management transition and support for the forthcoming user survey.

2. FENZ New Development Main Street Water Race Re-alignment

The Subcommittee is advised that a section of the Moroa Water Race is proposed to be aligned as depicted in the attached diagram. A plan is attached as Appendix 1.

Fire Emergency New Zealand (FENZ) wish to expand their station facilities and have owned the land immediately north of the existing Fire Station for a period of time. It is planned to divert the existing water race around the northern boundary to allow full connectivity of the new building with the existing station and increase operational efficiencies. This is sufficient evidence in itself to support this application.

Council will not allow a water race to be piped beneath a building hence this is not an option to consider.

The diversion will be clear of the extended building and hence accessible for future maintenance as required. It is proposed to be piped and be connected to the existing piped system in Main Street. It is not considered that this re-alignment would result in any measurable loss in water race utility/capacity value.

It is recommended that the proposed diversion be approved by the Assets and Service Committee.

3. Water race Realignment 78 Kuratawhiti Street, Greytown

This development (see Appendix 2) was approved by Council in October 2019 and therefore was not referred to the water race Subcommittee. It is recommended that on the basis that this re-alignment is minor in nature and not expected to result in any adverse effects that this information be received and relayed to the Assets and Services committee for information.

4. Supporting Information

4.1 Consultation

None considered needed as there are no known wider community affected parties.

4.2 Legal Implications

NIL.

4.3 Financial Considerations

NIL.

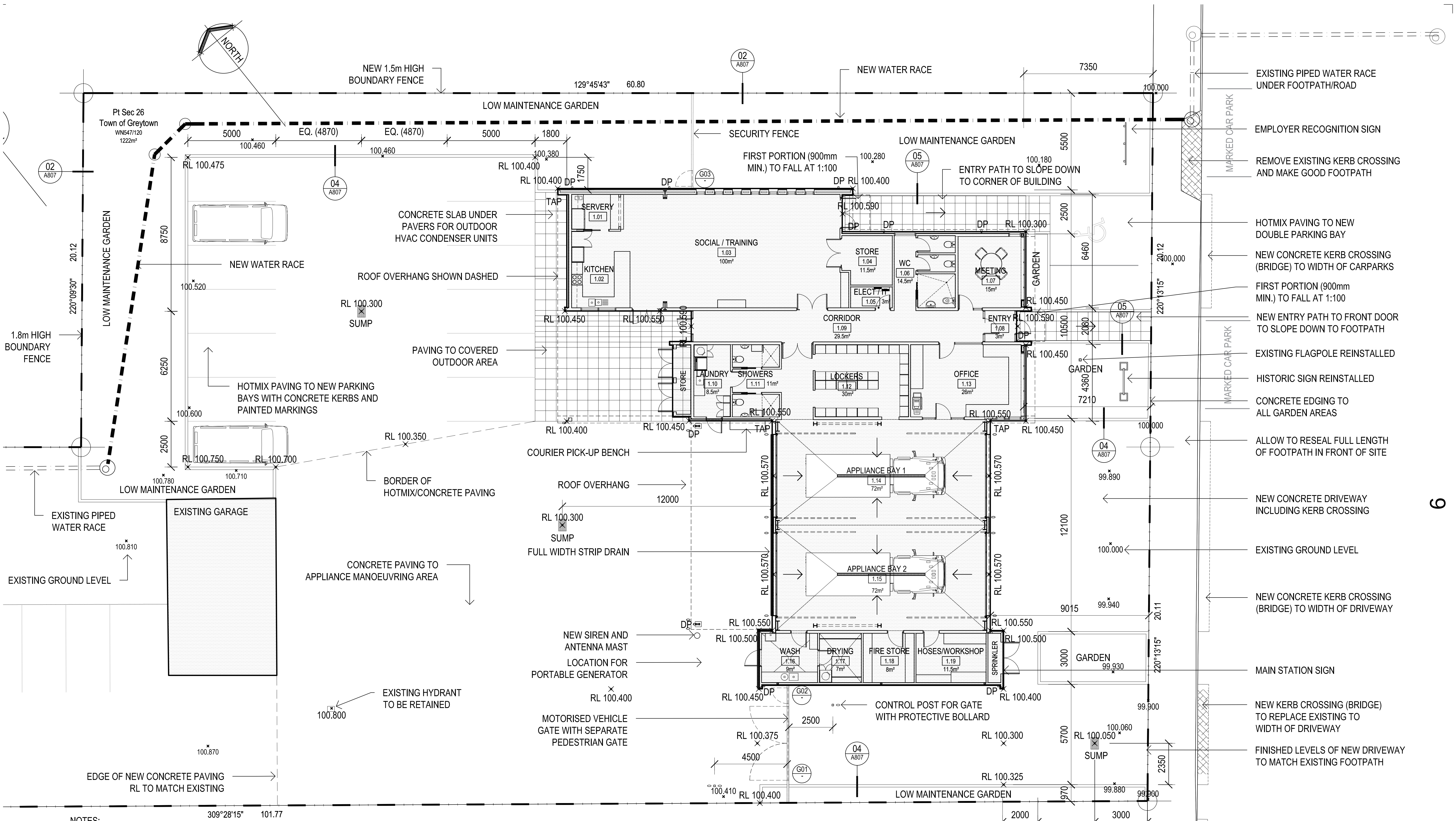
5. Appendices

Appendix 1 - FENZ New Development Main Street, Greytown

Appendix 2 - 78 Kuratawhiti Street, Greytown

Contact Officer: Bill Sloan Water Projects Officer
Reviewed By: Euan Stitt Group Manager Partnerships and Operations

Appendix 1 - FENZ New Development
Main Street, Greytown



01 PROPOSED PART SITE PLAN
SCALE 1 : 200

NOTES:

1. A FINAL ASSESSMENT AND CONFIRMATION OF SITEWORK LEVELS IS TO BE MADE ON SITE PRIOR TO WORK ON PAVEMENT COMMENCING.

Rev.	Date	Description	Dr.	Chk.	Dir.	Rev.	Date	Description	Dr.	Chk.	Dir.
4	04/08/16	DD PRICING & APPROVAL	adb								
5	04/12/16	RESOURCE CONSENT	adb								
6	08/08/17	SIREN RELOCATED	adb								
7	25/10/19	RESOURCE CONSENT REVISIONS	adb								
B	01/05/20	CONSENT & TENDER	adb								

FIRE EMERGENCY NEW ZEALAND

CONSENT & TENDER

PROJECT NORTH

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FIRE & EMERGENCY NEW ZEALAND

GREYTOWN
VOLUNTEER FIRE STATION
52-54 MAIN STREET, GREYTOWN

PROPOSED SITEWORKS PLAN

File Ref: V:\NZ\WEA 820632 Greytown Firestation\9 Documentation\9_3 Plot Files\A205 SITE PLAN.dwg
Scale: 1:200 @ A3
Job No: WEA 820632
Drawing No: A205
Rev: B

Friday, May 15, 2020

Appendix 2 - 78 Kuratawhiti Street, Photographs


YNDS

AGENDA ITEM C1

WATER RACE SUBCOMMITTEE REPORT

Purpose of Report

To inform members of activity and issues arising since June 2020.

Recommendations

Officers recommend that the Subcommittee:

1. *Receive the Water Race Subcommittee Report.*

1. Executive Summary

This report presents various items that should be considered by the Water Race Subcommittee for information and decision where appropriate. To be noted in particular are matters around management transition and support for the forthcoming user survey.

2. Items for Discussion

2.1 Longwood Resource Consent Application Progress Report

The additional information requested by Greater Wellington Regional Council has now been submitted. The reporting required and submitted is attached for the committee's information as part of Appendix 1.

It is anticipated that the Regional Council will accept the application as being sufficient in detail to allow the process to continue however this is not expected to be advised until October.

Russell Hooper will be in attendance to answer any queries.

2.2 Greytown Urban Storm-water and other Issues

This matter was referred again to the Assets and Services Committee on 12th August. That costs associated with any future SW storm-water investigations for the urban area not be a charge on Moroa rural water race ratepayers as resolved by the Water Races Subcommittee

The Assets and Services Committee's agenda item and minuted response to this is attached as Appendix 2.

2.3 Operational Report

The subcommittee is advised that since last reported water race activity operated routinely and in compliance with the resource consents.

Surface flooding in Main Street Greytown on June 18 again highlighted inadequacies with water race conduits and the associated storm-water network with an inability to cater adequately for the additional load imposed during even moderate rainfall events. In this instance surface flooding occurred on private property on both sides of the roads for a short period of time.

At this particular location, the water race pipework has to cater for Main Street and West Street carriageway storm water runoff as well as residual water race flow. The pipework in place can only cater at best for a minor rainfall event.

This and other capacity inadequacies elsewhere are known features of the urban storm-water network in Greytown.

2.4 Wellington Water (WWL) See Appendix 5 (Transition Plan)

Items reported for information and discussion include:

- The Transitional Project Plan and associated statement (see Appendix 3)
- Field Trip 14th July
- User Survey Update

2.4.1. Transition Plan

The transition plan developed by WWL seeks to identify roles and responsibilities, various work streams, the consenting process and management of control systems and communications.

In addition the plan discusses risk management measures and identifies various stake holders. Subject to some fine tuning around committee support the plan is reasonably complete.

Pope and Gray Ltd have decided not to continue with operational water race management duties beyond October 01 2020 but will assist WWL during the transition for a short period of time leading up to the hand over and beyond.

2.4.2. Field Trip 14th July 2020

Pope and Gray, WWL staff, Council staff and the Water Race Subcommittee Chairperson attended a field trip which mainly focused on headworks and flow measurement infrastructure for both the Moroa and Longwood water networks and two issues within the Greytown Urban Area, Main Street flooding and Jellicoe Street urban /rural water race infrastructure/interface. A debrief discussion was held at the conclusion of the trip.

2.4.3. User Survey Update

The Subcommittee has been earlier advised that the Council wishes to fold this process and its outcomes into the forthcoming LTP process. Beyond which the Council and the subcommittee can co-jointly determine the way forward for its water race users and ratepayers and other internal and external affected parties.

WWL via its internal communication arm have indicated that it would be prepared to support this process and this is referenced in the transition plan. Officers feel that this will be helpful but are not ruling out other external expertise to assist in the first instance with survey framework development subject to funding being available.

The Greytown urban area ratepayers affected will be included in the survey.

2.5 Financial Report

Draft operating expenses and budgets for the 19/20 year:

Water Race Network	19/20 YTD Draft Actuals June	19/20 YTD Budgets June	19/20 YTD Draft Variance June
Longwood Water Race (OPEX)	$55,054	$65,000	$9,946
Moroa Water Race (OPEX)	$66,606	$70,000	$3,394
Total	**$121,660**	**$135,000**	**$13,340**

3. Appendices

Appendix 1 – Longwood Consent Application Supporting Additional Information

Appendix 2 – Greytown Urban Storm water Reporting to the Assets and Services Committee

Appendix 3 – Wellington Water (WWL) Transition Plan

Contact Officer: Bill Sloan, Water Projects Officer

Reviewed By: Euan Stitt, Group Manager Partnerships and Operations

Appendix 1 – Longwood Consent Application Supporting Additional Information

31st July 2020

Greater Wellington Regional Council
PO Box 41
MASTERTON

Attn: Toni de Lautour (via email)

Longwood Water Race Consent Application – SWDC response to GWRC comments

Proposed term of the consent

As has previously been discussed, the South Wairarapa District Council is now seeking a five year consent duration. This will align the timing of renewal of the Longwood and Moroa water race consents so they can be captured in one application and considered together. This short term consent will also allow SWDC to further canvas property owners with sections of water race within their property in order to establish whether or not they have a place in modern agriculture.

During this time, it is also anticipated that the collaborative approach set out in the PNRP Method M13 and the Ruamahanga Whaitua Implementation Program (Recommendations 12, 107, and 108) will be progressing and good quality data required for long term consenting decisions will be available. This work will be of considerable value during future consenting processes. SWDC will be a full and active participant in this work.

Method M13: Wairarapa water races *Wellington Regional Council will work with Wairarapa district councils, water race committees and landowners to characterise the hydrology, water quality, ecology, and the economic, social, heritage and cultural values of the Wairarapa water races to develop management options for the water race systems by 2017. The management options include, but are not limited to:* *(a) identifying areas of management overlap and potential integration, (such as existing individual water race and district-wide by-laws, regional consents for the discharge of water to rivers from the races, and runoff and discharges to the races), and* *(b) options for increasing efficiency including opportunities for transfer of water takes or providing alternatives to the use of water races, and* *(c) options for retaining ecological values, and* *(d) options for improving water quality, and* *(e) opportunities for shared services, such as consent monitoring, education, and best practice, and* *(f) using a plan change or variation specific to rules for livestock access to water races.*

Information request (prior to s88 decision)

SWDC was requested to provide further information on Ecology, Surface Water Hydrology, Ground Water Hydrology, and Weir Maintenance.

Ecology

Ecologist Keith Hamill of River Lake Ltd was engaged to provide the further detail requested relating to ecology.

As discussed yesterday, Mr Hamill has not been able to provide his information this week and will have completed his work next week. We had hoped to have this information to you this week and appreciate your acceptance of the delay.

Surface Water Hydrology and Groundwater Hydrology

Groundwater expert Greg Butcher of Professional Ground Water and Environmental Services was engaged to provide the further detail requested relating to Surface and Ground Water. Please find Mr Butcher's report "*Water Permit Renewal Application WAR010201, Longwood Water Race, Featherston, Additional Information Request, Surface Water and Groundwater Hydrology*" is attached.

With regard to the findings;

Surface water hydrology

> Mr Butcher has assessed available data and the impact of the water race take and concludes that;
>
> "*the water take has only a very minor effect on the flow distribution characteristics of the Tauherenikau River*".
>
> Mr Butcher further notes that;
>
> "*Low flow in the downstream section of the river is largely governed by the rate of water loss to groundwater between SH2 and SH53. As such, the relatively small percentage reduction in river flow at the water race intake will have a very minor affect on flow downstream of SH2. Low flows in this downstream section of the river are likely to be primarily influenced by riverbed characteristics and river management practices e.g. gravel extraction and "ripping and cross-blading" of the riverbed*".

The reporting addresses points 1 – 4 of GWRC's request.

With regard to point 5, the inlet at the river is controlled with a section of plywood over the end of the inlet pipe to comply with the consent requirement to take less than 20% of river flow. Mr Butcher recommends that the SWDC install a new telemetered flume in the bypass channel in the vicinity of the existing race flume to monitor bypass flow. The telemetry software should include provision of an alarm if total flow (race plus bypass) is approaching 20% of the river flow as recorded at the gorge. SWDC will install this hardware once the resource consent is renewed.

<u>Groundwater</u>

Mr Butcher concludes that;

"it is very unlikely that leakage of water from the race, with potentially degraded quality, would affect groundwater quality in the area, for the following reasons;

- *The degree of confinement of aquifers. The presence of semi-confining layers of fine grained sediments (silts and clays) will attenuate affects.*
- *The very limited extent of the water race network located within the Category A groundwater zones.*
- *High attenuation rates due to the high aquifer transmissivities and throughflow."*

The reporting addresses impact on groundwater quality. Given that it is very unlikely that groundwater would be affected monitoring of groundwater is not considered to be required.

Weir Maintenance

The inlet is 84.30m MSL and the weir is maintained (when required) to a height above this to ensure that water feeds the inlet pipe. From LIDAR data the water level above the weir is between 0.5 and 1m higher than below it.

The inlet pipe is on the true right side of the Tauherenikau River.

The weir is made up of concrete blocks (which were used before 2010 and are bedded into the river rocks), taipo boulders, and river aggregate. Railway iron has been placed vertically to provide a backbone to the weir. No demolition material is used. There have been no issues with loss of material down river. Annual maintenance is carried out in December when the main flooding has likely finished for the summer to maintain adequate flow during the summer months.

Otherwise maintenance is carried out as and when required. This can be done by hand, to a point, through clearing wood debris from around the inlet pipe. Depending on the amount and type of debris (aggregate or wood) an excavator may be required.

Fish passage is maintained at all times. The weir has the effect of directing flow over to the true left side of the river which acts as a riffle.

I have attached photographs of the weir and inlet structure.

Once the ecology information is received it will be forwarded to you to complete the information request.

Please contact me if you have any questions in relation to this matter.

Yours Sincerely

Russell Hooper
Planning Consultant (on behalf of SWDC)

Photographs of the weir structure and inlet


Open riffle allowing
fish passage on
opposite side of river

17th August 2020

Greater Wellington Regional Council
PO Box 41
MASTERTON

Attn: Toni de Lautour (via email)

Longwood Water Race Consent Application – SWDC response to GWRC comments

Information request (prior to s88 decision)

SWDC was requested to provide further information on Ecology, Surface Water Hydrology, Ground Water Hydrology, and Weir Maintenance. Further to the information provided on the 31st July 2020 covering Surface Water Hydrology, Groundwater Hydrology and Weir Maintenance, the Ecology parts of the request are now provided.

Ecology

Ecologist Keith Hamill of River Lake Ltd was engaged to provide the further detail requested relating to ecology.

Please find Mr Hamill's report "*Water Permit Renewal Application WAR010201, Longwood Water Race, Additional Information Request: Ecology*" enclosed.

With regard to the points under Ecology;

- ***Potential abstraction effects on the Tauherenikau River – the potential impacts on aquatic habitat downstream of the abstraction point;***

  Greg Butcher's hydrology report assessed effects on the Longwood water race take on the Tauherenikau River as "very minor" and found the low flow in the downstream section of the river was "largely governed by the rate of water loss to groundwater between SH2 and SH53".

- ***Barriers to fish passage – more detail in the description of the weir at the intake and the flume/weir, and assessed by an ecologist;***

  Mr Hamill has assessed fish passage in his report and recommends enhancing fish passage in two locations.

  The first is provide a ramp at the flow control structure to allow fish passage up from the residual flow channel.

  The second point is at the inlet from the Tauherenikau River where a spat rope is recommended through the culvert.

  SWDC proposes that this is a condition of consent.

- ***Characterisation of the stream values of Donald's Creek;***

  This has been set out in the ecology report.

- ***For the earlier consent, Donald's Creek was considered the most sensitive receiving environment and hence monitoring focused here. It is possible that "sensitive environments" have been reclassified against updated criteria that characterises their ecological state. The race seems to terminate in a number of spots and therefore the determination of the most sensitive receiving environment should probably be reviewed as part of the application;***

  This has been addressed in the ecology report and confirmed as appropriate. An additional monitoring point on the western branch where it crosses SH2 is proposed to allow a better understanding of where water quality issues are occurring.

  Please also find attached a report confirming the termination points of the various discharge points from the water race and the ultimate receiving waterbody.

- ***It appears in the water quality monitoring data that some variables (e.g. total nitrogen), at some times, increase downstream of the water race discharge point relative to the upstream monitoring. This should have more comment (e.g., are there seasonal or flow-based patterns?);***

  Mr Hamill has analysed the water quality monitoring data. This has highlighted anomalies at Site L5. Site L5 is the site at the end of the water race system. Between July 2016 and August 2019 the results at Site L5 showed this site being highly influenced by Donald's Creek (particularly electrical conductivity measurements). In August 2019 the water quality increased to beyond the pre-2016 levels.

  An explanation of this is that in 2016 the SWDC staff member sampling the water race left the SWDC. In 2019, this same person resumed sampling the water. It appears that the contractors sampling the water race for Council between 2016 and 2019 was sampling too close to Donald's Creek to get a sample of the water race. Mr Hamill anticipates that the increase in quality of the correctly sampled results for Site L5 from pre 2016 to 2019 is probably a reflection of nearby land use change. Milking in the cowshed near the L5 sampling point ceased in April 2018 and this could be an explanation for the increase in water quality.

  In any case, it is pleasing that Mr Hamill's work shows that the water quality has improved over time.

- ***The race discharge appears to have increasing concentrations of contaminants (not just relating to the WWTP discharge) - it would be worth quantifying the loads and what proportion the race makes up in Donald's Creek;***

  Mr Hamill has addressed the influence of the Longwood water race on Donald' Creek in his report. He notes that there have been recent improvements in water quality.

- ***Effects of maintenance work – some parts of the water race system are natural watercourses; instream habitat can be significantly impacted and slow to recover and mortality of fishes can be high.***

  SWDC contractors report that macrophyte control is the key to water flowing through the entire water race system, particularly in times of low flows. Without the ability to keep the water race clear the system would not be able to deliver water to the lower reaches of the system. This is acknowledged by the PNRP through identification of the Longwood water race as a water race and exclusion of water races from the drain cleaning rules (PNRP Rule 121). Cleaning of the water race is captured in the water race Code of Practice, including returning fish to the water during cleaning operations.

Ecological Recommendations

The ecological report makes a number of concluding recommendations. The SWDC is committed to

- *Include an additional water quality monitoring site on the Longwood Water Race western branch where it crosses SH2 near Featherston.*

- *Enhance upstream fish passage at the flow control structure between the inflow and the residual flow channel by installing a fish ramp or equivalent.*

- *Enhance the potential for upstream fish passage through the inlet culvert by installing spat rope through the culvert.*

  The South Wairarapa District Council proposes that the first three recommendation points are made condition of consent.

- *Identify areas where riparian planting and protection can be implemented. Initiate trials of riparian protection where practical and landowners are willing. Areas with high potential for riparian restoration include the channel taking the residual flow from the flow control structure to the Tauherenikau River.*

- *Review of the Code of Practice to provide a more comprehensive set of practices to reduce water contamination and more comprehensive procedures for ensuring widespread uptake of good practice. This should include:*

  - *use of offline stock watering (e.g. pumping water to a trough using a solar pump);*
  - *riparian fencing and planting;*
  - *procedures for clearing sediment and macrophytes including the use of on-line sediment traps, minimising removal of macrophytes, use physical removal methods in preference to herbicides to minimise environmental effects and optimise nutrient removal – particularly in downstream sections.*
  - *maintaining sections of stream in the lower part of the catchment with macrophyte cover to enhance instream sediment retention and nutrient processing.*
- *Undertake a survey to identify potential sources of contamination to the Longwood Water Race including stock access points, stream crossings, and overland flow paths.*

The SWDC proposes to address the last three recommendation points through its Water Race Sub Committee and continual evolution of the Code of Practice for the Longwood and Moroa Water Races within the timeframes of this consent. These topics will also be explored during the collaborative approach directed by NRP Method 13 and the Ruamahanga Whaitua Implementation Programme.

Overall, in relation to the hydrology and ecological recommendations, there are a number of improvements and good outcomes which will result from this proposed consent renewal.

Please do not hesitate to contact me if you have any questions relating to the information in this response.

Yours sincerely,

Russell Hooper
Planning Consultant (on behalf of SWDC)

Encl.

PROFESSIONAL GROUND WATER AND ENVIRONMENTAL SERVICES

- RESOURCE CONSENTS
- ASSESSMENT OF EFFECTS
- WATER RESOURCE EVALUATIONS
- HYDROGEOLOGIC STUDIES

GREG BUTCHER (B.Sc)

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Water Permit Renewal Application WAR010201

Longwood Water Race, Featherston

Additional Information Request

Surface Water and Groundwater Hydrology

Report Produced For:
South Wairarapa District Council

June 2020

1) Introduction

An application to renew the resource consent for the operation of the Longwood water race was made to Greater Wellington Regional Council by South Wairarapa District Council on 13/1/2020. The consent (WAR010201) expired on 13/4/2020. The consent renewal application was made for a term of 15 years.

Upon receipt of the application Greater Wellington sought a timeframe extension for the processing of the application under s37 of the Resource Management Act 1991.The reason for the timeframe extension was to allow for expert review of various aspects of the application.

Included in the expert reviews were assessments of surface water and groundwater hydrology. These reviews concluded that additional information was required in respect to both the surface water and groundwater aspects of the application. A copy of the additional information request is appended to this report.

Professional Groundwater and Environmental Services (PGWS) were engaged to provide the additional information requested in relation to these matters. The PGWS proposal was to complete WAIORA modeling of the river in the vicinity of the take to provide much of the requested information in relation to the impacts of the water take on hydrology and aquatic habitat. Due to timeframe constraints and the Covid 19 lockdown this work could not be completed within the required timeframe.

In May 2020 South Wairarapa District Council varied the consent application to reduce the requested term of consent to 5 years only. This was to align the new consent with the expiry date of the consent for the Moroa water race (13 April 2025). It was proposed that much of the additional requested information could be compiled over the time of the new short term consent. This was agreed to by Greater Wellington; however the consent authority considered that much of the additional surface water and groundwater information requested could still be supplied to support the short term consent. It was considered that much of the requested information could be obtained from desktop evaluations.

Information provided in this report is therefore largely compiled from existing databases and information, and is provided in support of the short term consent application. Several river flow gaugings were completed in February and May 2020 to help confirm spatial river flow variability (these results are discussed in Section 4 whilst flow gauging sheets are appended to this report).

