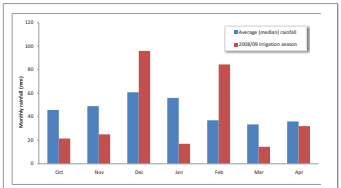
Long-term rainfall comparison

Total monthly rainfall was compared to long-term monthly averages for the Hills Creek (1987-2009) and Lauder (1984-2009) rainfall sites.

Hills Creek

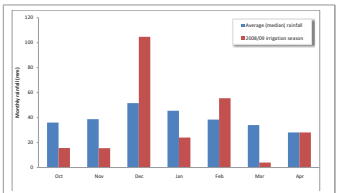
Rainfall totals at Hills Creek were slightly below normal early in the season; however, much higher than normal totals were recorded in December (96mm) and February (84mm). Based on the flow data for these sites, it is apparent that most of February's rainfall did not penetrate as far as the Dovedale and Moa Creek Catchment.



HILLS CREEK MONTHLY RAINFALL

Lauder

Monthly rainfall totals at the Lauder Electronic Weather Station (EWS) followed a similar pattern to Hills Creek, with below normal totals early in the season and significantly higher falls recorded in December (104.7 mm) and February (55.5 mm). High rainfall totals for these months caused significant flow increases in the western and northern tributaries of the Manuherikia River.



LAUDER MONTHLY RAINFALL

Overview

The highest yields in the Manuherikia Catchment were recorded in the upper reaches of the main stem (5.87 l/km²). Overall, the western tributaries yielded significantly more than those in the Ida Valley; however, yields for the western tributaries progressively decreased moving down the catchment.

Analysis of long-term rainfall patterns shows that rainfall totals were significantly higher than normal for December and February. However, the seasonal total was below the long-term average. Although total rainfall for the 2008-09 irrigation season was not unusually high, the timing of rainfall events meant that there was no extended period of low flows at any time during the season. Subsequently, all 7-day low flows and catchment yields are likely to be higher than the long-term average as observed in Table 3.

In order to gain a better understanding of yields during an extended period of low rainfall in the Manuherikia Catchment, flow monitoring has been continued for the 2009/10 irrigation season.

Summary

This study is the most comprehensive of its type to be completed in Otago and will allow for informed management decisions to be made for our most over-allocated catchment. This report card provides an overview of water resources in the Manuherikia Catchment in a form that is readily available to the public, and further analysis of the data from this study will be undertaken as required to provide clarity for specific water management goals as they arise.

Otago Regional Council

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Manuherikia water resources

SUMMARY 09

Otago Regional Council

MANUHERIKIA RIVER

Introduction

Water is our most precious resource, and increased demand has placed additional pressures on its quantity and quality. Water availability is usually a major driving factor for future development, and it is important to assess the sustainability of this valuable resource. This study presents a comprehensive quantitative analysis for the surface water of the Manuherikia Catchment during the 2008-09 irrigation season in comparison to long-term records.

This study has successfully captured a robust water balance of the Manuherikia Catchment and its results will allow for informed water management decisions such as the setting of residual flows and the feasibility of water storage. It will also empower local communities to self-manage their water resources in a sustainable manner throughout the catchment.

Current water use

Irrigation accounts for 85% of water abstraction in Otago, and is likely to be the main future demand for water in the region. Currently, 97% of consented water takes from the Manuherikia River are used for irrigation, with most of this water used for pasture production. There are seven major irrigation schemes in the Manuherikia Catchment (Table 1) that irrigate a collective total of close to 22,000ha, as well as many privately-held water rights. These schemes are largely reliant on gravity-fed open channel irrigation races for transporting water throughout the Manuherikia Catchment.

Table 1.
Major irrigation schemes in the Manuherikia Catchment

Irrigation scheme	Irrigated area (ha)
Mt Ida Water Race (Hawkdun Race)	3,580
Blackstone Race	530
Downs Race	600
Omakau	8,300
Manuherikia	2,100
Galloway	1,200
Ida Valley	5,600
Total	21,910

Historically, irrigation water has been applied using overland flow systems such as flood and border dyke irrigation. In more recent years, technological advances have seen spray systems such as centre pivot and k-line become more common in the catchment. Water availability is generally the main factor limiting irrigated land for many farms in the Manuherikia Catchment, and changing to spray irrigation has allowed a greater area of land to be irrigated using the same volume of water.

With improved application efficiency and increases in the area of land irrigated, there is a significant decrease in the amount of runoff that is returned to streams or re-taken by downstream users. As many irrigators throughout the Manuherikia Catchment move towards more efficient irrigation methods, this provides further challenges to both water users and managers.

