Hydrology of Marlborough Summary for December 2022

Report prepared by Charlotte Tomlinson, 10th January 2023.

Data from the Marlborough District Council's Environmental Monitoring network was primarily used in preparing this report and supplemented with data from sites operated by the Marlborough Research Centre, MetService, NIWA, and FENZ.

Executive Summary

December rainfall has been near or slightly below average for most of the region, with convective events producing localised rainfall over some areas. Looking at 2022 as a whole, it has been a wet year throughout the region, with all rainfall monitoring sites recording greater than average annual totals. Blenheim had its 4th wettest year in 2022 over the 92-year period from 1930 to 2022.

Soils throughout the region are slightly above normal moisture levels for this time of year, and compared to the same time last year, the soil moisture deficit is lower.

La Niña conditions continued in December, although neutral conditions are expected in early autumn. The marine heatwave around New Zealand continues. Rainfall and river flows are predicted to be near or above average through to March, with soil moisture near average.

Rainfall

December rainfall has been average or slightly below average in most parts of the region (see *Figure 1*). Convective weather events such as thunderstorms were experienced throughout the month, leading to localised rainfall in some areas.

Tunakino recorded just over half of average December rainfall, while to the east of the region, Flaxbourne recorded 66 mm of rain, which is 120% of average December rainfall.

Looking at the 2022 annual rainfall totals in Table 1, all rainfall monitoring sites in Marlborough surpassed their average annual rainfall totals in 2022. This is made more remarkable because of the monthly distribution of rainfall throughout the year. 2022 was the 4th wettest year on record for Blenheim in the period 1930-2022 (data courtesy of the Marlborough Research Centre). However, 6 months of the year (January, March, April, May, September, and October) recorded rainfall below average, which is unexpected in a year that had so much rain overall. December rainfall in Blenheim was near average, while the remaining 5 months (February, June, July, August, and November) had above average rainfall.

This pattern was repeated at rainfall sites across the region. In 2022 the Branch rainfall site had its 2nd wettest year in the period 1975-2022, with 133% of average yearly rainfall recorded. However, 6 months of the year recorded below average rainfall.

Tunakino rainfall in 2022 was even more extreme, as it was the wettest year recorded in the 43-year period from 1979-2022. 160% of average annual rainfall was recorded in 2022, despite 5 months of below average rainfall. This pattern of large monthly rainfall variation is seen at the Picton, Awatere and Flaxbourne rainfall sites as well (see *Figure 1*).

