greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Climate and Water Resource Summary for the Wellington Region

Spring 2015

Contents

Bridge over the Akatarawa River at Birchville, Upper Hutt. The bridge pier slumped during a 1-in-3 year flood event in the river on 29 October 2015. A community of around 70 homes were isolated without road access for about three weeks until a temporary access road was constructed to Totara Park. A new bridge is to be constructed in 2016.

In this report you will find:

More information

For more information on monitoring sites and up-to-date data please visit http://www.gw.govt.nz/environmental-science/. Several climate sites are operated by NIWA and/or MetService, and GWRC is grateful for permission to present the data in this report.

Disclaimer

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Report release date: December 2015

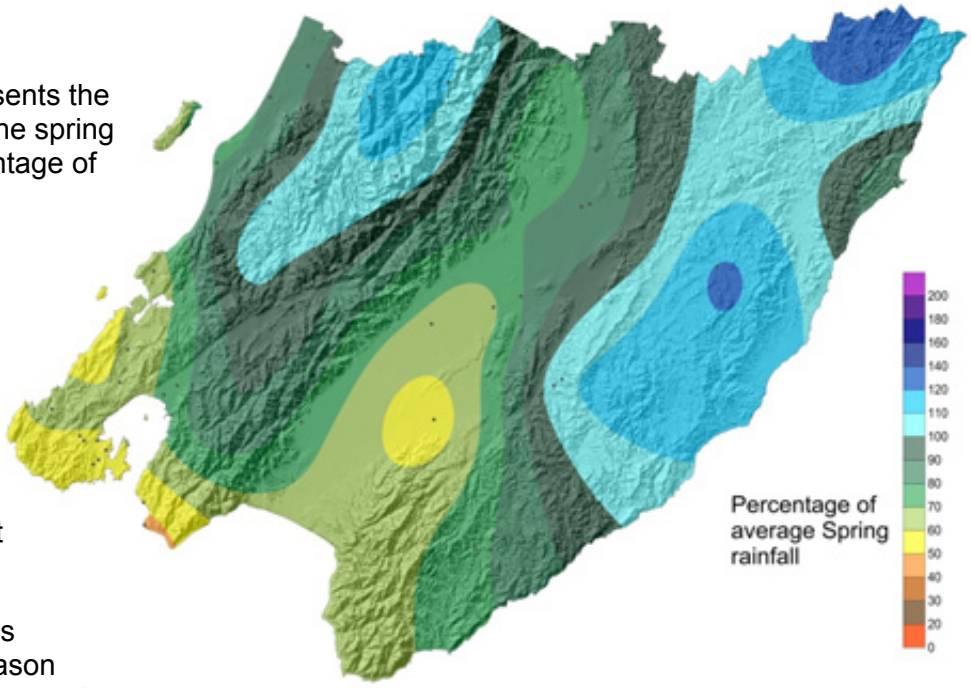
Spring 2015 (September to November inclusive) was slightly wetter than average for the north-eastern part of the region and drier than normal in the lower Ruamahanga valley, Porirua and Wellington.

Spring rainfall

The map at the right presents the rainfall recorded during the spring 2015 season as a percentage of the long term average.

The Tararua Range and parts of the north-east Wairarapa recorded above average spring rainfall. Rain gauges located in the headwaters of the Whareama and Pahaoa rivers received totals that were 130% of normal.

Although the rainfall totals over the entire spring season were above average in the north-east, most of the rainfall occurred in an exceptionally wet September (see next page) while October and November saw below average conditions prevail.



Spring 2015 rainfall as a percentage of the long-term average shows areas of above average spring rainfall in the Tararua Range and the eastern hills of the Wairarapa. The lower Ruamahanga valley, Porirua and Wellington show the lowest seasonal rainfall compared to normal.

The south of the region saw the lowest spring rainfall percentages with the Wellington and Porirua areas receiving between 50% and 70% of average. Martinborough and the lower Ruamahanga valley also recorded below average rainfall.

Another way to consider the season's weather is to look at the number of days that it rained. If more than 1mm of rain is recorded in a day this is called a 'Rain Day' and if there is more than 25mm this is termed a 'Heavy Rain Day'.

The table below shows that most areas had around the normal number of rain days. The greatest difference from average is the number of days with more than 1mm of rain in the Eastern Wairarapa where there was seven days fewer than the average.

Table 1: Number of Rain Days and Heavy Rain Days across the region (with the average shown in square brackets). Most places experienced close to, or slightly below, the typical number of rainy days.

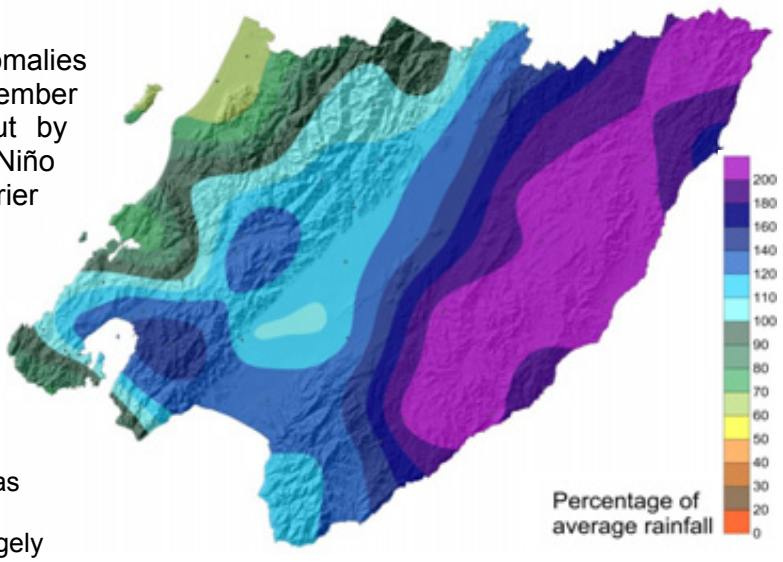
	Kapiti Coast		Porirua	Hutt Valley & Wellington		Ruamahanga		Eastern Wairarapa
	Lowland	Hills	Lowland	Lowland	Hills	Lowland	Hills	
Rain Days (>1mm)	29 [31]	53 [50]	26 [30]	27 [31]	42 [48]	25 [29]	55 [55]	30 [37]
Heavy Rain Days(>25mm)	1 [2]	15 [13]	0 [2]	1 [2]	9 [9]	0 [2]	17 [16]	2 [1]

Rainfall by the month

The maps below show rainfall anomalies (percentage of average) by month. September showed higher rainfall in the east but by October and November the strong El Niño started to impose its typical pattern of drier conditions in the east.

September

A prevalence of south-easterly rainfall events during September was reflected in the well above average rainfall recorded on the Wairarapa east coast.

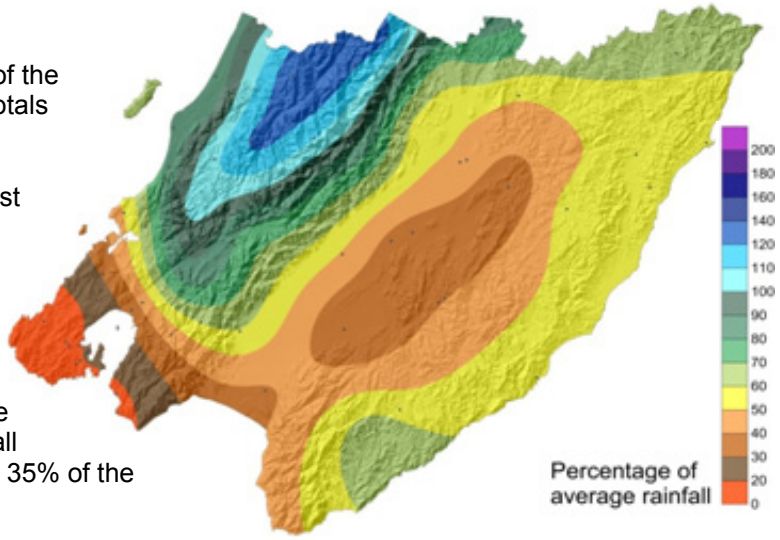


Up to 225% of average September rainfall was received at the Tanawa Hut rain gauge in the north-east. Kapiti Coast and Porirua were largely sheltered from most of the rain events and experienced drier conditions. Otaki and Waikanae recorded around 60% of the average.

October

October rainfall was below average for most of the region. Only the Tararua Range had rainfall totals above the normal (110% to 140%).

The Ruamahanga valley, eastern hills and east coast experienced significantly lower than average rainfall ranging between 30% in the mid and lower valley to 60% in the north-east.

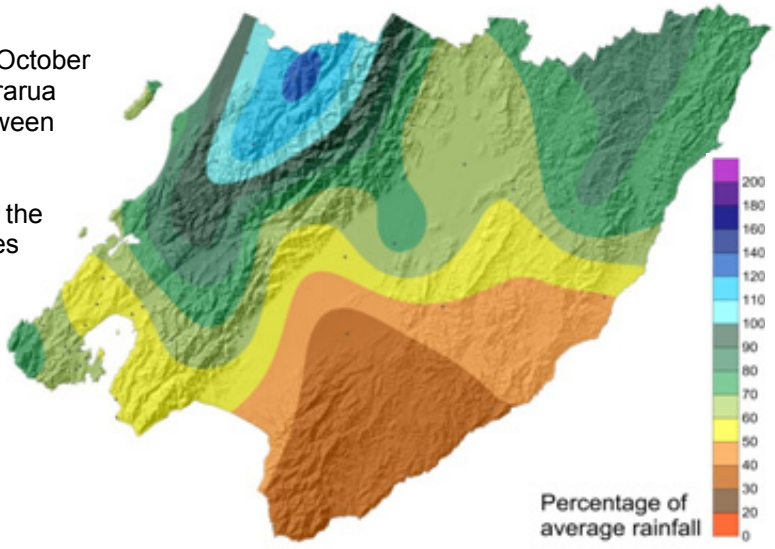


However, the southern parts of Wellington registered the lowest rainfall anomalies for the month with less than 20% of the normal rainfall recorded across the city. Lower Hutt received 35% of the average rainfall.

