Otago Regional Council

Flow naturalisation of the Waikouaiti River

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Contents

This document describes how naturalised flow statistics at the current flow recorder on the Waikouaiti River 200m downstream of the DCC intake, and the simulated actual flows at the bridge at McGrath Road were derived.

Daily flow time series data for Waikouaiti River

The daily flow time series data available for analysis are listed in **Table 1** below. The locations of the flow sites and current consents are shown in **Figure 1**. The current consents used for flow naturalisation are listed in **Table A1** in the **Appendix**. (Note: Waikouaiti at 200m d/s DCC Intake is downstream of the confluence of the North and South Branches of the Waikouaiti River.

Table 1: The daily flow time series data available for the analysis above the flow site 200m d/s DCC intake on the Waikouaiti River.

Site	Start	End	Length (year)
Waikouaiti North Branch at Bucklands	30/01/1991	3/08/1999	8.5
Waikouaiti South Branch at Lawsons	5/02/1991	5/10/2010	19.7
Waikouaiti at Cloverdowns	23/12/1976	28/02/1987	10.2
Waikouaiti at Confluence d/s	8/02/2010	30/10/2015	5.7
Waikouaiti at 200m d/s DCC intake	22/09/2014	8/06/2023	8.7

Daily water use time series

Time series data of water use (WU) is used to naturalise the flow of the Waikouaiti river at the flow recorder 200m d/s of the DCC intake. All consents above the flow recorder must first be identified.

Total water use above the flow recorder 200m d/s of the DCC intake

Altogether 43 consents have historically been issued above the flow recorder 200m d/s of the DCC intake on the Waikouaiti River. However, after removing consents which did not affect flow, 20[1] consents are used in the flow naturalisation process (See **Table A1** in the Appendix). As shown in the table, 4 consents are currently active. **Figure 2** shows the total water use (WU) regime above the flow recorder 200m d/s of the DCC intake on the Waikouaiti River. An additional current irrigation consent located downstream of the flow recorder will also be used in a second part of this study (see Table 2 and Figure 3).

[1] 20 consents used in this study are listed in **Table A1** in the **Appendix**. They are the consents left by filtering out:

- Groundwater takes with no effect on the nearby water body (refer to the attribute of *Stream depletion rate*)
- Non-consumptive takes
- Retakes

