

Summary

Generally Canterbury river flows and groundwater levels remain lower than average for the end of winter across Canterbury. The month of August 2016 has seen the alpine area receive much lower than average rainfall totals pushing the mean monthly flows in the alpine rivers to well below their long-term averages.

Total rainfall for some sites in North Canterbury, notably Lowry Hills near Cheviot, has received only a little over 50% of the long term average to the end of August, on top of only 50% for the year 2015. Similarly, rainfall in the Selwyn district is well below average.

Rainfall in the east, including the Canterbury Plains, has been low. This makes three successive winters with very low recharge of groundwater. Likely consequences of this are:

- More springs and spring-fed streams drying up, particularly in the Christchurch and Selwyn areas;
- Surface water irrigation, particularly in the lower Canterbury Plains being very limited next summer;
- Groundwater consents tied to adaptive management conditions in the Selwyn-Waimakariri, Rakaia-Selwyn and Valetta-Ashburton River groundwater allocation zones (i.e. can't abstract when groundwater levels are low) will have very poor reliability next summer. The majority of wells in these areas recorded lower than average groundwater levels in August 2016.
- Some groundwater abstractors will have difficulties with wells either drying up or supplying low volumes.

There is still time for groundwater levels to recover at least to some degree if we receive significant rain in the next two or three months, but it is unlikely that they will recover to average levels.

Numerous rivers and streams start the spring season on full or partial restriction.

August 2016

Soil moisture

NIWA plots of soil moisture deficit (Figure 1) show that there are patches of Canterbury soils that are still much drier than normal for the end of winter. In particular, the North Canterbury area from Cheviot to south of Kaikoura has less than 50% storage.

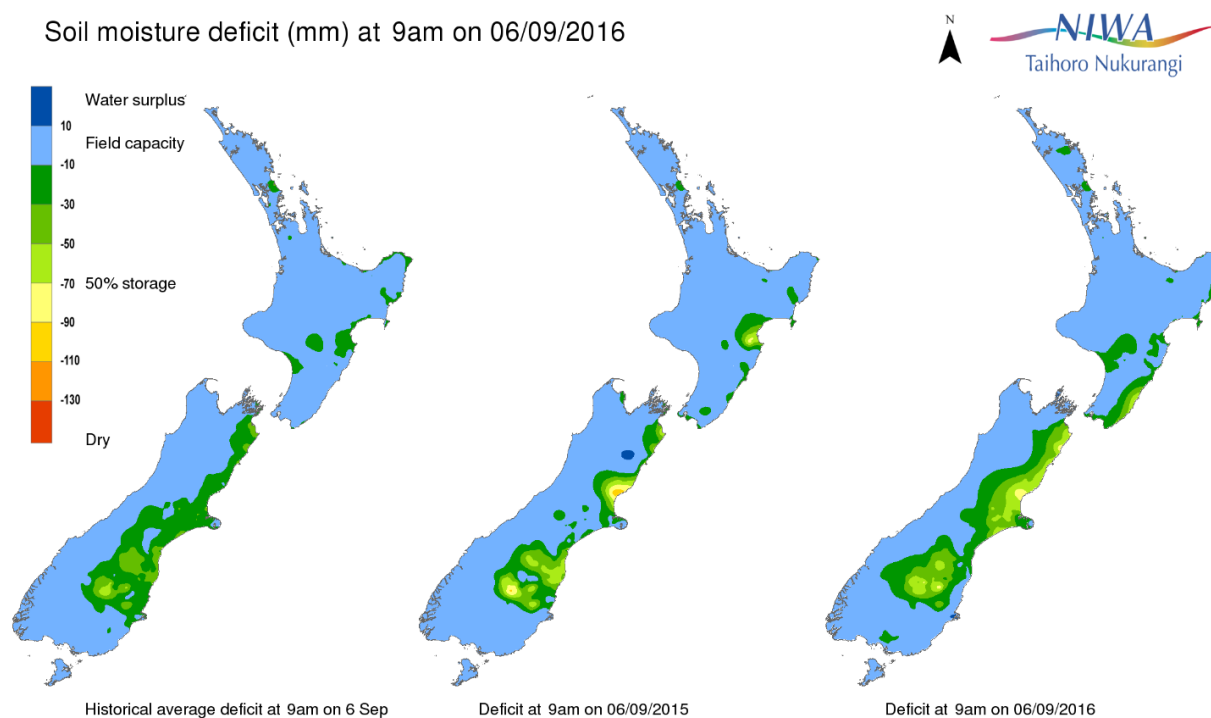


Figure 1: Soil Moisture Deficit 6/9/2016 compared with same date 2015 and historically (from niwa.co.nz)

Rainfall

Table 1 shows data from representative rain gauges across Canterbury. After low rainfall across the region in 2015, some sites (particularly rain gauges in North Canterbury) are still recording lower than average totals for 2016 to date. Even the Alpine rain gauges, located at Arthurs Pass and Mt Cook, which both received almost twice their July average rainfalls last month, only received 36 and 25 % of their long-term August averages, respectively. This is reflected in the alpine river flows shown in latter sections of this summary. Plots for representative sites across the region are shown below.

Table 1: Rainfall sites with 2015 and 2016 (to end August) totals compared with long-term annual averages.