November

November showed a similar pattern to that of October with the highest rainfall percentages in the Tararua Range. Totals on the Kapiti Coast ranged between 70% and 95% of normal.

The southern part of the Wairarapa registered the lowest November percentages with rain gauges at Martinborough and Ngawi receiving 22% and 38% of average rainfall respectively.

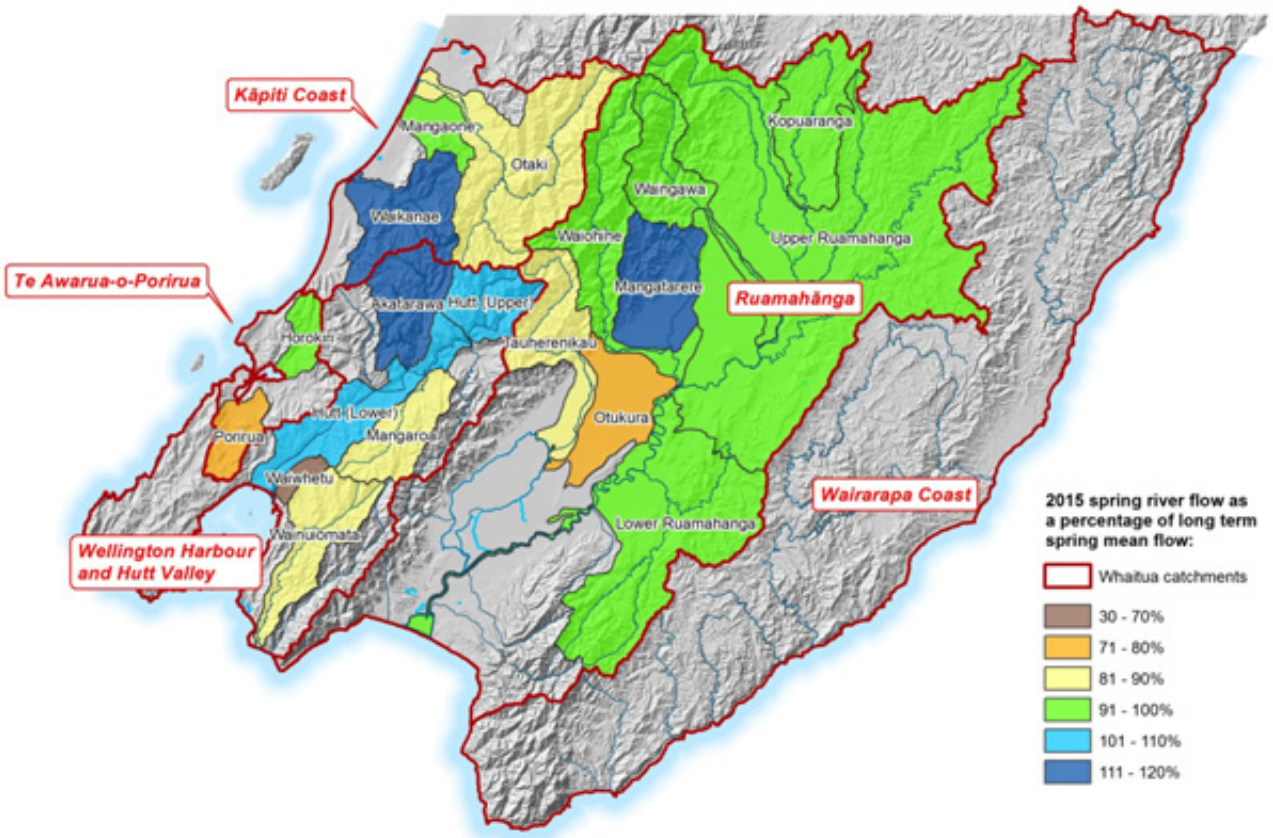


Rainfall anomalies increased from south to north with 80% of normal received at Tanawa hut in the north-east hill country.

River flows

The map below shows spring river and stream flows for various monitored catchments as a percentage of the average flow. The pattern around the region was quite mixed. Catchments around Wellington and the south coast (Porirua, Waiwhetu and Wainuiomata) mirrored the lower than average seasonal rainfall totals with spring flows that were 78%, 60% and 82% of average respectively.

The bulk of the Ruamahanga catchment was around 90-100% of normal with the exception of the Mangatarere (118%) and the Otukura (72%).



Mapping of river and stream flows recorded during spring 2015 as a percentage of the long-term average shows that above average flows were recorded in just a few catchments (Waikanae, Akatarawa, Hutt and Mangatarere) with the remainder being average to below average.

29 October - minor flood but large effect on community

On the 29 October 2015 a heavy rainfall event hit the Tararua Range bringing high river flows to Kapiti Coast rivers with spill over into the Akatarawa and Whakatikei rivers (in the Hutt catchment).

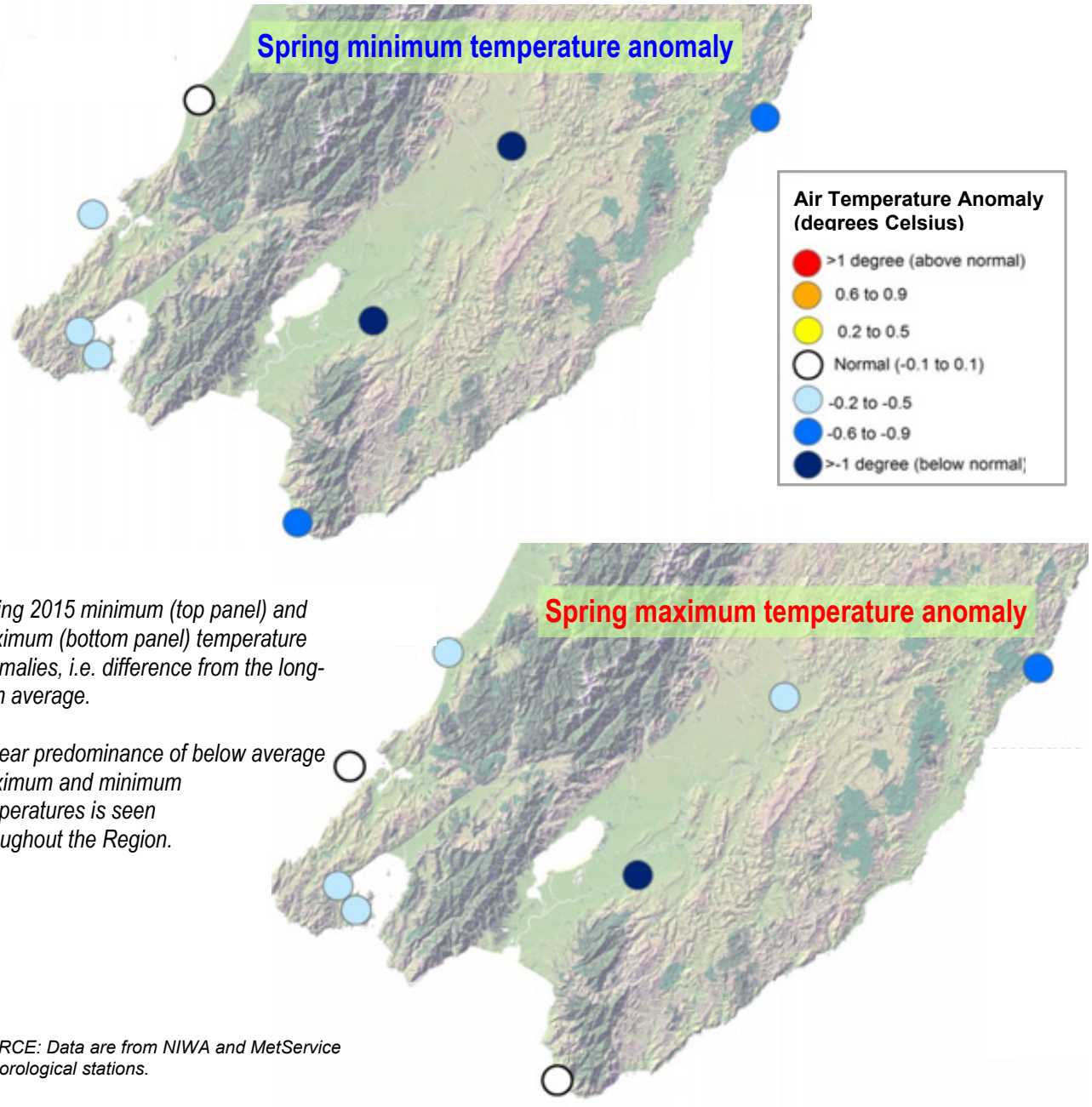
The Akatarawa River breached its floodwarning alarm level and peaked at a flow that has a 1-in-3 year return period. While the river was at a high level the middle pier of the Bridge Road bridge slumped and the road was closed to all traffic. The bridge was the sole vehicle access connecting a community of around 70 homes to the Akatarawa Rd.

The only access in and out of the area for residents was via a 20 minute bush walk until a temporary access road was built about two weeks later.

Spring air temperatures

Air temperature is measured at a number of meteorological monitoring sites across the region. It is useful to look at patterns in seasonal anomalies (differences from normal) in extremes of temperature across the region to help interpret how dominant and widespread climate drivers have been. The anomaly between the average daily minimum and maximum temperatures recorded during spring and the historical averages for this season is shown below. For the range of extreme maximum and minimum temperatures (i.e., not daily averages), please refer to the climate statistics table on page 13.

