



Otago  
Regional  
Council

# Flow naturalisation of the Waiwera River

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ISBN

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Completed June 2023

Published: November 2023

# Contents

<b>Daily flow time series data for Waiwera River .....</b>	<b>3</b>
<b>Daily water use time series.....</b>	<b>4</b>
Total water use above Waiwera at Maws Farm flow recorder .....	5
<b>Flow naturalisation.....</b>	<b>6</b>
Method.....	6
Naturalised flow Statistics.....	6
<b>Appendix.....</b>	<b>7</b>
Table A1. The consents used for flow naturalisation at site Waiwera at Maws Farm.....	7

This document describes how naturalised flow statistics at the flow recorder on Waiwera at Maws Farm were derived.

## Daily flow time series data for Waiwera River

The daily flow time series data available for analysis are shown in **Table 1**. The locations of the site and current consents are shown in **Figure 1**. The current consents used for flow naturalisation are listed in **Table A1** in the **Appendix**.

*Table 1: The daily flow time series data available for analysis above Mill Creek at Fish Trap.*

<b>Sites</b>	<b>Start</b>	<b>End</b>	<b>Length (year)</b>
Waiwera at Maws Farm	21/04/2010	24/06/2023	13.2

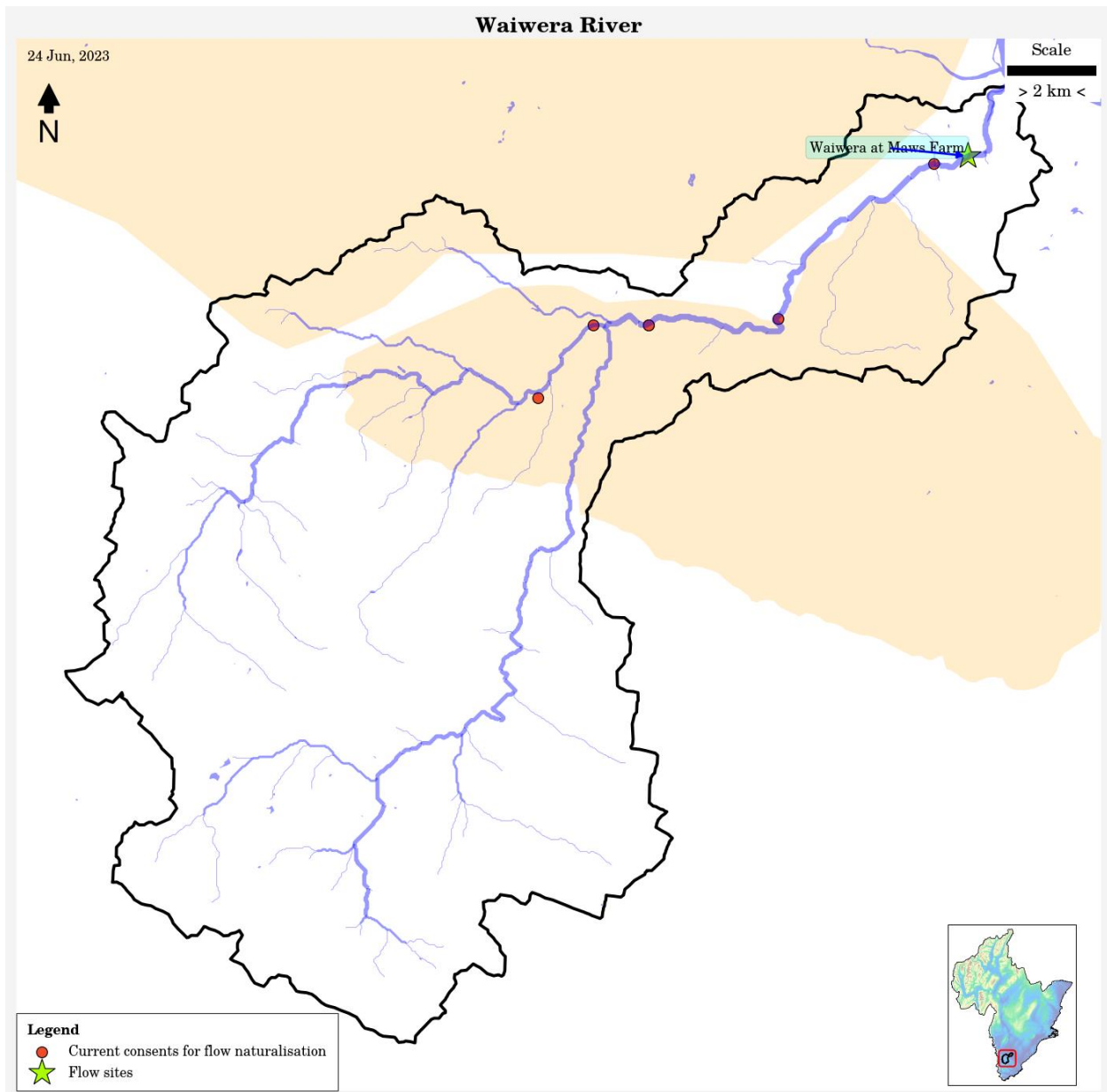


Figure 1: The location of flow recorders and current consents used in this study on Waiwera River in South Otago.

## Daily water use time series

Time series data of water use (WU) is used to naturalise the flow of the Waiwera River at the Maws Farm flow recorder. All consents above the flow recorder must first be identified.

## Total water use above Waiwera at Maws Farm flow recorder

Altogether 13 consents have been issued above the Maws Farm flow recorder on the Waiwera River. However, after removing consents which do not affect flow, 11<sup>1</sup> are used for estimating the natural flow (See **Table A1** in the Appendix), and six consents are currently active. **Figure 2** shows the total water use (WU) regime above the Waiwera at Maws Farm flow site.