Rainfall Site	2015 Total annual rainfall (mm)	% of average annual rainfall	2016 Total rainfall to end August (mm)	% of average total to end August
Luke Creek (1969-2015)	1117	66%	757	65%
Stanton (1973-2015)	405 *	47%	340	59%
Lowry Hills (1967-2015)	414 *	50%	292	52%
Mandamus (1988-2015)	632.5 *	72%	526	88%
White Gorge (1989-2015)	386	61%	367	87%
Cust Main Drain (1998-2015)	374.5	66%	299	76%
Arthurs Pass (1955-2015)	4434	100%	3074	112%
13 Mile Bush (1963-2015)	950	78%	605	77%
Ridgens Road (1990-2015)	425*	66%	315	71%
Coopers Knob (1990-2016)	699	87%	451	78%
Blandswood (1993-2015)	1005.5 *	81%	675	85%
Mt Cook (1989-2015)	3290.5	97%	2887	113%
Geraldine (1985-2015)	552.5 *	61%	493	84%
Kimbell (1988-2015)	553.5 *	65%	486	91%
Rocky Gully (1963 -2015)	627.5	73%	454	83%
Hadlow (1988 -2015)	412 *	68%	356	87%
Bluecliffs (1989-2015)	501.5	73%	355	79%
Morven (1988 -2015)	436.5	75%	407	102%
Sunny Peaks (1990-2015)	535 *	78%	481	114%

*Lowest recorded annual total

Foothills and plains north of the Rakaia River

If we look a bit closer into northern Canterbury (Figure 3) for the month of August, cumulative rainfall totals for the year are still well short of average cumulative totals. For the year to date, the Lowry Hills rain gauge has only received 52% of the average cumulative total, which follows on from record dry 2015. Ridgens Road rain gauge, near Hororata, has very similar rainfall to this time last year and is well below the average to this time of year. Appendix 1 includes maps showing the location of all the rain gauges and water level recorders represented in this summary.

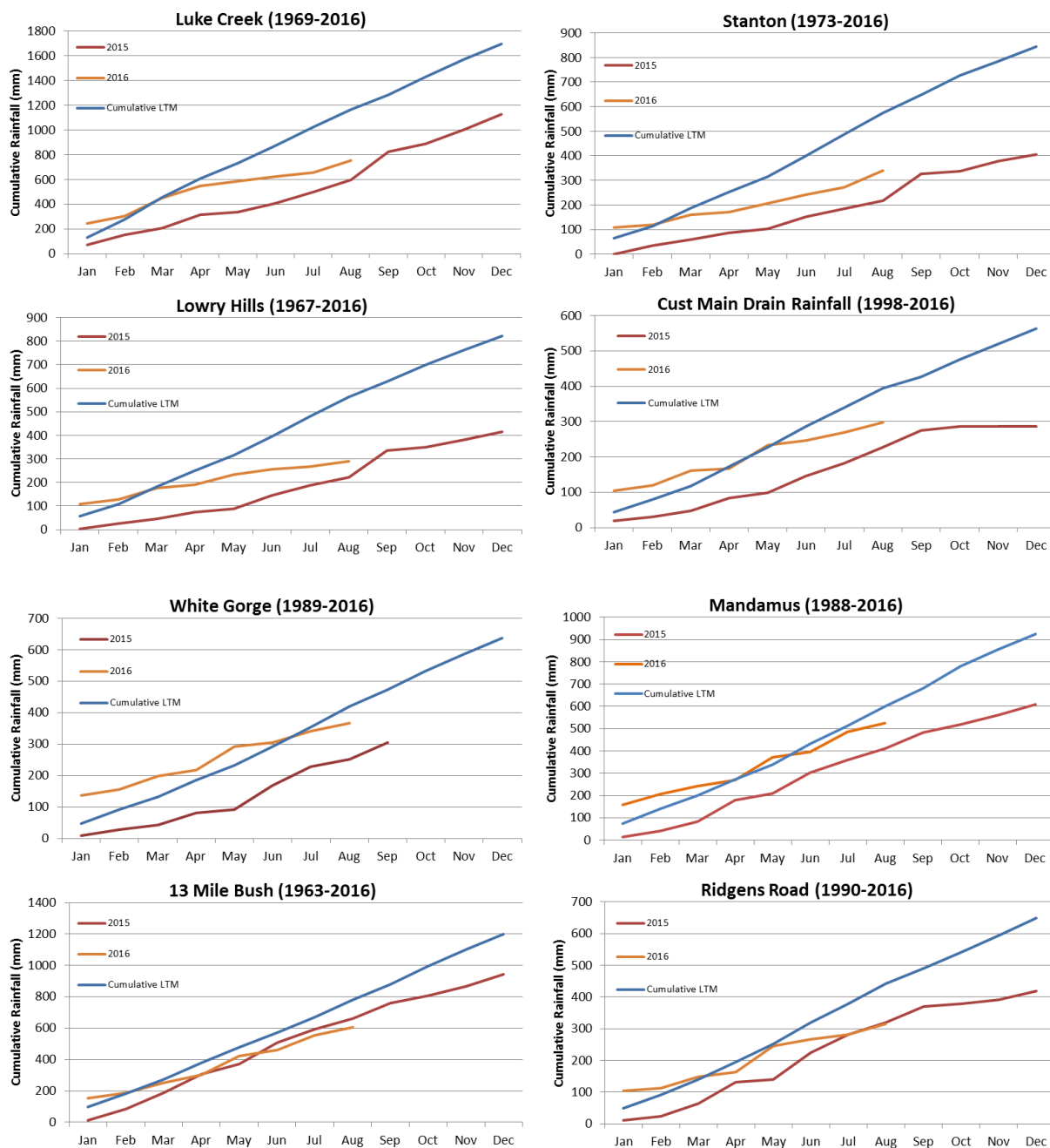


Figure 3: North Canterbury foothills and central plains cumulative rainfall - see Appendix 1 for locations

Foothills and plains south of the Rakaia River

Cumulative rainfall measured at eight representative rain gauges south of the Rakaia River (Figure 4) show that for the year to date most of these sites' rainfall totals are less than long term cumulative averages but mostly higher than 2015 to the end of winter. Sunny Peaks and the Morven site are the exceptions here which are tracking at or about the long-term average.