2) The Consent

When Consent WAR010201 was approved in 2005 it permitted the taking of up to 250 litres/second (l/s) of water from the Tauherenaikau River under supplementary allocation and up to 180 l/s under core allocation, for 24 hours/day, 7 days/week, January to December inclusive.

Supplementary allocation flow was set at 2000 l/s at the Gorge flow monitoring site. If the flow at the Gorge dropped below 1350 l/s the maximum rate of take had to be restricted to 100 l/s.

When WAR010201 was approved in 2005 the consent application was assessed against the relevant provisions of the Regional Freshwater Plan for the Wellington Region (RFWP). In particular the RFWP specifies a minimum flow for the Tauherenikau River of 1100 l/s, a core allocation of 405 l/s and step down allocations of 350 and 155 l/s at flows of 1350 and 1300 l/s respectively. Supplementary allocation flow is set at 2000 l/s. All flows are referenced to the Gorge flow monitoring site.

Consent WAR010201 was varied on 9/8/2016. The variation enabled additional water to be taken at high (supplementary) river flows, whilst the water take was referenced as a 3 day moving mean to help prevent occurrences of non-compliance caused by rapidly changing river flows. Specifically the change permitted the taking of up to 300 l/s (expressed as a 3 day moving mean) if the Tauherenikau River flow at the Gorge is greater than 4900 l/s and the taking of up to 250 l/s (expressed as a 3 day moving mean) if the river flow at Gorge is between 2000 and 4900 l/s. Water can also be taken at a rate of up to 180 l/s at river flows of between 1350 to 2000 l/s and up to a rate of 100 l/s when river flow is less than 1350 l/s.

The 2016 consent variation application was assessed against the relevant provisions of the Proposed Natural Resources Plan for the Wellington Region (PNRP). The PNRP sets a core allocation for the Tauherenikau River of 410 l/s (including groundwater takes that directly affect river flow), whilst the supplementary allocation flow is set at the median flow (4900 l/s, see Section 4). The PNRP retains the same minimum flow as the FWP i.e. 1100 l/s at the Gorge flow monitoring site.

Consent WAR010201 also permits the diversion of water from the Tauherenikau River for the water race at a rate not exceeding 20% of the river flow at the point of diversion and discharge of any residual water back to the river. Water is discharged back to the river approximately 800 metres downstream from the intake.

The application to renew Consent WAR010201 was made on 13 January 2020 by Russell Hooper (Planning Consultant) on behalf of South Wairarapa District Council. The renewal application is for the same rates of take from the Tauherenikau River.

3) Location

Water is abstracted from the Tauherenikau River at a site adjacent to Underhill Road. The location of the diversion site, take point and discharge site are shown in Figure 1. Grid references of these sites are:

Diversion point:	NZTM 1798481.5450150
Take location:	NZTM 1798291.5449730
Discharge point:	at or about NZTM 1798691.5449230

The diversion/take location is in the immediate vicinity of the West Wairarapa Fault Line, as shown in Figure 1.

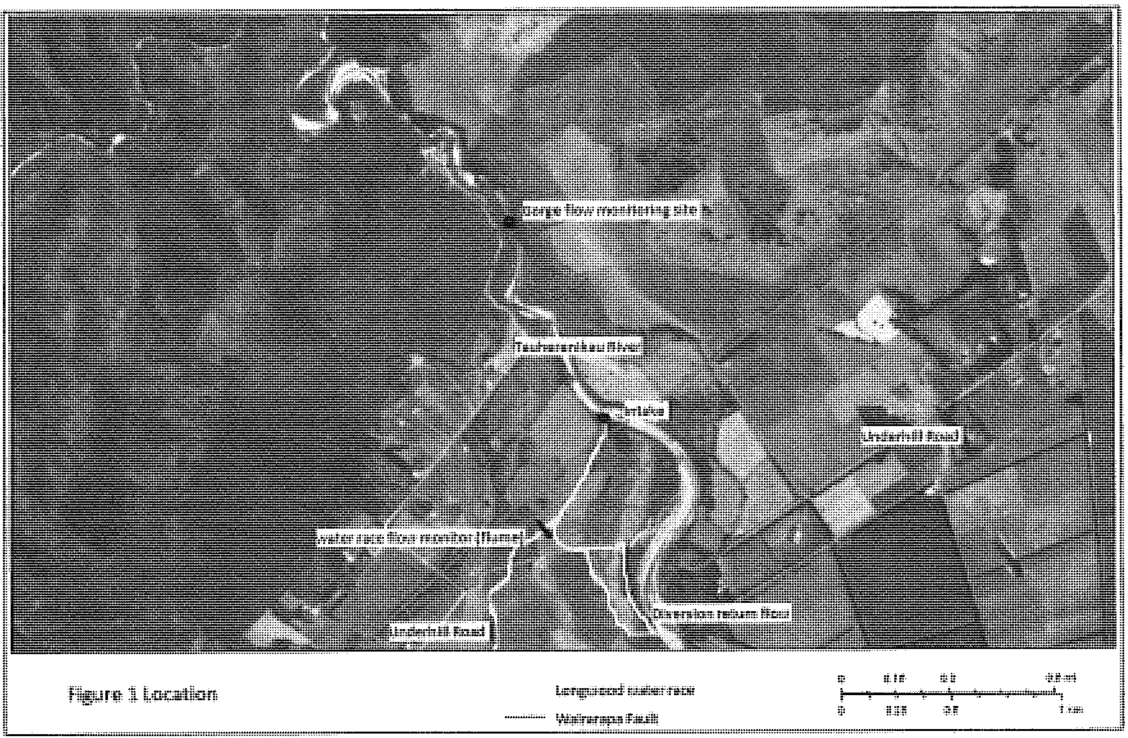

Figure 1 Location

4) Hydrology

The river in the vicinity of the water race intake (and to a point roughly adjacent to SH53) is essentially a single thread channel with alternating gravel beaches. The substrate is predominantly coarse boulder and cobbles. Run sections of the river predominate, with riffle and pools also present. Historical catchment works downstream of SH 53 has resulted in this section of the river being straighter with runs and pool sections dominating.

On leaving the Tararua Range the gradient of the riverbed gradually reduces from approximately 1:180 adjacent to the water race intake to 1:150 at SH 2 before flattening to approximately 1:600 in the river delta area prior to discharging to Lake Wairarapa.

A flow monitoring site has been operational on the Tauherenikau River at 'Gorge' since April 1976 (44 years of record). The Gorge monitoring site is approximately 950 metres upstream of the take location.

Upstream of the take (and the West Wairarapa Fault Line) the river flows across sandstone rock. Due to low permeability of this basement material the river is expected to be relatively neutral or gain minor flow between the Gorge monitoring site and the abstraction point. PGWS completed concurrent flow gaugings in February 2020, with the flow measured at the take location being 16% higher than the flow at the Gorge. The flow at the Gorge on this occasion was 1006 l/s, below the minimum flow of 1100 l/s as defined in the PNRP. Although some of the flow gain of 156 l/s between the gorge and the downstream take location could possibly be accounted for by gauging error, it is considered more likely that the river does gain some flow over this length, and that the flow gain may actually be more than the rate of take for the water race.

It is considered that the river is likely to be relatively neutral i.e. neither gain nor lose water, between the take location and the point that any diverted water is discharged back to the river. PGWS completed concurrent flow gaugings over this length of river on 15/5/2020. The flow measured just upstream of the take was 2602 l/s, whilst the river flow just downstream of the return flow was 2477 l/s. At the time of completing these gaugings 180 l/s was being fed into the water race i.e. a net gain of flow in this river reach of 55 l/s (although this small gain in within gauging error).

It is considered that flow statistics from the gorge monitoring site can be used to represent flow conditions at the take location and downstream to the point where water is discharged back to the river. However it is also considered that flows at the take location and downstream to the discharge location may be higher by an order of magnitude at least as much as the rate of take for the water race.

The following flow statistics for the Gorge monitoring site were supplied by Greater Wellington. Flow statistics are based on data from the commencement of record to 2016 (the most up to date statistics Greater Wellington could supply at the time of writing this report).

Mean river flow is 9016 l/s, with monthly mean flow varying between 4998 l/s in February to 13,111 l/s in July (Table 1).

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean
Min	1583	1428	1887	1559	2978	4122	3929	3941	3208	4263	2153	2984	6244
Mean	5422	4998	5882	6859	9172	11707	13111	12041	10937	11682	8026	7916	9016
Max	16798	25011	17480	16617	16848	20873	23967	22890	25503	28890	18753	19591	12244

Table 1 Monthly mean flows

Figure 2 is the flow distribution curve for the Tauherenikau River at Gorge. This curve shows the percentage of time the flow is less than a certain value e.g. the flow is less than 3000 l/s for 30% of the time. Median river flow is 4900 l/s.

Flow in the headrace is measured via a calibrated flume and associated telemetry. To comply with the condition limiting the diversion rate to a maximum of 20% of river flow, the diversion rate is controlled at the intake structure in order to minimize the amount of bypass flow. However to show compliance with this condition it is proposed that a new telemetered flume be installed in the bypass channel, in the general vicinity of the existing race flume, to monitor bypass flow. The telemetry software should include provision of an alarm if total flow (race plus bypass) is approaching 20% of the river flow as recorded at the gorge.

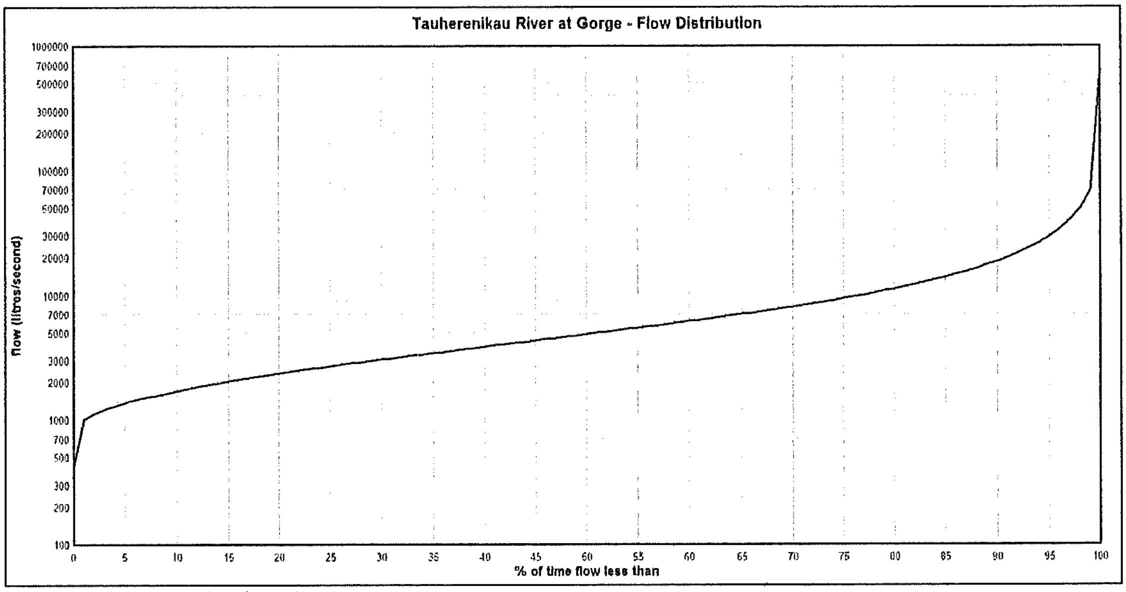

Figure 2 Flow distribution curve

Low flow statistics for the Tauherenikau River at Gorge are presented in Table 2. Assessed 7-day mean annual low flow is 1309 l/s.

Return Period	1 day	7day	14 day	28 day
MALF	1127	1309	1512	2168
2.33	1053	1201	1385	1908
5	914	1011	1139	1488
10	836	905	1002	1255
20	779	927	901	1083
50	722	748	800	909
100	686	700	737	803

Table 2 Low flow frequency

Although good data exists for the gorge flow monitoring site, there is only limited information currently available to quantify the spatial variation in river flow i.e. how the river may gain or lose flow along its length.

Greater Wellington has completed 5 concurrent gauging runs of the Tauherenikau River. These results are shown in Figure 3, reproduced from Greater Wellington's Report "Wairarapa Valley Groundwater Resource Investigation - Lower Valley catchment hydrogeology and modeling"[1] .

[1] Wairarapa Valley Groundwater Resource Investigation - Lower Valley catchment hydrogeology and modeling. Greater Wellington Report GW/EMI-T-10/75 November 2010

Figure 3 however does not take account of any water takes from, or discharges to, the river. The flows measured at Underhill Road do not take account of the water race take. During these concurrent gauging runs between 100 to 150 l/s could been taken for the water race, and up to 20% of the river flow diverted. Figure 3 shows the section of river between the Gorge and Underhill Road as 'losing' water, however this 'loss' is accounted for by the take and diversion of water for the water race. Figure 3 also shows a significant 'loss' of water between the Gorge and Underhill Road during the 22/2/2006 concurrent gauging run. It is noted however that the flow at the Gorge on this day was not gauged; with the reported flow presumably derived from rated data i.e. the accuracy of this flow figure is dependent on the accuracy of the rating curve at this time

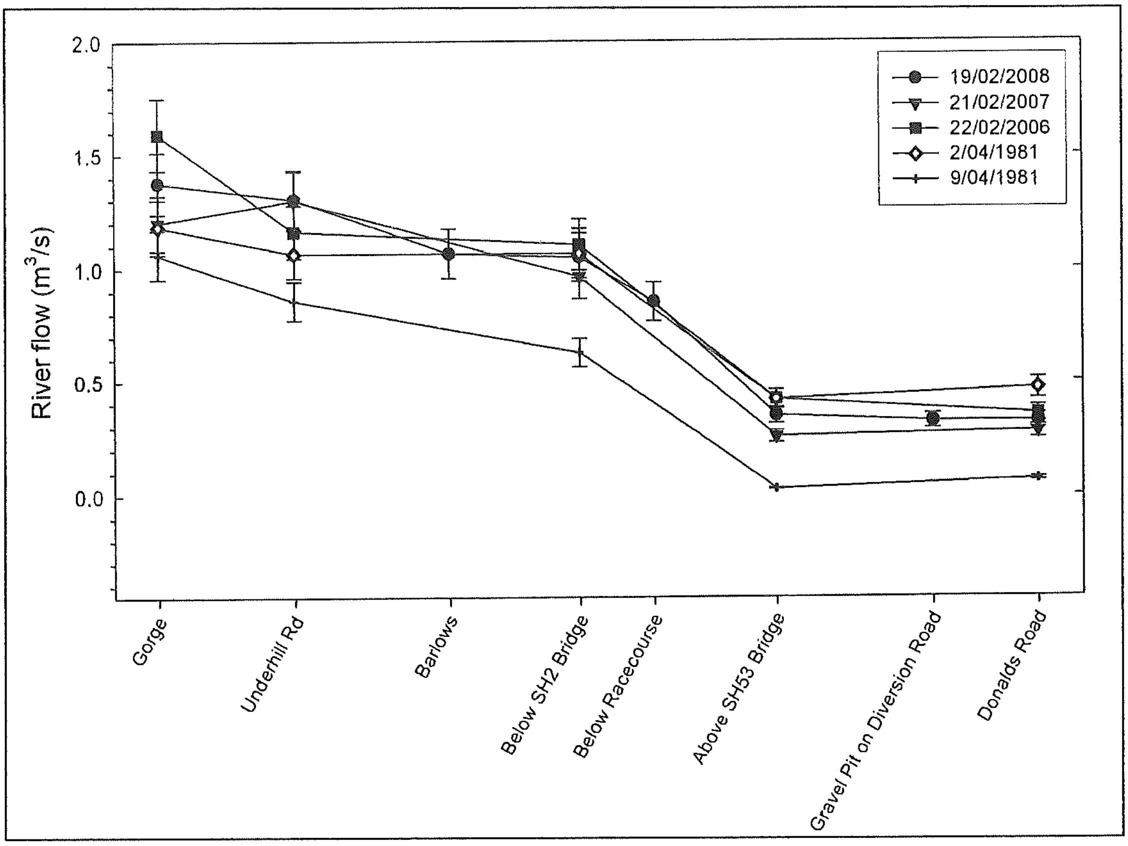

Figure 3 Concurrent flow gauging runs of the Tauherenikau River (reproduced from "Wairarapa Valley Groundwater Resource Investigation - Lower Valley catchment hydrogeology and modeling" Figure 7.34. Greater Wellington November 2010)

Figure 3 shows that the section of river between Underhill Road and SH2 is relatively neutral, but probably with a reduction in flow in a downstream direction of up to approximately 20%. This is consistent with the known hydrogeology of this area where transmissive recent (Holocene) gravels tend to be limited in thickness and extent and are often perched above the current level of the river.

Between SH2 and SH53 the river rapidly losses water to groundwater (average 65% loss or approximately 600-700 l/s at minimum flow). In this area the transmissive Holocene sediments flanking the river are typically more extensive. It is also considered that water may be lost to one or more very transmissive gravel filled channels that exist along former courses of the river. Much of this water is considered to re-emerge as seepage into Dock Creek and possibly the Tauherenikau Seepage drain.

Downstream of SH 53 the river appears to be relatively neutral i.e. neither gains or losses measurable flow, or has a very minor flow loss.

5) Assessment of Effects

5.1) The Tauherenikau River

The maximum percentage rate of take from the Tauherenikau River for the Longwood water race is approximately 13-15% of river flow, as below:

300 l/s take at a river flow of 4900 l/s = 6%
250 l/s take at a river flow of 2000 l/s = 13%
180 l/s take at a river flow of 1350 l/s = 13%
100 l/s take at an extreme low flow of 686 l/s = 15%

In the above assessment extreme low flow is taken as the 1 day flow with a 100 year return period (see Table 2).

There is only one other water take (direct surface water take or Category A groundwater take) from the Tauherenikau River upstream of SH2. This Category A groundwater take permits water to be taken up to a maximum rate of 20 l/s. If the Tauherenikau River flow at the gorge drops below 1350 l/s this take is restricted to 12 hours/day at night time. Total allocation from the upper section of the river is therefore currently a maximum of 15% of the river flow at gorge for flows above 1350 l/s. Total allocation is 16% of river flow at flows of less than 1350 l/s.

A condition of consent is also that the rate water is diverted from the river does not exceed 20% of the river flow i.e. the river flow in the reach between the diversion location and the site of the return flow (approximately 800 metres) may be reduced by up to 20%.

It was proposed that a WAIORA assessment be completed for the river reach between the diversion point and the point where the return flow discharges back to the river. Due to time constraints and the Covid 19 lockdown, this work could not be completed. Greater Wellington considered that an assessment of effects on stream hydrology and habitat availability could be completed as a desktop study. Greater Wellington provided a copy of a draft 2012 report on the instream values and a minimum flow assessment for the

Tauherenikau River[2]. This report included results of GHM (Generalized Habitat Modeling) undertaken to assist in defining an appropriate minimum flow for the Tauherenikau River. The GHM modeling was completed on two river reaches. One of the reaches was a 1 km long reach just upstream from SH 2. River morphology and flow characteristics of this section of river are similar to those in the reach between the water race intake and point of return flow. The flows at this downstream reach are probably about 20% lower than those adjacent to the water race intake.

Data collected for the GHM assessment has been compiled to determine the relationship between river flow and the following parameters:

water depth (Figure 4)
stream width (Figure 5)
water velocity (Figure 6)

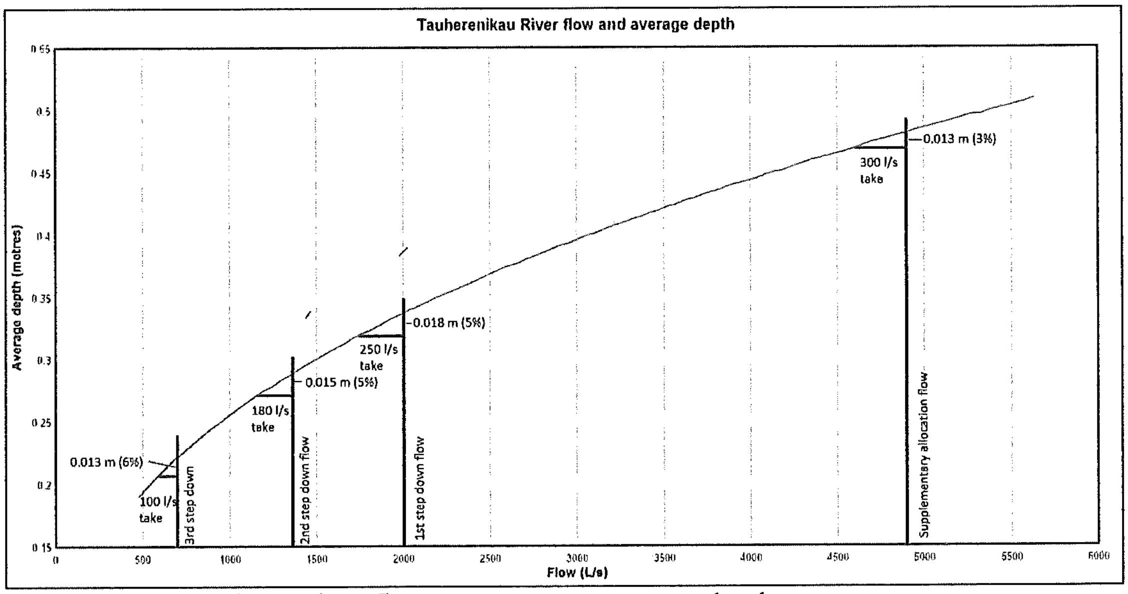

Figure 4 Tauherenikau River flow versus average water depth

Using Figures 4 to 6, the effects of the water race take on the respective hydraulic properties was assessed.

These effects were based on the maximum permitted rates of take at each step-down level. For river flows less than 1350 l/s the take has been assessed against an extreme low flow of 700 l/s (assessed 100 year 7-day low flow at the gorge/water race intake).

The results of this assessment are summarised in Table 3.

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[2] Tauherenikau River instream values and minimum flow assessment (draft report by Mike Thompson, Environmental Monitoring and Investigation Department, Greater Wellington 2012)

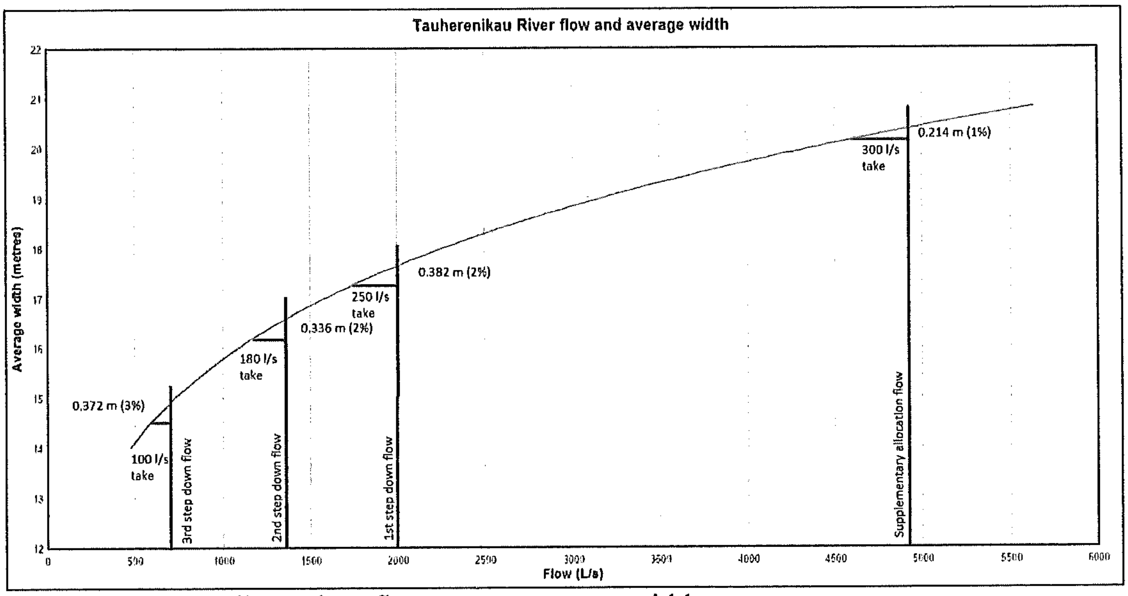

Figure 5 Tauherenikau River flow versus average width

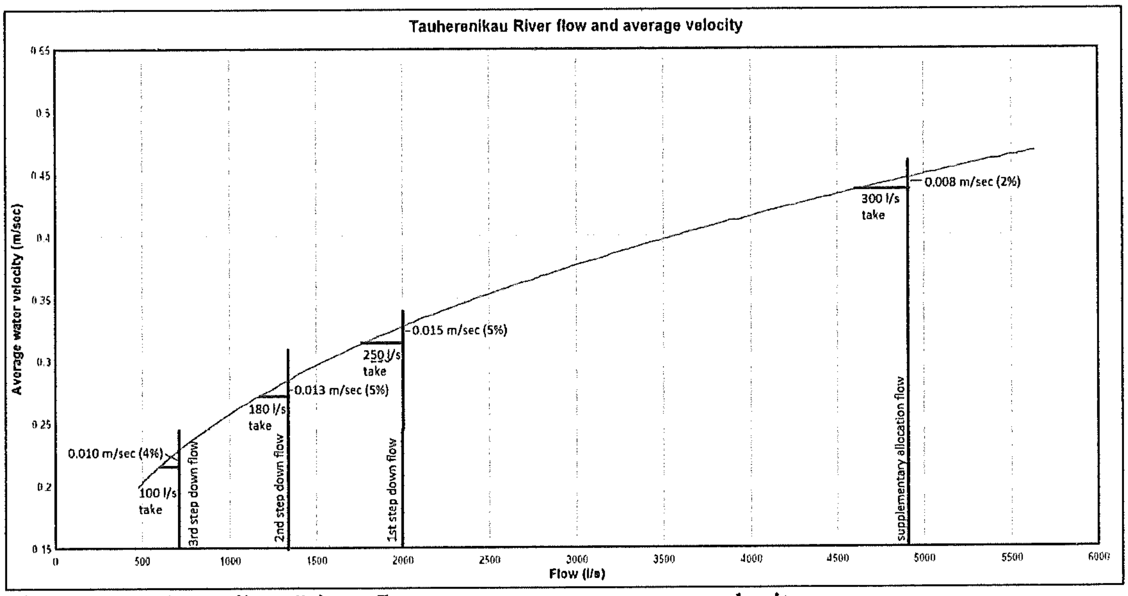

Figure 6 Tauherenikau River flow versus average water velocity

River flow (l/s)	Maximum permitted rate of take (l/s)	Water depth change		Velocity change		Width change	
		Absolute (metres)	%	Absolute (m/s)	%	Absolute (metres)	%
4900	300	-0.013	-3	-0.008	-2	-0.214	-1
2000	250	-0.018	-5	-0.015	-5	-0.382	-2
1350	180	-0.015	-5	-0.013	-5	-0.336	-2
700	100	-0.013	-6	-0.010	-4	-0.372	-3

Table 3 Assessed effect of water race take on river hydraulic parameters

The assessed effects on water depth, water velocity and channel width are all very minor (1-6% change). The same exercise was repeated to model the potential effects of reducing the river flow by 20% between the point of diversion and return flow. This resulted in a minor increase to the percentage changes (1-8%). These are maximum effects i.e. just before the take is required to reduce due to the river flow dropping below the supplementary allocation or step down flows. Average effect will be about 50% of these maximums i.e. <1 to 3% change.