GLOSSARY

Irrigation Season
Is defined as being between October 1st and April 30th

7-Day low flow
The lowest 7-day moving average in any given year

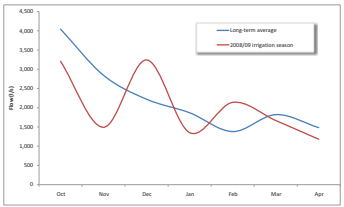
MALF (7-day Mean Annual Low Flow):
The average of all 7-day low flows over the period of record.

SMALF (Specific yield at MALF):
The amount of water yield per km² of catchment area when river flows are at MALF.

Long-term flow comparisons

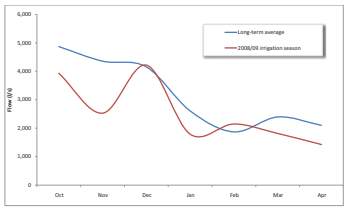
Dunstan Creek at Gorge

Average flows in Dunstan Creek at the Gorge closely followed rainfall patterns in the catchment with higher than normal flows experienced in December (3.24 m³/s, 146% above normal) and February (2.14 m³/s, 155% above normal).



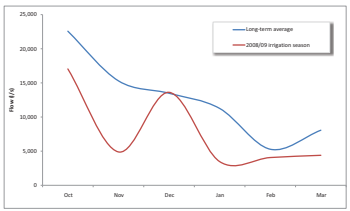
Manuherikia River downstream of Forks

As with elsewhere in the catchment, flows in the Manuherikia River downstream of the forks were relatively high in December and February. The westerly rainfall patterns that brought high flows to Dunstan Creek reduced in intensity as they moved eastward, resulting in flows close to the long-term average for these months.



Manuherikia River at Ophir

Further down the catchment at Ophir, average flows increased in December (13.6 m³/s, close to the long-term average) in response to high rainfall throughout the catchment; however, unlike the upper catchment, this pattern was not repeated in February (4 m³/s, 77% below the long-term average).



This difference is most likely due to the large amount of surface water abstraction that occurs throughout the catchment and to Falls Dam, which captures high flows from the upper catchment. This is in contrast to Dunstan Creek at the Gorge and Manuherikia River downstream of Forks which are not significantly affected by storage or surface water abstraction.

Table 2.
Summary of hydrological statistics for the Manuherikia Catchment 2008-09 irrigation season

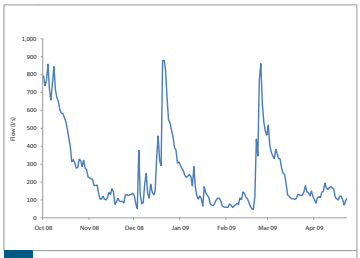
Flow site	Catchment area (km2)	Minimum flow (l/s)	2008/09 7-day low flow (l/s)	Catchment yield at 7-day low flow (l/s/km²)	Median flow (l/s)	Mean flow (l/s)	Maximum flow (l/s)
Manuherika River below the Forks	174	852	1020	5.872	2187	2560	13848
Manuherikia River at Ophir	2036	2112	2524	1.240	4433	7347	76108
Manuherikia River at Alexandra Camp Ground	3010	579	957	0.318	2984	5163	52732
Dunstan Creek at the Gorge	159	695	782	4.931	1511	2042	16661
Dunstan Creek at Beatties Rd	268	151	300	1.119	1407	2276	20315
Lauder Creek at the Cattle Yards	74	333	365	4.966	591	874	6294
Thompson's Creek diversion weir	65	195	237	3.657	419	596	4593
Chatto Creek at Matakanui Station	44	42	63	1.445	149	243	1699
Moa Creek at Rock Bivy	47	0	0	0.000	7	32	654
Dovedale Creek at Rock Bluff	37	0	0	0.000	10	30	564
Ida Burn at Auripo Road	233	4	8	0.034	40	111	1705
Pool Burn excluding Ida Burn	582	0	0	0.000	10	50	3320
Pool Burn at Cob Cottage	816	0	1	0.001	50	163	4894

Table 3
Flow statistics for the 2008-09 irrigation season relative to historical data for each flow site in the Manuherikia Catchment