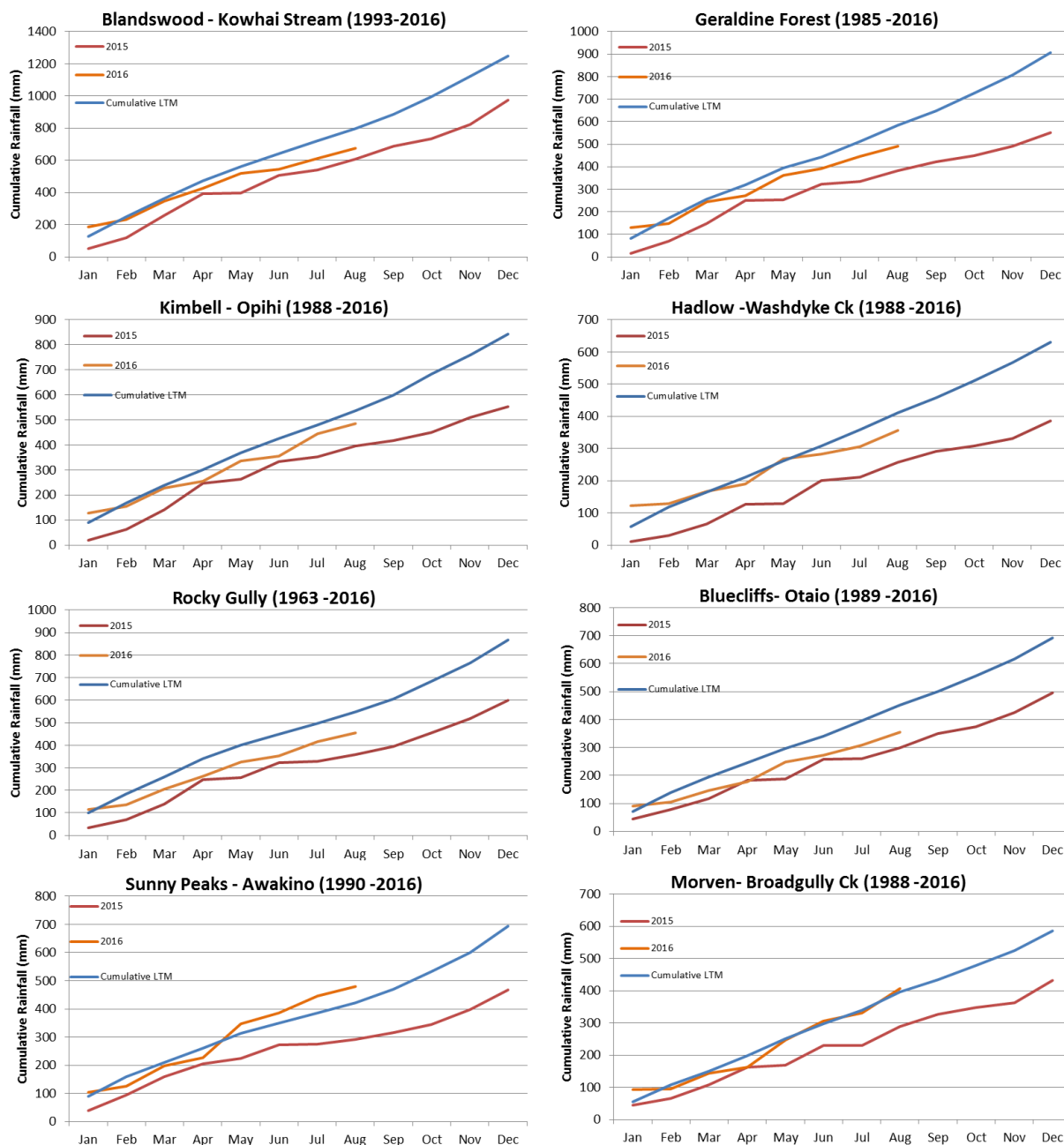


Figure 4: South Canterbury foothills cumulative rainfall – see Appendix 1 for location maps

Alpine rainfall

The Canterbury Alpine area is represented here by two rain gauges, Arthurs Pass and Mt Cook (village) (Figure 5). After a wet July in the mountains, August totals have been significantly less than average, meaning the totals for the year to date are now tracking at just above average totals for the two sites to the end of August.