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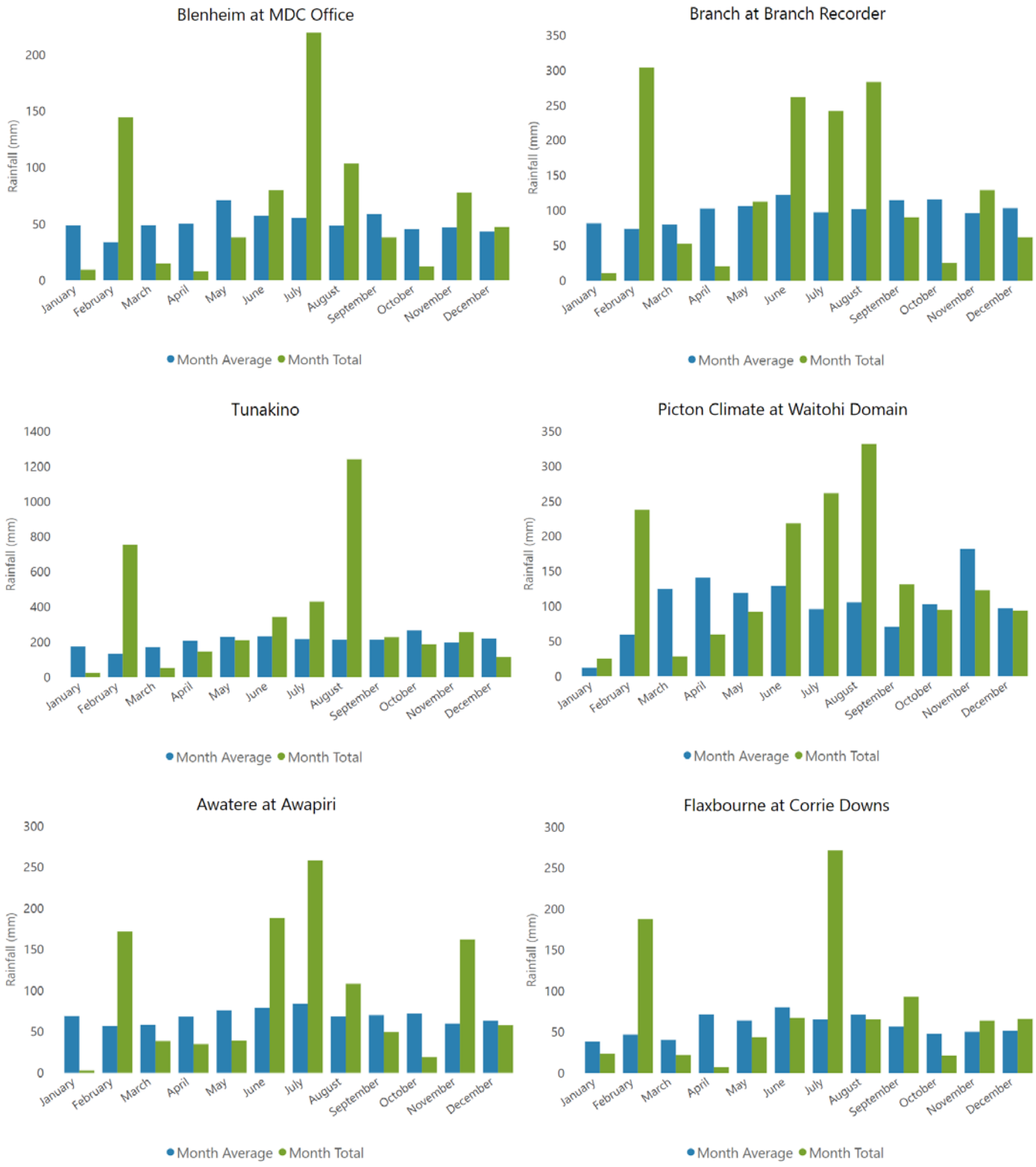

Figure 1. 2022 monthly rainfall totals from 6 key sites around Marlborough, compared to average monthly rainfall totals.

Table 1. Monthly and annual 2022 rainfall totals (mm) at rainfall monitoring sites in Marlborough.

Site	January	February	March	April	May	June	July	August	September	October	November	December	**Total**
Awatere at Awapiri	3	172	39	35	39	188	258	108	50	19	162	58	**1131**
Awatere Glenbrae NRFA	8	161	28	12	35	61	169	57	39	11	37	42	**661**
Beneagle at Farm Stream	10	157	21	13	76	86		94	78	21	92	60	**707**
Blenheim at MDC Office	10	145	15	8	38	80	220	104	38	13	78	48	**794**
Branch at Branch Recorder	11	304	53	20	113	262	242	283	90	25	129	62	**1594**
Flaxbourne at Corrie Downs	24	188	22	7	44	67	272	66	93	21	64	66	**934**
Kaituna Rainfall at Higgins Bridge	13	283	32	82	112	254	287	363	87	104		58	**1672**
Kenepuru Head NRFA	7	373	51	96	105	361	469	516	192	159	182	127	**2640**
Koromiko NRFA	30	301	44	45	99	244	337	287	186	130	126	148	**1976**
Lansdowne NRFA	14	263	43	42	71	161	298	239	88	25	130	50	**1423**
Malings	26	374	23	88	143	308	201	276	91	95	151	54	**1825**
Mid Awatere Valley NRFA	2	159	27	21	54	129	181	78	29	7	98	71	**855**
Molesworth NRFA	9	180	20	12	59	182	152	99	39	12	75	77	**918**
O Dwyers Road NRFA	13	211	29	19	56	122							**450**
Omaka at Ramshead Saddle	7	191	21	53	63	140	210	141	72	20	102	58	**1080**
Onamalutu at Bartletts Creek Saddle	13	331	47	86	119	326	459	450	130	124	147	97	**2328**
Onamalutu at Hilltop Road NRFA	19	356	47	85	106		462	448	135	169	167	88	**2080**
Picton Climate at Waitohi Domain	26	238	28	60	92	218	262	332	132	95	123	94	**1699**
Pudding Hill NRFA	11	211	17	16	76	144	98	124	49	23	90	62	**921**
Rai at Rai Falls	32	544	48	118	214	338	394	913	177	193	254	65	**3290**
Rai Valley NRFA	27	591	48	148	200	346	419	735	209	158	263	110	**3254**
Rarangi at Driving Range	9	251	35	18	64	160	324	186		58	121	76	**1301**