Site	Catchment area upstream (km2)	7-day MALF (l/s)		SMALF		Mean Flow (l/s)		Historical data length record
		2008-09	Historical	2008/09	Historical	2008/09	Historical	
Manuherika River below the Forks	174	1020	920	5.87	5.30	2562	3369	1975-1994
Dunstan Creek at the Gorge	159	782	686	4.93	4.33	2042	2255	1973-1994
Dunstan Creek at Beatties Rd	268	300	331	1.12	1.24	2279	2262	1996-2009
Pool Burn at Cob Cottage	816	1	25	0.00	0.03	161	1074	1989-1994
Manuherikia River at Ophir	2036	2524	2189	1.24	1.08	7460	13773	1970-2009

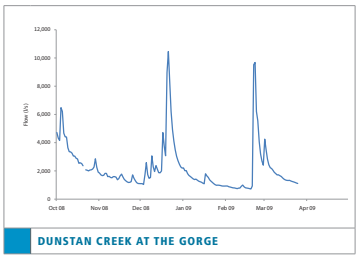
HYDROLOGY OF MANUHERIKIA CATCHMENT

2008/09 IRRIGATION SEASON



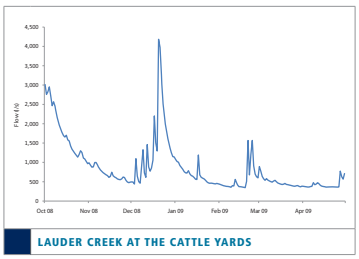
MANUHERIKIA RIVER BELOW THE FORKS

The Manuherikia River below the Forks site is subject to upstream abstraction from the Hawkdun Race and measures flows from a catchment area of 173.4 km². The 7-day low for the 2008-09 irrigation season was 1,020 l/s, while the mean flow was 2,560 l/s. The long-term 7-day Mean Annual Low Flow and mean flow for this site are 920 and 3,369 l/s, respectively. The Specific Yield at MALF for the 2008-09 irrigation season was 5.87 l/s/ km².



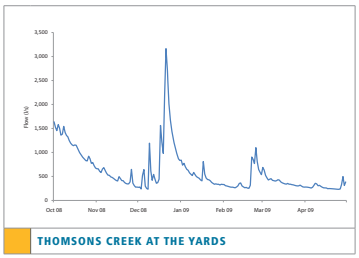
DUNSTAN CREEK AT THE GORGE

The Dunstan Creek at the Gorge site has no abstraction upstream and measures flow from a catchment area of 158.6 km². The 7-day low flow for the 2008-09 irrigation season was 782 l/s, the SMALF was 4.93 l/s/ km², while the mean flow was 2042 l/s. The long-term 7-day MALF and mean flow for this site is 686 l/s and 2,255 l/s respectively, and were calculated using data from 1973 to 1994



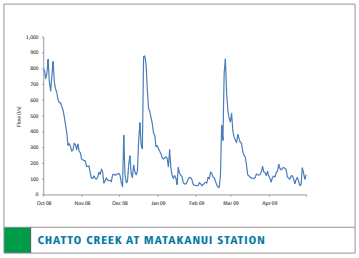
LAUDER CREEK AT THE CATTLE YARDS

The Lauder Creek at the Cattle Yards site has no abstraction upstream and measures flows from a catchment area of 73.5 km². The 7-day low flow for the 2008-09 irrigation season was 365 l/s, with SMALF of 4.97 l/s/km² and a mean flow of 874 l/s.