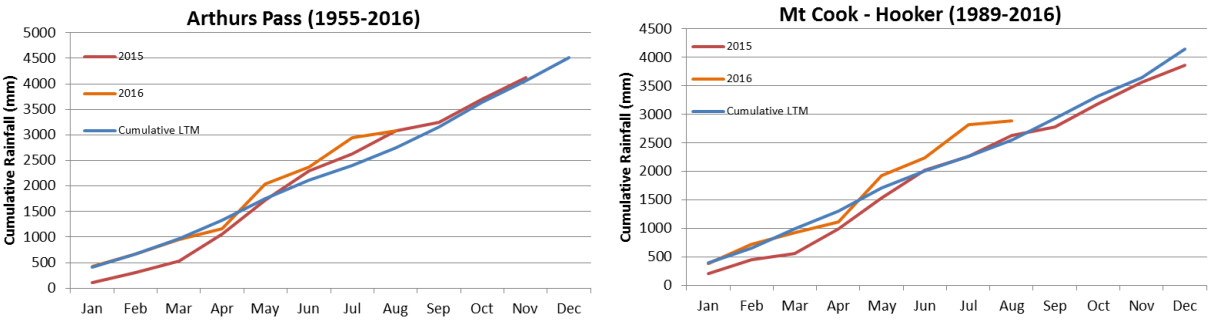


Figure 5: Alpine cumulative rainfall – see Appendix 1 for location maps

Groundwater levels

Compared to August records from previous years, 72% of the wells we monitor had 'low' groundwater levels (0 to 1 standard deviation below the mean) 12% had 'very low' levels (more than 1 standard deviation below the mean). 'Low' and 'very low' groundwater levels are indicated by the orange and red dots, respectively, in Figure 6.

'Low' levels were recorded across the region, but 'very low' water levels were particularly notable in the coastal Selwyn-Waihora area (in particular the spring-fed tributaries of Te Waihora / Lake Ellesmere), the Ashburton plains, the West Melton area and the Waipara area. This pattern remains similar to what we've been seeing for the past several months.

Figure 7 illustrates the historical groundwater levels in three wells (K37/0215, M35/3614, and M34/0765) where the levels were 'very low' in August 2016. The locations of these wells are labelled on Figure 6. Although groundwater levels are low when compared to previous August levels, a little more than half of wells we monitor recorded slightly higher water levels in August than in July.

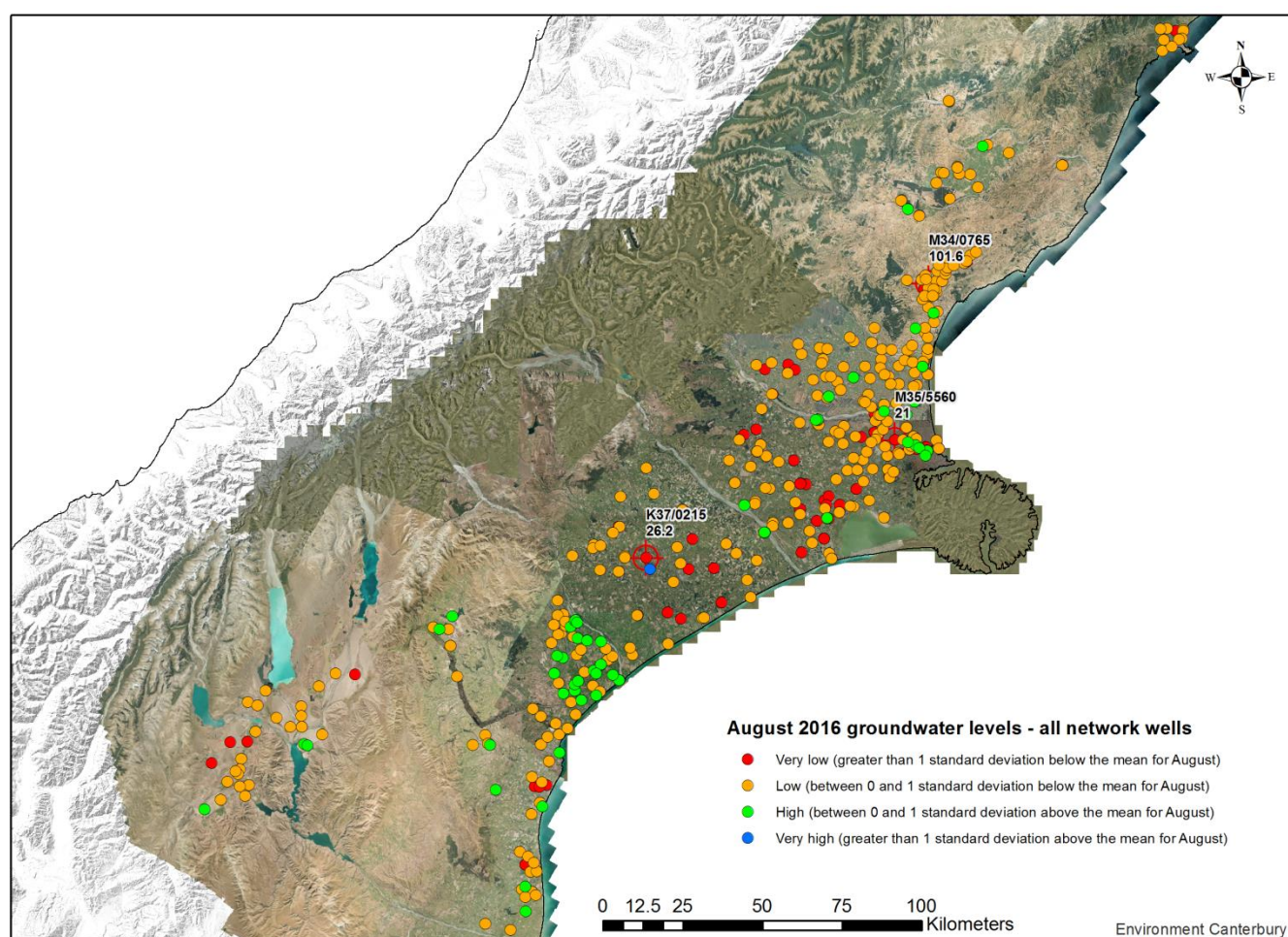


Figure 6: August 2016 groundwater levels. Wells selected for historical groundwater level time series plots (Figure 7) are identified by well number and depth.