To assess the impact of the water take on flow distribution (and therefore the occurrence of freshes/flushing flows and flow recession rates) the river flow record for the gorge monitoring site has been adjusted to take account of the water race intake operating at it maximum permitted rates of take. This was modeled for the entire flow dataset. The resultant flow distribution curve is shown in Figure 7, with the curve plotted against the unadjusted data. This assessment shows that the water take has only a very minor effect on the flow distribution characteristics of the Tauherenikau River.

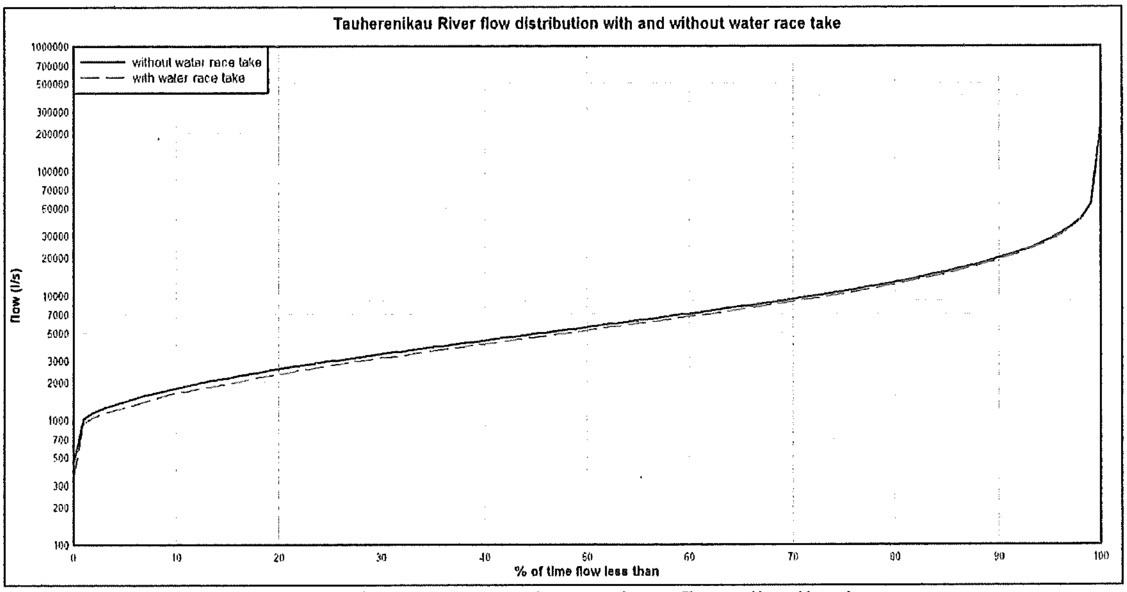

Figure 7 Effect of Longwood water race take on river flow distribution

Low flow in the downstream section of the river is largely governed by the rate of water loss to groundwater between SH 2 and SH53. As such, the relatively small percentage reduction in river flow at the water race intake will have a very minor affect on flow downstream of SH2. Low flows in this downstream section of the river are likely to be primarily influenced by riverbed characteristics and river management practices e.g. gravel extraction and "ripping and cross-blading" of the riverbed.

5.2 Groundwater

The Longwood water race flows in a generally southerly direction across a large alluvial fan surface. The fan comprises a sequence of heterogeneous fluvial and glacial outwash sediments that were deposited during late Quaternary glacial periods. These sediments are typically poorly sorted sandy gravels in a matrix of fine sediments (primarily silts and clays). Hydraulic conductivity of these sediments is typically very low due to rapid depositional rates and intrinsic lack of sorting.

The operation of the Longwood water race is very unlikely to impact on groundwater quality due to the hydraulic properties of the alluvial fan sediments i.e. typically low vertical and horizontal conductivities. Also due to the age of the water race network and siltation of the streambed (skin effect) the hydraulic conductance of the streambed is expected to be very low.

Close to the Tauherenikau there are areas of younger Holocene sediments. These sediments are typically well sorted sandy gravels that contain far less fine sediments than the older fans deposits. Due to the nature of these sediments and their depositional environment they typically have much higher hydraulic conductivities than the fan sediments. These areas are classified as Category A groundwater systems, as defined in the PNRP i.e. are considered to display a direct hydraulic connection with surface water.

Figure 8 shows the boundary between the Holocene Sediments and the older late Quaternary fan sediments (the boundary between Category A and Category B/C groundwater systems as defined on the PNRP).

The bulk of the race network flows across the older fan sediments. In the vicinity of the water race intake is an area defined as a Category A groundwater zone. As the quality of the water race water near the intake will essentially be the same as that of the Tauherenikau River, any leakage of water from the race should not impact on groundwater quality.

The second area where the race flows across Holocene sediments is a relatively small area where three tailraces discharge to the Tauherenikau Seepage drain. In this area the aquifers become semi-confined due to the intercalation of the sands and gravels with fine sediments of marine origin. Further south the degree of confinement of these aquifers increases and the aquifers become confined under Lake Wairarapa. Figure 9 (derived from Figure F17 of the Wairarapa Valley groundwater resource investigation report – proposed framework for conjunctive water management) shows that the section of water race within the Category A groundwater zone lies within the area of semi-confined aquifers.

It is considered very unlikely that leakage of water from the race, with potentially degraded quality, would affect groundwater quality in this area, for the following reasons:

- The degree of confinement of aquifers. The presence of semi-confining layers of fine grained sediments (silts and clays) will attenuate affects.
- The very limited extent of the water race network located within the Category A groundwater zones.
- High attenuation rates due to the high aquifer transmissivities and throughflow.

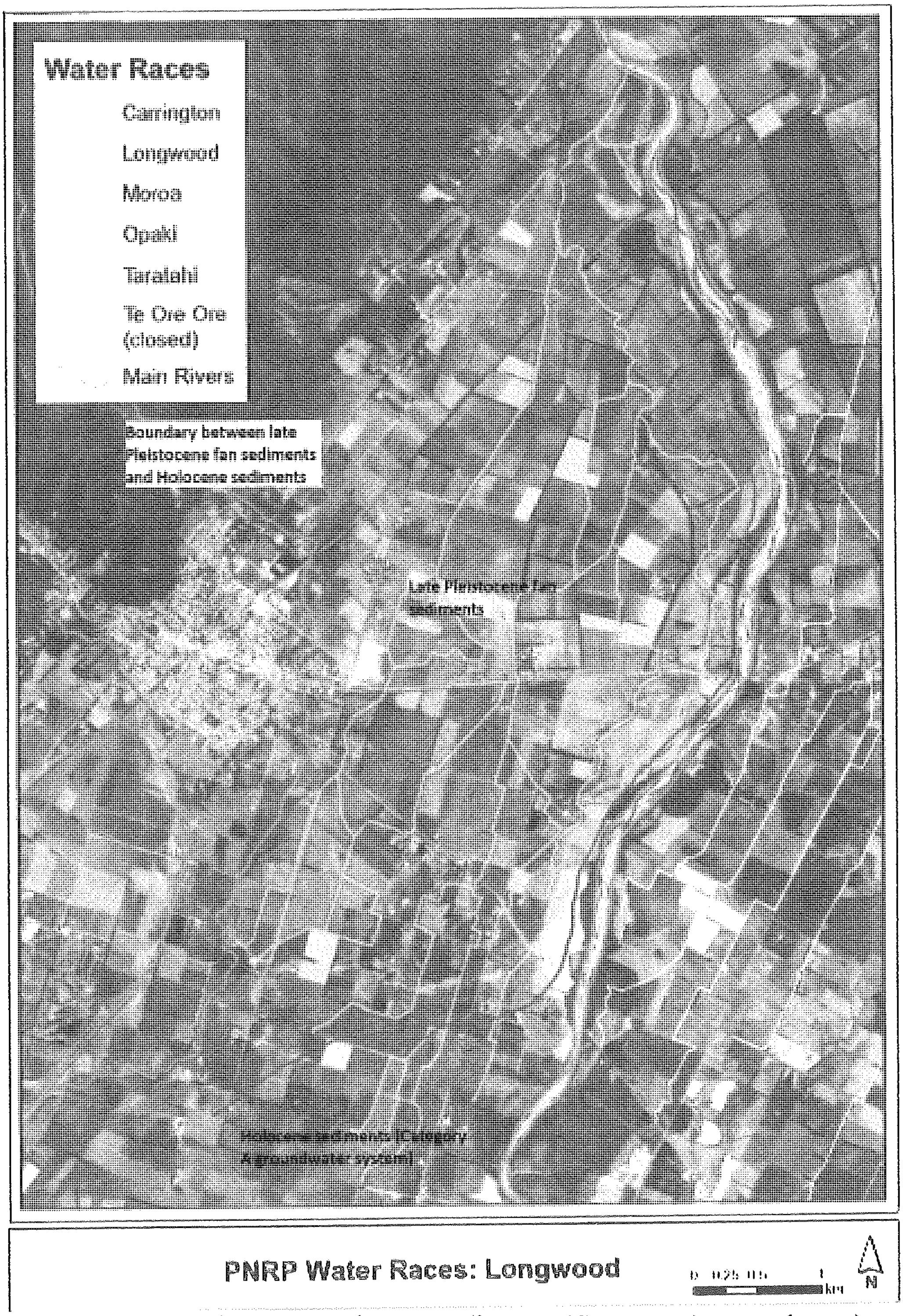

Figure 8 Boundary between Holocene sediments (Category A groundwater) and late Pleistocene fan sediments

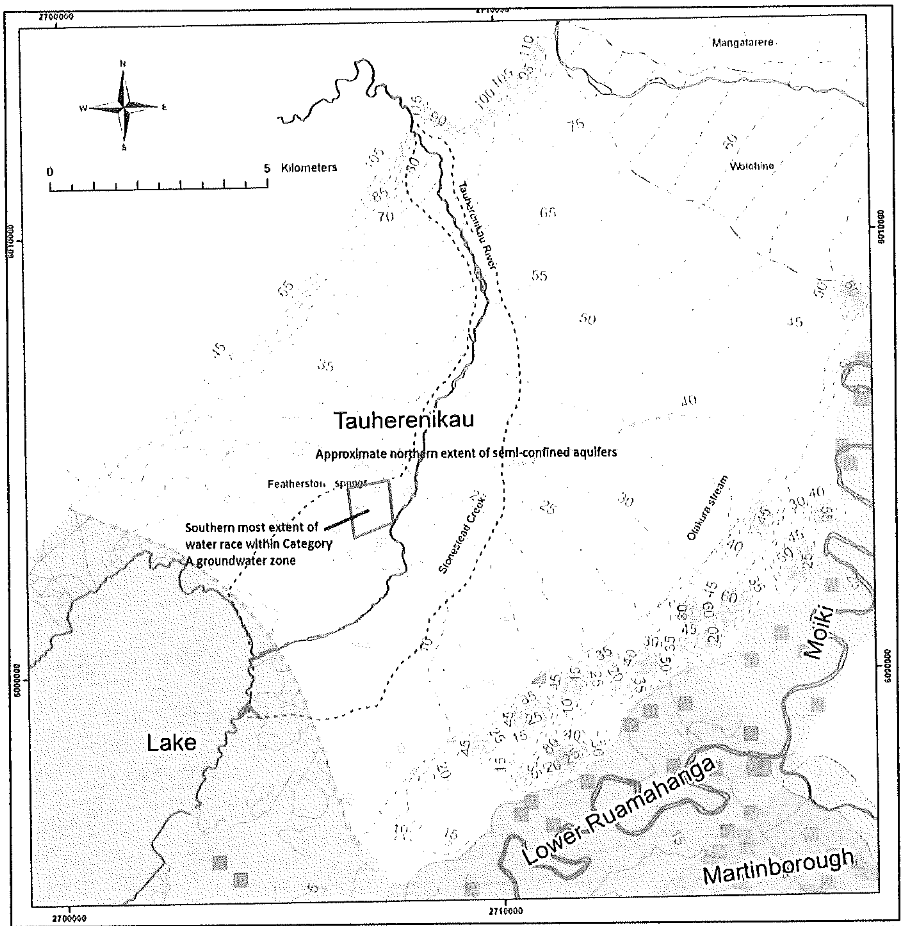

Figure 9 Map showing approximate extent of semi-confined aquifers in relation to water race network

Appendix 1

Greater Wellington Additional Information Request

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

MEMO

TO	Russell Hooper
COPIED TO	Bill Sloan, South Wairarapa District Council (SWDC)
FROM	Toni de Lautour, Greater Wellington Regional Council (GWRC)
DATE	25 February 2020
FILE NUMBER	WAR200185

Re: Longwood water race consent application – GWRC expert comments

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Background

An application relating to the Longwood water race consent was submitted to GWRC on 13 January 2020 by Russell Hooper (Planning consultant), on behalf of South Wairarapa District Council (SWDC). The applicant (SWDC) is proposing to replace existing consent WAR010201 which includes the following permits:

- to divert water from the Tauherenikau River;
- to take surface water from the Tauherenikau River
- to discharge water into Donald's Creek and the Tauherenikau River; and
- to undertake stream works in the bed of the Tauherenikau River to maintain the water intake

The Longwood water race consent WAR010201 consent expires 13 April 2020.

On initial review of the application, it was considered that there are aspects for which further detail is needed to inform an assessment of the effects that the activities may have on the environment. GWRC made a request to SWDC for an extension of time, under s37 of the Resource Management Act 1991 (RMA), to allow time for experts to review and provide input on the application.

The application documents were referred to the following experts for GWRC, for their review and comments on whether the application provides sufficient detail:

- Alton Perrie (GWRC Environmental Scientist, Marine and freshwater) – reviewed aquatic ecology
- Laura Keenan (Consultant Hydrologist, Awanui Science) – reviewed surface water hydrology

- Andrea Broughton (Hydrogeologist, Groundwater Solutions International) – reviewed groundwater hydrology

- Hamish Fenwick (GWRC Area Engineer, Flood Protection) – reviewed design and flood risk aspects

This memo provides the feedback received from relevant experts for GWRC, as listed above.

Summary of preliminary expert review comments on behalf of GWRC

This section provides comments from the experts for GWRC (listed above) and suggested further detail that they recommend should be submitted by SWDC.

Ecology (Alton Perrie)

I consider it (the application) pretty light on ecological details that I think it should cover and the application recognises this with "It is acknowledged that a comprehensive and holistic study of the positive and negative attributes of the water race system has not been undertaken"…..

- Potential abstraction effects on the Tauherenikau River – the potential impacts on aquatic habitat downstream of the abstraction point;

- Barriers to fish passage – more detail in the description of the weir at the intake and the flume/weir, and assessed by an ecologist;

- Characterisation of the stream values of Donald's Creek;

- For the earlier consent, Donald's Creek was considered the most sensitive receiving environment and hence monitoring focused here. It is possible that "sensitive environments" have been reclassified against updated criteria that characterises their ecological state. The race seems to terminate in a number of spots and therefore the determination of the most sensitive receiving environment should probably be reviewed as part of the application;

- It appears in the water quality monitoring data that some variables (e.g. total nitrogen), at some times, increase downstream of the water race discharge point relative to the upstream monitoring. This should have more comment (e.g., are there seasonal or flow-based patterns?);

- The race discharge appears to have increasing concentrations of contaminants (not just relating to the WWTP discharge) - it would be worth quantifying the loads and what proportion the race makes up in Donald's Creek;

- Effects of maintenance work – some parts of the water race system are natural watercourses; instream habitat can be significantly impacted and slow to recover and mortality of fishes can be high.

Surface water hydrology (Laura Keenan)

The information provided is insufficient to assess the hydrological impacts of the take and diversion on the Tauherenikau River. In particular the information required is:

- A more detailed assessment of river flows at the point of diversion/take, including the low flow regime of the Tauherenikau River;
- A more thorough description of the morphology of the river at the point of diversion and in the approximately 800m reach between the point of diversion and discharge back to the river;
- Specific effects of the take on hydrology and habitat availability (effects of the flow reduction on hydraulic properties such as river width/depth/velocity and how they may affect habitat); including, effects particularly during times of low flow (such as when the river is below mean annual low flow), effects on recession rates, freshes/accrual periods, etc
- Analysis of the effects of the diversion within the approximately 800 m reach (down to the point the diversion re-enters the river)
- A description of how the diversion rate is controlled and monitored – how is compliance with the 20% of river flow limit ensured?

Groundwater hydrology (Andrea Broughton)

The water race spans both Tauherenikau Category A Groundwater, at the intake area and discharge areas; and Tauherenikau Category B Groundwater, which is the bulk of the water race area.

- My main concern is with the Category A groundwater quality being degraded along the water race, due to direct connectivity; and at the 5 discharge points. I believe the vertical hydraulic conductivity will be an order of magnitude lower than the horizontal hydraulic conductivity. Maybe the degraded water could be remediated as it migrates downwards but this will depend greatly on the residence time for the groundwater migrating downwards into the Cat A unconfined aquifers (<20m bgl). Most of the Category A aquifers are due to the high horizontal hydraulic connectivity via river gravels and sands with the Tauherenikau River.

- In particular...**Section: 7.3 Effects of discharges on the receiving water environment.** The Tauherenikau Category A Groundwater bore users are also a 'receiving environment' from these discharges (not just Tauherenikau River and Donald Creek). I want to see some words around this and some importance put on those bores accessing the Category A groundwater that may be affected. Especially those bores located closer to the water race than the Tauherenikau River. I believe attenuation and dilution effects will help mitigate this but numbers will need to be worked through. A groundwater quality monitoring network should be discussed as well.

Weir maintenance (Hamish Fenwick)

Further detail required regarding the maintenance of the inlet and weir.

- A Maximum height level for the weir (it is holding back gravel in an area of the river that is degrading)
- Materials used to construct/maintain the weir (if the weir is damaged we would not want to see concrete blocks and demolition material washing down stream)
- Maintaining the gravel and re-contouring the gravel beaches around the water take
- Fish passage

Next steps

It is requested that you please submit further detail, as recommended above by the experts for GWRC, to support your application. As agreed in the s37 time extension for the processing of this consent, the due date for SWDC to respond to this review and input to the consent application is 23 April 2020 (40 working days). Following this, GWRC has until 22 May 2020 (20 working days) to complete assessment of the application.

I will get in with you during April to see how the preparation of your work is tracking. However, please get in touch with me if you have any queries or you would like clarification on any aspects of this memo.

Kind regards
Toni

Toni de Lautour | Kaitohutohu | Resource Advisor, Environmental Regulation
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Appendix 2

Concurrent flow gauging data sheets

Tauherenikau River 200 metres upstream of Longwood water race intake
27/2/2020 start 1000 end 1045

Distance from initial point (metres)	Observed depth (metres)	Method of observation	Depth of observation (metres)	Revolutions	Time (secs)	At point velocity (m/sec)	Mean velocity in vertical (m/sec)	Mean velocity in section (m/sec)	Mean depth (metres)	Width (metres)	Area (m2)	Discharge (m3/sec)
3.8	0	WERB 70%										
								0.3233	0.18	0.4	0.072	0.02328
4.2	0.36	0.6	0.216	62	40.8	0.4618	0.4618					
								0.4393	0.35	0.4	0.14	0.0615
4.6	0.34	0.6	0.204	55	40.2	0.4167	0.4167					
								0.4415	0.32	0.4	0.128	0.05651
5	0.3	0.6	0.18	62	40.4	0.4663	0.4663					
								0.4774	0.315	0.4	0.126	0.06015
5.4	0.33	0.6	0.198	65	40.4	0.4885	0.4885					
								0.4717	0.325	0.4	0.13	0.06132
5.8	0.32	0.6	0.192	60	40.1	0.4549	0.4549					
								0.4754	0.31	0.4	0.124	0.05894
6.2	0.3	0.6	0.18	66	40.4	0.4958	0.4958					
								0.4811	0.3	0.4	0.12	0.05773
6.6	0.3	0.6	0.18	62	40.4	0.4663	0.4663					
								0.4516	0.295	0.4	0.118	0.05329
7	0.29	0.6	0.174	58	40.4	0.4368	0.4368					
								0.4379	0.28	0.4	0.112	0.04904
7.4	0.27	0.6	0.162	58	40.2	0.4390	0.4390					
								0.4587	0.285	0.4	0.114	0.05229
7.8	0.3	0.6	0.18	63	40.0	0.4784	0.4784					
								0.5044	0.285	0.4	0.114	0.0575
8.2	0.27	0.6	0.162	70	40.0	0.5305	0.5305					
								0.4837	0.29	0.4	0.116	0.0561
8.6	0.31	0.6	0.186	58	40.4	0.4368	0.4368					
								0.4590	0.3	0.4	0.12	0.05507
9	0.29	0.6	0.174	64	40.4	0.4811	0.4811					
								0.4903	0.28	0.4	0.112	0.05491
9.4	0.27	0.6	0.162	66	40.1	0.4995	0.4995					
								0.4487	0.29	0.4	0.116	0.05205
9.8	0.31	0.6	0.186	53	40.6	0.3980	0.3980					
								0.4233	0.315	0.4	0.126	0.05333
10.2	0.32	0.6	0.192	59	40.0	0.4486	0.4486					
								0.3895	0.305	0.4	0.122	0.04751
10.6	0.29	0.6	0.174	44	40.8	0.3304	0.3304					
								0.3261	0.3	0.4	0.12	0.03914
11	0.31	0.6	0.186	42	40.0	0.3219	0.3219					
								0.3331	0.325	0.4	0.13	0.0433
11.4	0.34	0.6	0.204	45	40.0	0.3443	0.3443					
								0.3141	0.355	0.4	0.142	0.0446
11.8	0.37	0.6	0.222	37	40.1	0.2840	0.2840					
								0.2783	0.365	0.4	0.146	0.04063
12.2	0.36	0.6	0.216	36	40.7	0.2726	0.2726					
								0.2245	0.325	0.4	0.13	0.02919
12.6	0.29	0.6	0.174	24	42.7	0.1765	0.1765					
								0.1757	0.26	0.4	0.104	0.01828
13	0.23	0.6	0.138	23	41.3	0.1750	0.1750					
								0.1774	0.255	0.4	0.102	0.0181
13.4	0.28	0.6	0.168	23	40.1	0.1799	0.1799					
								0.1986	0.19	0.4	0.076	0.01509
13.8	0.1	0.6	0.06	29	41.5	0.2172	0.2172					
								0.1520	0.05	0.4	0.02	0.00304
14.2	0	WELB 70%										
								Total flow (m3/sec)				1.16191

