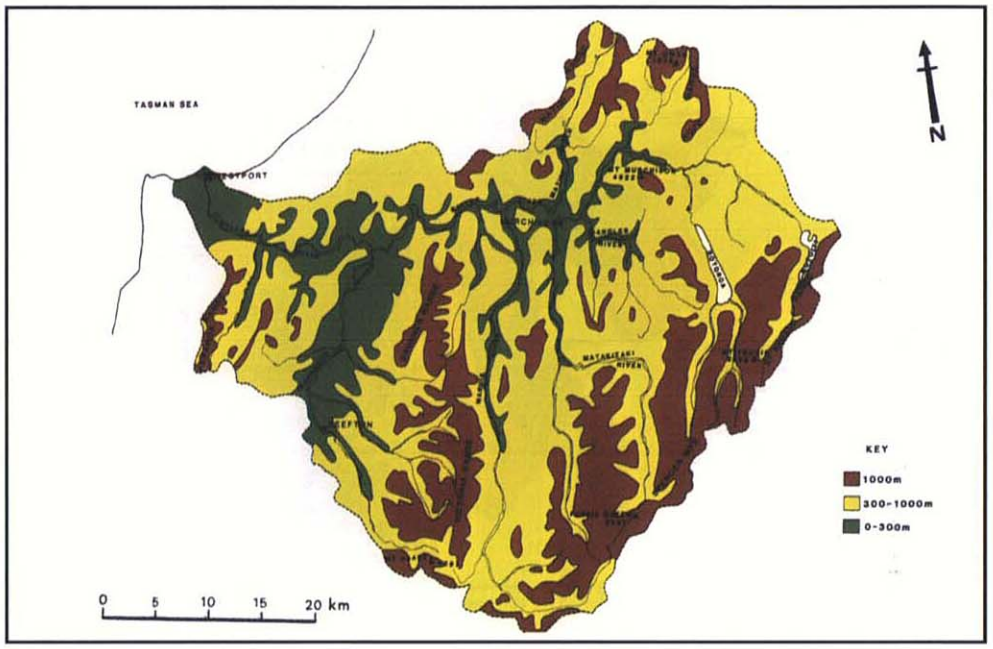
Buller River

Map of River



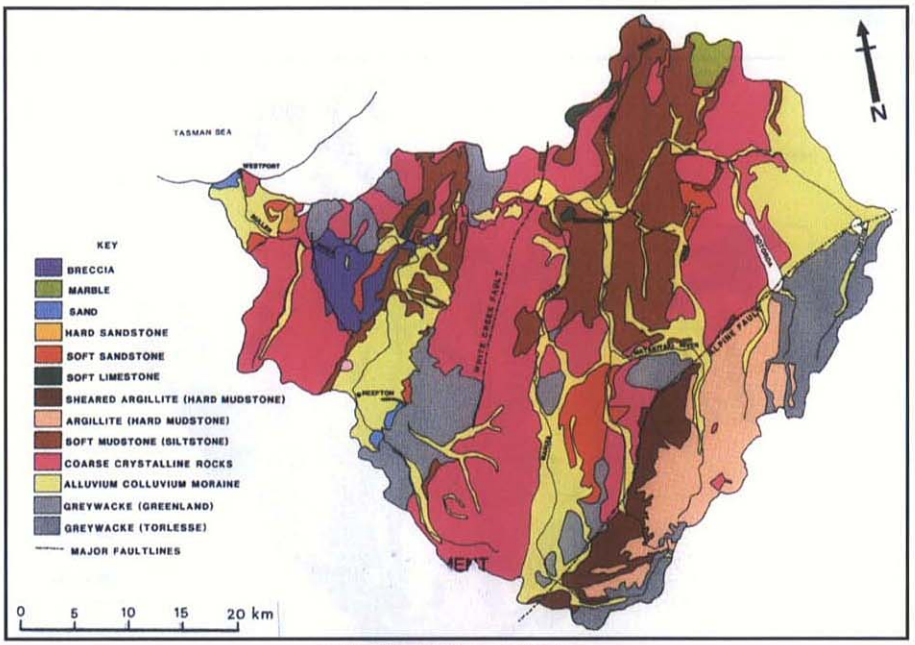
Buller River catchment: relief
(source: Westland catchment Board, 1987)