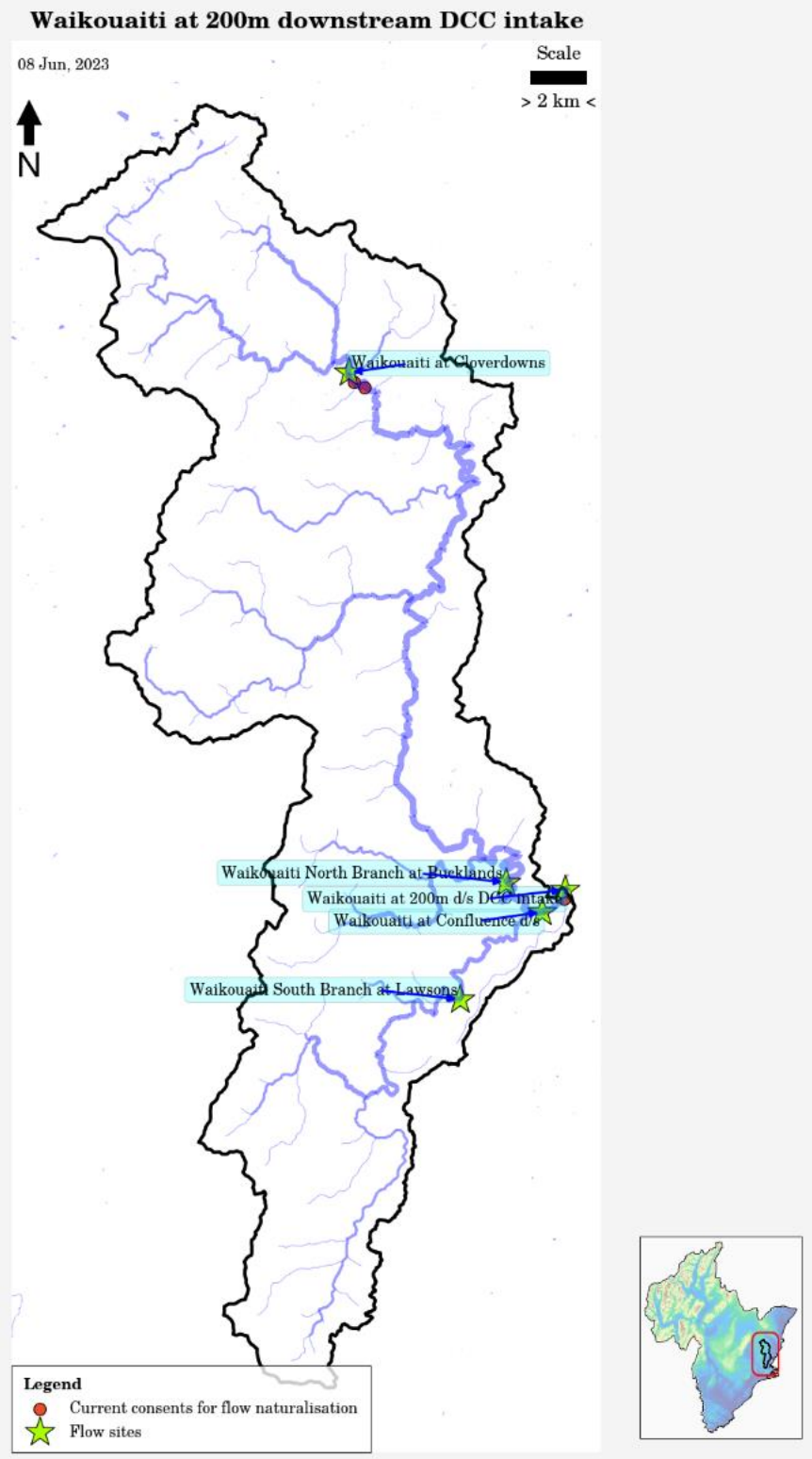

Figure 1: The location of flow recorders and current consents used in this study on Waikouaiti River.