Tauherenikau River at Gorge GW gauge 0.300 metres
27/2/2020 start 1130 end 1215

Distance from initial point (metres)	Observed depth (metres)	Method of observation	Depth of observation (metres)	Revolutions	Time (secs)	At point velocity (m/sec)	Mean velocity in vertical (m/sec)	Mean velocity in section (m/sec)	Mean depth (metres)	Width (metres)	Area (m2)	Discharge (m3/sec)
4	0	WERB 70%										
								0.0738	0.02	0.5	0.01	0.00074
4.5	0.04											
								0.0738	0.075	0.5	0.0375	0.00277
5	0.11	0.6	0.066	13	40.2	0.1054	0.1054					
								0.1425	0.115	0.5	0.0575	0.0082
5.5	0.12	0.6	0.072	24	41.9	0.1797	0.1797					
								0.1306	0.135	0.5	0.0675	0.00882
6	0.15	0.6	0.09	10	41.1	0.0815	0.0815					
								0.1497	0.165	0.5	0.0825	0.01235
6.5	0.18	0.6	0.108	30	42.8	0.2179	0.2179					
								0.2292	0.185	0.5	0.0925	0.0212
7	0.19	0.6	0.114	32	41.2	0.2405	0.2405					
								0.2222	0.21	0.5	0.105	0.02333
7.5	0.23	0.6	0.138	28	42.8	0.2040	0.2040					
								0.2273	0.23	0.5	0.115	0.02614
8	0.23	0.6	0.138	33	40.7	0.2506	0.2506					
								0.2613	0.245	0.5	0.1225	0.03201
8.5	0.26	0.6	0.156	36	40.8	0.2719	0.2719					
								0.2813	0.285	0.5	0.1425	0.04009
9	0.31	0.6	0.186	38	40.2	0.2907	0.2907					
								0.3017	0.32	0.5	0.16	0.04828
9.5	0.33	0.6	0.198	42	41.2	0.3128	0.3128					
								0.3106	0.34	0.5	0.17	0.05281
10	0.35	0.6	0.21	41	40.8	0.3085	0.3085					
								0.3148	0.355	0.5	0.1775	0.05588
10.5	0.36	0.6	0.216	42	40.1	0.3211	0.3211					
								0.3211	0.37	0.5	0.185	0.05941
11	0.38	0.6	0.228	42	40.1	0.3211	0.3211					
								0.3103	0.395	0.5	0.1975	0.06129
11.5	0.41	0.6	0.246	39	40.0	0.2996	0.2996					
								0.3113	0.42	0.5	0.21	0.06537
12	0.43	0.6	0.258	43	40.8	0.3231	0.3231					
								0.3344	0.455	0.5	0.2275	0.07608
12.5	0.48	0.6	0.288	46	40.7	0.3458	0.3458					
								0.3195	0.49	0.5	0.245	0.07827
13	0.5	0.6	0.3	39	40.9	0.2932	0.2932					
								0.2986	0.5	0.5	0.25	0.07465
13.5	0.5	0.6	0.3	20	20.2	0.3040	0.3040					
								0.2429	0.51	0.5	0.255	0.06194
14	0.52	0.6	0.312	12	20.7	0.1818	0.1818					
								0.2235	0.485	0.5	0.2425	0.0542
14.5	0.45	0.6	0.27	35	40.7	0.2653	0.2653					
								0.2197	0.465	0.5	0.2325	0.05108
15	0.48	0.6	0.288	23	41.5	0.1742	0.1742					
								0.1428	0.405	0.5	0.2025	0.02892
15.5	0.33	0.6	0.198	14	40.7	0.1115	0.1115					
								0.1270	0.34	0.5	0.17	0.02158
16	0.35	0.6	0.21	18	40.2	0.1424	0.1424					
								0.1460	0.29	0.5	0.145	0.02117
16.5	0.23	0.6	0.138	20	42.4	0.1496	0.1496					
								0.1147	0.22	0.5	0.11	0.01261
17	0.21	0.6	0.126	10	42.1	0.0798	0.0798					
								0.0559	0.17	0.5	0.085	0.00475
17.5	0.13											
								0.0559	0.065	0.5	0.0325	0.00182
18	0	WELB 70%										
								Total flow (m3/sec)				1.00575

Tauherenikau River 200 metres upstream of Longwood water race intake
15/5/2020 start 1220 end 1300

Distance from initial point (metres)	Observed depth (metres)	Method of observation	Depth of observation (metres)	Revolutions	Time (secs)	At point velocity (m/sec)	Mean velocity in vertical (m/sec)	Mean velocity in section (m/sec)	Mean depth (metres)	Width (metres)	Area (m2)	Discharge (m3/sec)
1.5	0	WERB 70%										
								0.1002	0.18	0.5	0.09	0.00902
2	0.36	0.6	0.216	18	40.0	0.1431	0.1431					
								0.1249	0.34	0.5	0.17	0.02123
2.5	0.32	0.6	0.192	14	42.7	0.1067	0.1067					
								0.1276	0.42	0.5	0.21	0.02679
3	0.52	0.6	0.312	19	40.6	0.1485	0.1485					
								0.1376	0.52	0.5	0.26	0.03577
3.5	0.52	0.6	0.312	16	40.5	0.1267	0.1267					
								0.2622	0.53	0.5	0.265	0.06949
4	0.54	0.6	0.324	27	20.7	0.3977	0.3977					
								0.3134	0.55	0.5	0.275	0.0862
4.5	0.56	0.6	0.336	15	20.3	0.2292	0.2292					
								0.3163	0.54	0.5	0.27	0.0854
5	0.52	0.6	0.312	27	20.4	0.4034	0.4034					
								0.3137	0.54	0.5	0.27	0.08469
5.5	0.56	0.6	0.336	15	20.8	0.2239	0.2239					
								0.3820	0.58	0.5	0.29	0.11078
6	0.6	0.6	0.36	36	20.2	0.5401	0.5401					
								0.4894	0.585	0.5	0.2925	0.14316
6.5	0.57	0.6	0.342	30	20.8	0.4388	0.4388					
								0.4294	0.545	0.5	0.2725	0.11702
7	0.52	0.6	0.312	28	20.3	0.4200	0.4200					
								0.5140	0.535	0.5	0.2675	0.13749
7.5	0.55	0.6	0.33	41	20.4	0.6079	0.6079					
								0.5992	0.525	0.5	0.2625	0.15729
8	0.5	0.6	0.3	40	20.5	0.5905	0.5905					
								0.5358	0.465	0.5	0.2325	0.12457
8.5	0.43	0.6	0.258	32	20.2	0.4811	0.4811					
								0.5106	0.435	0.5	0.2175	0.11105
9	0.44	0.6	0.264	36	20.2	0.5401	0.5401					
								0.4821	0.47	0.5	0.235	0.1133
9.5	0.5	0.6	0.3	28	20.1	0.4241	0.4241					
								0.4503	0.53	0.5	0.265	0.11933
10	0.56	0.6	0.336	32	20.4	0.4765	0.4765					
								0.4163	0.54	0.5	0.27	0.11241
10.5	0.52	0.6	0.312	24	20.6	0.3562	0.3562					
								0.4433	0.52	0.5	0.26	0.11527
11	0.52	0.6	0.312	35	20.0	0.5305	0.5305					
								0.5132	0.51	0.5	0.255	0.13086
11.5	0.5	0.6	0.3	33	20.2	0.4958	0.4958					
								0.4516	0.495	0.5	0.2475	0.11176
12	0.49	0.6	0.294	27	20.2	0.4073	0.4073					
								0.3696	0.47	0.5	0.235	0.08686
12.5	0.45	0.6	0.27	22	20.3	0.3320	0.3320					
								0.4042	0.455	0.5	0.2275	0.09196
13	0.46	0.6	0.276	32	20.4	0.4765	0.4765					
								0.4198	0.465	0.5	0.2325	0.09759
13.5	0.47	0.6	0.282	24	20.2	0.3631	0.3631					
								0.3524	0.45	0.5	0.225	0.07929
14	0.43	0.6	0.258	23	20.6	0.3417	0.3417					
								0.3376	0.395	0.5	0.1975	0.06668
14.5	0.36	0.6	0.216	22	20.2	0.3336	0.3336					

								0.2787	0.38	0.5	0.19	0.05296
15	0.4	0.6	0.24	15	20.8	0.2239	0.2239					
								0.2112	0.365	0.5	0.1825	0.03854
15.5	0.33	0.6	0.198	26	40.9	0.1984	0.1984					
								0.1696	0.31	0.5	0.155	0.02629
16	0.29	0.6	0.174	18	40.7	0.1408	0.1408					
								0.1378	0.26	0.5	0.13	0.01791
16.5	0.23	0.6	0.138	17	40.3	0.1347	0.1347					
								0.1363	0.215	0.5	0.1075	0.01465
17	0.2	0.6	0.12	18	41.6	0.1379	0.1379					
								0.04137	0.18	0.5	0.09	0.00372
17.5	0.16											
								0.04137	0.11	0.5	0.055	0.00228
18	0.06											
								0.04137	0.03	0.5	0.015	0.00062
18.5	0	WELB 30%										
								Total flow (m3/sec)				2.60222

Tauherenikau River 150 metres downstream of railway bridge
15/5/2020 start 1345 end 1420

Distance from initial point (metres)	Observed depth (metres)	Method of observation	Depth of observation (metres)	Revolutions	Time (secs)	At point velocity (m/sec)	Mean velocity in vertical (m/sec)	Mean velocity in section (m/sec)	Mean depth (metres)	Width (metres)	Area (m2)	Discharge (m3/sec)
1.5	0	WERB 70%										
								0.0424	0.025	0.5	0.0125	0.00053
2	0.05											
								0.0424	0.065	0.5	0.0325	0.00138
2.5	0.08											
								0.0424	0.08	0.5	0.04	0.00169
3	0.08	0.6	0.048	7	40.5	0.0605	0.0605					
								0.0866	0.09	0.5	0.045	0.0039
3.5	0.1	0.6	0.06	14	40.2	0.1128	0.1128					
								0.1393	0.1	0.5	0.05	0.00697
4	0.1	0.6	0.06	22	41.8	0.1658	0.1658					
								0.1924	0.14	0.5	0.07	0.01346
4.5	0.18	0.6	0.108	15	21.3	0.2189	0.2189					
								0.2696	0.215	0.5	0.1075	0.02898
5	0.25	0.6	0.15	21	20.1	0.3203	0.3203					
								0.2871	0.255	0.5	0.1275	0.03661
5.5	0.26	0.6	0.156	18	21.9	0.2539	0.2539					
								0.2629	0.295	0.5	0.1475	0.03878
6	0.33	0.6	0.198	18	20.4	0.2719	0.2719					
								0.3900	0.325	0.5	0.1625	0.06338
6.5	0.32	0.6	0.192	34	20.3	0.5081	0.5081					
								0.5008	0.325	0.5	0.1625	0.08138
7	0.33	0.6	0.198	33	20.3	0.4934	0.4934					
								0.5103	0.365	0.5	0.1825	0.09314
7.5	0.4	0.6	0.24	36	20.7	0.5273	0.5273					
								0.5810	0.385	0.5	0.1925	0.11185
8	0.37	0.6	0.222	42	20.0	0.6348	0.6348					
								0.5603	0.395	0.5	0.1975	0.11066
8.5	0.42	0.6	0.252	32	20.0	0.4858	0.4858					
								0.5817	0.42	0.5	0.21	0.12217
9	0.42	0.6	0.252	46	20.5	0.6777	0.6777					
								0.6753	0.385	0.5	0.1925	0.12999
9.5	0.35	0.6	0.21	45	20.2	0.6729	0.6729					
								0.6039	0.365	0.5	0.1825	0.11021
10	0.38	0.6	0.228	36	20.4	0.5349	0.5349					
								0.5362	0.395	0.5	0.1975	0.1059
10.5	0.41	0.6	0.246	36	20.3	0.5375	0.5375					
								0.4767	0.405	0.5	0.2025	0.09654
11	0.4	0.6	0.24	28	20.5	0.4160	0.4160					
								0.4509	0.415	0.5	0.2075	0.09356
11.5	0.43	0.6	0.258	32	20.0	0.4858	0.4858					
								0.4188	0.425	0.5	0.2125	0.08898
12	0.42	0.6	0.252	23	20.0	0.3517	0.3517					
								0.4262	0.39	0.5	0.195	0.08311
12.5	0.36	0.6	0.216	33	20.0	0.5007	0.5007					
								0.5191	0.36	0.5	0.18	0.09344
13	0.36	0.6	0.216	36	20.3	0.5375	0.5375					
								0.5462	0.355	0.5	0.1775	0.09694
13.5	0.35	0.6	0.21	37	20.2	0.5548	0.5548					
								0.5650	0.375	0.5	0.1875	0.10594
14	0.4	0.6	0.24	38	20.0	0.5752	0.5752					
								0.6208	0.395	0.5	0.1975	0.1226
14.5	0.39	0.6	0.234	45	20.4	0.6664	0.6664					

								0.6371	0.38	0.5	0.19	0.12106
15	0.37	0.6	0.222	41	20.4	0.6079	0.6079					
								0.6079	0.375	0.5	0.1875	0.11399
15.5	0.38	0.6	0.228	41	20.4	0.6079	0.6079					
								0.4618	0.43	0.5	0.215	0.0993
16	0.48	0.6	0.288	21	20.4	0.3158	0.3158					
								0.4515	0.445	0.5	0.2225	0.10046
16.5	0.41	0.6	0.246	39	20.1	0.5872	0.5872					
								0.4604	0.395	0.5	0.1975	0.09093
17	0.38	0.6	0.228	22	20.2	0.3336	0.3336					
								0.3008	0.345	0.5	0.1725	0.0519
17.5	0.31	0.6	0.186	18	20.7	0.2681	0.2681					
								0.2603	0.31	0.5	0.155	0.04035
18	0.31	0.6	0.186	17	20.8	0.2526	0.2526					
								0.1556	0.205	0.5	0.1025	0.01594
18.5	0.1	0.6	0.06	7	42.1	0.0585	0.0585					
								0.0410	0.05	0.4	0.02	0.00082
18.9	0	WELB 70%										
								Total flow (m3/sec)				2.47682

RIVER LAKE

Water Permit Renewal Application WAR010201, Longwood Water Race, Additional Information Request: Ecology

Prepared for:

South Wairarapa District Council

Water Permit Renewal Application WAR010201, Longwood Water Race, Additional Information Request: Ecology

Prepared by:

K. D. Hamill

Prepared for:

South Wairarapa District Council

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Date: 12 August 2020
Status: Final
Reference: wk-1136

Cover photo: Longwood Water Race at the flow recording weir, upstream of Homeward Road, 3 June 2020

Contents

1 Introduction

1.1 Background

South Wairarapa District Council (SWDC) submitted an application to Greater Wellington Regional Council (GWRC) on 13/1/2020 to renew the resource consent for the operation of the Longwood water race, near Featherston. The application was initially for a term of 15 years but was later reduced to a period of 5 years to align the new consent with the expiry date of the consent of the Moroa water race (13 April 2025).

The original application was reviewed by GWRC technical experts and additional information was requested with respect to ecology, hydrology and weir maintenance (de Lautour 2020). SWDC proposed that much of the additional information request could be complied over the time of the short-term consent, this was partially accepted by GWRC, however GWRC also considered that much of the additional information request could be obtained from desktop assessments.

River Lake Ltd was engaged to provide additional information with respect to ecology. Information provided in this report is based on a background literature, water quality data collected as part of the current consent, and a site visit on 3 June 2020 which included the collection of aquatic macroinvertebrate samples at four sites longitudinally down the stream.

Additional information relating to hydrology of the Longwood Water Race and Tauherenikau River is provided in Butcher (2020).

1.2 Additional information request: Ecology

Additional information requested from GWRC on the consent were with respect to ecology were:

- Potential abstraction effects on the Tauherenikau River – the potential impacts on aquatic habitat downstream of the abstraction point;
- Barriers to fish passage – more detail in the description of the weir at the intake and the flume/weir, and assessed by an ecologist;
- Characterisation of the stream values of Donald's Creek;
- For the earlier consent, Donald's Creek was considered the most sensitive receiving environment and hence monitoring focused here. It is possible that "sensitive environments" have been reclassified against updated criteria that characterises their ecological state. The race seems to terminate in a number of spots and therefore the determination of the most sensitive receiving environment should probably be reviewed as part of the application;
- It appears in the water quality monitoring data that some variables (e.g. total nitrogen), at some times, increase downstream of the water race discharge point relative to the upstream monitoring. This should have more comment (e.g., are there seasonal or flow-based patterns?);

- The race discharge appears to have increasing concentrations of contaminants (not just relating to the WWTP discharge) - it would be worth quantifying the loads and what proportion the race makes up in Donald's Creek;
- Effects of maintenance work – some parts of the water race system are natural watercourses; instream habitat can be significantly impacted and slow to recover and mortality of fishes can be high.

1.3 Longwood Water Race Scheme

1.3.1 Location and flow

The Longwood Water Race scheme takes water from Tauherenikau River, north of Featherston township in south Wairarapa. The water is gravity distributed along unlined channels on the plains between Featherston and the Tauherenikau River. Stock have access to the Water Race for drinking water.

An intake control structure regulates the amount of water flowing down the race, with the residual excess being diverted back to the Tauherenikau River at two locations about 800m downstream of the intake.

The race has four main branches which terminate at multiple discharge points to the Tahererenikau River, drains leading to Barton's Lagoon and Donald Creek. Apart from the residual flow, the main discharge from the Water Race is via Branch 2 (western side) that enters Donald Creek about 1.7km south for Featherstonm and to a lesser extent via Branch 4 that enter Barton Lagoon on the northern shore of Lake Wairarapa. The other discharges to the Tauherenikau River are very small (Figure 1.1).

The Longwood Water Race draws water from the Tauherenikau River at a maximum consented[1] rate of 300 L/s under supplemental conditions, which steps down to 250 L/s and 180 L/s and 100 L/s as the flow in the Tauherenikau River reduces below 4900 L/s, 2000 L/s and 1350 L/s respectively (see Butcher 2020).

The consent also allows for a higher level of water diversion from the Tauherenikau River, not exceeding 20% of the river flow, but with the discharge of the residual water (in excess of allowance for the water race) back to the Tauherenikau River about 800m downstream of the intake.

1.3.2 Code of Practice (CoP)

A Code of Practice (CoP) has been developed for the Moroa and Longwood Water Races (revised 23 February 2017). This encourages uses to adopt "best practical means" to reduce water wastage and to minimise water contamination and other environmental effects. The CoP recognises that the source water quality from the Tauherenikau River is of very high quality but that there is a progressive decline in water quality as water flows along the race. A key aspect of the CoP is the encouraging of visual inspections by landowners to identify and minimise any stock entering the races, minimise runoff from paddocks and stock races entering the races, creating drinking bays for stock, ensuring stock and vehicle crossings at fixed points, encouraging culverts over the race for animal crossings and ensuring fish rescue during any mechanical clearing of the water race.

[1] Consent WAR010201 was varied on 9/8/2016.

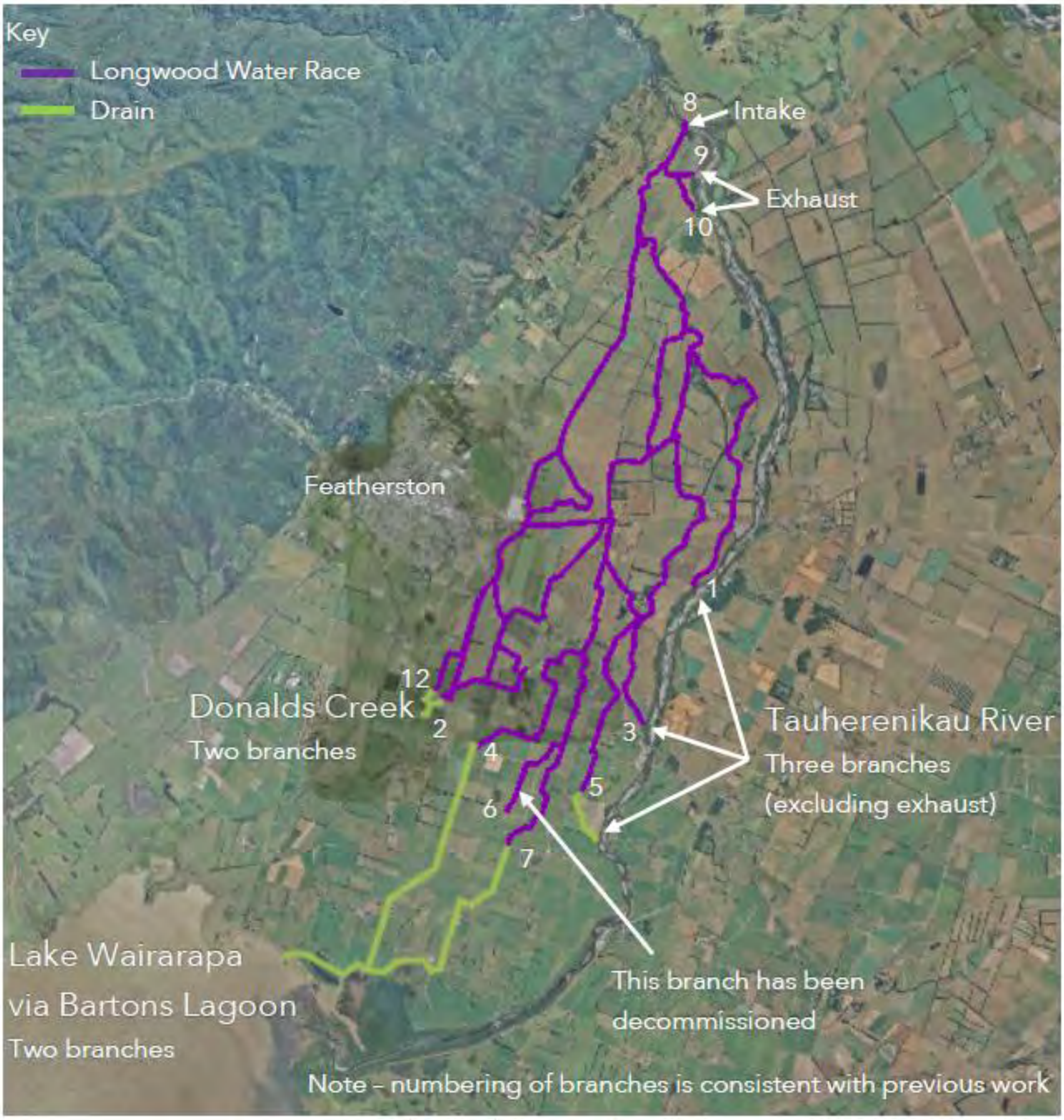

Figure 1.1: Longwood Water Race system showing inlet from Tauherenikau River, outlet of residual water (Exhaust) and outlets from the Water Race (source SWDC, Longwood Water Race Discharge Points, 28 May 2020)

2 Receiving Environments

2.1 Tauherenikau River

2.1.1 Hydrology

Tauherenikau River drains from the eastern side of the Tararua Range and flows into Lake Wairarapa north of Featherston. The mean flow of the Tauherenikau River is 9.1 m^3/s (Gordon 2011). The river substrate is dominated by cobbles and gravel (Thompson 2013).

2.1.2 Water quality

The Tauherenikau River high water quality with good visual clarity, low nitrogen and phosphorus concentrations, low concentrations of *E. coli* bacteria and an aquatic macroinvertebrate community indictive of good water quality. Over the last ten years the water quality appears to have improved for water clarity, turbidity and phosphorus, but has declined for nitrate and *E. coli* bacteria (**Table 2.1**). The high water quality reflects the high proportion of the catchment that remains as unmodified indigenous forest in the Tararua Range. On the plains the river is buffered by wide vegetated riparian margins. The improving trends in river clarity and TP were widespread in the Greater Wellington region and probably do not reflect changes in human activity (Snelder 2017).

Table 2.1: Water quality in the Tauherenikau River at Websters (from LAWA).

Variable	median (5-yr)	State	Trend 2010-2020
Black disc	2.99	best 50%	likely improving
Turbidity	1.69	best 50%	likely improving
TN	0.14	best 25%	not assessed
TON	0.0455	best 25%	very likely degrading
NH4-N	0.005	best 25%	not assessed
TP	0.006	best 25%	likely improving
DRP	0.0025	best 25%	very likely improving
E. coli	22	A	likely degrading
MCI	116	Good	Indeterminate
Taxa richness	17		
% EPT	45.5		

2.1.3 Ecology

The Tauherenikau River has a wide range of habitats and high diversity of fish, It is recognised as a river with nationally threatened indigenous fish and also as a water body with important habitat for trout fishery and trout spawning.