Both maximum and minimum temperatures were below average across the region, especially in the Wairarapa with Martinborough, Masterton and Castlepoint being the coldest spots measured. This colder than average pattern is consistent with increased southwesterly winds observed during El Niño years.



Spring 2015 minimum (top panel) and maximum (bottom panel) temperature anomalies, i.e. difference from the long-term average.

A clear predominance of below average maximum and minimum temperatures is seen throughout the Region.

SOURCE: Data are from NIWA and MetService meteorological stations.

Global climate drivers

Climate variability and climate change

People often ask if the variable weather patterns in our region are a result of climate change. While natural climate variability has always been quite pronounced in our region, weather extremes are expected to get worse as a result of human-induced climate change and "global warming" caused by the emission of greenhouse gases (https://www.niwa.co.nz/natural-hazards/hazards/climate-change).

Some key observations about climate variability and change in our region during spring 2015 are:

- Several historical temperature records (both low and high temperatures) were broken. This is consistent with expected climatic changes as a result of increased anthropogenic (i.e., caused by humans) CO_2 in the atmosphere
- The effects of climate change are already being felt as superimposed onto natural climate fluctuations
- The current El Niño phenomenon is the strongest since the 1997/98 event, and is now in its mature phase. From now on the El Niño is predicted to slowly start to decline, returning to normal by winter 2016. This is causing below average rainfall in a significant part of our region.

Global climate drivers and extreme weather events

Climate drivers are global mechanisms that can influence the weather in our region. The current major driver is the El Niño/Southern Oscillation[1], which has been in its positive (El Niño) phase since April 2015.

As mentioned above, the current El Niño phenomenon is the strongest since 1997/98. Recognising the potential concern that this situation is causing, we have developed a separate climate briefing to specifically inform about the latest drought information and the state of the current El Niño, compared to previous events. The latest climate briefing, using about 30 years of climate data for the Wellington region, can be accessed from:

http://www.gw.govt.nz/seasonal-climate-and-water-resource-summaries-2/

[1] https://www.niwa.co.nz/education-+-and-training/schools/students/enln

Seasonal climate outlook for summer 2016

Based on the fact that the current El Niño is very strong, there is an overall tendency for a significantly dry summer for most of the Wairarapa and southern parts of the Wellington Region.

Based on previous statistics, it is possible that the rainfall will sit in a one in a 50-year dry summer in some areas. However, this El Niño has certain unique characteristics that have not been observed in previous events (e.g. a very warm Indian Ocean), and caution should be taken that isolated heavy rainfall events can also happen throughout the season, as occurred in the Wairarapa in September 2015.

Climate Outlook for summer 2016:

Dry conditions are expected for most of the region, which are typical of El Niño summers. A greater likelihood of extreme weather events, in particular extremes of cool and warm temperatures and greater diurnal thermal amplitude, is also expected.

While not commonly observed during El Niño events, heavy easterly rainfall events are also possible due to the unique characteristics of the current ENSO episode.

The forecasts are qualitative only, as it is not possible to accurately estimate the actual amount of seasonal rainfall. Based on previous El Niño events, it is possible that the seasonal rainfall could sit at one in a 50-year drought in some areas.

Whaitua[1]		Climate Outlook for Summer 2016
Wellington Harbour & Hutt Valley	**Temperature:** **Rainfall:**	Normal to below normal, higher variability of cool and warm. Normal to below normal.
Te Awarua-o- Porirua	**Temperature:** **Rainfall:**	Normal to below normal, higher variability of cool and warm. Normal to below normal
Kāpiti Coast	**Temperature:** **Rainfall:**	Normal to below normal, higher variability of cool and warm Normal
Ruamāhanga	**Temperature:** **Rainfall:**	Higher variability of cool and hot, greater diurnal amplitude Below normal, possibly sitting at one in a 50-year dry summer
Wairarapa Coast	**Temperature:** **Rainfall:**	Higher variability of cool and hot, greater diurnal amplitude Below normal, possibly sitting at one in a 50-year dry summer

[1] Whaitua catchment areas are shown on the map on the next page

This climate outlook was prepared by the Air and Climate Team of GWRC based on our own expertise, and information provided by NIWA, MetService and international centres such as the International Research Institute for Climate and Society of Columbia university (http://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/). This guidance is qualitative only, and GWRC takes no responsibility for the use or accuracy of this information. For more details on long-term climate forecasts at a national level the reader should refer to NIWA in the first instance (https://www.niwa.co.nz/climate/sco)

What happened in each whaitua catchment?

Climate and water resource summaries are provided in the following sections for each of the five Wellington region whaitua catchment areas (as shown below). The whaitua catchments provide an important sub-regional basis for environmental management in the Wellington region[2], and roughly coincide with the different climate and water resource zones.

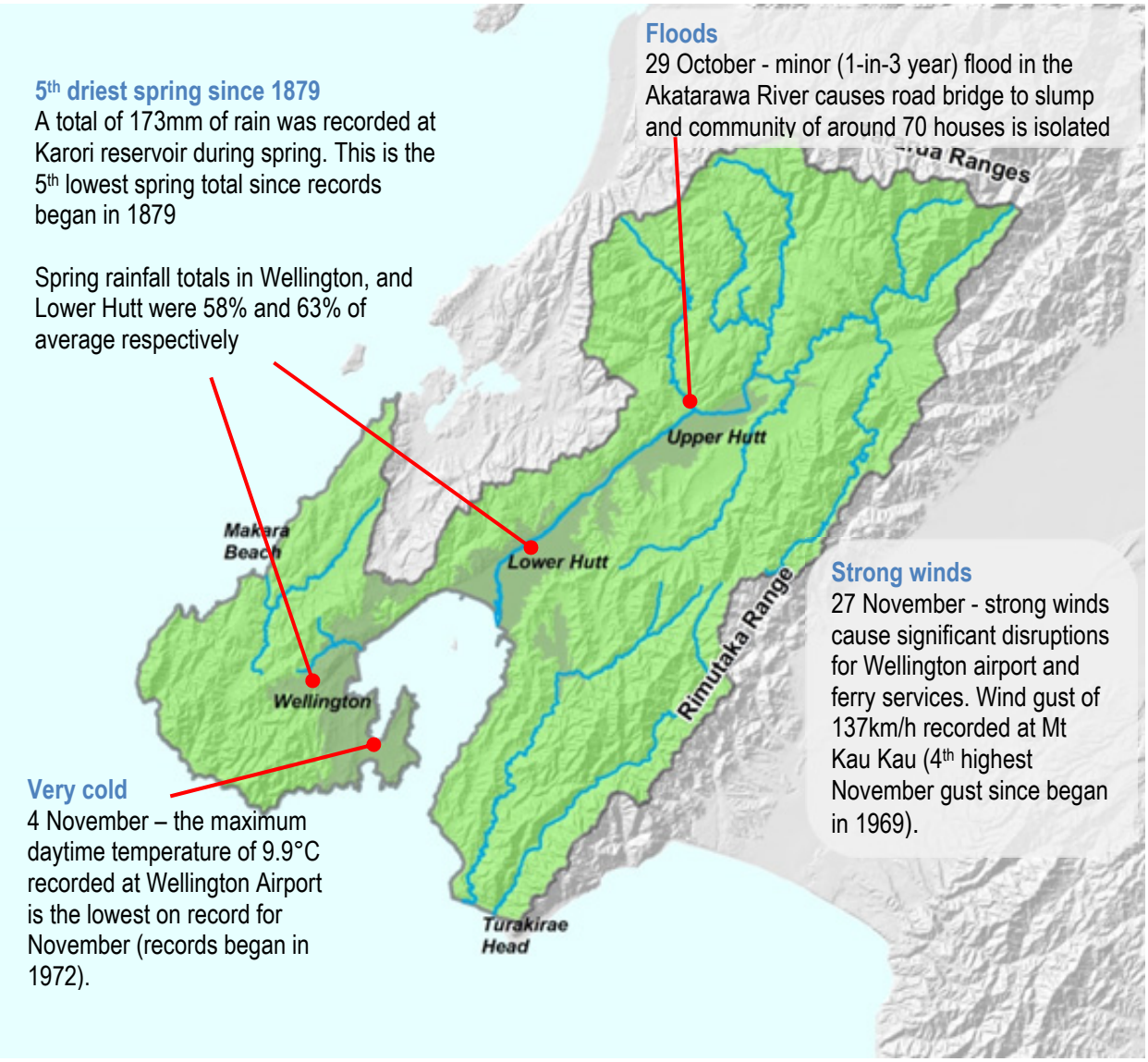
Click the following links for spring 2015 summaries on:

Map of the five whaitua catchment areas in the Wellington region. Each whaitua roughly coincides with a climatic zone, expressing the marked east-to-west contrast that we experience in our region.