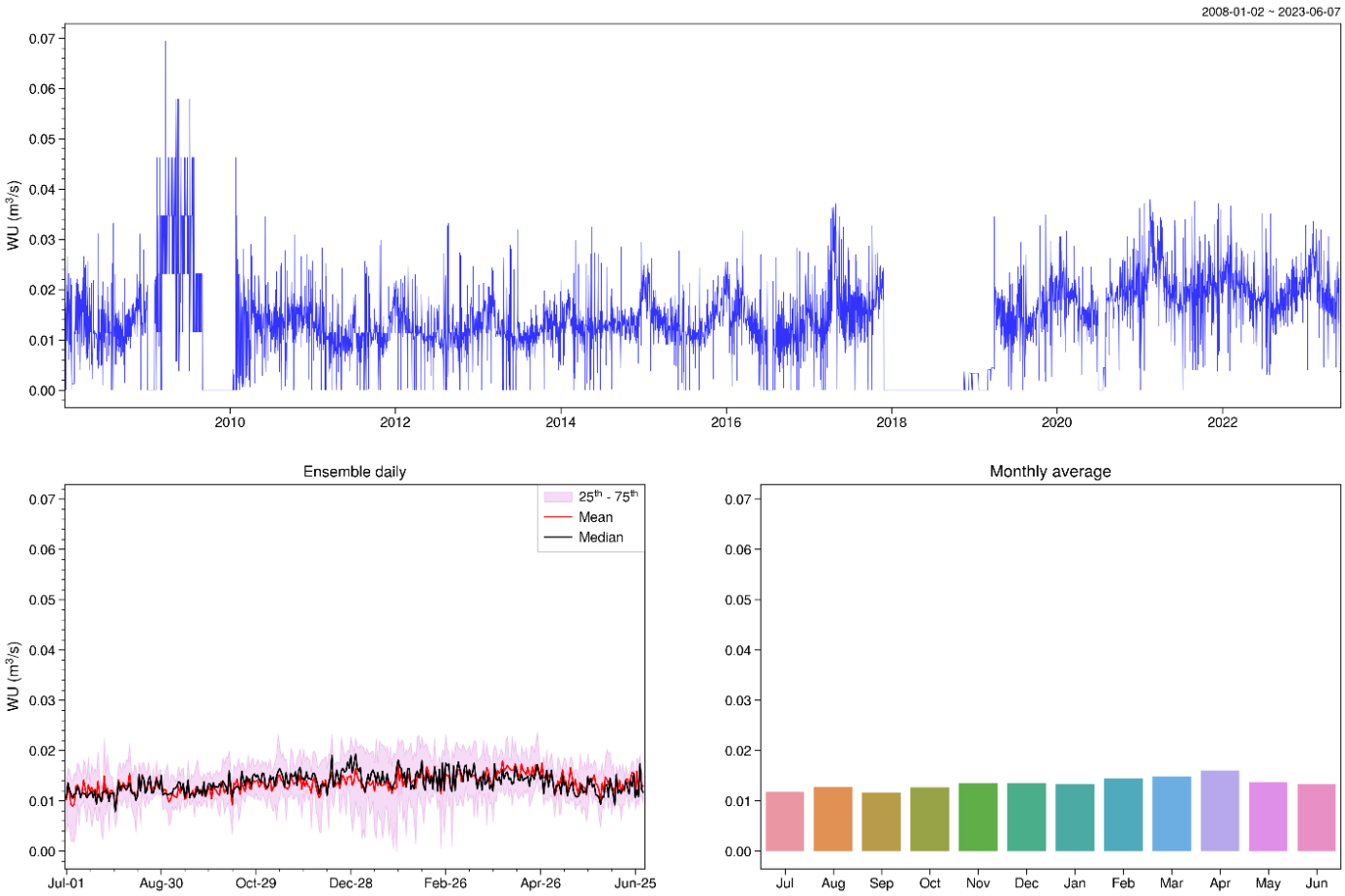

Figure 2: The total water use upstream of the recorder 200m d/s of the DCC intake on the Waikouaiti River.

As shown in **Figure 2**, the water has been used across the whole year since all 4 current consents have been using the water for the purpose of domestic and stock water supply with the largest being the DCC take for Waikouaiti township and surrounding area. The average total WU is 13 L/s.

Flow naturalisation at the flow recorder 200m d/s of the DCC intake

This section describes how the naturalised flow statistics are estimated for the flow recorder 200m d/s of the DCC intake on the Waikouaiti River.

Method

The naturalised flow time series can be estimated by adding the upstream total WU to the observed flow records.

One of the study's key goals is to produce long-term flow statistics, including the naturalised seven-day mean annual flow (7dMALF) and long-term median and mean flows for the flow recorder 200m d/s of the DCC intake on the Waikouaiti River.

Basic flow statistics (Table 2) for the flow recorder 200m d/s of the DCC intake.

Table 2: Naturalised flow statistics for the recorder 200m d/s of the DCC intake on the Waikouaiti River (22/09/2014 - present).

Site	Mean (m^3/s)	Median (m^3/s)	FRE3[2] ($year^{-1}$)	7dMALF (m^3/s) (Jul - Jun)
Waikouaiti at 200m d/s DCC intake (observed)	2.482	0.898	6.4	0.234
Waikouaiti at 200m d/s DCC intake (naturalised)	2.497	0.909	6.4	0.251

Actual flows estimated at the bridge at McGrath Road

Another goal of this study is to estimate the actual flows at the bridge at McGrath Road. **Figure 3** shows the target location and its relative location to the flow recorder at 200m d/s DCC intake. It also shows location of the current irrigation consent between the flow recorder and the McGrath Road bridge.