Table of Basic Data

Name: Buller River		**Serial No.:** New Zealand-1
Location: South Island, New Zealand	S 41° 29′ ~ 42° 24′	E 171° 35′ ~ 172° 54′
Area: 6 480 km^2	**Length of main stream:** 159 km	
Origin: Lake Rotoiti	**Highest point:** Mt. Travers (2 338 m)	
Outlet: The Tasman Sea	**Lowest point:** River mouth (0 m)	
Main geological features: Coarse crystalline basement rocks (granite and gneiss), Cambrian to Ordovician sandstones and mudstones, Tertiary limestones and sandstones, and Quaternary fluvioglacial sediments.		
Main tributaries: Inangahua River (280 km^2), Maruia River (366 km^2), Matakitaki River (245 km^2)		
Main lakes: Rotoroa, Rotoiti, and Matiri		
Main reservoirs: None		
Mean annual precipitation: 1 580 mm at Lake Rotoiti, 1961~1990 (representative of central catchment)		
Mean annual runoff: 426m^3/s at Te Kuha (6 350 km^2) (1964~1993)		
Population: 9 220 (1981)	**Main settlements:** Westport, Murchison, Reefton	
Land use: Forest (71.7%), Pasture (8.0%), Shrubland (6.7%), Sub-alpine vegetation (12.3%), Other (1.3%) (1980)		

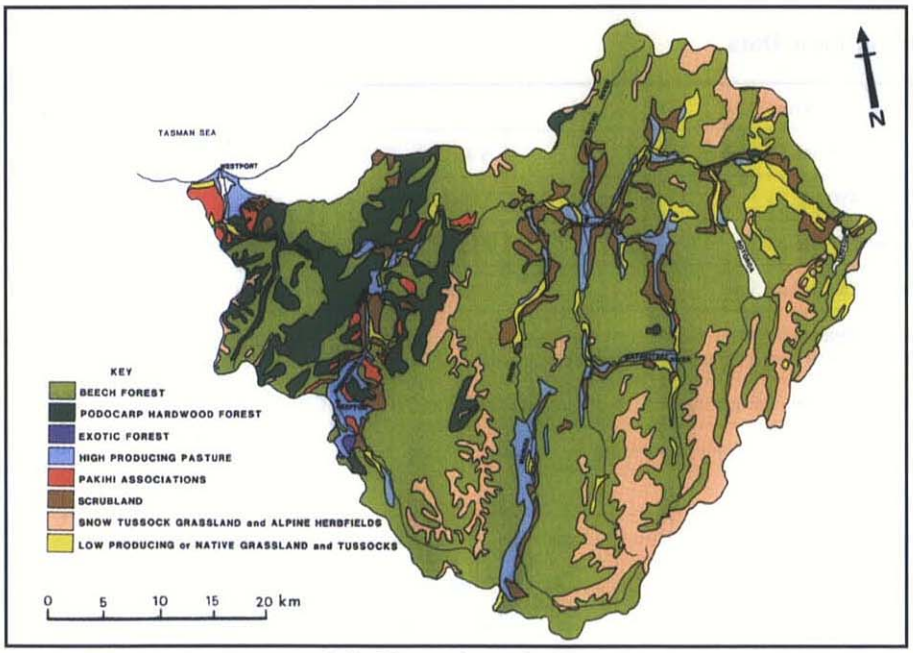
2. Geographical Information

2.1 Geological Map



Buller River catchment: lithology
(source: westland catchment Board, 1987)

2.2 Land Use Map



Buller River catchment: landuse
(source: Westland Catchment Board, 1987)

1. General Description

Although the Buller River is not the largest river in New Zealand in terms of mean flow or catchment area, it holds the country's record for instantaneous peak discharge, estimated at 10 400 m^3/s from the catchment area of 6 420 km^2. The main river is 159 km long from its point of outflow from Lake Rotoiti, which in turn is about 30 km from the most upstream point in the catchment, in the Spencer Mountains of Nelson Lakes National Park. The river flows westwards into the Tasman Sea, through the Buller Gorge. Much of the catchment has a forested, hilly to mountainous landscape which is highly regarded for its scenic beauty.

Because of its location on the West coast of the South Island and its exposure to the rain-bearing westerly winds blowing in from the ocean, the catchment receives rainfall which is abundant and rather evenly distributed throughout the year, but with a spring maximum. Precipitation varies from about 2 000 mm/year at the coast to about 6 000 mm/year in the headwaters of the Spenser Range. There is a marked rainshadow in the mid to upper catchment, between Murchison and St. Arnaud, where precipitation is of the order of 1 500 mm/year.

The population of the catchment is only 9 220 persons (1981 census), and the catchment is over 90% forest, shrubland, or alpine grassland, rock and ice. There is negligible development of the Buller's waters for human use, except for domestic and stock water supply, recreation, and recreational fishing. The river is subject to a National Water Conservation Order, which strictly limits water resources development. Nevertheless, there has been long interest in the hydro-electricity potential of the catchment. The first flow recorders were established in the 1930s to assess this potential, and the most recently established, on the Matiri River, has the same purpose.