Table 1 (continued).

Site	January	February	March	April	May	June	July	August	September	October	November	December	**Total**
Red Hills	22	217	79	46	137	247	236	251	114	28	167	113	**1654**
St Arnaud NRFA	31	214	79	58	174	338	208	199	138	67	177	84	**1769**
Taylor at Taylor Pass Landfill	8	146	14	9	56	89	227	111	56	15	85	48	**864**
Taylor at Tinpot	9	216	22	38	75	142	310	138	105	47	107	70	**1279**
Te Rapa	52	251	47	31	71	72	378	86	133	32	65	82	**1300**
Top Valley at Staircase Ridge	17	357	59	115	116	320	388	410	114	57	165	72	**2191**
Tor Darroch NRFA	19	216	32	49	76	170	248	164	79	20	139	91	**1304**
Tunakino	25	755	54	145	210	344	431	1242	228	187	257	117	**3993**
Upper Clarence NRFA	12	180	19	5	42	91	93	34	28	14	68	47	**634**
Waihopai at Craiglochart	9	204	20	29	56	125	218	128	61	19	79	45	**993**
Waihopai at Spray Confluence	6	199	34	36	73	187	235	163		10	109	84	**1137**
Waikakaho	13	251	49	25	67	177	358	6	94	54	115	79	**1287**
Waikawa at Boons Valley	67	164	20	41	78	114	139	143	119	84	53	139	**1159**
Wairau at Narrows	8	216	26	37	84	157	292	246	79	51	103	65	**1360**
Wairau Valley at Southwold	10	245	35	42	77	185	310	273	77	35	89	42	**1418**
Wakamarina at Twin Falls	37	418	27	91	200	359	318	590	183	186	228	64	**2700**
Ward NRFA	29	192	40	23	66	77	294	65	87	24	80	67	**1044**
Wye at Charlies Rest	21	250	33	30	94	195	215	208	95	22	125	87	**1373**

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River Flows

River flows were generally lower than average in December, with most river flows declining until a small fresh around the 20th, then declining flows again for the rest of the month.

The Kaituna and Ohinemahuta rivers both had an additional fresh on Christmas Eve, as the result of localised rainfall in the area.

Convective rainfall in the upper Awatere and Waihopai Valleys lead to a fresh in both rivers on the 18th of December, followed by a further fresh from more widespread rainfall on the 20th. Both rivers had near average monthly flow (see Table 2) due to the input of these rain events.

The rainfall on the 20th of December also led to a fresh in the Branch and Wairau rivers. Peak flow in the Wairau River at Barnetts Bank was 115 m^3/s on the 21st of December. The Branch River and Wairau River at Barnetts Bank had 68% and 63% of average monthly flows respectively.

Table 2. A summary of river flows in Marlborough for December 2022.