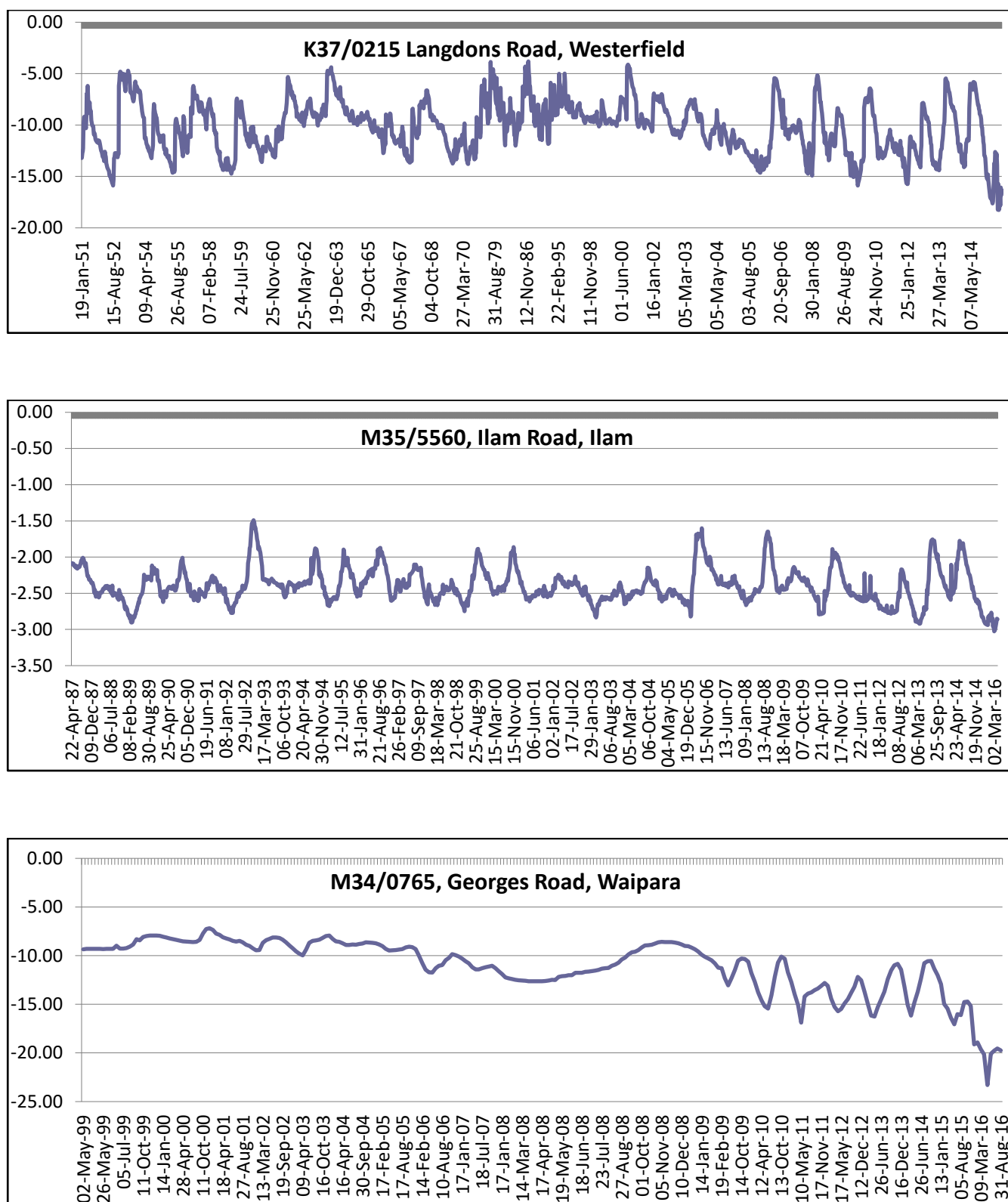


Figure 7: Historical groundwater levels in three wells (K37/0215, M35/5560, and M34/0765) where the levels were 'very low' in August 2016.

River flows

Foothills and plains rivers north of the Rakaia River

Figure 8 shows data from selected streams in the northern foothills and plains where flows have been well below average and mostly well below August 2015 flows. Flows remain exceptionally low in spring-fed rivers such as the lower Selwyn. The Selwyn at Coes Ford has recorded a record low August monthly mean flow of $0.410 \text{ m}^3\text{s}$.