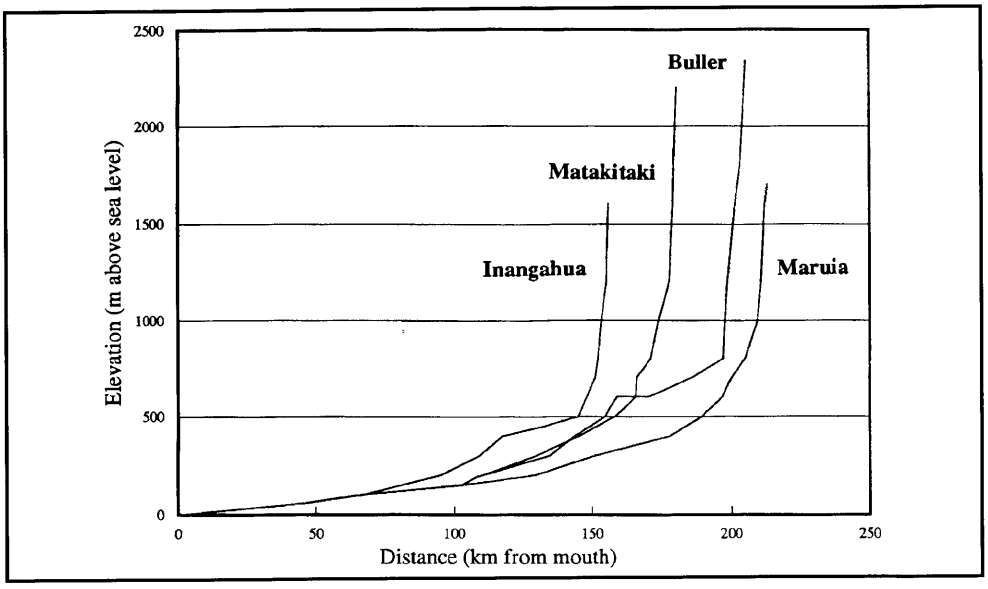
The principal water resource management issues in the Buller catchment is the need to reconcile pressure to develop the hydro-electricity potential and the desire to retain the river system in a pristine condition. Flooding and bank erosion present threats to two or three small towns and a number of road and rail bridges, and to the pasture lands along the limited areas of floodplain.

2.3 Characteristics of River and Main Tributaries

No.	Name of river	Catchment area [km^2]	Highest peak [m] Lowest point [m]	Settlements (population in 1994)	Land use (%) (1980)
1	**Buller** (Main River)	6 480	Mt. Travers, 2 338 ----------	Westport 5 000	F (71.7) G (8.0)
2	**Inangahua** (Tributary)	1 100	Victoria Range, 1 730 ----------	Reefton 1 000	L (1.3) SA (12.3)
3	**Maruia** (Tributary)	1 000	Mt. Technical, 1 867 ----------		SL (6.7)
4	**Matakitaki** (Tributary)	800	Mt. Ella, 2 256 ----------		

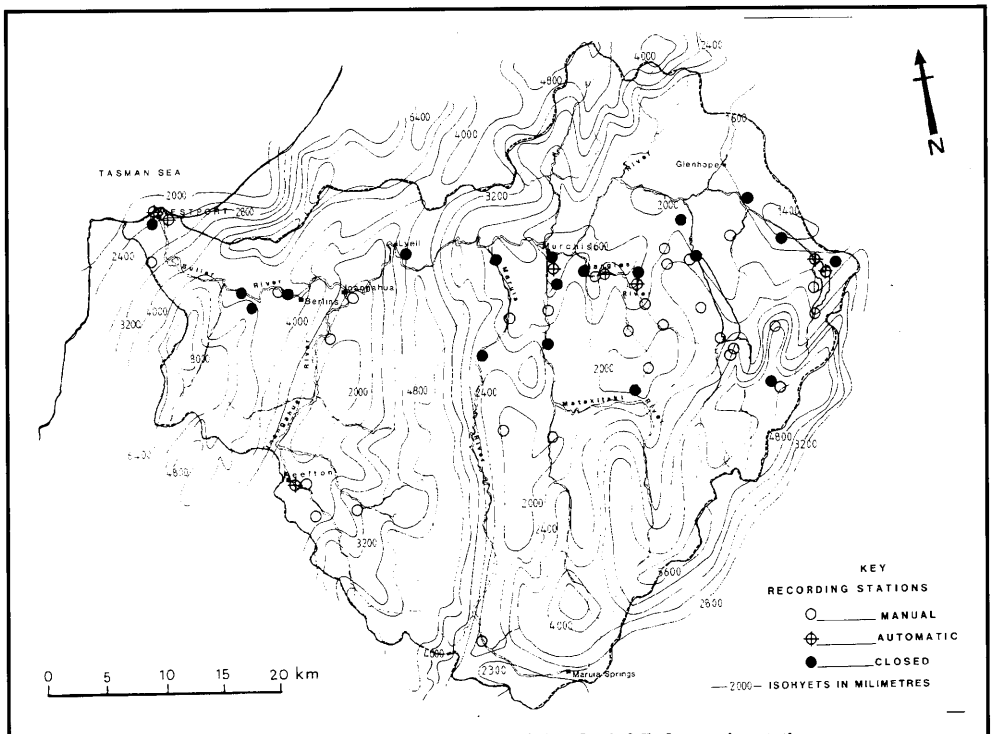
F: Forest G: Grazing (or Pasture) L: Lake, River, Marsh SA: Sub-alpine vegetation SL: Shrubland