[2] http://www.gw.govt.nz/whaitua-committees/

Wellington Harbour and Hutt Valley Climate Summary

- **Colder than average**
- **Drier than average**
- Some notable winds gusts, low overall rainfall, localized flooding and record cold daytime temperatures



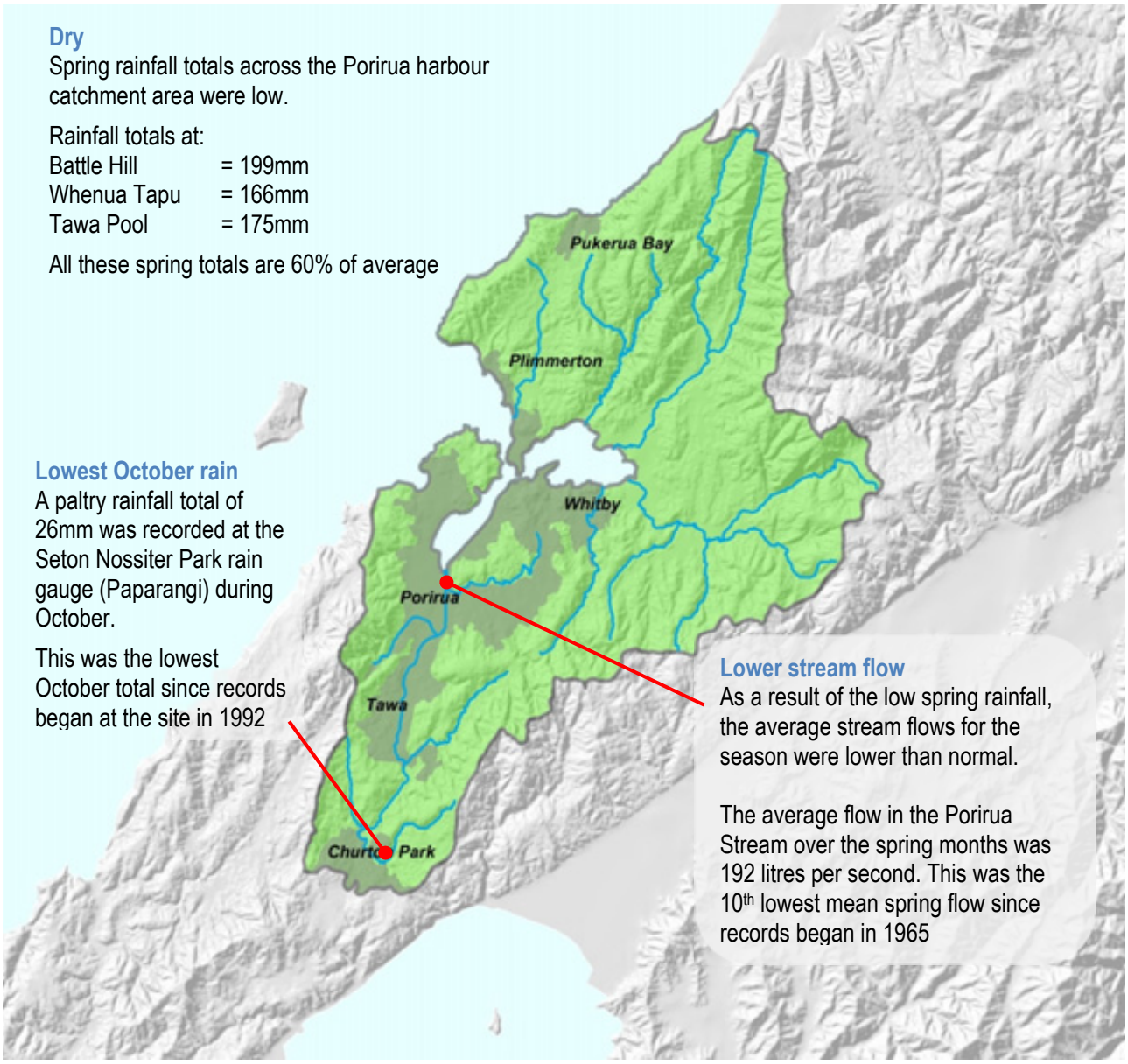
Want to look at the summary tables and graphs?

Climate | Rainfall

River flows | Groundwater levels

Te Awarua-o-Porirua Climate Summary

- **Colder than average**
- About **average** seasonal rainfall
- Some notable wind gusts



Want to look at the summary tables and graphs?

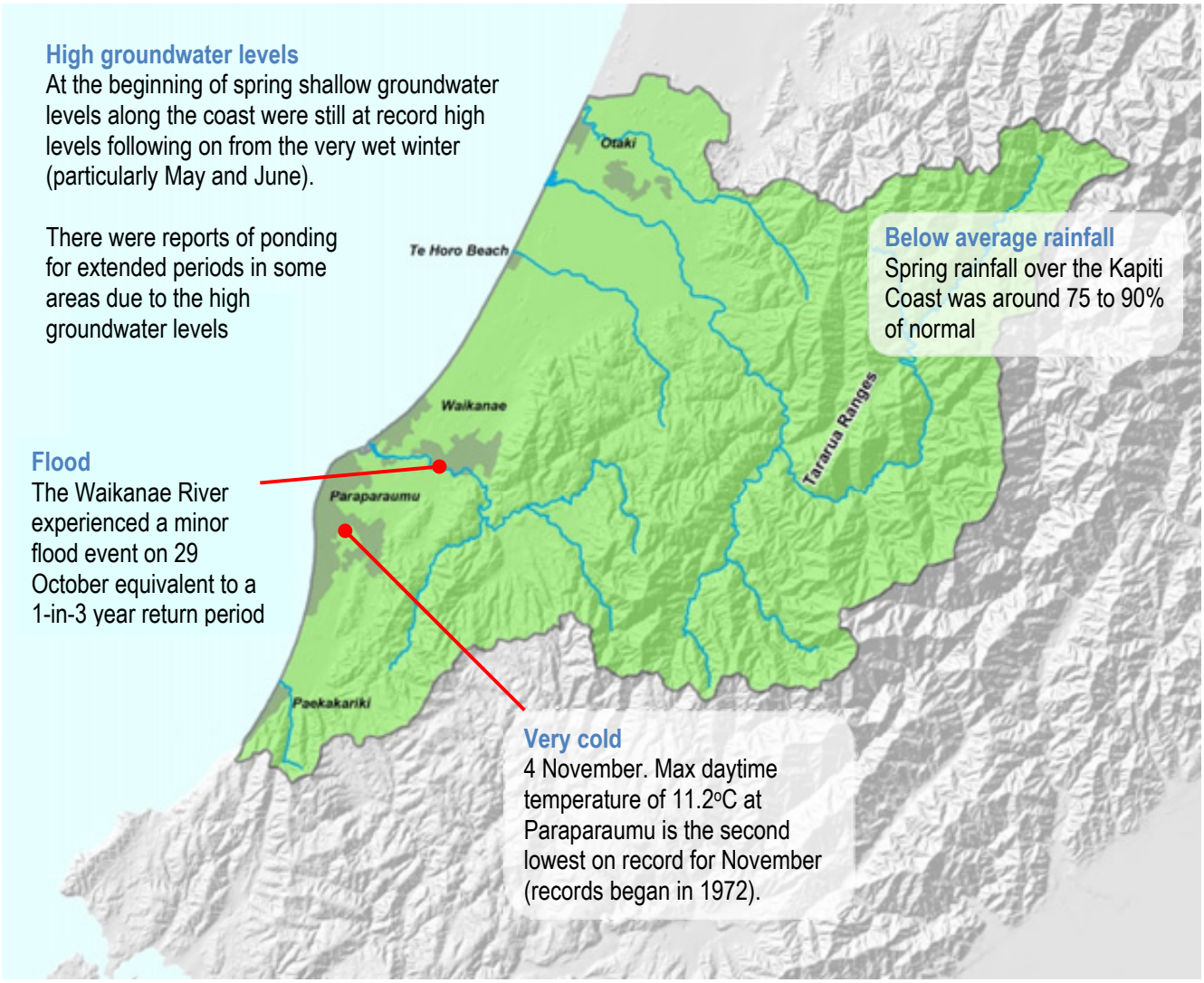
Climate

Rainfall

River flows

Kāpiti Coast Climate Summary

- **Colder than average**
- About **average** seasonal rainfall
- Some notable wind gusts, localised flooding, and low daytime temperatures



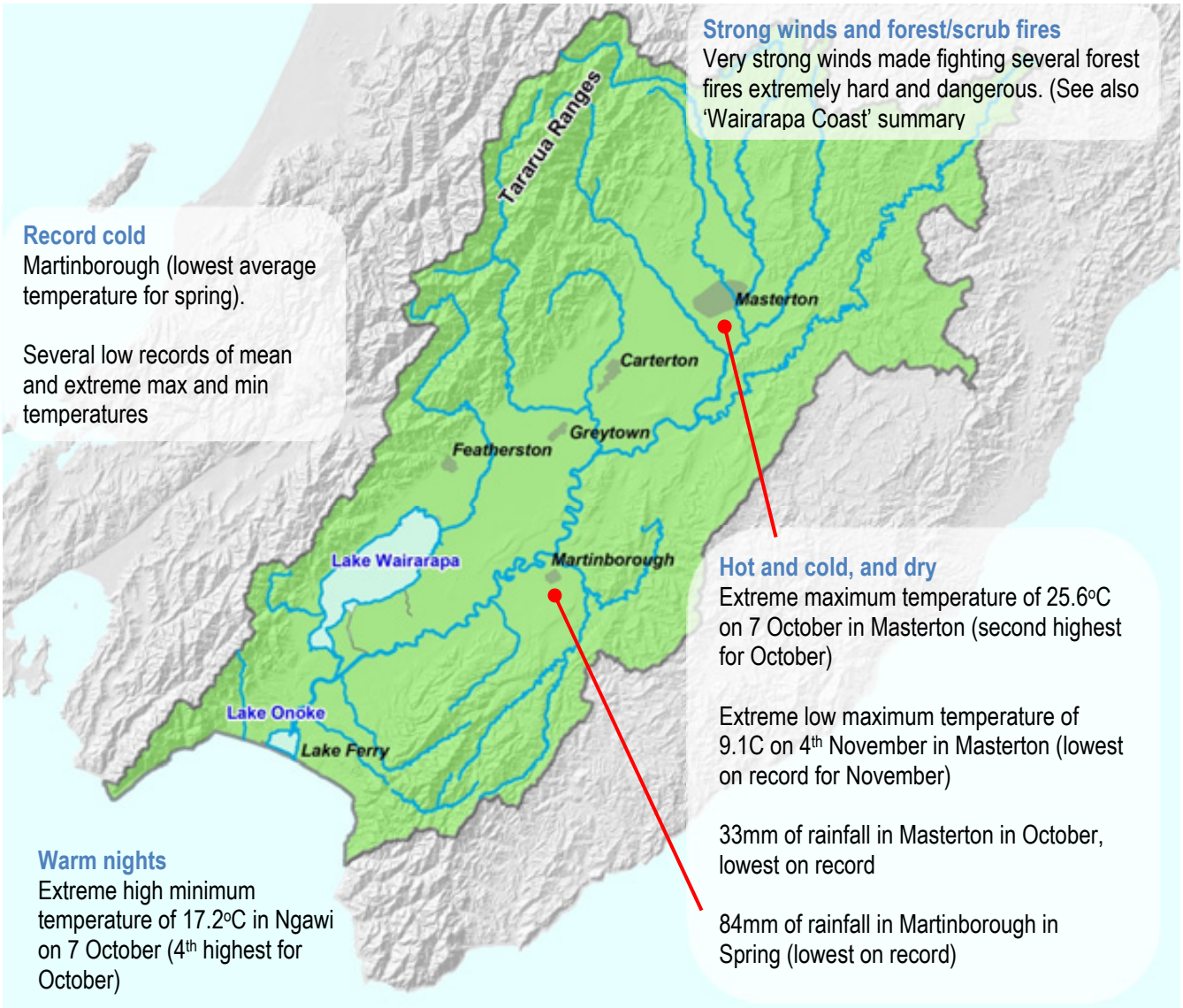
Want to look at the summary tables and graphs?