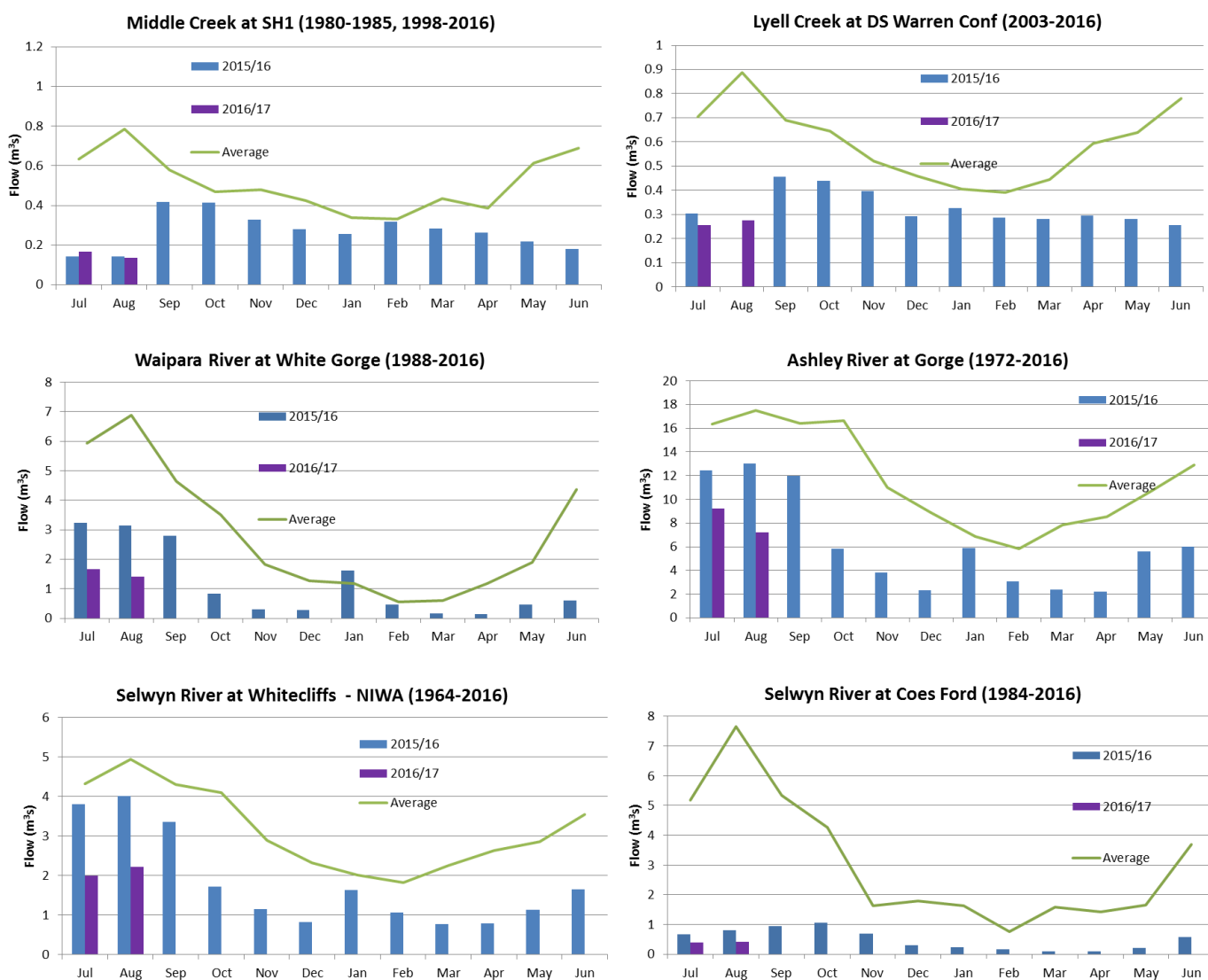


Figure 8: Mean monthly flows for streams in the North Canterbury foothills and central plains compared to 2015/16 – see Appendix 1 for location maps

Alpine river flows, Rakaia and north

After a wet July in the mountains, flows in these alpine rivers were well above average (Figure 9). Much less rain in the month of August is reflected in lower than average flows. For example, the Waimakariri River at the Old Highway Bridge site recorded a mean monthly flow of $80 \text{ m}^3\text{s}$, only 66% of the long term August average, and the lowest since 2011.