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



Buller River catchment: mean annual rainfall and rainfall observation stations (source: Westland Catchment Board, 1987

3.2 List of Meteorological Observation Stations

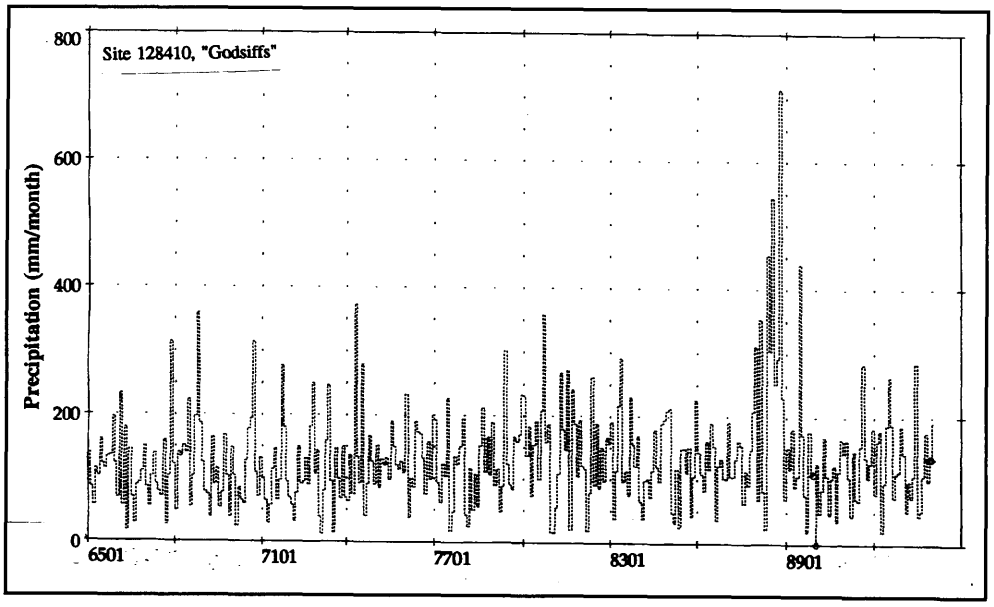
No.[1]	Station	Elevation [m]	Location[2]	Observation period	Mean annual precipitation [mm], 1961~90	Observation items
F12882	Lake Rotoiti	634	S 41° 48′ E 172° 51′	1958~present	1 580	Climate station
F21182	Reefton	198	S 42° 07′ E 171° 52′	1960~present	1 989	Climate station
F12831	Murchison	160	S 41° 48′ E 172° 20′	1946~1987	1 563	Precipitation
F12842	Mangles Valley	232	S 41° 50′ E 172° 24′	1956~present	1 605	Precipitation
128410	Godsiffs	236	M29:662311	1964~present	1 608	Precipitation intensity
128802	L Rotoiti Outlet	634	N29:968338	1963~present	1 556	Precipitation intensity
212913	Craigs Clearing	279	L31:230883	1964~1992	2 076	Precipitation intensity

1) : Meteorological Service of New Zealand code number (F prefix) or National Institute of Water & Atmospheric Research code number.
2) : Latitude/longitude or New Zealand map reference