Climate | Rainfall

River flows | Groundwater levels

Ruamāhanga Valley Climate Summary

- **Colder than average**
- **Drier** than average
- Some notable windgusts, frosts as well as record warm and cold daytime temperatures, with record low rainfall caused by El Niño



Want to look at the summary tables and graphs?

Climate

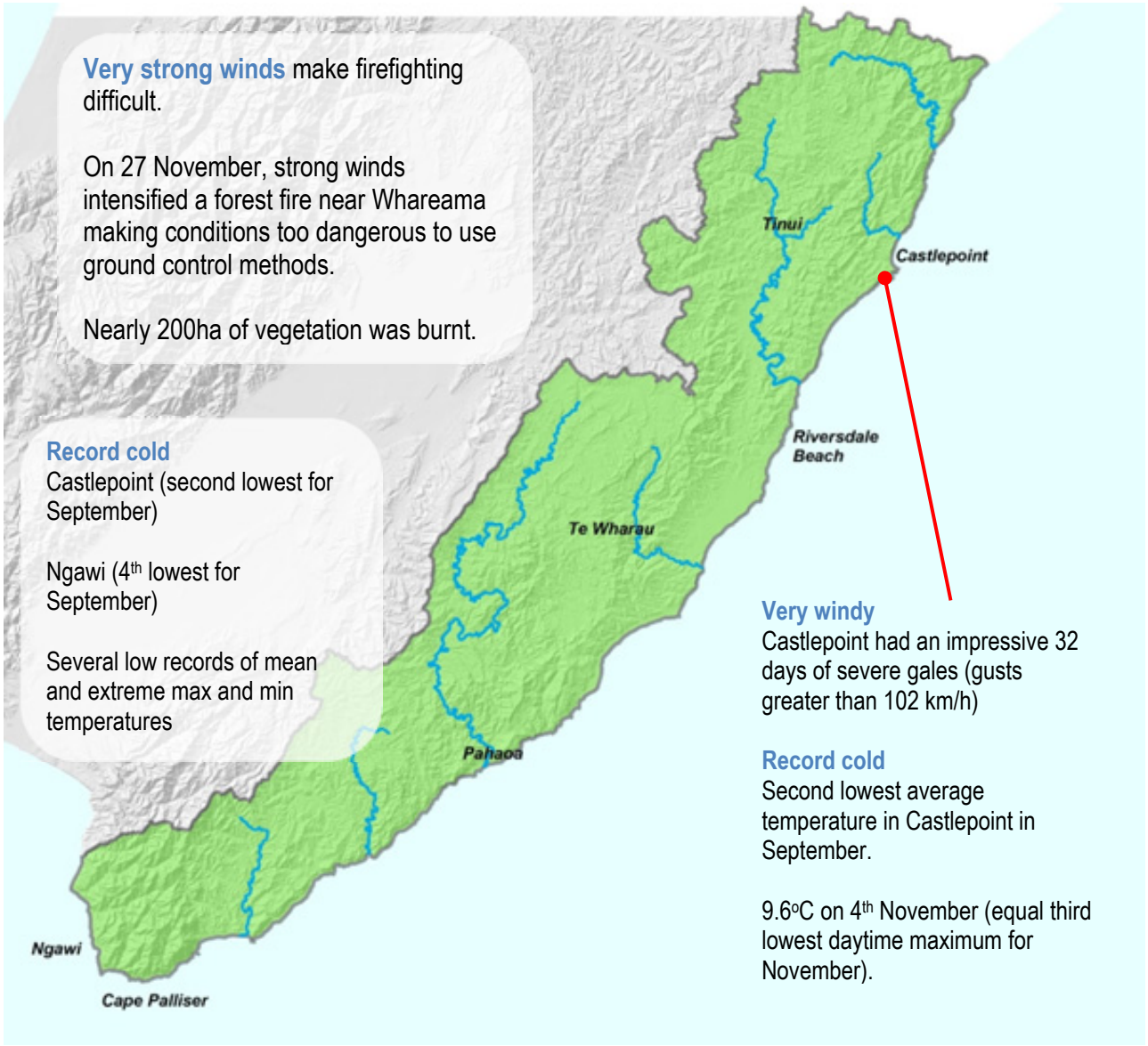
Rainfall

River flows

Groundwater levels

Wairarapa Coast Climate Summary

- **Colder than average**
- **Drier than average**, wet spots in the central coast
- Some notable wind gusts and record low temperatures. Very variable rainfall caused by an atypical El Niño



Want to look at the summary tables and graphs?

Climate

Rainfall

Soil moisture

Climate statistics

A climate summary for selected monitoring sites within each whaitua catchment area is presented below for spring 2015. Orange shading denotes record breaking extreme warm temperatures compared to the long-term historical records, and/or positive departures from the mean temperatures. Blue shading denotes the opposite (cold).

The predominance of blue clearly shows colder than average conditions for all whaitua catchments. Higher incidence of severe gales is noted for Mt Kau Kau, Rimutaka Hill and Castlepoint, with more frosts around Masterton and Upper Hutt.

Whaitua	Location[1]	Extreme Max Temp (°C)	Extreme Min Temp (°C)	Mean Max Temp Departure from average (°C)	Mean Min Temp Departure from average (°C)	Severe Gale days (>102 km/h wind gusts)	Severe Frost days (Minimum Temp < 0°C)
Wellington Harbour & Hutt Valley	Kelburn AWS (MS)	22.8	3.9	-0.3	-0.2	9	0
	Wellington Airport AWS (MS)	22.1	4.7	-0.5	-0.3	2	0
	Mt Kau Kau (MS)	---	---	---	---	17	---
	Shandon Golf Club	22.0	2.5	---	---	0	0
	Lower Hutt (Waterloo)	25.1	3.2	---	---	0	0
	Wainuiomata	25.3	-0.3	---	---	0	1
	Upper Hutt (Central)	25.4	0.7	---	---	0	0
Te Awarua-o-Porirua	Mana Island AWS (MS)[2]	19.8	3.9	-0.1	-0.2	2	0
Kāpiti Coast	Paraparaumu Airport AWS (MS)	20.5	0.9	-0.2	-0.1	0	0
Ruamāhanga	Masterton Airport AWS (MS)[2]	26.2	-2.8	-0.4	-2.0	3	4
	Martinborough EWS (N)	23.6	-1.0	-1.0	-1.1	---	---
	Tauherenikau (Featherston)	24.3	0.4	---	---	0	0
	Rimutaka Summit AWS (MS)	18.8	0.2	---	---	19	0
Wairarapa Coast	Castlepoint AWS (MS)	22.9	4.0	-0.6	-0.7	32	0
	Ngawi (MS)	26.5	5.2	-0.1	-0.6	0	0

[1] Sites owned by MetService = MS,Sites owned by NIWA = N, all other sites are owned by GWRC

[2] The departures from average for Masterton Airport AWS and Mana Island AWS are only approximate, based on an inferred climatology obtained via interpolation from nearby sites.

Click the following links to return to climate summaries for:

- Wellington Harbour & Hutt Valley
- Te Awarua-o-Porirua
- Kāpiti Coast
- Ruamāhanga
- Wairarapa Coast

Rainfall statistics

Rainfall total and percentage of average for each month and whole of spring 2015.