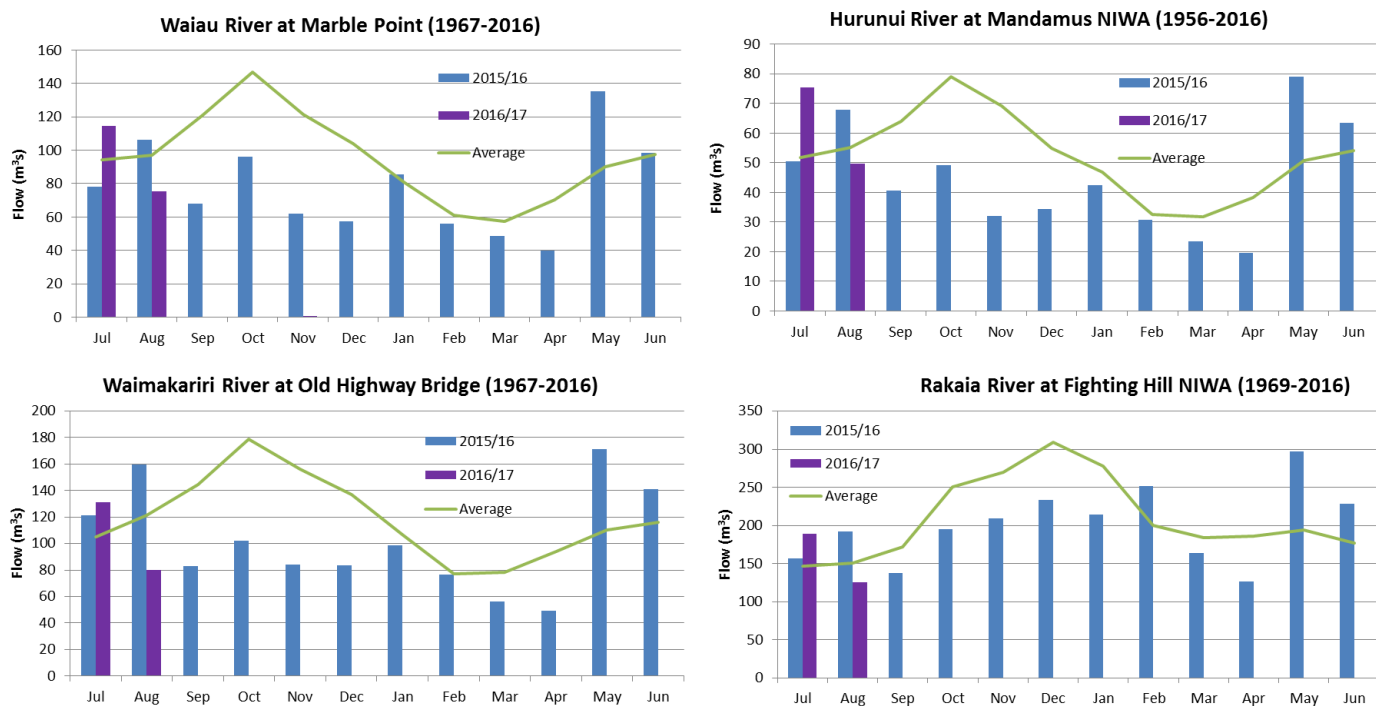


Figure 9: Mean monthly flows for alpine rivers compared to 2015/16 – see Appendix 1 for location maps

Foothills and plains south of the Rakaia River

Flows in rivers in the foothills and on the plains south of the Rakaia (Figure 10) were still mostly lower than the long-term average. However, most have seen an increase in average flows compared with the month of July, with three exceptions. Omarama Stream which has dropped off somewhat from a wet July in the area, but the August flow is approximately average for this time of year. Orari at Gorge and Opihi at Rockwood also have dropped off since July. Mostly they have higher flows than for August 2015, with the exception of the Orari at the Gorge.

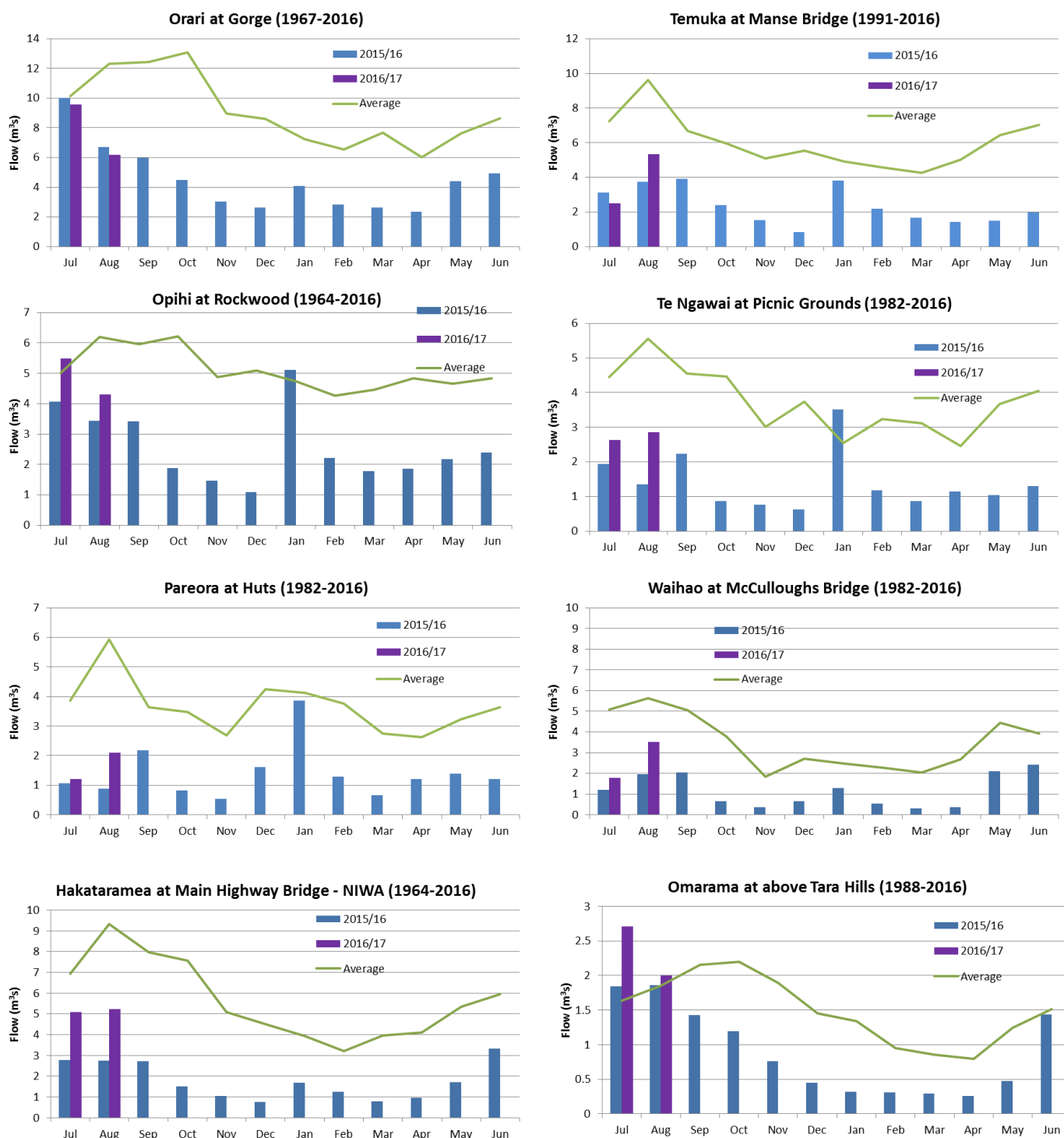


Figure 10: Mean monthly flows for streams in the South Canterbury foothills compared to 2015/16 - see Appendix 1 for location maps.