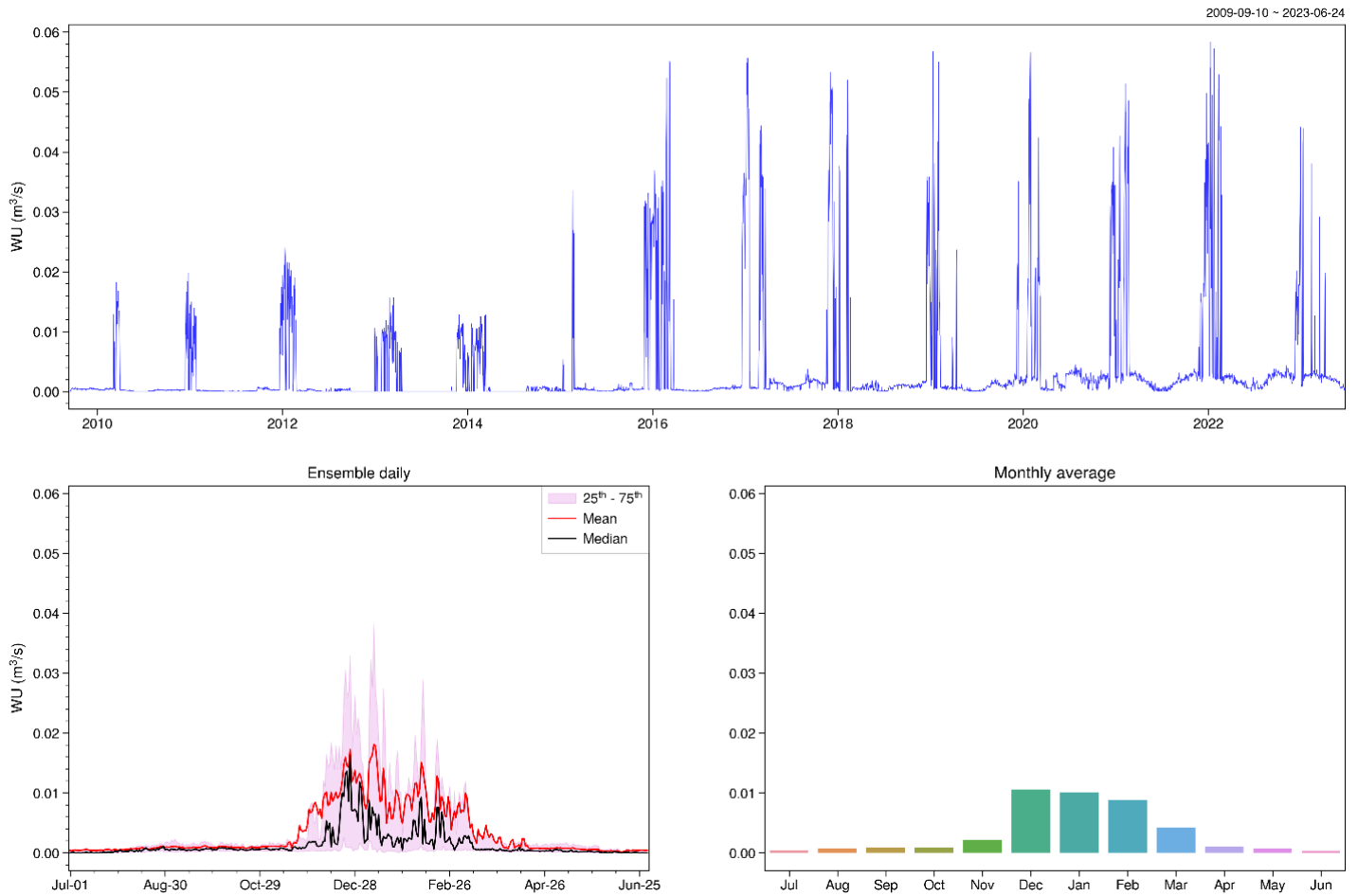


Figure 2: The total water use upstream of the recorder at Waiwera at Maws Farm.

As shown in **Figure 2**, the patterns before and after the water year 2015/16 are different due to water meter abstraction data availability. In this study, only the water use data after 2015/16 is used. The

<sup>1</sup> 11 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

average total WU during the water year (July - June) is 10 L/s after 2015/16 during the irrigation season between November and March.

## Flow naturalisation

This section describes how the naturalised flow statistics are estimated for the flow recorder at Waiwera at Maws Farm.

### Method

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

Producing long-term flow statistics is this study’s key goal, including the naturalised seven-day mean annual flow (7dMALF) and long-term median and mean flows for the flow recorder on the Waiwera river at Maws Farm.

### Naturalised flow Statistics

#### **Basic flow statistics (Table 2).**

*Table 2: Statistics of the observed and naturalised flows for the recorder at Waiwera at Maws Farm (01/07/2015 ~ present).*