River	Site	December mean flow 2022 (m^3/s)	December mean flow all records (m^3/s)	% of monthly average	Records begin	Catchment area (km^2)
Pelorus	Bryants	7.74	19.64	39	1977	375
Rai	Rai Falls	5.46	11.08	49	1979	211
Kaituna	Higgins Bridge	1.61	2.53	63	2006	133
Branch	Intake Weir	14.76	21.61	68	1958	550
Wairau	Barnetts Bank	55.95	88.74	63	1960	3,430
Wairau	Dip Flat	22.56	33.50	67	1951	505
Ohinemahuta	Domain	0.30	0.70	42	1998	33
Waihopai	Craiglochart	11.51	12.25	94	1960	764
Awatere	Awapiri	12.51	13.24	94	1977	987
Omaka	Gorge	0.51	0.74	68	1994	90
Taylor	Borough Weir	0.17	0.31	54	1961	64
Flaxbourne	Corrie Downs	0.10	0.15	65	2003	70

Soil Moisture

Marlborough Research Centre data shows that average shallow soil moisture was 26.6% in December 2022, compared to the 21.5% long term average. Soil moisture declined throughout the month from 28.5% on the 1st of December to 23.4% on the 31st of December.

The soil moisture deficit map below (from the 8th of January 2023) shows less soil moisture deficit than this time last year and the historical average (see *Figure 2*).

The soil moisture anomaly map (*Figure 3*) shows soils throughout the region are at or above normal moisture levels for this time of year. Soils in the Awatere and Wairau Valleys are 10-20 mm wetter than normal for this time of year.