[2] The frequency of events exceeding three times the median flow value. In this study, an independent event is defined by a minimal event interval of 7 days.

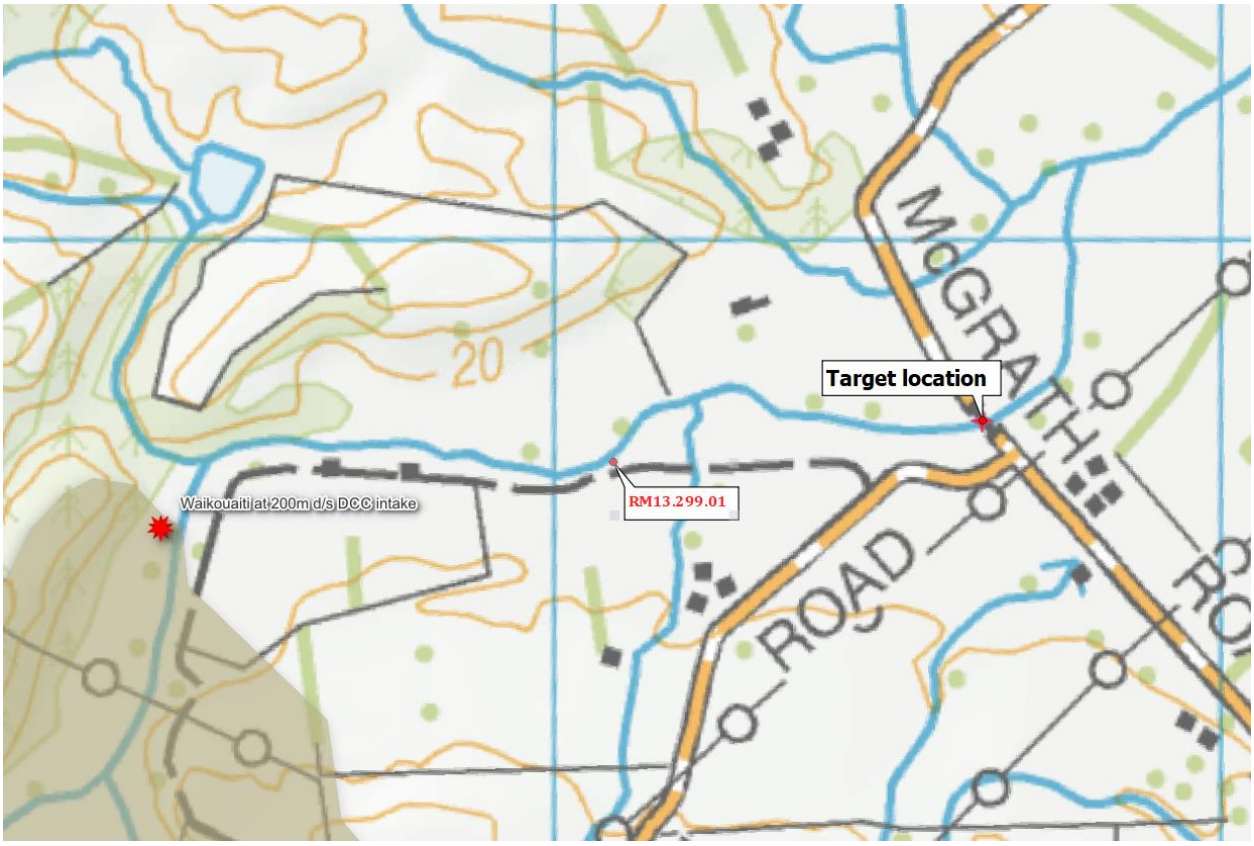

Figure 3. The target location relative to the flow recorder at DCC intake

Method

To simulate actual flows at the bridge at McGrath Road, the naturalised flows at this location need to be estimated first. The area between the DCC flow recorder and the bridge at McGrath Road is small and has insignificant flow contributions to the Waikouaiti River when error is considered. Therefore, the naturalised flows at the target location are assumed to be the same as those at the flow recorder 200m d/s of the DCC Intake. Therefore, the simulated actual flows at the bridge at McGrath Road can be estimated by subtracting the total water use along the Waikouaiti River between the d/s DCC Intake recorder and the bridge at McGrath Road. There is only one take in this area, which is the consent RM13.299.01 (**Figure 3**), with 65 L/s consented (**Table A2** in the **Appendix**). **Figure 4** shows the water use hydrograph for this consent.