Native fish recorded in the Tauherenikau River catchment include: Common bully, Giant bully, Redfin bully, Common smelt, Dwarf galaxias, Inanaga, Lampray, Longfin eel, Shortfin eel, Torrentfish and Brown mudfish (wetlands). Brown trout are also common (NZ Freshwater Fish Database). Most of the fish found in the Tauherenikau River are diadromous, which means they need to migrate between freshwater and marine environments to complete part of their lifecycle.

The Regional Freshwater Plan identifies the Tauherenikau River is significant to manage for threatened indigenous fish and trout habitat. The Tauherenikau delta is also significant based on a high degree of natural character.

The aquatic macroinvertebrate community in the Tauherenikau River is indicative of good water quality / habitat (Table 2.1).

2.2 Donald Creek

2.2.1 Hydrology and Habitat

Donald Creek originates from the foothills of the Tararua Ranges between Featherston and the Tauherenikau River. It joins the Otauria Stream (Abbot Creek) before entering Lake Wairarapa. The Featherston Waste Water Treatment Plant discharges treated effluent to Donald Creek about 430m upstream of the confluence with the Water Race. Most of Donald Creek flows through pasture but immediately upstream of the Longwood Water Race confluence the stream passes through a remnant of protected bush.

Donald Creek is about 5m wide near the Longwood Water Race confluence. Aquatic macrophytes are common in the stream including the sprawling emergent *Apium nodiflorum*.

Donald Creek has an annual median flow of 258 L/s, but it is very seasonal with the median flow in the months January to March is about 75 L/s (**Figure 2.1**, Butcher 2016, Butcher 2018).

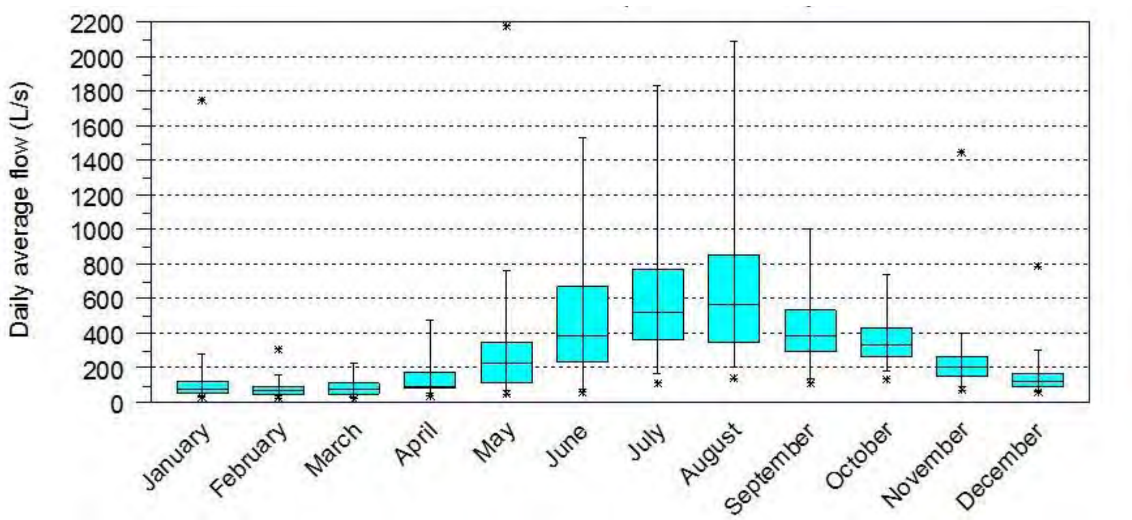

Figure 2.1: Seasonal variation in flow in Donald Creek (2005-2016). The graph shows the median, 50%ile (within the box), 95 %ile error bars and extreme values. The annual median flow is 241 L/s (Butcher 2016). The median flow for the months January to March is about 75 L/s.

2.2.2 Water quality

The water quality in Donald Creek is characterised by high concentrations of nitrate and moderate concentrations of dissolved phosphorus upstream of the Featherston WWTP discharge, i.e. a winter median of about 0.98 mg/L and 0.011 mg/L for dissolved inorganic nitrogen (DIN) and dissolved reactive phosphorus (DRP) respectively. The discharge adds further N and P, increasing downstream concentrations to ca. 1.6 mg/L and 0.094 mg/L for DIN and DRP respectively. Much of the additional nitrogen from the WWTP is in the form of total ammonium.

2.2.3 Ecology

Water quality and ecological surveys have been undertaken on several occasions to assess the effects of the Featherston WWTP on Donald Creek (Hamill 2016, Forbes 2013, Coffey 2013, Coffey 2010), including sites located upstream and downstream of the Longwood Water Race. Past sampling of Donald Creek has found sites along Donald Creek with MCI and QMCI scores indicative of 'poor' to 'fair' ecological condition. During summer low flow periods the water quality and macroinvertebrate community is substantially reduced at the sites downstream of the WWTP discharge (but upstream of the Longwood Wate Race confluence) (**Figure 2.2**) (Hamill 2017).

Donald Creek and Otauira Stream support populations of large longfin eel and common bully. Rainbow trout and inanga have also been caught in the streams. Good habitat is provided for fish where the stream passes through the bush remnant by riparian cover, and woody debris in the stream creating a diversity of hydraulic regimes (Hamill 2017).

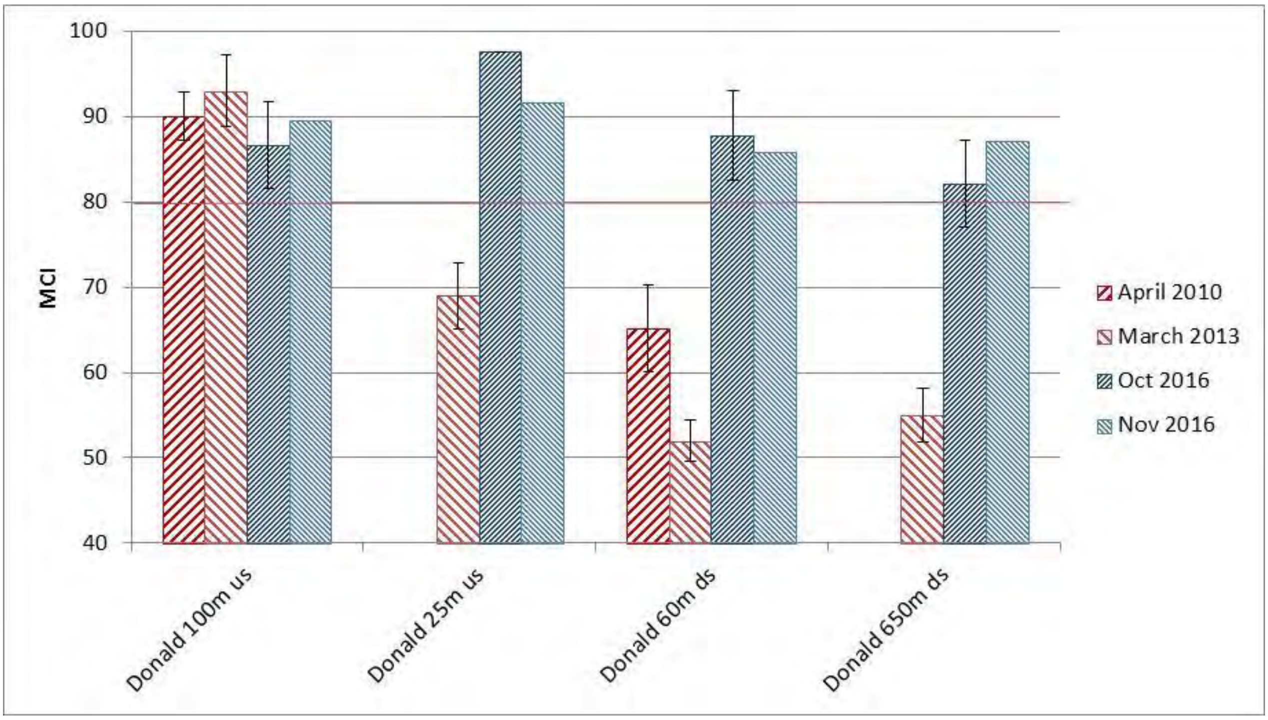

Figure 2.2: Median MCI scores for Donald Creek for surveys in April 2010, March 201, October 2016 and November 2016 (Coffey 2010, 2013, Hamill 2017). The error bars show one standard deviation of replicate samples. The red horizontal line indicates scores indicative of 'poor' water quality /habitat.

3 Longwood Water Race Ecology Survey

3.1 Method

3.1.1 Stream longitudinal survey

A stream longitudinal survey was undertaken along Longwood water race on 3 June 2020. There had been rain the week prior to the survey and the water level at the recorder was reading 3.2m. This included inspecting inlet and outlet locations, measuring substrate composition, macrophyte cover and key physio-chemical variables (i.e. temperature, specific electrical conductivity, dissolved oxygen saturation), and collecting aquatic macroinvertebrate samples are four locations along the western branch of the water race. Observations were made of the inlet and flow control structures to assess potential barriers to upstream fish passage.

Sites where ecology samples were collected during the survey are show in Figure 3.1 (Sites E1, E2, E3, and E4). Also shown on the map are sampling sites for regular water quality monitoring (Sites L1 WR, L5 WR, L4 and L6), and additional water quality sample sites (Sites SH2 WR B2, SH53 WR B4, and L B2) collected on 17 July 2020 (see next section).

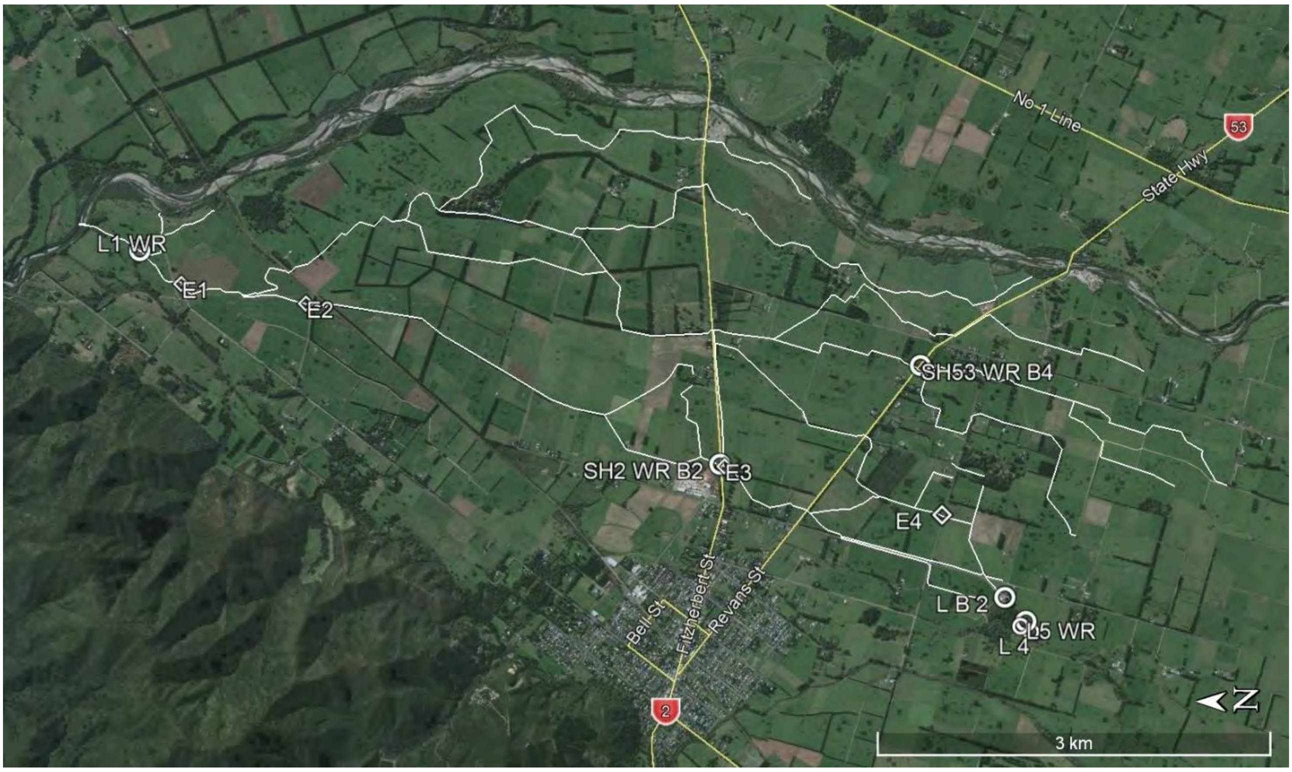

Figure 3.1: Longwood Water Race showing sample sites for ecology (diamonds) and water quality (circles).

3.1.2 Macroinvertebrates

The use of macroinvertebrates for assessing the condition of streams is widespread in New Zealand and overseas. The structure and composition of macroinvertebrate communities is a good indicator of stream condition as they are found in almost all freshwater environments, are relatively easy to sample and identify, and different taxa show varying degrees of sensitivity to pollution.

Aquatic macroinvertebrates were collected from riffle/run habitat using a Surber sampler and following Protocol C1 of Stark et al. (2001). All macroinvertebrate samples were preserved in alcohol and sent to Ryder Environmental to be processed using Protocol P2 (200 fixed count with scan for rare taxa) of the Protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001).

The following ecological indices were calculated to assess the biological health of the river and potential effects on the stream ecology:

- Taxa Richness: This is a measure of the types of invertebrate taxa present in each sample.
- EPT richness and EPT abundance (Ephemeroptera-Plecoptera-Trichoptera). This measures the number of pollution sensitive mayfly, stonefly and caddisfly (EPT) taxa in a sample excluding *Oxyethira* and *Paroxyethira*.
- % EPT abundance.
- Macroinvertebrate Community Index (MCI). The MCI is an index for assessing the water quality and 'health' of a stream using the presence/absence of macroinvertebrates (Stark 1985).
- Quantitative MCI (QMCI). The QMCI is similar to the MCI but is based on the relative abundance of taxa within a community (Stark 1993, Stark 1998).

The MCI and QMCI reflect the sensitivity of the macroinvertebrate community to pollution and habitat change, with higher scores indicating higher water quality. Generally accepted water quality classes for different MCI and QMCI scores and soft-bottomed version are shown in Table 2.2.

Table 3.1: Suggested quality thresholds for interpretation of the MCI & QMCI from Stark (1998)

Quality Class	Description	MCI	QMCI
Excellent	Clean water	> 120	> 6.0
Good	Doubtful quality or possible mild pollution	100 – 120	5.0 - 6.0
Fair	Probable moderate pollution	80 – 100	4.0 – 5.0
Poor	Probable severe pollution	< 80	< 4.0

3.2 Water Race habitat description

3.2.1 General

Habitat characteristics of sites longitudinally along the Longwood Water Race are shown in **Table 3.2**. There was a progressive reduction in substrate size at sites further down the Water Race. Near Underhill Road (prior to the split between the east and west branches) the water race substrate was dominated by cobbles and large gravel, near Algies Road the substrate was dominated by medium to small gravel with areas of sand or silt common, and sites at SH2 and downstream were dominated by sand or silt with areas of gravel occurring in sections of faster flow.

Macrophytes were common along the Water Race and were abundant by Algies Road. Along most of the water race the presence of macrophyte appeared to be determined by the presence of stream shading, riparian fencing to exclude stock and recent maintenance activities or. Downstream of Longwood East Road the western branch had almost 100% cover of dense watercress.

The focus of the field survey was on the western branch that discharges to Donald Creek, but observations of the water race along the eastern branch at Fernside (upstream of SH2) and at SH53 indicated similar characteristics of the water race with distance downstream.

Table 3.2: Sample site for stream survey with location, temperature, specific electrical conductivity, % dissolved oxygen and key physical characteristics

Site	Description	Latitude, Longitude	Temp. (oC)	Spec. EC (uS/cm)	%DO	Width (m)	Depth (m)	Substrate / macrophyte cover
E1 u/s	d/s Underhill Road	41.082702, 175.357277	8.8	71.7	99.5	1.8	0.35	B 10%, C 30%, G 40%, S 10%, Si 10%. Macrophytes 10%
E2	u/s Algies Rd	41.089021, 175.356553	9.3	74.2	108	1.5	0.3	G 40%, S 30%, Si 30%. Macrophytes 35%
E3 SH2	d/s SH2	41.119955, 175.341439	9.6	72.5	108	2.1	0.25	G 25%, S 35%, Si 40%. Macrophytes 40%
E4	u/s Longwood E Rd	41.134756, 175.337177	9.9	71.3	109	1.5	0.25	G 30%, S 35%, Si 35%. Macrophytes 20%
100m u/s LB2	Murphys Line on B2	41.138911, 175.331202	7.3	72.9	95	1.3	0.3	Si 100%. Macrophytes 100%

3.2.2 Inlet to flow control structure

The inlet to Longwood water race is via a culvert from the Tauherenikau River (**Figure 3.2**). The channel to the flow control structure is about 2m wide and 0.5m deep with cobble/large gravel substrate. Long grass dominated the riparian margins of the incised channel and there would be good potential for restoration planning along one side of the channel.

Figure 3.2: Longwood Water Race inlet structure on the Tauherenikau River, June 2020

Figure 3.3: Longwood water race between inlet and flow control structure, 3 June 2020

3.2.3 Flow control structure

The flow control structure is about 460m from the inlet. Water flows to the water race via a culvert and controller, while the residual water flows over a small (0.7m high) weir (**Figure 3.4**). The main water race channel flows towards Underhill Road via a water level recorder with a V-notch weir. The flow splitter and V-notch weir create potential fish barriers that is discussed later in this report. Macrophytes are common in the channel (e.g. watercress, *Potamogeton crispus*, *Glyceria fluitans*).

The channel carrying the residual flow was typically about 1m wide and up to 0.5m deep (**Figure 3.5**). The substrate was dominated by cobble/gravels and macrophytes were common in places (e.g. *Potamogeton crispus*). There is considerable potential for riparian enhancement and stream restoration in the overflow channels and in sections of the Water Race upstream of Algies Road.

Figure 3.4: Longwood water race flow control structure showing the weir controlling the residual flow; the flow to the Water Race is via a culvert on the upper left of the picture, 3 June 2020.

Figure 3.5: Longwood water race residual flow towards the Tauherenikau River outlet 9 and 10, 3 June 2020.

3.2.4 Underhill Road

Site E1 (Underhill Road) was characterised by clear water with substrate dominated by cobbles and large gravel. There was a small amount of macrophyte cover (e.g. watercress, *Potamogeton crispus*, *Glyceria fluitans*) and mosses were common on the cobbles. The site was open and had fencing on only one side, stream banks were pugged by stock in some upstream sections (**Figure 3.6**). The water velocity at the site was about 0.7 m/s. A natural tributary (possibly intermittent flow) enters the Water Race downstream of this site. This tributary is mostly unfenced and runs through pasture with stock access.

Figure 3.6: Longwood Water Race at Underhill Road facing downstream towards sample site, June 2020

Figure 3.7: Common style of stock crossing on Longwood water race, June 2020

3.2.5 West Branch, Algies Road

Between Underhill Road and Algies Road most of the water Race is fenced with stock access and stock crossing restricted to defined areas. However, the stock access points had bare ground that provided a source of sediment runoff to the Water Race (Figure 3.7). A small weir controls the flow in sections where the flow is split between the east and west branches. Deeper water pools behind the weir and the substrate consists of mobile sands.

Site E2 (Algies Road) was characterised by gravel substrate with about 35% macrophyte cover. The section was fenced but the riparian vegetation was dominated by grass.

Figure 3.8: Longwood water race (west branch) upstream of Algies Road (facing downstream), June 2020

3.2.6 West branch, SH2

The water race channel near SH2 is relatively wide and shallow. Site E3 (SH2) was dominated by fine substate and has about 40% macrophyte cover. The stream habitat quality was noticeably poorer (e.g. more fine sediment) compared to upstream and the water was turbid at the time of the survey.

Some section of the Water Race between Algies Road and SH are fenced but many sections are not fenced, including immediately upstream and downstream of SH2, where there is unrestricted stock access and evidence of bank erosion (**Figure 3.8, Figure 3.9**).

Figure 3.9: Longwood water race (west branch) at SH2 facing upstream (top) and downstream (bottom).

3.2.7 West branch, Longwood East Road

Site E4 on Longwood East Road was dominated by fine gravel and sand. There were relatively low cover of macrophytes at the sample site (upstream of Longwood East Road) compared to downstream of Longwood East Road and it appeared that macrophytes had been removed from the upstream section about one or two months previous. The water race is fenced and the riparian margins dominated by grass. There is potential for riparian planting on one side of the stream, this would improve habitat values and provide shading to reduce macrophyte growth (**Figure 3.10**).

The dense macrophyte cover downstream of Longwood East Road will be providing a filter for sediments and the seasonal uptake of dissolved nutrients from the stream. Constructing on-line sediment traps (i.e. wider deeper sections of streams) could provide a useful tool to reduce the frequency that sections of stream need to be cleared.

Figure 3.10: Longwood Water Race (west branch) at Longwood East Road, facing upstream (top) and facing downstream (bottom), June 2020

3.2.8 West branch, Murphy's Road

Branches of the Longwood Water Race run along and cross under Murphys Line. These channels are relatively narrow (1m wide) with silt substrate and close to 100% macrophyte (*Apium nodiflorum* and watercress) cover (**Figure 3.11**). There was very little change in electrical conductivity of the water along the water race from inlet to outlet at the time of the survey, indicating little influence from groundwater on the stream at this time.

Figure 3.11: Longwood Water Race west branch section running parallel to Murphy's Road, June 2020

3.3 Fish passage

Many fish present in the Tauherenikau River catchment are diadromous and so require passage to and from the coast. Downstream fish passage is possible along most of the water race branches with the possible exception of branches 3, 6 and 7 which are commonly dry in summer. The effect of these dry branches on fish passage is likely negligible considering the incrementally reduced flow and low in habitat values in downstream sections of the water race, and the multiple alternative routes to the Tauherenikau River, Bartons Lagoon and Donald Creek.

Upstream fish passage through the Longwood Water Race or residual overflow channels is potentially restricted at three main locations, these are the inlet culvert from the Tauherenikau River, the flow splitter and the flow recorder weir. These barriers will likely restrict upstream passage to a 500m reach of the water race upstream of the flow recorder weir, although fish access to this section of waterway is still possible via the Tauherenikau River inlet culvert.

The number of fish affected by these barriers is unknown, but it is likely that the number of fish trying to migrate upstream via the water race system will be small relative to the number using Tauherenikau River itself. Most of the outlets to the water race are low volume and via macrophyte dominated drains. Any fish passage migration effort should focus on the residual flow channel which is relatively large and of similar water quality to the Tauherenikau River itself.

The inlet culvert from the Tauherenikau River potentially presents velocity barrier to upstream fish passage. The effect of the culvert on fish passage could be mitigated by installing multiple strands of spat rope through the culvert, fixed at the upstream end. Fish passage would also be assisted by installing baffles at the upstream and downstream end but this would be contingent safe access to the culvert.

The flow splitter structure causes a potential barrier to the residual flow via a weir (**Figure 3.4**). This barrier could be mitigated by installing a ramp attached to the top of the weir. **Figure 3.12** shows an example of an off-the-shelf fish ramp that could be easily installed.

Upstream fish passage via the water race itself is restricted by the culvert in the flow splitter and by the V-notch weir used for water discharge monitoring. Retrofitting fish passage in either of these locations is considered a low priority at this time because retrofitting fish passage in a way that does not compromise the operation of the existing infrastructure would be challenging, and the value of installing fish passage in these locations is questionable.

Figure 3.12: An example of a ramp to provide fish passage that could be installed on the weir to the residual flow.

3.4 Aquatic macroinvertebrate results

The aquatic macroinvertebrate community composition had MCI and SQMCI scores indicated 'good' water quality/habitat at sites E1 (Underhill Road) and E2 (Algies Road) but 'poor' water quality / habitat at sites E3 (SH2 western branch) and E4 (Longwood East Road, western branch). Differences between sites as also reflected in lower number of EPT taxa, lower percentage of EPT taxa and a lower number of total taxa at the two sites downstream of SH2. Pollution sensitive stonefly taxa were abundant at Site E1 but rare or absent at sites further downstream, similarly pollution sensitive mayfly taxa were abundant at Sties E1 and E2 but had much reduced abundance at Sites E3 and E4 (**Table 3.3**).

The change in the aquatic macroinvertebrate community is consistent with a change in substrate and stream habitat, with a progressive reduction in substrate size at sites further down the Water Race (**Table 3.2**).