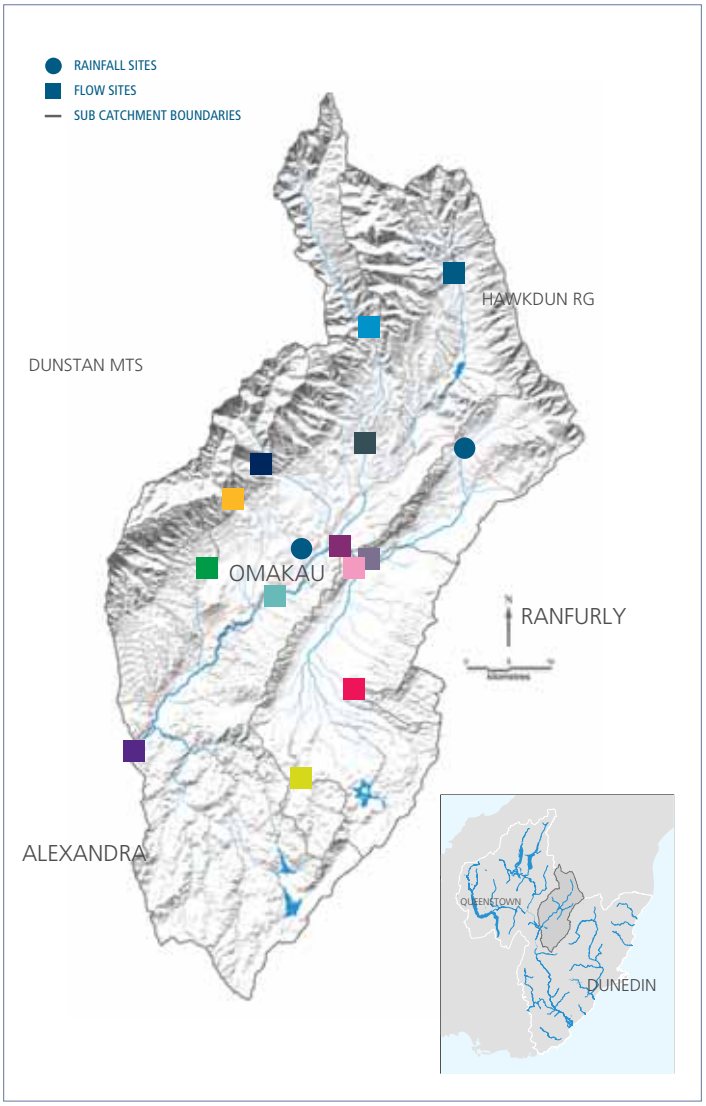
THOMSONS CREEK AT THE YARDS

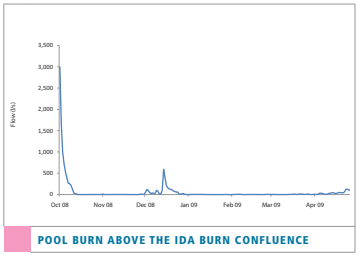
The Thomsons Creek at the Yards site has no abstraction upstream and measures flows for a catchment area of 64.8 km. The 7-day low flow for the 2008-09 irrigation season was 237 l/s, with a SMALF of 3.66 l/s/km² and a mean flow of 542 l/s.



CHATTO CREEK AT MATAKANUI STATION

The Chatto Creek at Matakanui Station site has no abstraction upstream and measures flows from a catchment area of 43.6 km². The 7-day low flow for the 2008-09 irrigation season was 63 l/s, with a SMALF of 1.44 l/s/km² and a mean flow of 243 l/s.





POOL BURN ABOVE THE IDA BURN CONFLUENCE

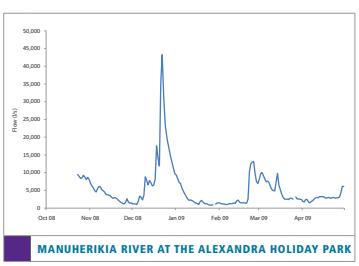
Flows for the Pool Burn excluding the Ida Burn were calculated by subtracting daily average flows for the Ida Burn at Auripo from Pool Burn at Cobb Cottage. Flows in the Pool Burn above the Ida Burn confluence are significantly affected by abstraction and irrigation runoff throughout the 582 km² catchment area. Surface flows ceased in the lower catchment for most of the season. The 7-day low flow for the 2008-09 irrigation season was 0 l/s (SMALF of 0 l/s/km²) and the mean flow was 50 l/s.

Catchment description

The Manuherikia River is located in Central Otago and flows north-east to south-west with a catchment area of 3075 km². The catchment is surrounded by mountainous terrain on all sides, except to the south-west where it joins the Clutha River at Alexandra. The Manuherikia Catchment includes two major depressions, the Manuherikia Valley and the Ida Valley, that are connected by the Poolburn Gorge. The Ida Valley receives lower annual rainfall than the Manuherikia Valley.

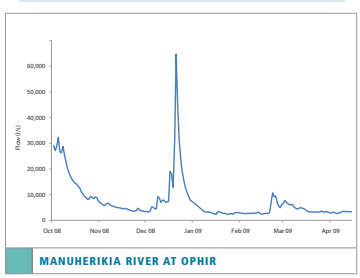
Methodology

This assessment of water resources in the Manuherikia Catchment was based on the available rainfall and flow data for the catchment, archived at the Otago Regional Council, Dunedin. Continuous river flows were monitored at 13 sites from October 2008 – April 2009 (inclusive). Rainfall data observed at two sites (Hills Creek and Lauder) in the region were included in this study. Four of the 13 flow recorder sites have long-term records that allow a comparison to be made between the 2008-09 irrigation season and previous seasons.