Whaitua	Location	September		October		November		Spring	
		(mm)	(%)	(mm)	(%)	(mm)	(%)	(mm)	(%)
Wellington Harbour & Hutt Valley Click to see cumulative rainfall plots	Kaitoke	259	136	184	86	118	60	561	93
	Lower Hutt	120	132	47	31	42	49	209	63
	Wainuiomata	278	176	72	43	78	62	428	95
	Karori	101	101	18	17	54	61	173	58
	Wellington City	86	119	22	24	49	81	157	68
Te Awarua-o-Porirua Click to see cumulative rainfall plots	Battle Hill	63	52	76	54	60	85	199	60
	Whenua Tapu	70	76	49	44	47	64	166	60
	Tawa	88	113	40	29	47	59	175	59
Kāpiti Coast Click to see cumulative rainfall plots	Otaki	54	63	94	95	77	97	225	85
	Waikanae	69	61	117	79	81	90	267	76
	Paekakariki	96	100	80	77	45	58	221	78
	Tararua (Otaki catchment)	540	114	651	113	480	104	1671	111
Ruamāhanga Click to see cumulative rainfall plots	Masterton	100	140	43	48	36	66	179	81
	Featherston	82	96	55	54	42	49	179	65
	Longbush	167	232	29	41	30	51	226	112
	Tararua (Waiohine catchment)	510	114	558	116	376	100	1444	112
Wairarapa Coast Click to see cumulative rainfall plots	Tanawa Hut	260	230	62	63	58	80	380	134
	Stoney Creek (Awhea)	104	113	51	41	51	64	206	72
	Ngaumu (Pahaoa)	258	339	16	18	20	31	294	138

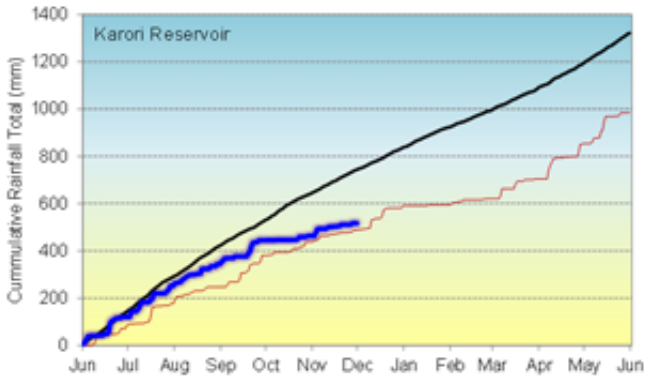
Click the following links to return to climate summaries for:

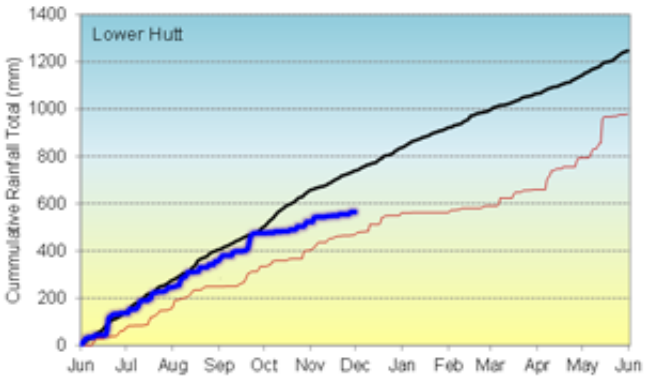
- Wellington Harbour & Hutt Valley
- Te Awarua-o-Porirua
- Kāpiti Coast
- Ruamāhanga
- Wairarapa Coast

Cumulative rainfall plots

Wellington and Hutt Valley

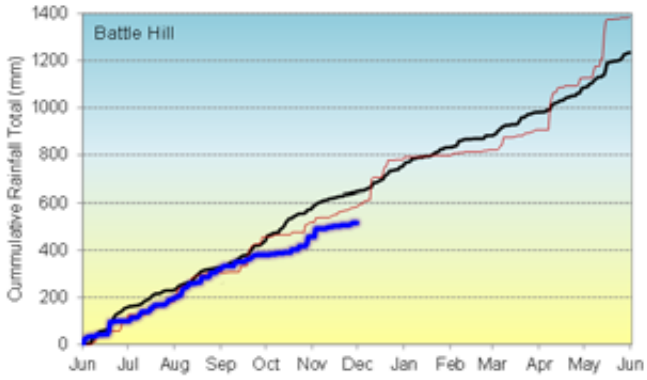
Cumulative rainfall total 2015/16 (blue line), 2014/15 (red line) and long-term average (black line). The plots highlight that since the beginning of spring the rainfall accumulation has started to fall below the long-term average. The previous year (2014/15) was drier than normal and the current accumulation is tracking towards a similar position at the end of spring

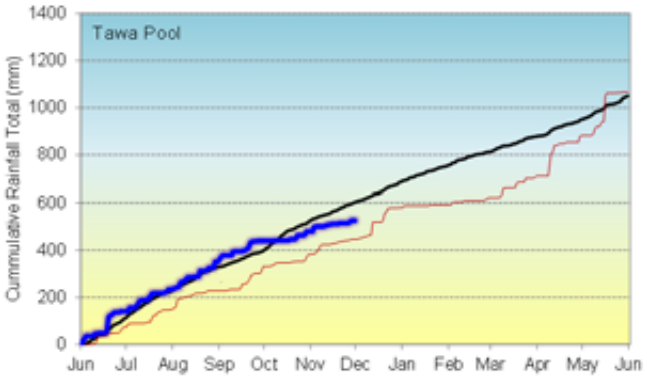




Porirua Harbour

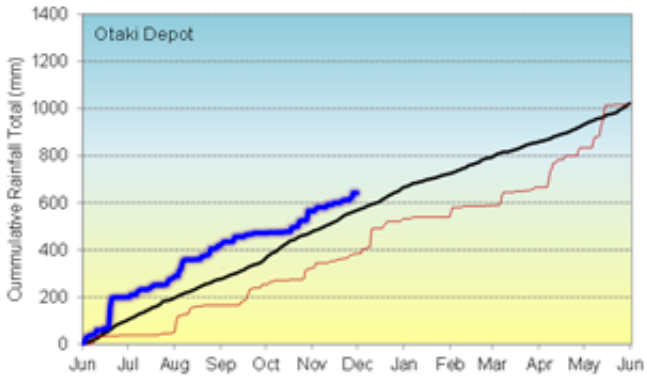
Cumulative rainfall total 2015/16 (blue line), 2014/15 (red line) and long-term average (black line). The plots highlight that spring rainfall accumulation has been slightly below average.

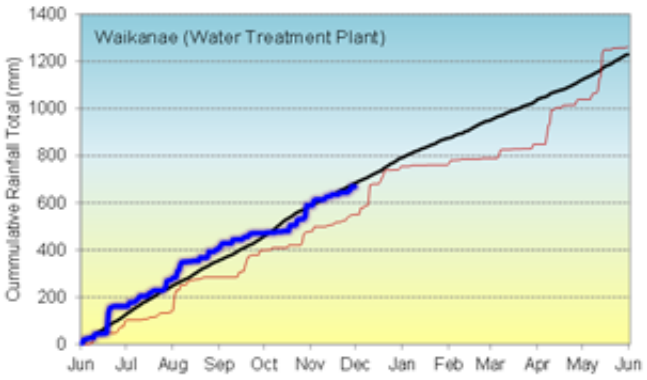




Kapiti Coast

Cumulative rainfall total 2015/16 (blue line), 2014/15 (red line) and long-term average (black line). After a wet winter where the rainfall accumulation tracked above average, spring rainfall has brought the years total back towards the average line.

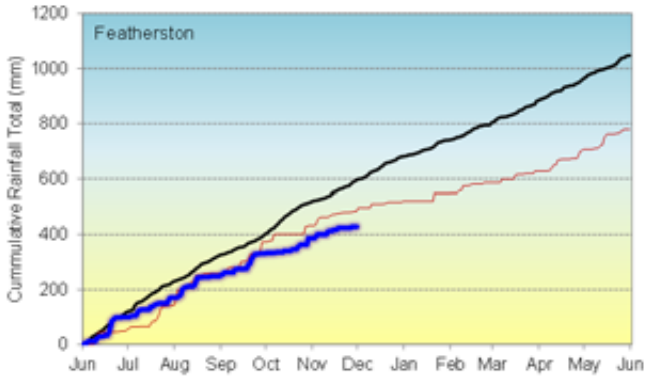


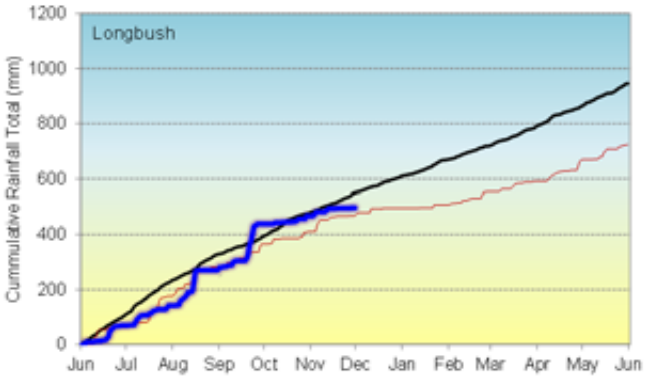


Ruamahanga

Cumulative rainfall total 2015/16 (blue line), 2014/15 (red line) and long-term average (black line). The plots show a difference between the Featherston (Tauherenikau) and Longbush (Waikoukou) sites in terms of rainfall accumulation. Rainfall in the lower Ruamahanga valley is currently tracking below average and below last years trend.

Two large rainfall events have provided sharp upward jumps in the Longbush rainfall accumulation for this year.

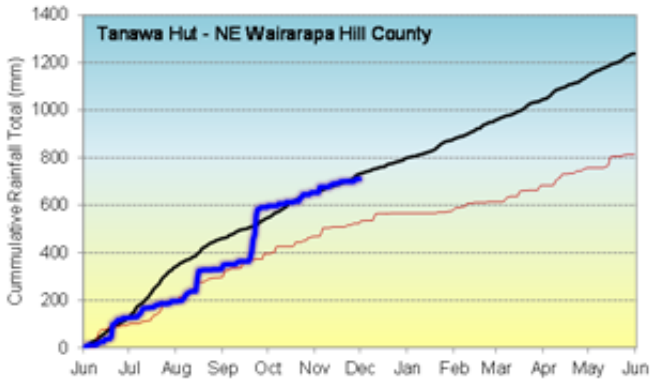




Wairarapa Coast

Cumulative rainfall total 2015/16 (blue line), 2014/15 (red line) and long-term average (black line). Spring rainfall has seen the 2014/15 rainfall accumulation jump up to be near the long-term average.