Table 3.3: Aquatic macroinvertebrates in Longwood Water Race, 3 June 2020

TAXON	MCI score	E1 Underhill Rd	E2 Algies Rd	E3 SH2	E4 Longwood E Rd
COLEOPTERA					
Elmidae	6	20	1	20	
Hydraenidae	8	1			
COLLEMBOLA	6	30	20	27	40
CRUSTACEA					
Ostracoda	3	10	40	534	2600
Paracalliope fluviatilis	5	60	20		
Talitridae	5		1		1
DIPTERA					
Austrosimulium species	3	1	1	13	320
Corynoneura scutellata	2			53	
Hexatomini	5				20
Maoridiamesa species	3	50			1
Muscidae	3				20
Orthocladiinae	2	190	140	233	220
Tanypodinae	5			7	1
Tanytarsini	3	40	1		40
EPHEMEROPTERA					
Austroclima species	9	520	620		20
Coloburiscus humeralis	9	30			
Deleatidium species	8	20	1		
Zephlebia species	7	10	40		
HEMIPTERA					
Sigara species	5			7	
HIRUDINEA	3			13	1
MEGALOPTERA					
Archichauliodes diversus	7	40			
MOLLUSCA					
Ferrissia species	3		20		
Latia species	3	70	40		
Lymnaeidae	3			1	
Physa / Physella species	3	1	20		220
Potamopyrgus antipodarum	4	80	3760	7	
Sphaeriidae	3	1	100		
NEMATODA	3			7	
NEMERTEA	3	10		7	
ODONATA					
Xanthocnemis zealandica	5			1	
OLIGOCHAETA	1	20	40	200	100
PLATYHELMINTHES	3		80	60	20
PLECOPTERA					
Megaleptoperla species	9		1		
Stenoperla species	10	10			
Zelandobius species	5	50			
Zelandoperla species	10	40	1		
TRICHOPTERA					
Beraeoptera roria	8	10			
Costachorema species	7	1			
Hudsonema alienum	6	10	1		
Hudsonema amabile	6		20		1
Hydrobiosidae early instar	5			7	60
Hydrobiosis clavigera group	5				1
Hydrobiosis umbripennis group	5	50	20	20	80
Hydropsyche - Aoteapsyche group	4	520	120	13	
Olinga species	9	10			
Oxyethira albiceps	2	10		153	1840
Psilochorema species	8	1	20		1
Pycnocentria species	7	10	40		20
Pycnocentrodes species	5	40	660		
Triplectides species	5		1		
Number of taxa		33	28	20	22
Number of EPT taxa		17	13	4	8
% EPT taxa		52	46	20	36
MCI score		110	101	73	86
SQMCI score		5.9	5.4	2.8	2.7

4 Longwood Water Race Water Quality

4.1 Water Quality Sampling Sites

4.1.1 Regular Sampling for the consent

Water quality samples are collected at two locations on Longwood Water Race and four location on Donald Creek, upstream and downstream of the Longwood water Race confluence and upstream and downstream of the Featherston Wastewater Treatment Plant (WWTP) discharge. The site locations are:

- Longwood Water Race intake (L1 WR);
- Longwood Water Race discharge B to Donald Creek (L5 WR);
- Donald Creek upstream of the Water Race B (L 4),
- Donald Creek downstream of the Water Race B (L 6),
- Donald Creek upstream of the Wastewater Treatment Plant B (L 2 WWTP U/S),
- Donald Creek downstream of the Water Race B (L 3 WWTP D/S),

Site location details are shown in Cardino (2016). Site L2 WWTP U/S provides an upstream site before the influence of the Featherston WWTP on Donald Creek.

Water quality samples are collected monthly and analysed for total nitrogen (TN), total phosphorus (TP), Total Suspended Sediment (TSS), *E. coli* bacteria, electrical conductivity (EC), pH and dissolved oxygen (DO). Additional variables are analysed for the sites relating to the Featherston WWTP. For the purpose of analysis electric conductivity was converted to specific EC to remove variability related to water temperatures. Similarly, dissolved oxygen measurements were converted to percent dissolved oxygen saturation to remove the influence of temperature.

4.1.2 Synoptic survey sampling

Additional water quality samples were collected during synoptic surveys to better understand the change in water quality along the water race branches. These occurred on 20 March 2020 (electrical conductivity measurements only) and 17 July 2020 (regular water quality variables). The water quality sampling site locations are shown in **Figure 3.1**.

4.2 Water Quality Audit 2016

A Water Quality Audit of the Longwood Water Race was undertaken by Cardino in 2016 to assess the impact of the Longwood Water Race on the receiving environment. The report examined water quality data and found a substantial deterioration in water quality within the Longwood Water Race between the Tauherenikau River and where it discharges to Donald Creek, however there was no obvious deterioration in the water quality of Donald Creek between sampling points upstream and downstream of where the Longwood Water Race enters. This was attributed in part due to the water quality in

Donald Creek already being reduced by the Featherston Waste Water Treatment Plant discharge, upstream of Longwood Water Race. The water quality variables considered to be of greatest concern were nitrogen, phosphorus, dissolved oxygen and *E. coli* bacteria.

The water quality audit recommended that the following land use practises and management strategies should be considered to reduce the impact on Donald Creek:

- Removal of stock from accessways;
- Education regarding most efficient fertiliser application practices; and
- Assistance from South Wairarapa District Council to understand and minimise excessive water use and entry of contaminants into waterways.

4.3 Results of regular water quality monitoring

4.3.1 Water quality over time

The results for water quality sampling in Longwood Water Race and Donald Creek over time are shown below in **Figure 4.1 to Figure 4.4**. There is high variability in the water quality in the Longwood Water Race downstream site (L5 WR) compared to upstream or compared to Donald Creek, particularly with respect to EC and TN.

There appears to be a reduction (improvement) in TP at Site L5 WR between 2006 and 2009. There also appeared to be a step change reduction (improvement) *E. coli* bacteria at Site L5 WR since about 2010. Similar reductions occur around the same time (2010-2012) in all of the Donald Creek sites downstream of the Featherston WWTP (i.e. L3 D/S WWTP, L 4, and L 6).

There is strong seasonality in the TP and to a less extent *E. coli* bacteria in Donald Creek sites downstream of the Featherston WWTP (i.e. L3 D/S WWTP, L 4, and L 6), which is higher in the summer/autumn compared to winter/spring. This is caused by higher dilution of the WWTP discharge during higher stream flows in winter/spring. A seasonal pattern in TN was also apparent at all sites except L1 WR, with TN typically higher in the winter months (**Figure 4.5, Figure 4.6**).

4.3.2 Time period used for water quality comparisons

A comparison of water quality between sample sites was made using data from a five-year time period of January 2010 to December 2015, and separately for a time period from September 2019 to June 2020. The choice of time periods is to avoid a step change in water quality at Site L5 WR (the downstream site on Longwood Water Race). Between July 2016 to August 2019 there was a step change in water quality where the water quality at L5 WR very closely matches water quality in Donald Creek L4. This change is particularly apparent in the electrical conductivity measurements, which are typically quite stable. July 2016 corresponds to a change in sampling personnel and it appears that the sampling site may have shifted downstream to a section of Longwood Water Race influenced by the backflow from Donald Creek.

In 2019 the water quality at Site L5 WR considerably improved. Again, this was particularly apparent in the EC measurements. This change also appeared to correspond to a change in sampling personnel and probably reflects a change in sampling location to outside the influence of Donald Creek. But the lower EC readings compared to pre. 2016 probably also reflect a change in nearby landuse.

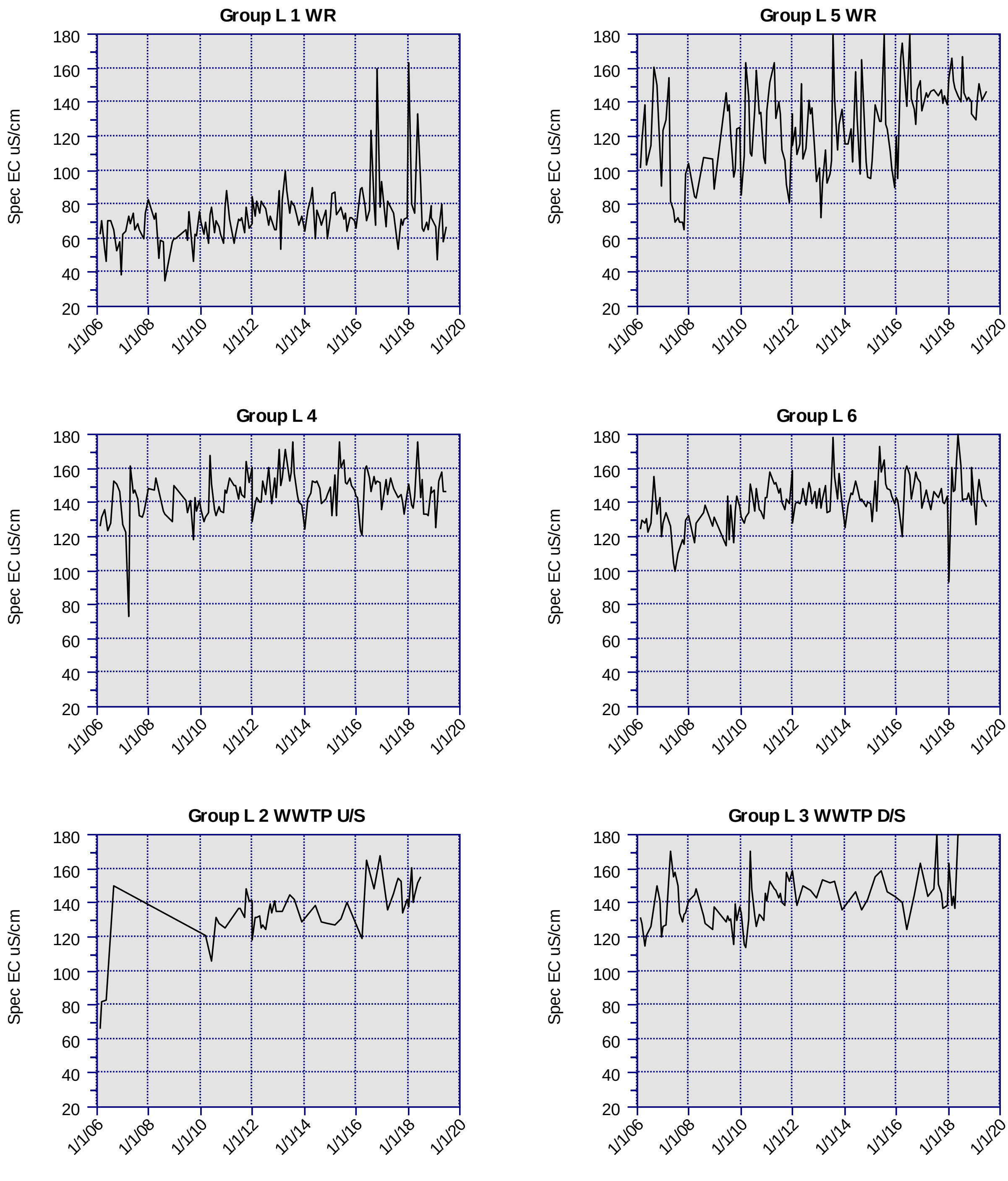

Figure 4.1: Specific electrical conductivity in Longwood Water Race and Donald Creek over time.

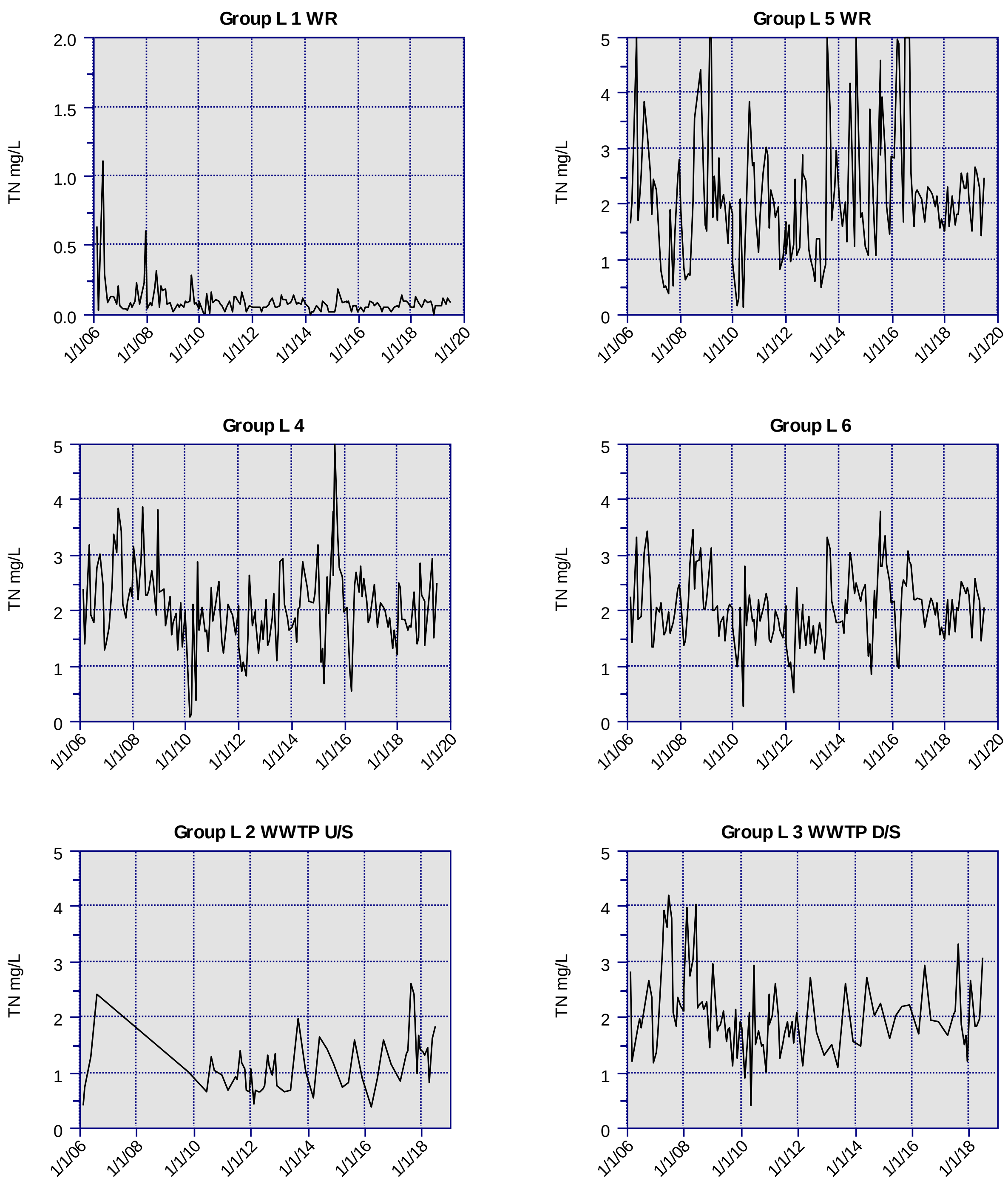

Figure 4.2: Total nitrogen in Longwood Water Race and Donald Creek over time.

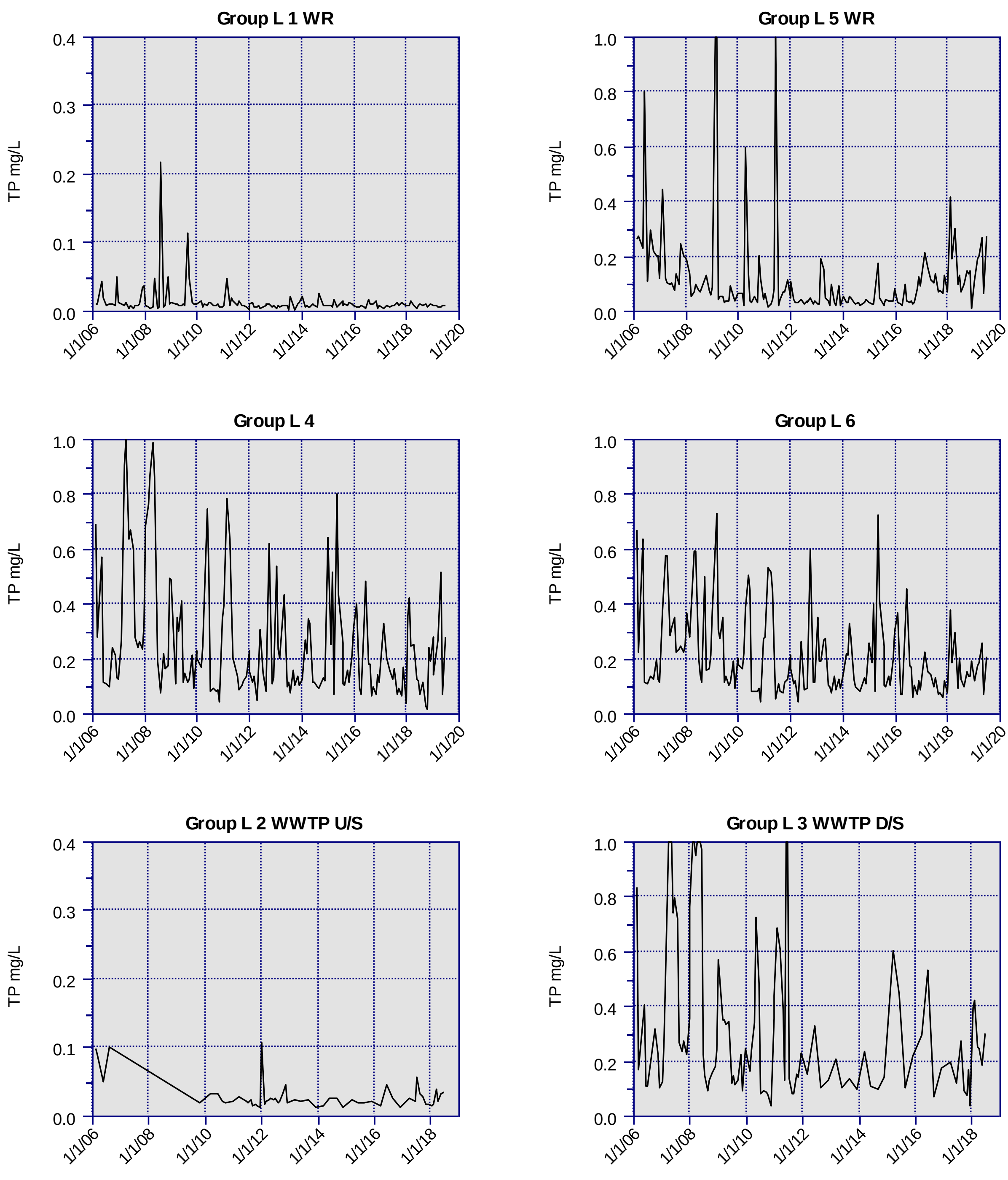

Figure 4.3: Total phosphorus in Longwood Water Race and Donald Creek over time.

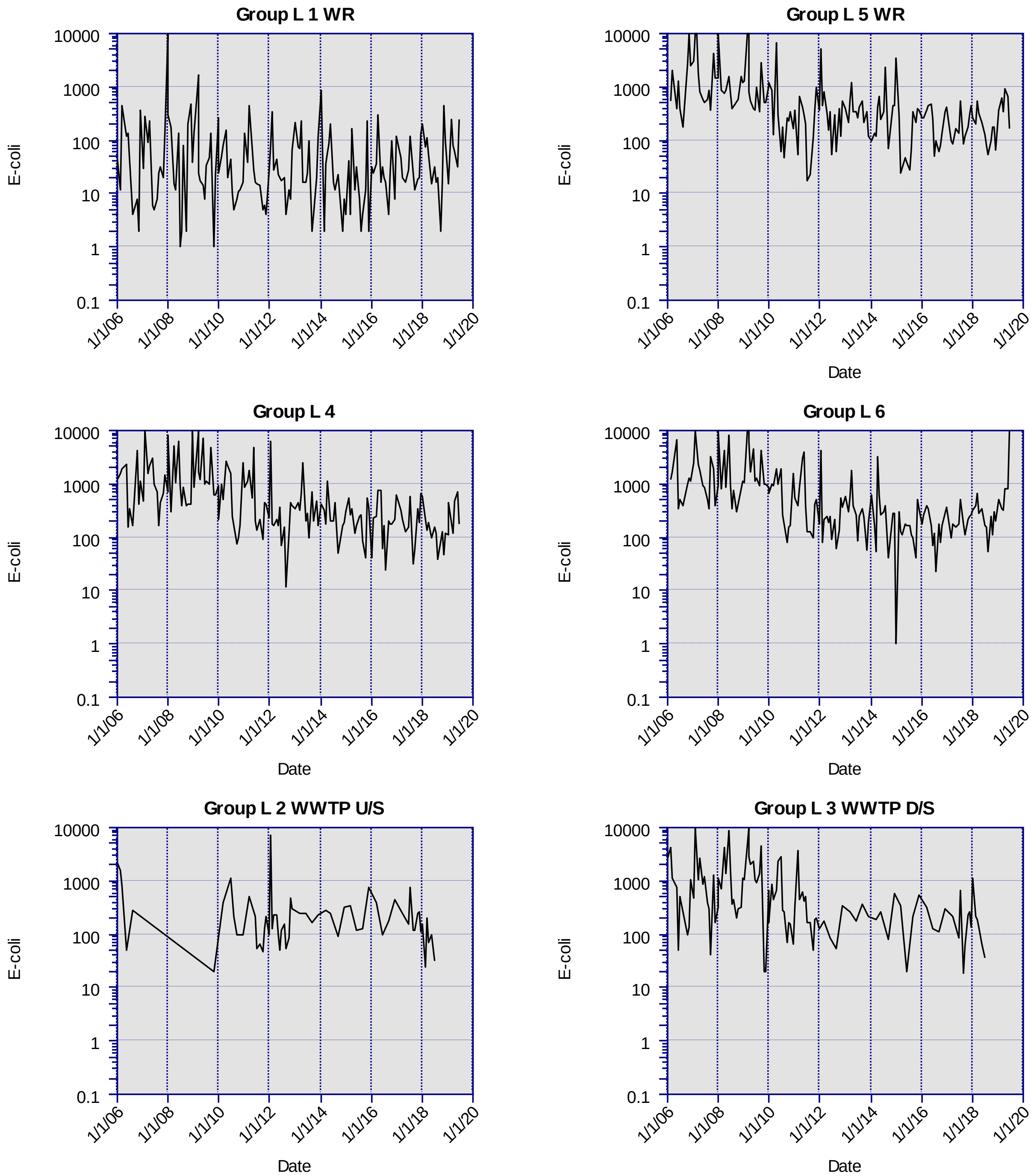

Figure 4.4: *E. coli* bacteria in Longwood Water Race and Donald Creek over time.

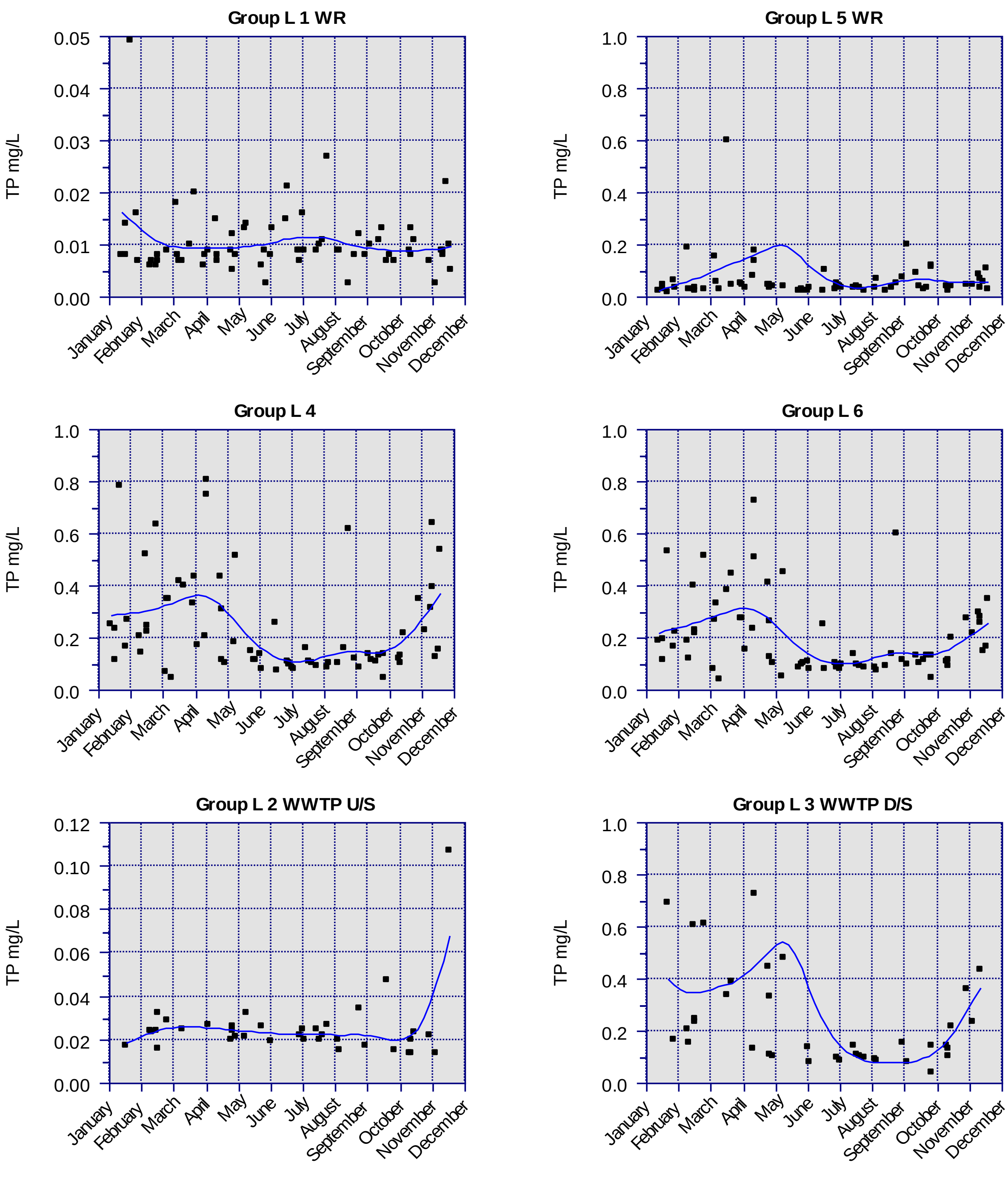

Figure 4.5: Seasonality of TP in Longwood Water Race and Donald Creek (2010-2015).