3.3 Monthly Climate Data

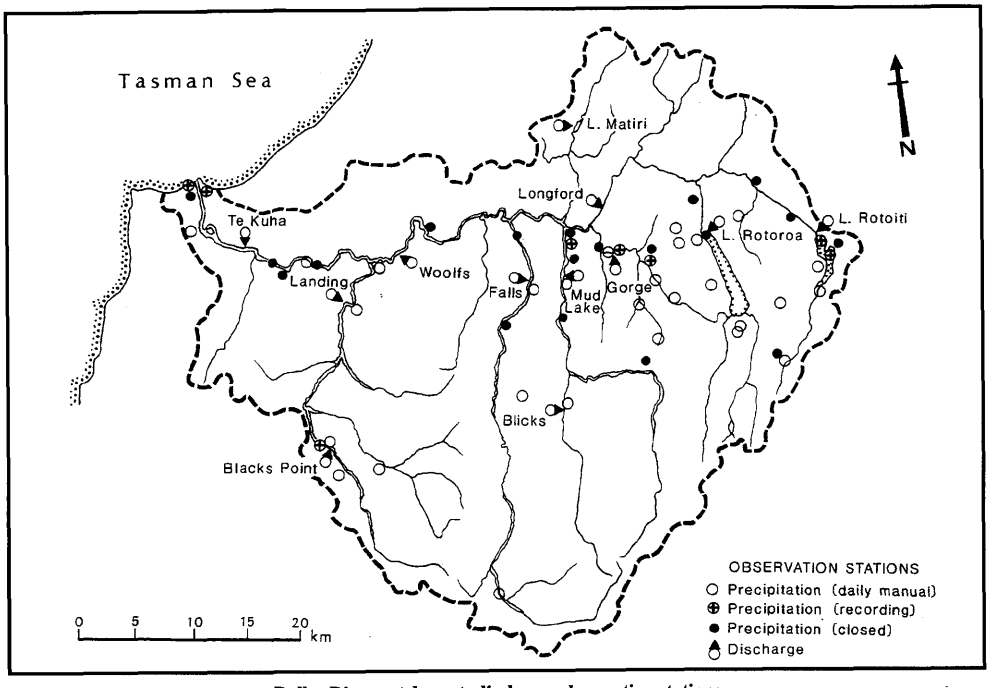
Observation item	Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	Lake Rotoiti	14.6	14.6	13.0	9.6	6.2	3.8	3.2	4.6	6.6	8.8	11.0	13.1	9.1	1961~1990
Precipitation [mm]	Lake Rotoiti	134	96	114	131	139	125	125	118	142	160	149	147	1 580	1961~1990
Duration of sunshine [hr]	Westport Aerodrome	218	183	173	154	126	111	123	147	153	161	183	205	1 937	1937~1976

3.4 Long-term Variation of Monthly Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



Buller River catchment: discharge observation stations
(soures: Westland Catchment Board, 1987)

4.2 List of Hydrological Observation Stations

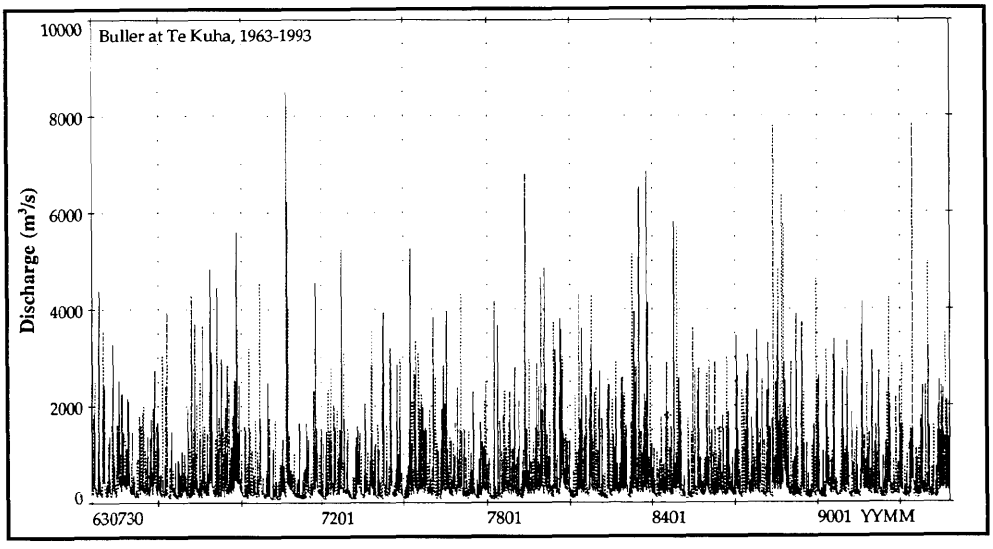
No.[1]	Station	Location[2]	Catchment area (A) [km^2]	Observation period	Observation items (frequency)
93202	**Buller at Longford**	M29:590380	1 410	1963~present	Q(15 min.), S(periodic), WQ(m)
93203	**Buller at Te Kuha**	K29:020295	6 350	1963~present	Q(15 min.), S(periodic), WQ(m)
93206	**Inangahua at Landing**	L29:182212	1 000	1963~1991	Q(15 min.), S(periodic)
93207	**Inangahua at Blacks Point**	L30:172976	234	1965~present	Q(15 min.), S(periodic)
93208	**Buller at Woolfs**	L29:261297	4 560	1963~1994	Q(15 min.), S(periodic)
93209	**Maruia at Falls**	L29:4782734	980	1963~1991	Q(15 min.), S(periodic)
93211	**Matakitaki at Mud Lake**	M29:532287	857	1963~1991	Q(15 min.), S(periodic)
93212	**Mangles at Gorge**	M29:624322	284	1958~1990	Q(15 min.), S(periodic)
93213	**Gowan at Lake Rotoroa**	M29:763348	368	1934~1991	Q(15 min.), S(periodic)
93214	**Matiri at Lake outlet**	M29:545492	136	1979~1993	Q(15 min.), S(periodic)
93216	**Buller at Lake Rotoiti**	N29:952339	195	1951~1994	Q(15 min.), S(periodic)
93217	**Glenroy at Blicks**	M30:547053	198	1966~1980	Q(15 min.), S(periodic)