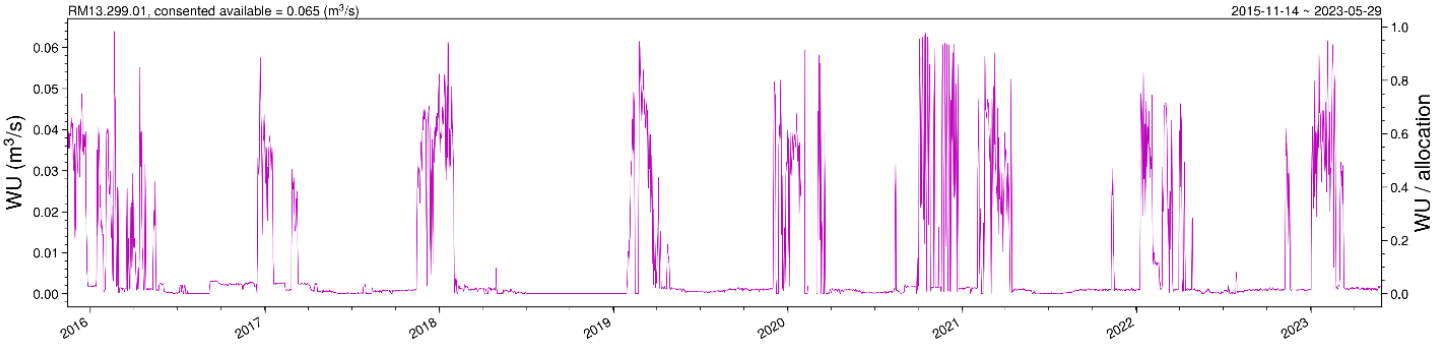

Figure 4. The daily water use for consent RM13.299.01.

Basic flow statistics (Table 3) for the Waikouaiti River at the bridge at McGrath Road.

Table 3: Flow statistics for the simulated actual flows at the target location

Site	Mean (m^3/s)	Median (m^3/s)	FRE3 ($year^{-1}$)	7dMALF (m^3/s) (Jul - Jun)
The bridge at McGrath Road (**Figure 3**)	2.490	0.906	6.4	0.233

Appendix

Table A1. The consents used for flow naturalisation 200m d/s of the DCC intake on the Waikouaiti River.

Consent	Status	Water meter	Allocation type	Category	Consented rate
2006.002.V1	Current	WM0837		Surface Take	60
2006.075.V1	Current	WM0837		Surface Take	60
RM17.121.01	Current	WM1483	Primary	Surface Take	4.2
RM17.121.02	Current	WM1483	Supplementary Block 1	Surface Take	0.5
1453	Expired			Surface Take	
2002.487	Expired			Surface Take	
2417	Expired			Surface Take	
2929	Expired			Surface Take	
3057	Expired			Surface Take	
4147C	Expired			Surface Take	
4208D	Expired			Surface Take	
4212D	Expired			Surface Take	
4216D	Expired			Surface Take	
93218	Expired			Surface Take	
97427	Expired			Surface Take	4.1
96798	Lapsed			Surface Take	
96806	Lapsed			Surface Take	
2004.091	Not Required			Surface Take	
2003.823.V1	Surrendered	WM0186	Primary	Surface Take	19
3427	Surrendered			Surface Take	

Table A2. The consent in the area between 200m d/s DCC intake and the target location (at McGrath Road) along the Waikouaiti River.

Consent	Status	Water meter	Allocation type	Category	Consented rate
RM13.299.01	Current	WM1140		Surface Take	65

The details in data processing can be found in this HTML file**.**