Alpine river flows, south of the Rakaia River

Similar trends are seen in the alpine rivers south of the Rakaia as those north (Figure 11), with higher than average flows in July dropping to below than average for the month of August. This will be a direct result of lower rainfall in the mountains for the month of August.

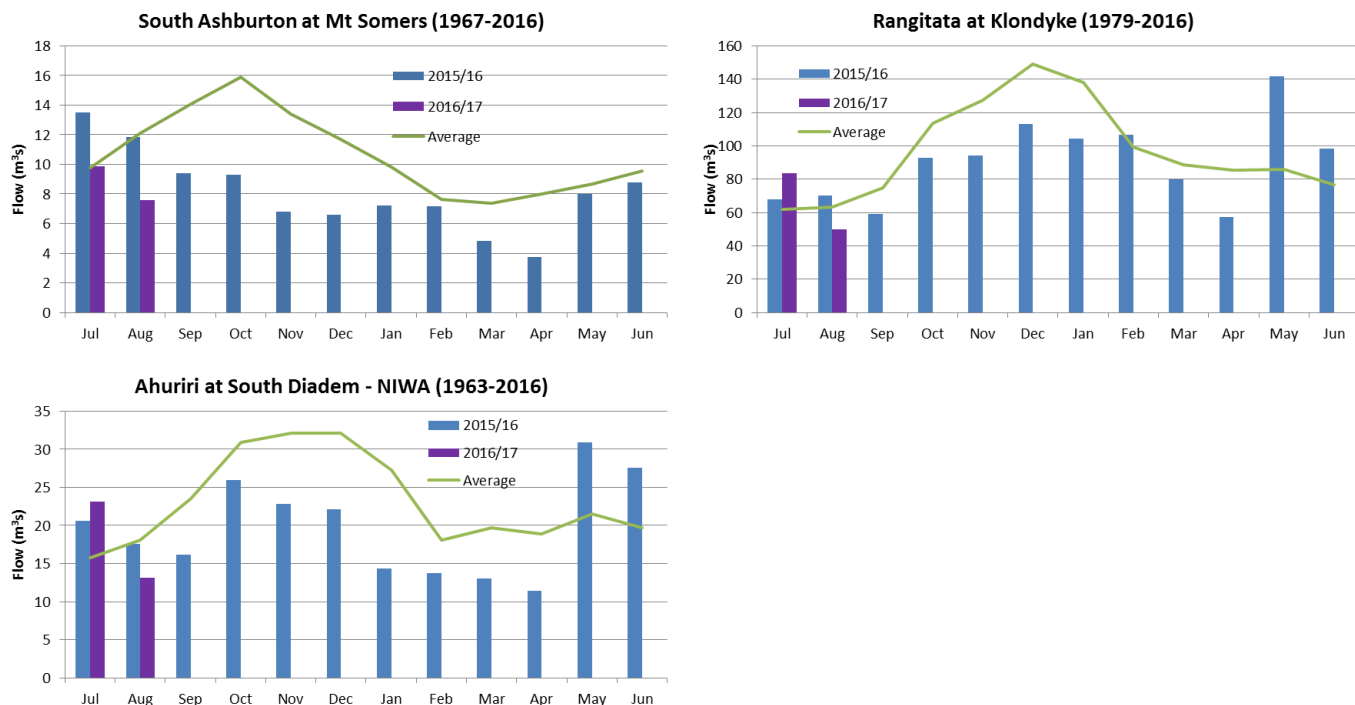


Figure 11: Mean monthly flows for streams in the South Canterbury Alpine areas compared to 2015/16 – see Appendix 1 for location map

Irrigation Restrictions

With many rivers flowing at relatively low flows, there a number of rivers with some form of restriction across the region as at the 1st of September. The Ahuriri River was the only Alpine River in full restriction across all bands, while the Rakaia, Waimakariri, Hurunui, and Rangitata had some bands in partial and some in full restriction. The Ashburton at SH1 was in full restriction also. Numerous foothill rivers and many spring-fed streams started the spring with some form of restriction.

Abstraction of groundwater for irrigation in the West Melton Special Zone is restricted based on the groundwater level in five monitoring bores (M35/1000, M35/1110, M35/1691, M35/5696 and M36/0217), one for each of five sub-zones. Water permits require abstractions to be restricted by specified percentages when water levels decline below the associated “trigger levels” in the monitoring bores. In August 2016, groundwater levels in all five bores were below their respective trigger levels, so groundwater takes tied to those five bores were on restriction.

Groundwater abstraction for some irrigation consents in the Selwyn-Waimakariri, Rakaia-Selwyn and Valetta-Ashburton River groundwater allocation zones is controlled by adaptive management programmes. The programmes set the maximum volume of water available each year based on groundwater levels at the start of the irrigation season. As the 2016/2017 irrigation season begins, the majority of the groundwater levels in our monitoring wells in all three groundwater allocation zones continue to be tracking below the monthly mean for August. In fact, groundwater levels in almost all of our monitoring wells in these zones are lower than they were in August 2015, so it is likely that these adaptive management consents will be under greater restrictions than last year.

Prepared by: Suzanne Gabites and Maureen Whalen; Science Group, Environment Canterbury
9 September, 2016

Appendix 1: Location maps of representative rain gauges and water levels sites