No.	$\overline{Q}$ [m^3/s]	Q_{sd} [m^3/s]	Q_{maf} [m^3/s]	Q_{max} [m^3/s]	Q_{min} [m^3/s]	$\overline{Q}/A$ [$m^3/s/100km^2$]	Q_{maf}/A [$m^3/s/100km^2$]	Period of statistics
93202	74.2	61.4	679	1 060	14.1	5.26	48.2	1963~present
93203	426	474	4 780	8 500	66.6	6.71	75.2	1963~present
93206	75.1	116	1 480	2 520	7.44	7.51	148.2	1963~1991
93207	16.0	27.4	454	988	1.31	6.84	194.0	1965~present
93208	255	255	2 840	5 040	54.1	5.59	62.2	1963~1994
93209	59.0	65.8	788	1 490	11.3	6.02	80.4	1963~1991
93211	55.7	53.1	689	1 220	13.0	6.50	80.4	1963~1991
93212	9.86	12.8	169	286	1.02	3.47	59.5	1958~1990
93213	26.6	14.5	85.7	167	4.59	7.23	23.3	1934~1991
93214	13.0	19.1	184	262	1.16	9.56	135.3	1979~1993
93216	12.9	9.77	69.1	117	2.41	6.62	35.4	1951~1994
93217	10.3	9.92	178	286	1.86	5.20	89.9	1966~1980

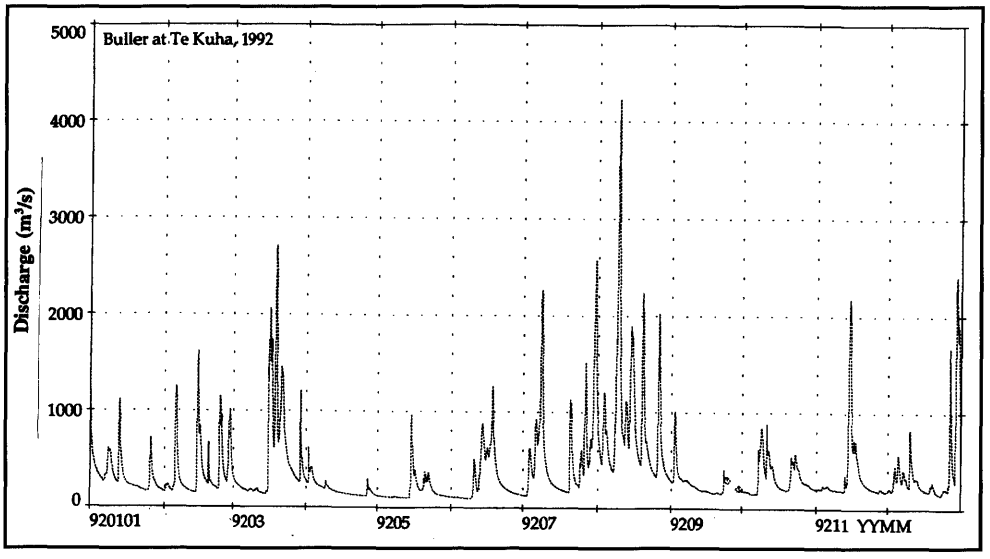
1) : National Institute of Water & Atmospheric Research code number.
2) :New Zealand map reference
Q: Discharge, S: Sediment concentration, WQ: Water quality

$\overline{Q}$: Mean discharge;
Q_{sd} : Standard deviation of discharges;
Q_{maf}: Mean annual flood;
Q_{max}: Maximum instantaneous discharge;
Q_{min}: Minimum instantaneous discharge.