The current line was tracking close to the 2014/.15 line and was well below average before over 200mm of rainfall occurred between from 19 to and 24 September.



River flows

Percentage of average river flow for each month and whole of spring 2015, reflecting the above average rainfall that occurred in September. October and November ranged from about 50% of average to above average.

Total spring flows were largely below average to average.

Whaitua	River	September	October	November	Spring
Wellington Harbour & Hutt Valley	Hutt River - Kaitoke	130	85	78	98
	Hutt River - Taita Gorge	147	91	94	108
	Akatarawa River	124	107	112	113
	Mangaroa River	144	62	59	88
	Wainuiomata River	151	47	60	83
Te Awarua-o-Porirua	Porirua	125	49	54	77
	Pauatahanui	107	55	72	77
	Horokiri	119	64	120	95
Kāpiti Coast	Otaki	105	94	61	87
	Mangaone	96	97	98	97
	Waikanae	116	111	129	118
Ruamāhanga	Kopuaranga	142	88	55	99
	Waingawa	111	87	72	91
	Waiohine	112	101	77	98
	Mangatarere	135	67	99	97
	Ruamahanga	117	71	60	85

Click the following links to return to climate summaries for:

- Wellington Harbour & Hutt Valley
- Te Awarua-o-Porirua
- Kāpiti Coast
- Ruamāhanga
- Wairarapa Coast

Minimum and maximum flows recorded during winter. Only one minor flood event occurred during spring bringing a 1-in-3 year return period flow down the Waikanae and Akatarawa rivers.

Whaitua	River	7-day Minimum Flow			Maximum Flow		
		Flow (m^3/s)	Date Begins	Return Period (years)	Flow (m^3/s)	Date	Return Period (years)
Wellington Harbour & Hutt Valley	Hutt (Kaitoke)	3.325	6-Oct	1	166	18-Oct	1
	Hutt(Taita Gorge)	10.715	11-Oct	1	613	29-Oct	1
	Akatarawa	2.387	11-Oct	1	326	29-Oct	3
	Mangaroa	0.9	20-Nov	1	60	29-Oct	1
	Wainuiomata	0.307	19-Nov	1	18	22-Sep	1
Te Awarua-o-Porirua	Porirua	0.255	20-Nov	1	10	22-Sep	1
	Pauatahanui	0.235	20-Nov	1	10	29-Oct	1
	Horokiri	0.252	23-Nov	1	8.4	29-Oct	1
Kāpiti Coast	Otaki	4.834	8-Nov	1	755	18-Oct	1
	Mangaone	0.14	11-Oct	1	13	29-Oct	1
	Waikanae	1.762	11-Oct	1	181	29-Oct	3
Ruamāhanga	Kopuaranga	0.547	23-Nov	1	29	23-Sep	1
	Waingawa	3.41	8-Nov	1	215	18-Oct	1
	Waiohine	8.606	8-Nov	1	695	18-Oct	1
	Mangatarere	0.546	11-Oct	1	20	18-Oct	1
	Tauherenikau	3.75	8-Nov	1	128	18-Oct	1
	Otukura	0.134	23-Nov		2.4	23-Sep	1
	Ruamahanga (Upper)	8.108	8-Nov	1	333	18-Oct	1
	Ruamahanga (Lower)	28.729	8-Nov	1	768	24-Sep	1

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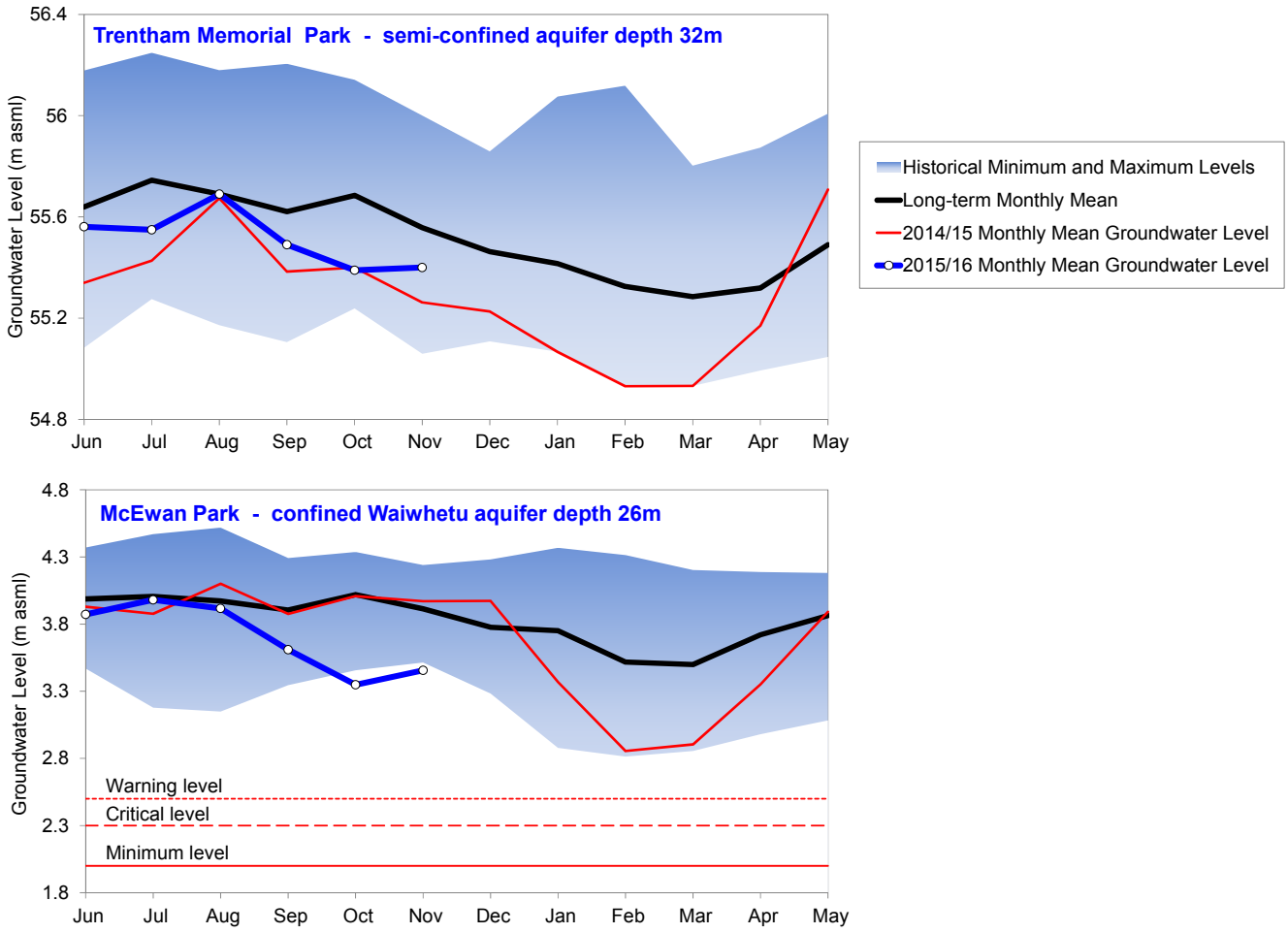
Groundwater levels

Wellington and Hutt Valley

Spring 2015 groundwater levels in two Hutt Valley bores compared to their long-term averages, the previous year's levels and historical extremes (blue envelope). The plots highlight that the groundwater levels have fallen below the long-term average during spring.

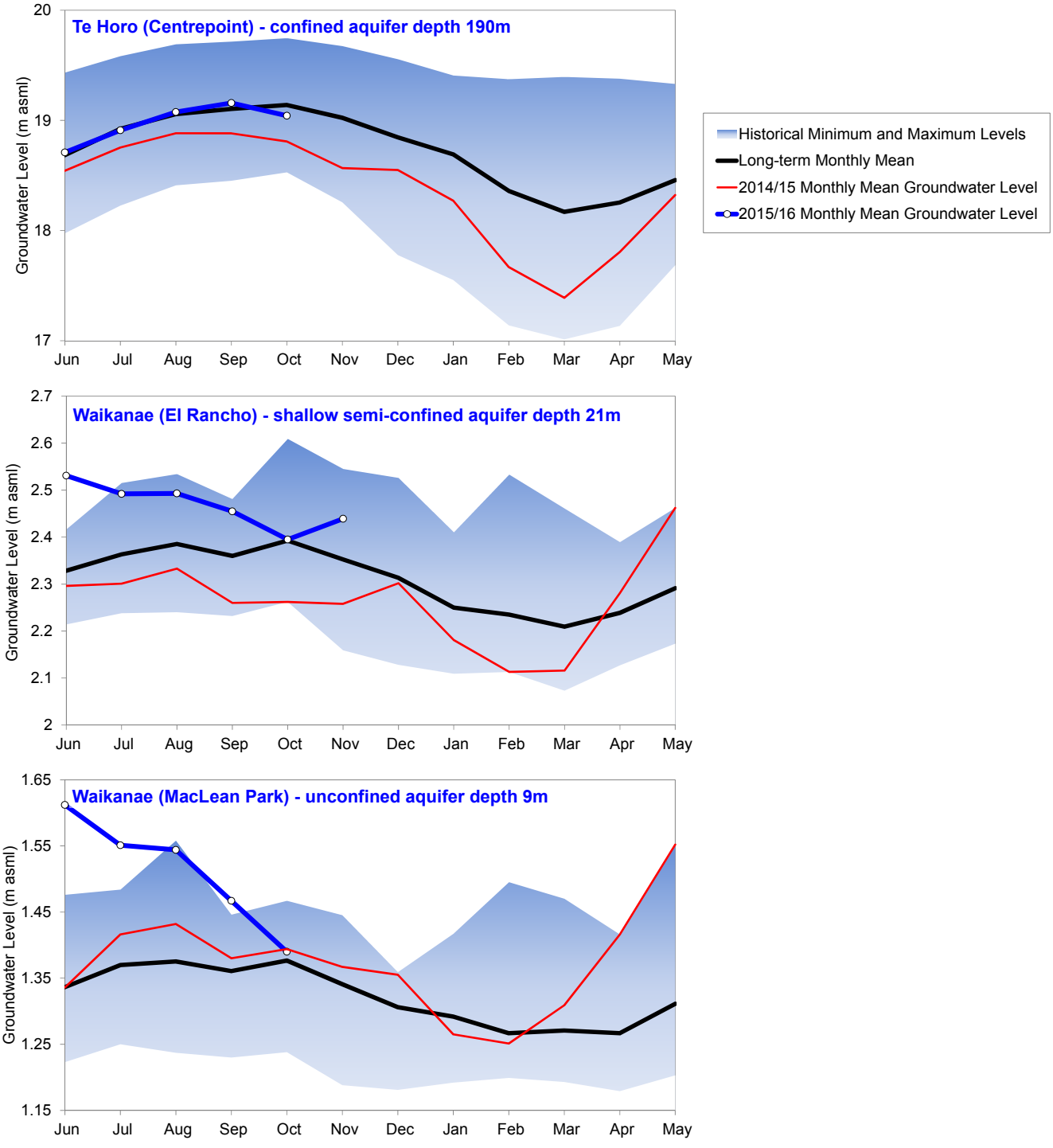
The October and November mean levels this year are the lowest in the groundwater level dataset that starts in 1990.