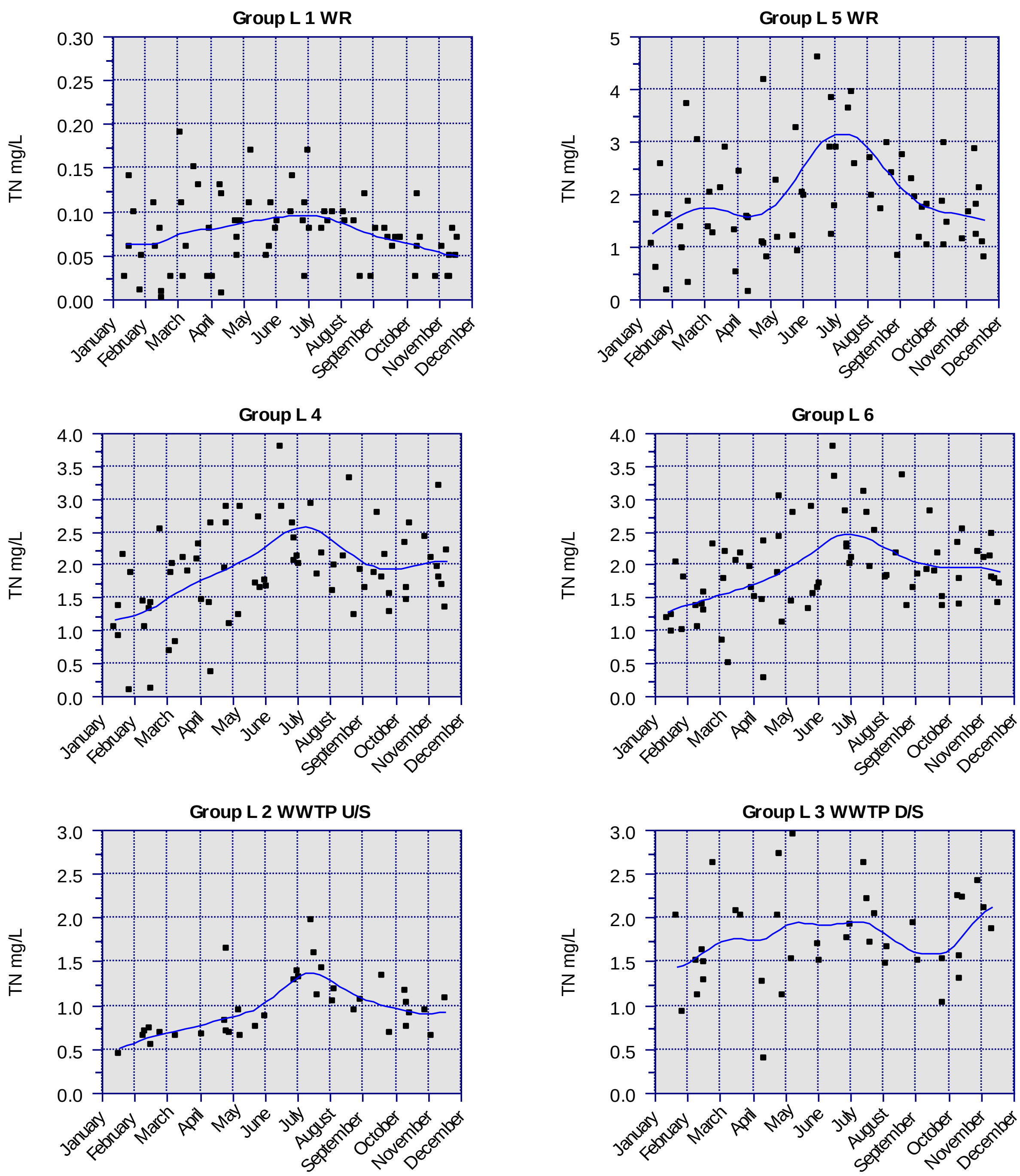

Figure 4.6: Seasonality of TN in Longwood Water Race and Donald Creek (2010-2015).

4.3.3 Comparisons between sites

The difference in water quality between sample sites was compared using box plots which allow comparison of median, the inter-quartile range, 5th and 95th percentile values. Comparisons for the 5-year time period 2010-2015 are shown in **Figure 4.7**, and comparisons for the recent time period 2019-2020 are shown in **Figure 4.8**.

The water quality in Longwood Water Race is of high quality at the intake from the Tauherenikau River but is of substantially lower quality at the outlet to Donald Creek. However, the discharge from the Water Race appears to make no significant difference in the water quality in Donald Creek when comparing sample sites upstream and downstream of the confluence, despite, occasional observations of highly turbid water has been observed coming from the Longwood Water Race.

The negligible influence of the Water Race on overall water quality in Donald Creek is partially because the water quality in Donald Creek is already compromised by the Featherston WWTP discharge about 400m upstream of the Longwood Water race confluence. When the Featherston WWTP discharge is improved or reduced it is possible that an adverse effect from the Water Race will be more apparent for water quality variables such as TSS, TN, TP and *E.coli* bacteria. There have been recent improvements in water quality in the water race at Site L5 since September 2019, that may relate to a change in sampler and change in nearby landuse.

The differences observed between sites for each variable are as follows:

- Median TN in the water race increases from about 0.1 mg/L to 1.8 mg/L and is higher than in Donald Creek upstream of the WWTP (0.92 mg/L). Since September 2019 TN at site L5 appears to have improved (1.1 mg/L) and is similar to Donald Creek upstream of the WWTP.

- Median TP in the water race increases from about 0.01 mg/L to 0.04 mg/L and is higher than in Donald Creek upstream of the WWTP (0.022 mg/L). Since September 2019 TP at site L5 appears to have improved (0.027 mg/L) and is similar to Donald Creek upstream of the WWTP.

- Median TSS in the water race increases from about 2.5 mg/L to 4.0 mg/L but is still lower than in Donald Creek upstream of the WWTP (3 mg/L). Since September 2019 TSS at site L5 appears to have improved (1.5 mg/L) and is similar to Donald Creek upstream of the WWTP.

- Median *E.coli* bacteria in the water race increases from about 20 cfu/100mL to 305 cfu/100mL L and is higher than in Donald Creek upstream of the WWTP (210 cfu/100mL). Since September 2019 *E. coli* levels at site L5 appears to have improved (218 cfu/100mL) and are similar to Donald Creek upstream of the WWTP.

- Median EC in the water race increases from about 73 µS/cm to 115 µS/cm between Sites L1 WR and L5 WR, but is lower than EC in Donald Creek upstream of the WWTP (132 µS/cm). Since September 2019 EC at site L5 appears to have improved (63 µS/cm) and is much lower than at Donald Creek upstream of the WWTP.

- This reflects a general increase in dissolved contaminants, possibly from interaction with shallow groundwater.

- Median pH decreases from 7.9 to 6.7 and is lower than in Donald Creek upstream of the WWTP (7.4). This may reflect an increased influence in organic substances.

- Median DO saturation decreases from about 100% to 72% and is lower than in Donald Creek upstream of the WWTP (94%). This probably reflects an accumulation of organic matter in the water race that exerts an oxygen demand. Respiration from macrophyte growth can cause diurnal fluctuations in DO, but is unlikely to be the primary driver of depressed DO in the race because no super-saturation (very high DO) has been observed.

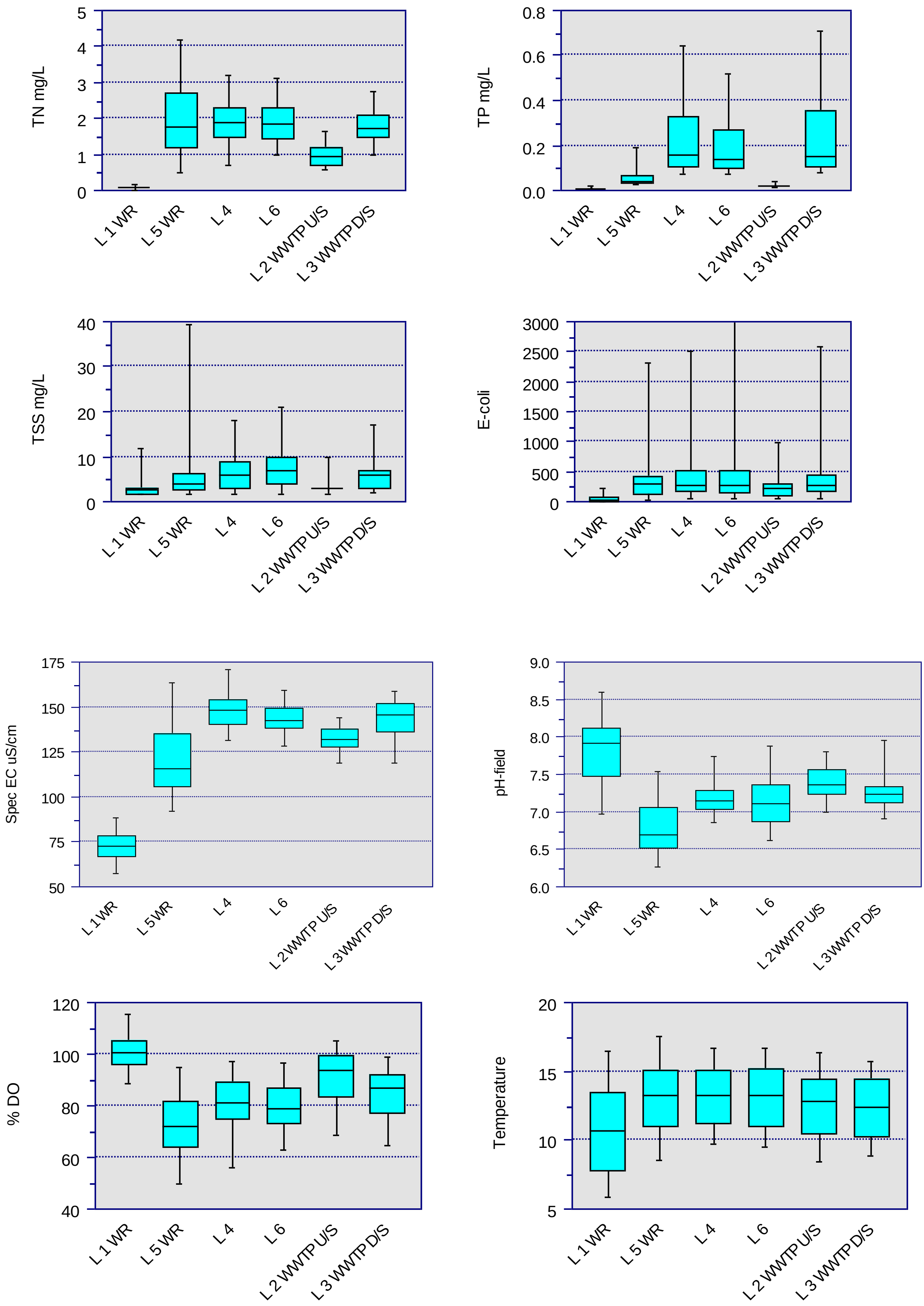

Figure 4.7: Water quality site comparison in Longwood Water Race and Donald Creek for 5-year period 2010 to 2015. Box plots show median, interquartile range with whiskers as 5th and 95th percentiles.

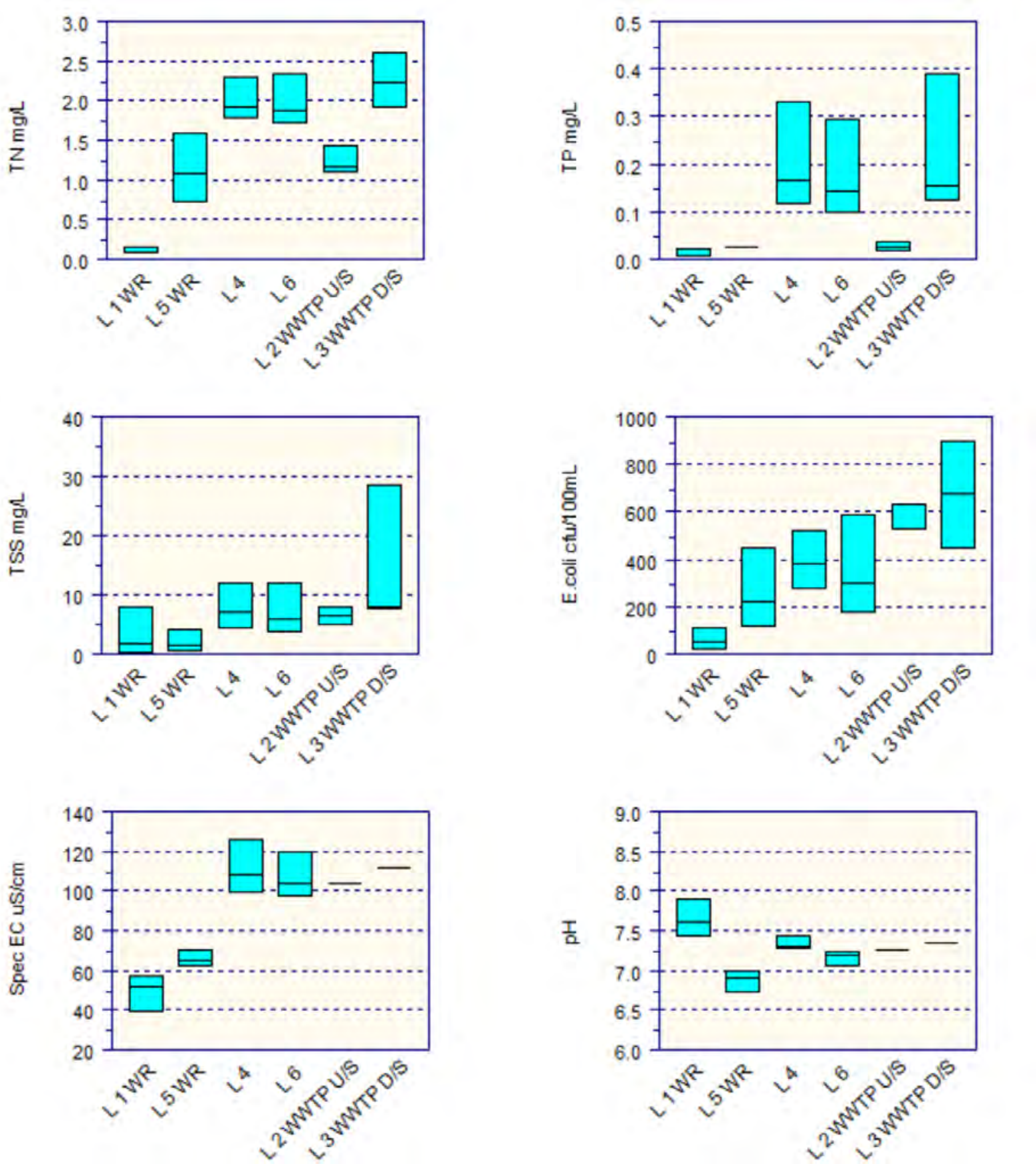

Figure 4.8: Water quality site comparison in Longwood Water Race and Donald Creek for the period September 2019 to May 2020. Box plots show median, interquartile range with whiskers as 5th and 95th percentiles.

4.4 Loads and dilution from Donald Creek

The review from GWRC requested an assessment of the relative load of contaminant from the Longwood Water Race to Donald Creek. This analysis would require a better assessment of flows at the outlet of the water race to Donald Creek than is currently available. EC can be used as a conservative tracer of the influence of Longwood Water Race on Donald Creek. EC in the water race is considerably lower than in Donald Creek, but comparing the concentrations of L4 and L6 indicates only a small influence of the water race on EC in Donald Creek (e.g. **Figure 4.7**). This suggest that the water race generally has a relatively small influence on water quality in Donald Creek.

EC readings can be used to calculate the approximate amount of dilution of Longwood Water Race water after it mixes with Donald Creek (at the downstream sample site location). This dilution factor can be used to calculate theoretical downstream contaminant concentrations under a scenario of no discharge from the WWTP.

Dilution was calculated using a mass balance approach over a 'control volume' using median electrical conductivity and the equation:

D = (Cwr– Cu/s)/(Cd/s – Cu/s)

Where: D = dilution factor, Cwr = concentration in the water race; Cu/s = concentration in Donald Creek upstream; Cd/s = concentration in Donald Creek downstream.

Dilution was calculated using median specific EC concentrations for summer (December to May) and Winter (July to November) separately[2]. This found that the mixing of Longwood Water Race with Donald Creek had a median dilution factor of **5.8** and **7.5** times for summer and winter respectively.

A dilution factor of **6** times was used to calculate a theoretical downstream concentration for variables of interest using the following formula:

Cd/s = ((Cwr – Cu/s) / D) + Cu/s)

Table 4.1 shows the theoretical downstream concentrations of key variables in Donald Creek assuming a conservative future scenario of no discharge occurring from Featherston WWTP (i.e. Cu/s was the concentration as measured upstream of the WWTP). Separate calculations were made for TN and TP using the recent values from the Water Race Site L5 (since Sept 2019).

These calculations show a relatively small effect of the Water Race on median water quality in Donald Creek downstream of the confluence – particularly if the recent (since September 2019) water quality in the Longwood Water Race is representative of ongoing future water quality.

Table 4.1: Theoretical concentrations of key variables in Donald Creek Site L6 (downstream) assuming a scenario of no discharge from Featherston WWTP and using a dilution factor (D) of 6 times.

Variable	C wr L5	C u/s L2	D	C d/s L6 future	% change
TN (mg/L)	1.8	0.92	6	1.07	15.9%
TP (mg/L)	0.04	0.022	6	0.025	13.6%
TSS (mg/L)	4	3	6	3.2	5.6%
E. coli (cfu/100mL)	305	210	6	226	7.5%
Spec. EC (uS/cm)	116	132	6	129	-2.0%
Since Sept 2019					
TN (mg/L)	1.1	0.92	6	0.95	3.3%
TP (mg/L)	0.027	0.022	6	0.023	3.8%

[2] Specific EC at L5 = 124.5 µS/cm and 115.9 µS/cm for summer and winter respectively; at L4 = 144.7 µS/cm and 147.4 µS/cm for summer and winter respectively; at L6 = 142 µS/cm for both summer and winter.

4.5 Water Quality Synoptic Surveys

There appears to be only small increases in electrical conductivity along most of the length of Longwood Water Race as seen in synoptic surveys on 20 March 2020 (**Table 4.2**), 3 June 2020 (Table 3.2) and recent water quality data (Figure 4.8). This suggest little groundwater influence along most of the water race. However, on occasions there is very poor water quality in Longwood Water Race downstream of Murphys Road (i.e. Site L 5 WR, B2 WR) (**Table 4.3**). This may be the result of localised discharges to the water race. It would be valuable to have an additional long-term water quality monitoring site on Longwood Water Race at either SH2 or SH53 to provide better spatial resolution as to where water quality issues occur.

Table 4.2: Electrical conductivity at inlet and outlets to water race on 20 March 2020. Note relatively small increase in EC along the reaches.

Branch ID	Description	Lat Long		EC (uS/cm)	Comment
8	Inlet	41.0763106S	175.3626390E	66.7	
9	Residual outflow	41.0810214S	175.3639506E	66.5	
10	Residual outflow	41.0842761S	175.3637935E	66.2	
1	Tuherenikau	41.1252543S	175.3613453E	71.5	Water slightly turbid
5	Tuherenikau	41.1484917S	175.3503707E	69.2	Very slow flow
4	Bartons	41.1439054S	175.3354084E	71.9	Water slightly turbid but normally cl
2	Donald Ck	41.1391030S	175.3297098E	70.4	
11	Donald Ck	41.1379036S	175.3288929E	73.0	100% macrophyte cover
6	Donald Ck	41.1506852S	175.3399628E	n/a	Dry
7	Donald Ck	41.1542577S	175.3401256E	n/a	Dry
3	Tuherenikau	41.1407687S	175.3589353E	n/a	Dry

Table 4.3: Water quality during longitudinal survey on 17 July 2020. Flow in the water race was high and unusually turbid at sites downstream of Murphy Road (i.e. Sites L B2 and L5).

Site	Spec EC (uS/cm)	DO%	Temp	pH	TN (mg/L)	NNN (mg/L)	NH4-N (mg/L)	TP (mg/L)	DRP (mg/L)	TSS (mg/L)	E.coli cfu/100mL
L 1 WR	67	100	7.6	6.7	0.09	0.043	<0.01	0.01	0.008	8	58
L SH2 B2	76	106	9.7	6.7	0.74	0.284	0.04	0.083	0.012	35	410
L B2	132	88	11.1	6.4	5.63	2.71	0.06	0.85	0.072	325	280
L 5 WR	135	89	11.2	6.3	3.86	2.75	0.06	0.342	0.076	107	230
SH53 L4	98	106	10.6	6.6	1.62	1.31	0.3	0.055	0.02	14	20

5 Conclusions and Recommendations

5.1 Conclusions

The Longwood Water Race has both positive effects on ecology by providing instream habitat and negative effects on water quality through diffuse contamination from landuse practices resulting in a progressive decline in water quality and instream habitat quality along its length.

The ecological effects on the Tauherenikau River are likely to be negligible to small because of the small volume of water discharged from the Water Race to the Tauherenikau River. The residual water not diverted to the water race, is discharged back into the Tauherenikau River about 800m downstream of the inlet. The water quality in this diversion is not monitored, but potential effects on the Tauherenikau River are expected to be small due to the short distance travelled through farmland.

The main discharge from the Water Race (excluding the residual overflow) is to Donald Creek. The discharge from the Water Race appears to make no significant difference in the water quality in Donald Creek when comparing sample sites upstream and downstream of the confluence, although on occasions highly turbid water has been observed coming from the Longwood Water Race.

The negligible influence of the Water Race on overall water quality in Donald Creek is partially because the water quality in Donald Creek is already compromised by the Featherston WWTP discharge about 400m upstream of the Longwood Water race confluence. When the Featherston WWTP discharge is improved or reduced it is possible that an adverse effect from the Water Race will be more apparent for water quality variables such as TN and TP. There have been recent improvements in water quality at Site L5 since September 2019 in the water race at Site L5, if these recent values are representative of ongoing future water quality then the effect of the Water Race on median water quality in Donald Creek is likely to remain small.

There is considerable potential for enhancing the positive benefits of the Longwood Water Race through riparian fencing and restoration. There is also potential for improving water quality in the Water Race and minimise potential adverse effects through improved management practices along the riparian zone of the water race.

5.2 Recommendations

I recommend that the following actions are undertaken during the term of the consent for the Longwood Water Race to assist understanding and to minimise effects on the water quality and aquatic ecology:

- Include an additional water quality monitoring site on the Longwood Water Race western branch where it crosses SH2 near Featherston.
- Enhance upstream fish passage at the flow control structure between the inflow and the residual flow channel by installing a fish ramp or equivalent.
- Enhance the potential for upstream fish passage through the inlet culvert by installing spat rope through the culvert.

- Identify areas where riparian planting and protection can be implemented. Initiate trials of riparian protection where practical and landowners are willing. Areas with high potential for riparian restoration include the channel taking the residual flow from the flow control structure to the Tauherenikau River.

- Review of the Code of Practice to provide a more comprehensive set of practices to reduce water contamination and more comprehensive procedures for ensuring widespread uptake of good practice. This should include:

    - use of offline stock watering (e.g. pumping water to a trough using a solar pump);

    - riparian fencing and planting;

    - procedures for clearing sediment and macrophytes including the use of on-line sediment traps, minimising removal of macrophytes, use physical removal methods in preference to herbicides to minimise environmental effects and optimise nutrient removal – particularly in downstream sections.