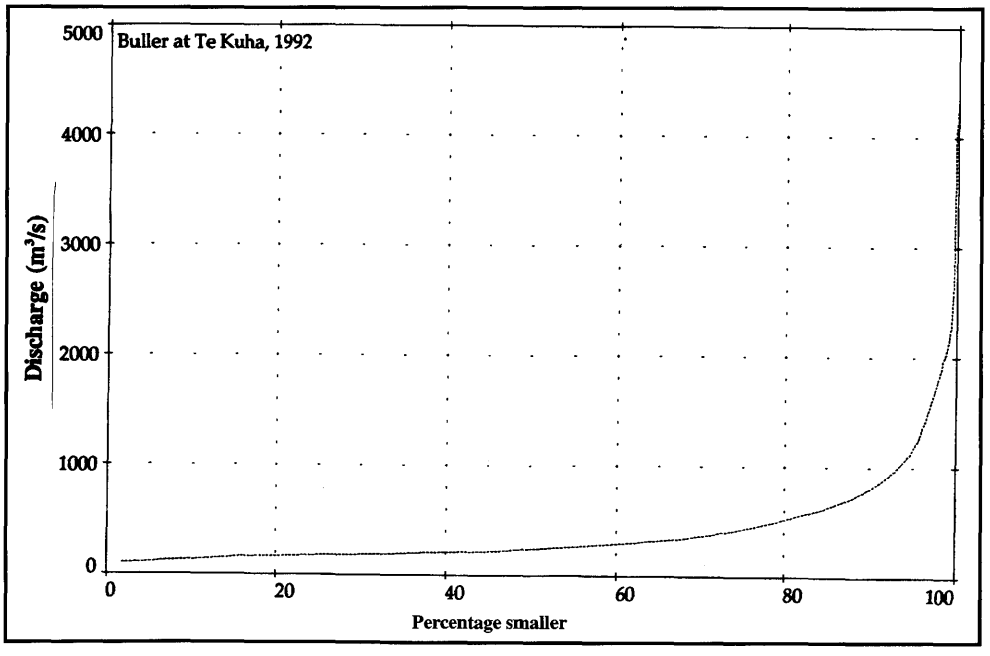
4.3 Long-term Variation of 15-minute Discharge



4.4 Annual Pattern of Discharge



4.5 Flow Duration Curve



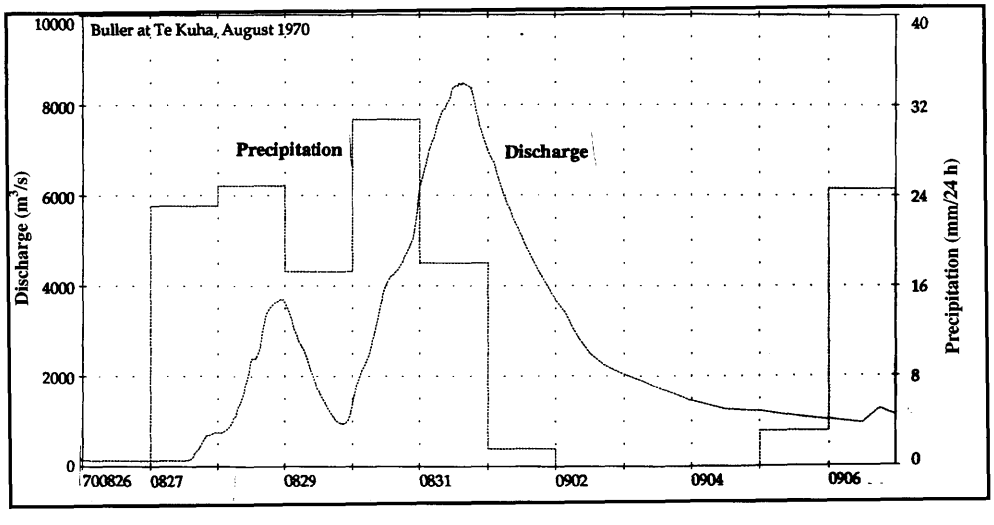
4.6 Annual Maximum and Minimum Discharges

Buller at Te Kuha [6 350 km^2]

Year	Maximum [1]		Minimum [2]		Year	Maximum [1]		Minimum [2]	
	Date	[m^3/s]	Date	[m^3/s]		Date	[m^3/s]	Date	[m^3/s]
1963	11.08	4 390	12.26	136	**1979**	5.07	6 790	3.28	98.3
1964	1.08	3 560	4.25	118	**1980**	1.24	4 880	5.13	107
1965	11.18	2 740	4.23	103	**1981**	4.29	4 330	1.27	90.8
1966	4.26	3 950	9.05	94.1	**1982**	5.20	3 080	5.07	91.1
1967	11.16	4 830	2.28	104	**1983**	10.21	6 840	3.23	100
1968	10.30	5 610	2.28	118	**1984**	10.18	5 810	3.02	116
1969	9.08	4 550	3.29	104	**1985**	6.21	3 620	4.17	81.6
1970	8.31	8 500	2.21	86.1	**1986**	1.25	3 020	4.02	129
1971	10.03	4 570	4.06	93.1	**1987**	10.13	3 570	3.30	120
1972	10.07	5 850	3.04	79.7	**1988**	5.20	7 780	5.08	106
1973	11.21	3 710	3.03	71.9	**1989**	12.16	4 630	9.14	104
1974	4.14	3 940	4.03	87.1	**1990**	8.13	3 390	3.08	96.7
1975	4.02	5 250	1.17	87.1	**1991**	8.17	4 170	3.27	102
1976	7.15	3 970	4.28	85.3	**1992**	8.09	4 240	6.08	101
1977	1.19	4 340	8.28	100	**1993**	6.13	7 830	5.03	98.5
1978	3.28	4 170	3.18	66.6					