Kapiti Coast

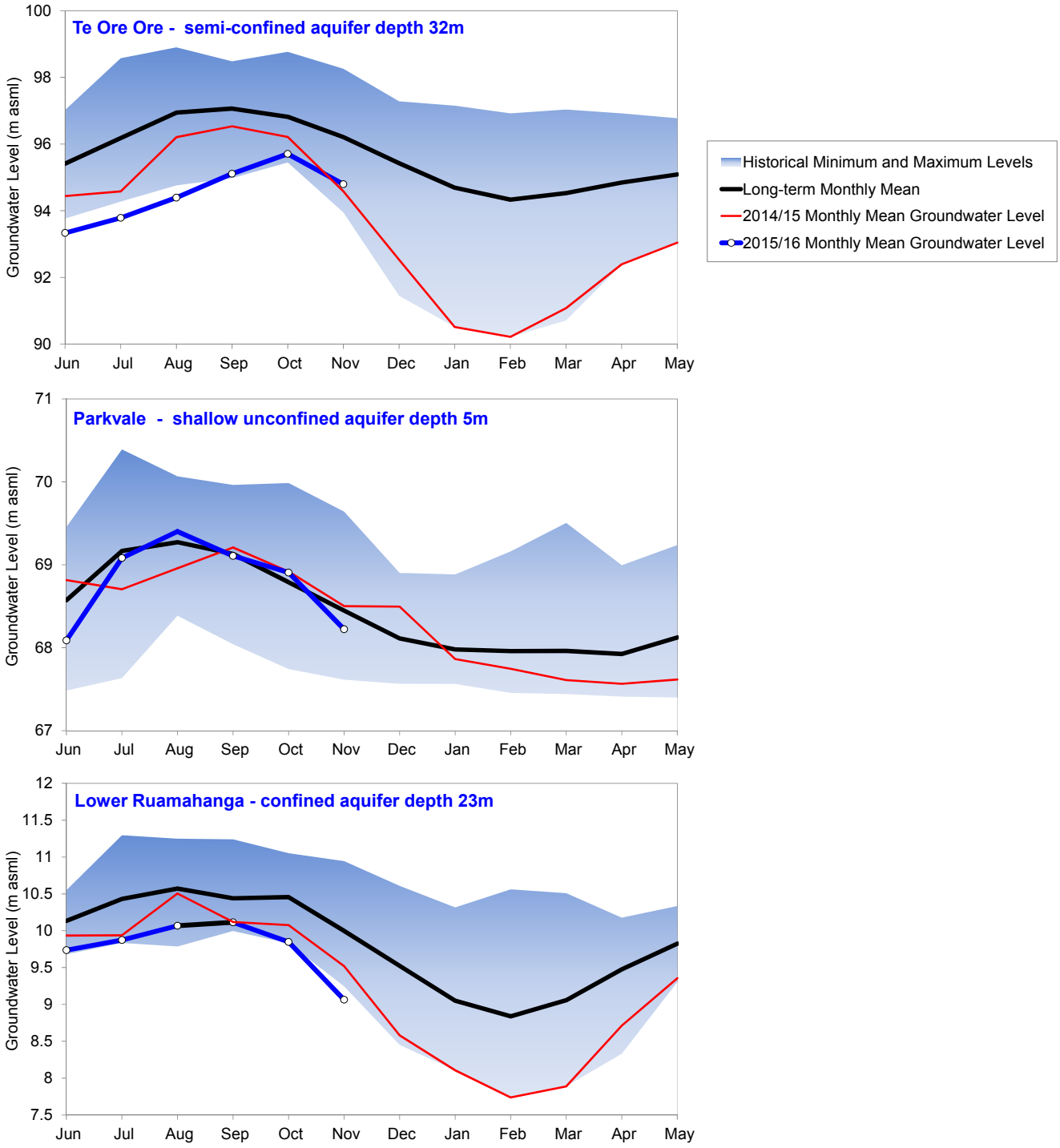
Spring 2015 groundwater levels in three Kapiti Coast bores compared to long-term averages, the previous year and historical extremes (blue envelope). The plots highlight that groundwater levels have come back to around average levels after a very wet autumn (see the 2014/15 line) and start of winter where shallow groundwater levels got very elevated.

Instance of ponding have been reported as occurring in some places on the Kapiti Coast due to the groundwater capacity being exceeded.



Ruamahanga

Spring 2015 groundwater levels in three Ruamahanga valley bores compared to their long-term averages, the previous year's levels and historical extremes (blue envelope). The plots highlight that levels in the two deeper aquifers (Te Ore Ore and Lower Ruamahanga) have been below average for some time – beginning in the 2014/15 year.

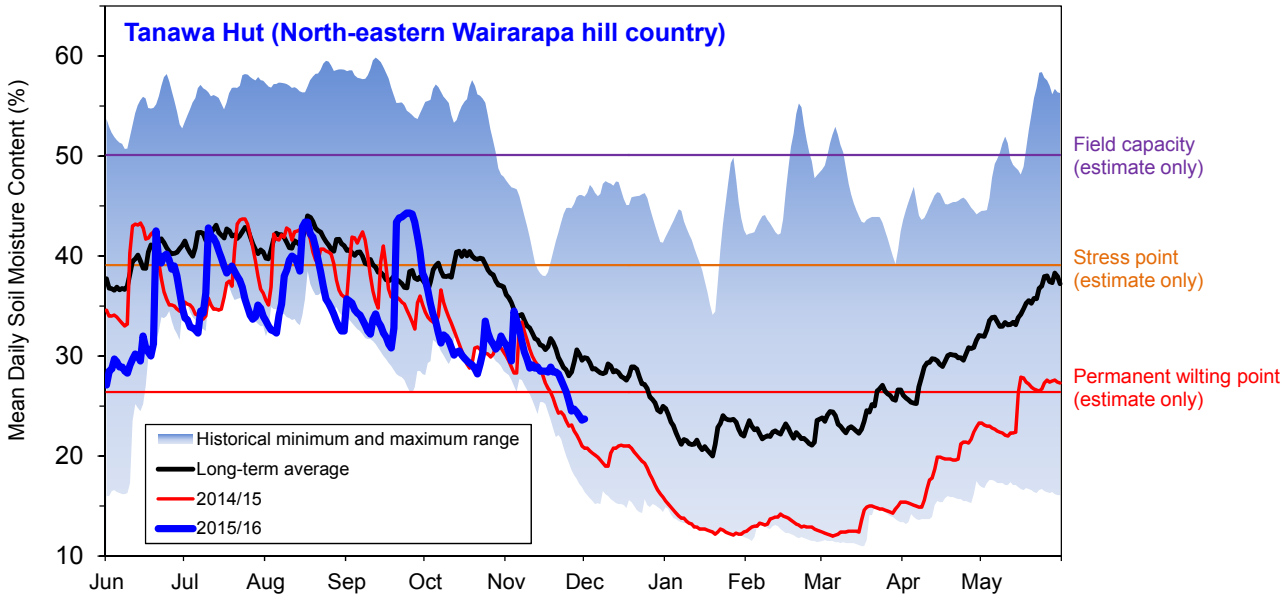


Soil moisture content

Wairarapa Coast

Spring 2015 soil moisture content at Tanawa Hut in north-east Wairarapa plotted against the historical mean, historical minimum and maximum (7-day average), and the year 2014/2015. The plot shows that the soil moisture level started spring at a low level before that 19-24 September large rainfall event elevated levels.

Levels at the end of December were below average but not as extreme as the previous 2014/15 year.



Drought monitoring

NIWA maintains a 'drought monitor' website that provides more information on soil moisture conditions (and other hydrological and climatic information relevant to drought assessment)

https://www.niwa.co.nz/climate/information-and-resources/drought

The Greater Wellington Regional Council's purpose is to enrich life in the Wellington Region by building resilient, connected and prosperous communities, protecting and enhancing our natural assets, and inspiring pride in what makes us unique

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September 2015
GW/ESCI-G-15/123