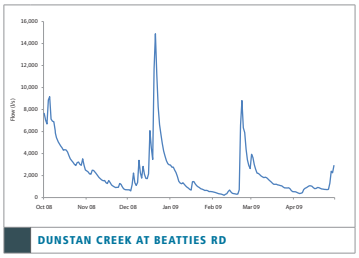
MANUHERIKIA RIVER AT THE ALEXANDRA HOLIDAY PARK

The Manuherikia River at the Alexandra Holiday Park is the most downstream flow recorder in the Manuherikia Catchment. The catchment area upstream of this site is 3,010 km² with flows being significantly altered due to numerous abstractions upstream and inputs from Falls Dam. The 7-day low flow for the 2008-09 irrigation season was 957 l/s and a mean flow of 5,163 l/s.



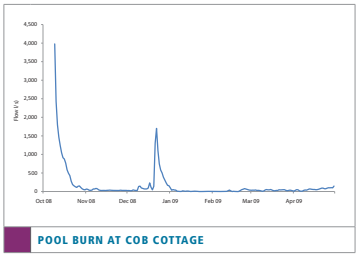
MANUHERIKIA RIVER AT OPHIR

The Manuherikia River at Ophir site has significantly altered flows due to numerous abstractions upstream and the influence of Falls Dam. The catchment area upstream of this site is 2,036 km², which is two-thirds of the Manuherikia Catchment. The 7-day low flow for the 2008-09 irrigation season was 2,524 l/s, while the mean flow was 7,460 l/s. The long-term 7-day MALF and mean flow for this site is 2,189 l/s and 13,773 l/s respectively.



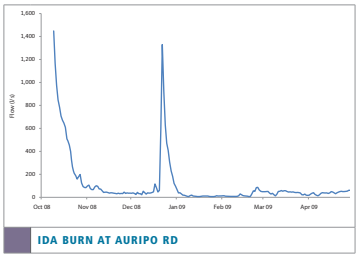
DUNSTAN CREEK AT BEATTIES RD

The Dunstan Creek at Beatties Rd site records flows altered by upstream abstractions and has a catchment area of 268 km². The 7-day low flow for the 2008-09 irrigation season was 300 l/s, while the mean flow was 2,276 l/s. The long-term 7-day MALF and mean flow for this site are 331 l/s and 2,262 l/s respectively.



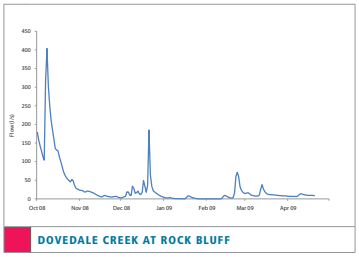
POOL BURN AT COB COTTAGE

The Pool Burn at Cob Cottage flow site is significantly affected by abstraction and irrigation runoff throughout its 815.5 km² catchment, which includes the Ida Burn. The 7-day low flow for the 2008-09 irrigation season was 1 l/s, with a SMALF of 0.001 l/s/km² and a mean flow of 163 l/s.



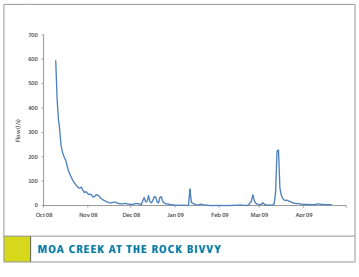
IDA BURN AT AURIPO RD

The Ida Burn at Auripo Rd flow site is significantly affected by abstraction and irrigation runoff throughout its 233.4 km² catchment. The 7-day low flow for the 2008-09 irrigation season was 8 l/s, with a SMALF of 0.03 l/s/km² and a mean flow of 111 l/s.



DOVEDALE CREEK AT ROCK BLUFF

The Dovedale Creek at Rock Bluff site has no abstraction upstream and has a catchment area of 37.4 km². The original Dovedale Creek flow site (The Willows) was in place from 1979 to 1987, and recorded significantly higher flows than observed at the Rock Bluff site during the 2008-09 irrigation season. There is no abstraction or significant inflows between the two sites, which are approximately 150m apart. The 7-day low flow for the 2008-09 irrigation season was 0 l/s (0 l/km²), while the mean flow was 30 l/s. It is unlikely that the unusually high flows observed in the historical data are representative of the actual flows at this site, therefore, no comparison has been made with flows for the 2008-09 irrigation season.



MOA CREEK AT THE ROCK BIVVY

The Moa Creek at the Rock Bivvy site has no abstraction upstream and has a catchment area of 47.1 km². As surface flow ceased for long periods throughout the irrigation season, the 7-day low flow for the 2008-09 irrigation season was 0 l/s (SMALF of 0 l/s/km²), with a mean flow of 32 l/s.