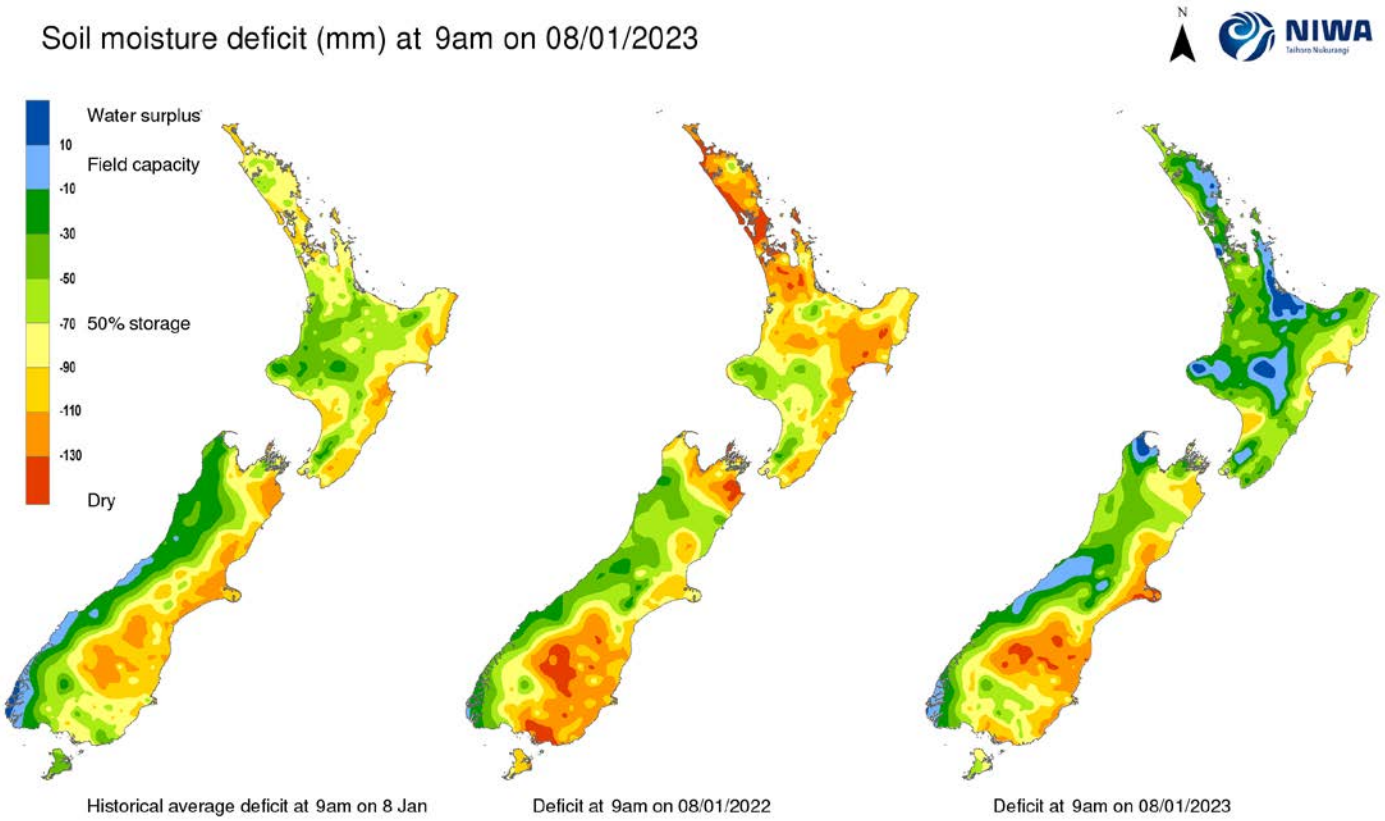

Figure 2. Soil moisture deficit maps of New Zealand, retrieved from NIWA on 08/01/2023.

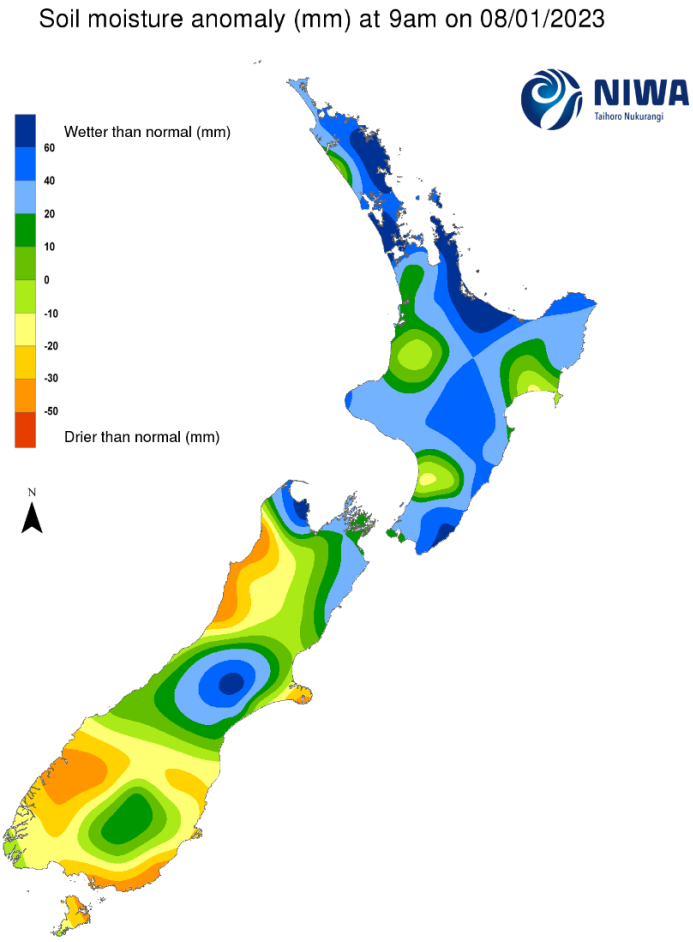

Figure 3. Soil moisture anomaly map of New Zealand, retrieved from NIWA 08/01/2023.

NIWA Seasonal Climate Outlook January – March 2023

La Niña continued in December; however neutral conditions are expected by early autumn. The marine heatwave intensified around the country, with surface sea temperatures 1.1 to 1.8°C above average. Air pressure over the South Island and further south is forecast to be higher than normal, and lower than normal north of the country. This will likely result in an easterly air flow anomaly over the summer season. The risk for ex-tropical cyclone activity is normal-to-elevated through to April. The warmer seas could lead to heavy rainfall in the first weeks of January; however, a dry period is possible from mid to late January.

The predictions for Marlborough/Tasman from January to March are:

- Temperature – near or above average
- Rainfall – near or above average
- Soil Moisture – near average
- River Flows – near or above average