    - maintaining sections of stream in the lower part of the catchment with macrophyte cover to enhance instream sediment retention and nutrient processing.

- Undertake a survey to identify potential sources of contamination to the Longwood Water Race including stock access points, stream crossings, and overland flow paths.

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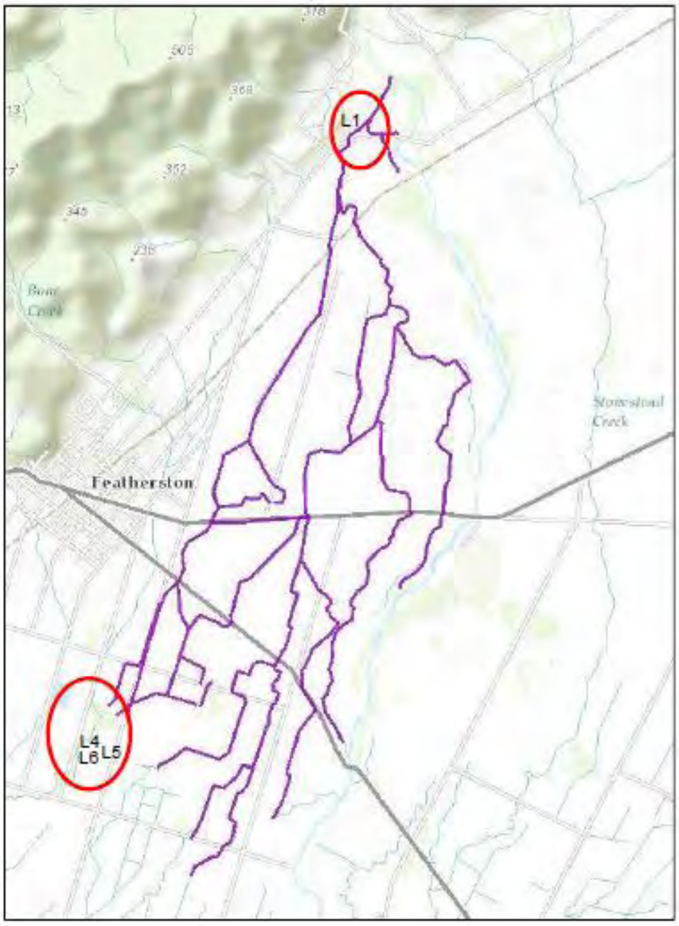
Appendix 1: Longwood Wate Race and Donald Creek Sample Sites



Longwood Water Race sample site location

Longwood Water Race sample site location

Appendix 2 – Greytown Urban Storm water Reporting to the Assets and Services Committee

SOUTH WAIRARAPA DISTRICT COUNCIL
Kia Reretahi Tātau

ASSETS AND SERVICES COMMITTEE
Minutes from 12 August 2020

Present:	Councillors Brian Jephson (Chair), Garrick Emms, Rebecca Fox, Pip Maynard, Alistair Plimmer, Ross Vickery and Mayor Alex Beijen.
In Attendance:	Euan Stitt (Group Manager Partnerships and Operations), Katrina Neems (Chief Financial Officer), Bryce Neems (Amenities and Solid Waste Manager), Karen Yates (Policy and Governance Manager) and Suzanne Clark (Committee Advisor). Wellington Water: Colin Crampton, Ian McSherry, Vic Maggs.
Conduct of Business:	The meeting was held in the Supper Room, Waihinga Centre, Texas Street, Martinborough and was conducted in public between 9:04am and 11:10am except where expressly noted.
Also in Attendance	Colin Olds (Chair of Water Race Subcommittee), Cr Pam Colenso.

Open Section

A1. Apologies

There were no apologies.

A2. Conflicts of Interest

There were no conflicts of interest declared.

A3. Public Participation

There was no public participation.

A4. Actions from Public Participation

There were no actions from public participation.

A5. Extraordinary Business

There was no extraordinary business.

A6. Minutes for Confirmation

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/38) that the minutes of the Assets and Services Committee meeting held on 17 June 2020 are a true and correct record.

(Moved Cr Fox/Seconded Cr Emms) Carried

A7. Minutes for Receipt

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/39) to receive the minutes of the Water Race Subcommittee meeting held on 30 June 2020.

(Moved Mayor Beijen/Seconded Cr Vickery) Carried

B Reports from Subcommittees

B1. Recommendations from Water Race Subcommittee

Mr Olds requested the Committee provide a resolution to the matter put forward by the Water Race Subcommittee and that water race ratepayers were not rated to fund urban stormwater. Council officers undertook to investigate the nature of water race event callouts.

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/40):

1. To receive the Recommendations from Water Race Subcommittee Report.

   (Moved Cr Vickery/Seconded Cr Plimmer) Carried

2. To recommend to Council that the management and further investigation of the Greytown stormwater system (which uses the Moroa Water Race Network as a conduit) and any consequent funding for capital improvement works within the Greytown urban area, needs to be considered by the Assets and Services Committee. The Water Race Subcommittee confirm and recommend that any resourcing to secure that outcome in any way is not funded by Moroa Water Race ratepayers.

   (Moved Mayor Beijen/Seconded Cr Plimmer) Carried

3. Action 400: Investigate the nature of Moroa Water Race events resulting in an operational callout (e.g. urban vs rural vs stormwater), cost and location, and put together some analysis; E Stitt

C Information and Verbal Reports from Chief Executive and Staff

C1. Wellington Water Annual Performance Report

Colin Crampton with support from Wellington Water staff discussed Wellington Water outcomes and South Wairarapa performance against these measures with Council.

Members noted that district water loss was high. Wellington Water were requested to review whether water discharged as part of the water improvements trials could be diverted to other purposes instead of wasted and to provide water loss statistics by town, and to find methodologies, including conservation, to drive down waste and loss.

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/41) to receive the Wellington Water Performance Report.

(Moved Cr Fox/Seconded Cr Vickery) Carried

C2. Wellington Water Report – Statement of Intent

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/42) to receive the Wellington Water Report – Statement of Intent.

(Moved Cr Maynard/Seconded Cr Jephson) Carried

C3. Water Reforms – Verbal Update from Wellington Water

Mr Stitt advised that central government were reforming and consolidating ways water services were delivered in New Zealand.

Wellington Water were putting together a delivery plan for South Wairarapa which included a central government monetary contribution for the South Wairarapa as well as a regional contribution. To access the funds Council needed to agree a Memorandum of Understanding (MoU) with the crown and the crown would need to endorse the plan. An extraordinary Council meeting to consider the MoU would be held 19 August 2020.

Mayor Beijen left the meeting at 10:05am.

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/43) to receive the water reforms verbal update report.

(Moved Cr Emms/Seconded Cr Vickery) Carried

C4. Lake Ferry Wastewater – Verbal Update from Wellington Water

Wellington Water were focusing on getting the Lake Ferry wastewater system running and were bringing planned work forward. A temporary wastewater system arrangement had been put in place. A lessons learned exercise would be undertaken once the system was operating correctly.

Progress on the Featherston Wastewater project was briefly discussed.

The meeting adjourned at 10:10am.

The meeting reconvened at 10:30am.

C5. Solid Waste Management and Minimisation Bylaw Report

Cr Colenso, Council's representative on the Wellington Region Waste Management and Minimisation Plan Joint Committee outlined the purpose of the joint bylaw and the requirements of Council, waste contractors and the public that would become mandatory once the bylaw was adopted.

Mayor Beijen returned to the meeting at 10:33am.

Members discussed the potential effect on rural communities.

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/44):

1. To receive the Partnerships and Operations Report.

(Moved Cr Plimmer/Seconded Mayor Beijen) Carried

2. To note that officers will seek Council's approval to undertake public consultation on the proposed bylaw in accordance with the Local Government Act 2002.

(Moved Cr Fox/Seconded Cr Maynard) Carried

C6. Partnerships and Operations Report

Mr Stitt discussed road maintenance against targets, community WiFi usage, a flooding and road camber issue in Greytown, planned reserves improvements, and the Hinekura Hill slip and roading situation with members.

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/45):

1. To receive the Partnerships and Operations Report.

(Moved Cr Emms/Seconded Cr Fox) Carried

2. Action 401: Liaise with NZTA about the flooding and road camber issue at 97 Main Street in Greytown; E Stitt

C7. Action items

ASSETS AND SERVICES COMMITTEE RESOLVED (A&S2020/46) to receive the Action Items Report.

(Moved Cr Fox/Seconded Cr Plimmer) Carried

D Consideration of Public Excluded Business

COUNCIL RESOLVED (A&S2020/47) that the public be excluded from the following part of the meeting, namely:

The general subject of each matter to be considered while the public is excluded, the reason for passing this resolution in relation to each matter, and the specific grounds under section 48(1) of the Local Government Official Information and Meetings Act 1987 for the passing of this resolution are as follows:

Report/General Subject Matter	Reason for passing this resolution in relation to the matter	Ground(s) under Section 48(1) for the passing of this Resolution
Hutchings Metal Pit, 100 Fenwicks Line, Greytown	Good reason to withhold exists under section 7(2)(a)(i)	Section 48(1)(a)

This resolution is made in reliance on Section 48(1)(a) of the Local Government Official Information and Meetings Act 1987 and the particular interest or interests protected by section 6 or section 7 of that Act which would be prejudiced by the holding of the whole or relevant part of the proceedings of the meeting in public are as follows:

Reason for passing this resolution in relation to the matter	Ground(s) under Section 48(1) for the passing of this Resolution
a) The withholding of the information is necessary to protect information the privacy of natural persons, including that of deceased natural persons.	Section 7(2)(a)
i) The withholding of the information is necessary to enable Council to carry out, without prejudice or disadvantage negotiations (including commercial and industrial sensitivity)	Section 7(2)(i)

(Moved Cr Maynard/Seconded Cr Jephson) Carried

Confirmed as a true and correct record

…………………………………………(Chair)

…………………………………………(Date)

Appendix 3 – Wellington Water (WWL) Transition Plan

South Wairarapa District Council - Water Races Transition

Project Plan

Start date: 21 July 2020

End date: 1 October 2020

Our water, our future.

Document information

People involved

Activity	Title	Name	Electronic signature	Date
Prepared by	Chief Adviser, Service Delivery	Ian McSherry		
Approved by	Choose an item.			

Revision history

Date	Version number	Description of change
6 August 2020	0.1	First draft
21 August	0.2	Second draft with SWDC feedback incorporated

Table of contents

1 Purpose of the plan

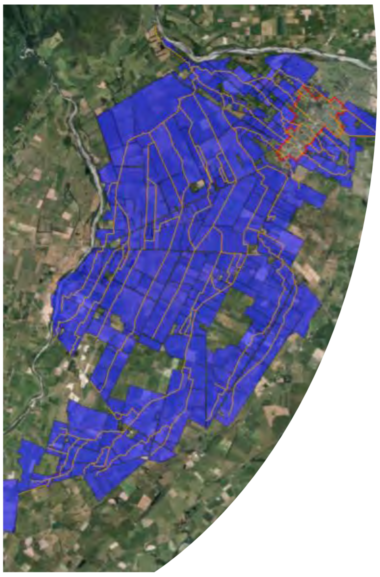
The purpose of this plan is to guide the project team through the transition of the South Wairarapa District Council Water Race functions into Wellington Water. It covers the 5 key work streams and programme to 1 October 2019 (the go-live date for Wellington Water managing SWDC water waters services).

This plan is a live document and is subject to change. It will be updated as the project progresses.

1 Introduction

1.1 Location and layout

There are two water race systems in the district:



Moroa Race

Length 240km and 8500 ha of serviced farmland

Rate Payers Serviced 282

Rates Raised 19/20 $80,500

Longwood Race

Length 40km and 1500 ha of serviced farmland

Rate Payers Serviced 62

Rates Raised 19/20 $74,750

1.2 Background

Wellington Water have been managing SWDC three waters network in a partnership arrangement since 1 October 2019. As part of the transition of the three waters network it was agreed to delay the transition of the forth network (water races) for 12 months.

The delay has allowed us time to get the new partnership model up and running and means we are now well placed to transition the water race network.

During this time SWDC have continued to manage the water race network in-house and signed a 12 month contract with Pope & Gray to perform inspection, operation and maintenance duties. We understand that during this time Pope & Gray have had a resource managing the network but have largely subcontracted out the actual maintenance work where required.

Council are currently engaging with the Water Race network users and are planning workshops and a user survey to better understand opinion on the water race which will influence future policy direction. No major upgrades of the networks until the future direction has been agreed.

1.3 Health and Safety

During induction visits by the team it has become apparent that there are some potential Health & Safety issues that need to be addressed as part of the transition we are proposing to carry out a risk assessment to understand the full extent of these issues. Once completed we will report to council with recommendations on how the risks need to be managed and any work that needs to be prioritised.

1.4 Scope

The scope of this plan is to transition the management of SWDC Water Races into Wellington Water. The proposed accountability for the main functions are listed below:

1) Customer Operations Group (Alliance) – day to day management, operation and maintenance.
2) Network Management Group – control systems, sampling, monitoring and consent compliance.
3) Network Development and Delivery – implementing strategy, delivery of capex programme.
4) Network Strategy and Planning – strategy, consenting, service planning (asset management).
5) Business Services – Finance, Health and safety, risk and assurance.

1.5 Objectives

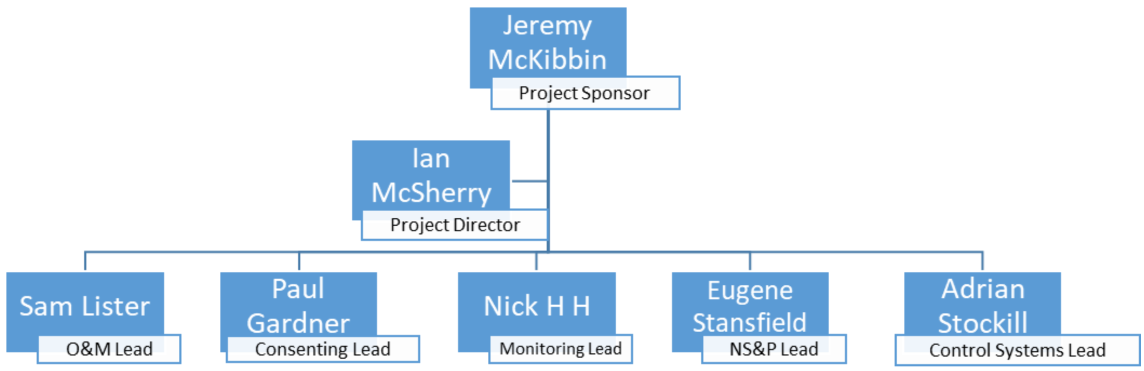
The objective of the transition is to enable a strategic and planned approach to service delivery for the water races networks, with management integrated with the other three waters networks and achieve our outcomes.

There are three project principles that underpin all elements of the transition:

1. Strong local knowledge and presence while also accessing Wellington Waters wider depth of capability.
2. A consistent delivery model but sized for the rural environment scale.
3. Delivering the same level of service with no increase in costs. Any increase in level of service and resulting cost increase needs to be agreed prior with SWDC.

2 Project management

2.1 Transition team structure



The structure above indicates the leads for the main but not all functions. The input from other functions is not considered significant at this stage however should that change the chart will be updated accordingly. The Leads will call on other supporting functions as required eg: Health & Safety, Finance etc.

2.2 Roles and responsibilities

The core transition team and associated roles and responsibilities

Role	Name	Responsibility
Project Sponsor	Jeremy McKibbin	Overall accountability for the transition and associated risks and opportunities. Direction setting.
Project Director	Ian McSherry	Responsibility for the transition and associated risks and opportunities. High level responsibility for stakeholder engagement (internal and external).

Role	Name	Responsibility
Operations & Maintenance Lead	Sam Lister	Accountable for the transition of all O&M functions
Consenting Lead	Paul Gardner	Accountable for the transition of all consenting matters including the Longwood re-consenting project
Monitoring lead	Nick Hewer-Hewitt	Accountable for the transition of water quality monitoring function, consent compliance and reporting
Network Strategy & Planning lead	Eugene Stanfield	Accountable for the transition of service planning (asset management) function, long term strategy and preparation for 21/24 LTP
Control Systems Lead	Adrian Stockill	Accountable for the incorporation of Water Race control systems into Wellington Water

2.3 Financial Management

Some costs will be passed onto South Wairarapa District Council for the transition work. These costs should be agreed with SWDC in advance.

There is an annual opex budget of $142.5k to operate and maintain the water races this needs to be allocated across the various functions.

2.4 Benefits of this project

The following benefits were intended to be delivered to SWDC during this project. Their expected realisation timeframe is listed as well.

Target Benefits			
	Description	**Nature**	**Expected Realisation**
1	*A strategic approach to water race management*	Indirect	Day 1
2	*Improved VFM through our scale, buying power and capability*	Value	Day 90+
3	*Improved processes and systems to increase efficiency*	Efficiency	Day 90+
4	*Access to subject matter experts for smarter solutions eg: Chief Advisers*	Indirect	Day 1
5	*Improved resilience*	Efficiency	Day 90+
7	*Access to our wider family of supplier expertise*	Value	Day 1

3 Operations & Maintenance Workstream

Below is the key information for the technology workstream:

Operations & Maintenance Workstream				
Workstream Lead:		*Sam Lister*		
Workstream Opportunity Statement:				
Critical workstream areas:				
	Area	Activity	Due Date	
1	Complete network	Delivery model determined and resources engaged.	4 September 2020	Sam Lister Manager Customer Planning - COG
2	Complete network	Risk assessment to determine Health & Safety and operational risks. Develop prioritised improvement plan.	4 September 2020	Sam Lister Manager Customer Planning - COG
3	Complete network	Full scope of work to be documented and agreed between SWDC & Wellington Water	1 October 2020	Sam Lister Manager Customer Planning - COG
2	Complete network	Network familiarisation required for the resource and/ or contractor engaged in the maintenance.	1 October 2020	Sam Lister Manager Customer Planning – COG
3	Complete network	Develop Operations and maintenance manual and procedures, cyclic maintenance program to maintain vegetation (in particular the spring growth) and infrastructure.	1 October 2020	Sam Lister Manager Customer Planning - COG
4	Complete network	Engagement with land owners / users to understand their duty of care and responsibility to maintaining the system through their respective property including clearing vegetation and doing this on time (before summer) this may need some specific land owner liaison.	1 October 2020	Sam Lister Manager Customer Planning – COG plus Community Engagement Team at Wellington Water

4 Consenting Workstream

Consenting Workstream				
Workstream Lead:		*Paul Gardner*		
Workstream Opportunity Statement:				
Critical workstream areas:				
	Area	Activity	Due Date	Responsible Team Member
1	Longwood network	Longwood water race is currently being re-consented, arrange briefing from consultant planner and agree transition of accountability with SWDC	1 October	Paul Gardner
2	Complete Network	Review and understand consent conditions	1 October	Paul Gardner
3	Complete Network	Engagement with GWRC	1 October	Paul Gardner

5 Monitoring Workstream

Monitoring Workstream				
Workstream Lead:		*Nick H H*		
Workstream Opportunity Statement:				
Critical workstream areas:				
	Area	Activity	Due Date	Responsible Team Member

1	Compliance Monitoring	Enter Consents into Infrastructure Data	1 October 2020	Nick H-H
2	Compliance Monitoring	Schedule monitoring programmes with Lutra and Eurofins	1 October 2020	Nick H-H
3	Compliance Monitoring	Set up reporting frameworks and templates	1 October 2020	Nick H-H
4	Compliance Monitoring	Develop contingency plans	1 October 2020	Nick H-H

6 NS&P Workstream

NS&P Workstream				
Workstream Lead:		Eugene		
Workstream Opportunity Statement:				
Critical workstream areas:				
	Area	Activity	Due Date	Responsible Team Member
1	Complete network	The infrastructure appears to be aged, there are previous reports and investigations. Bring this historic information together and evaluate. Undertake a condition assessment and operational performance investigation.	Post October 2020	Service Planning Team at Wellington Water

7 Control Systems Workstream

NS&P Workstream	
Workstream Lead:	Adrian Stockill

Workstream Opportunity Statement:	*Understand what technology is being used, and set up the relevant support*			
Critical workstream areas:				
	Area	Activity	Due Date	Responsible Team Member
1	Technology	Understand what controls technology is in use across the network. This action, and 2-4 below, will depend on availability of the current system provider (Harvest).	4 September	Adrian Stockill
2	Support	Understand the current arrangements for operation and maintenance of the control systems	4 September	Adrian Stockill
3	Compliance	Review as-built documentation to ensure controls systems are designed and installed in line with current electrical regulations.	4 September	Adrian Stockill
4	Performance	Understand how the controls perform, and what reports are available to ensure adherence to resource consent requirements	4 September	Adrian Stockill
5	Capability	Determine what the training and equipment is required to manage the new controls assets. Explore ongoing support arrangements between COG and Harvest.	1 October	Adrian Stockill, along with Sam Lister, COG.
6	Re-calibrate	Support COG team in activities above – flow measurement and valve operation adjustments.	1 October	Adrian Stockill, supporting Sam Lister, COG.
7	Repair	Determine if there is a requirement for any immediate repairs to existing monitoring systems.	11 September	Adrian Stockill
8	Asset Management	Support COG in ensuring assets are recorded in Maximo and relevant Planned Preventative Maintenance activities (PPMs) are configured.	1 October	Adrian Stockill, with Sam Lister, COG.

8 Communication

8.1 Communication Plan Purpose

To prepare everyone for the transfer of SWDC water races network to Wellington Water so they:

- Understands the 'why'
- Feel fully informed, engaged and listened to
- Are clear on where we are in the transition process
- Have been given the opportunity to feedback/contribute to the transition
- Understands the final model what it means for both organizations, their team and them
- Know how they can contribute to making the transfer success

To ensure all stakeholders are kept informed.

8.2 Communications Principles

The communications principles for this transition are:

- Build trust through transparency and responsiveness - Be clear and open about the process, and provide up to date information.
- Encourage collaboration and learning - Create a safe environment to explore new ideas, encourage open conversations and promote Kia Reretahi Tatau (lets fly together).
- Be inclusive – Listen to feedback and include a range of people and voices where possible from both organisations.

8.3 External communication and media

During the implementation process any media requests to go through Manager Community Engagement, Wellington Water who will liaise with SWDC Communications Team.

SWDC have a user survey planned which Wellington Water will support this will help inform the next LTP and future plans for the water races.

8.4 Internal Communications Activities and Dates

Comms Activities				
	Area	**Activity**	**Due Date**	**Responsible Team Member**
1	WWL Communications	On Tap	Monthly	Caroline
		Leader led conversations	GLT & Team meetings	Leads
		All Staff meetings	Quarterly	Ian/ Jeremy
		Intranet Blog	As Required	Ian
2	SWDC Communications	Email		Euan
		Leader led conversations		Euan
		Council meetings & workshops		Euan/ Ian/ Jeremy
		Assets & Service Committee		Euan/ Ian/ Jeremy
		Māori Standing Committee		Maiora/ Euan
		Water Races Committee		Euan/ Ian/ Jeremy

9 Risk Management

9.1 Risk Management Principles

Risk management is to be undertaken by the work-stream leads and discussed frequently and openly with the project team.

9.2 Key Risks

The residual risks considered 'High' after proposed treatment are:

Workstream	Risk Description	Risk Consequence	Proposed Treatment
Operations & Maintenance	H&S because the maintenance personnel appear to work remotely and on their own	Moderate	Complete ASAP a risk assessment and working policy, in particular a hurt alarm system
	There are a few precarious activities undertaken	Low / Moderate	H&S audit and review of procedure and practice
Consenting			
Monitoring	Non-compliance due to inadequate sampling	Moderate	Schedule sampling through Infrastructure Data
	Non-compliance due to poor water quality	Moderate	Regular COG operational inspections and maintenance
NS&P			
Control Systems	Technology used is not currently supported by our technicians	Low	Initial reliance on local support. Determine if upskilling or technology migration is required.
Comms	SWDC Water Race ratepayers react negatively to the transfer	customer complaints will rise, damaging reputations, and causing ongoing service delivery issues	"Engage through transition – piggy back on SWDC Water Race survey Key messages - local capability/capacity increased, call on

			wider regional capability engage through social media etc."

These risks are being actively monitored and managed by the Leads. Any tasks that require support with will be communicated to the project team and delegated to the person best placed to action them.

10 Stakeholders

Below is a RACI chart for the key stakeholders:

	Responsible	Accountable	Consult	Inform
SWDC ELT	√	√		
Wellington Water SLT	√	√		
Mana Whenua			√	√
SWD Council and the Water Race Subcommittee			√	√
Existing Client Councils				√
GWRC (Regulator)			√	√
Project Sponsors		√		
Project Team	√			
SWDC Staff			√	
WWL Staff			√	
Suppliers			√	√
Landowners				√
Public				√

Appendix 1: Further Documentation