Site	Mean (m <sup>3</sup> /s)	Median (m <sup>3</sup> /s)	FRE3 <sup>2</sup> (year <sup>-1</sup> )	7dMALF (m <sup>3</sup> /s) (Jul - Jun)
Waiwera at Maws Farm (observed)	2.280	1.124	7.1	0.225
Waiwera at Maws Farm (naturalised)	2.285	1.126	7.1	0.231

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<sup>2</sup> 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.

## Appendix

**Table A1. The consents used for flow naturalisation at site Waiwera at Maws Farm**

Consent	Status	Water meter	Allocation type	Category	Consented rate
2003.818.V1	Current	WM0363	Primary	Surface Take	80
RM13.079.01	Current	WM0646		Surface Take	2.7
RM13.278.01	Current	WM0895, WM1135		Surface Take	44
RM13.480.01.V1	Current	WM1270	Primary	Surface Take	
RM13.480.02.V1	Current	WM1270	Supplementary Block 1	Surface Take	120.5
RM14.032.01.V1	Current	WM1346, WM1481		Surface Take	1.5
RM10.456.02	Declined		Primary	Surface Take	1.3
RM12.541.04	Lapsed		Supplementary Block 1	Surface Take	80
2007.669.V1	Surrendered	WM0895	Primary	Surface Take	2
2150	Surrendered			Surface Take	
2003.366	Withdrawn			Surface Take	