1), 2) : Instantaneous observation by recording chart

4.7 Hyetographs and Hydrographs of Major Floods



5. Water Resources

5.1 General Description

The Buller River catchment occupies about 7% of the South Island. Mean annual discharge is 426 m^3/s (specific discharge of 67 $l/s/km^2$), high by New Zealand standards because of the exposure of the catchment to the rain-bearing westerlies coming in from the Tasman. Flood events are frequent, and the maximum recorded flow, at 10 400 m^3/s (640 $l/s/km^2$), is the highest measured in New Zealand. Monthly flows are greatest in spring to early summer, and are least in late summer. This pattern reflects the distribution of rainfall through the year. Winter precipitation is received as snowfall in parts of the headwaters, also contributing to the pattern.

Generally, soils are thin and bedrock is poorly permeable, so that the hydrological regime could be characterised as "flashy". Three of the sub-catchments - about 10% of the whole catchment - are controlled by natural lakes (Lake Rotoiti, catchment area 195 km^2; Lake Rotoroa, catchment area 368 km^2; Lake Matiri, catchment area 136 km^2). This moderates peak flows form the three sub-catchments, and to a lesser and decreasing extent along the main river system. The extensive (almost 80%) forest and shrubland cover should have a similar moderating influence on flows.

The rivers experience periods of low flows, with a minimum 7-day low flow of 88.4 m^3/s (14 $l/s/km^2$) experienced at Te Kuha in 1973. Nevertheless, the concept of drought occurrence has little relevance in the Buller catchment, because of both the generally equable distribution of precipitation and the limited human population which is dependent on the water resource.

5.2 Major Floods and Droughts

A narrative chronology of flooding on the West Coast of the South Island has been established, for the period 1846~1990, by the West Coast Regional Council. Because of the small population and limited economic development in the Buller catchment, impacts in terms of damage and loss of life have been relatively limited. Heavy rain associated with frontal systems and, less frequently, thunderstorms, is the usual cause of water-related damage in the Buller catchment. Mention of damage in the catchment is frequently related to road closures due to landslides and washouts, rather than to flooding per se.

Major Floods at Te Kuha [6 350 km^2]

Date	Peak discharge [m^3/s]	Dead or missing	Damage
1846, February 22			None. Exploration of river by Brunner was hindered.
1863			Westport CBD flooded.
1868, January			Extensive damage to wharves at Westport.
1870, May		1 dead	Inangahua area flooded for 2 weeks.
1872, February			Westport flooded and several wharves and buildings washed away.
1905, June			Westport flooded.
1925, September			Buller Gorge road flooded and Westport cut off. Bridges washed out and roads blocked.
1926, October			Buller Gorge road extensively damaged by washouts. Westport flooded.
1926, November	7 650		Extensive flooding of Westport and widespread damage to roads and railway.
1942, April			Severe flooding in the Buller and Murchison area; widespread damage to roads.
1942, July			Westport extensively flooded. Widespread damage to roads.
1950, May	12 460 at 5 910 km^2		Extensive flood damage and losses of livestock.
1955, February			Heavy flooding in Buller Gorge Westport, and low-lying areas. Many roads blocked.
1970, August	8 500		Widespread flooding and damage to roads; river bank erosion common.
1977, June			Extensive flooding in Westport; international rugby match disrupted.

The 1846~1990 narrative makes frequent mention of other rivers on the West Coast, and relatively infrequent mention of the Buller and its tributaries. The towns of Hokitika and Greymouth, further south, are both very frequently mentioned (both are ports at river mouths, and flood-prone). This may be a combination of lower rainfall in North Westland, and the lesser potential for damage to infrastructure in the Buller catchment. Westport, as the largest settlement and also a port at the mouth of the Buller River, has suffered the greatest damage from floods over the period of European settlement (i.e. since 1846). The Buller Gorge has been closed to road and rail traffic on many occasions; specific mention occasions is not warranted.

Droughts are not a significant concern in the Buller catchment, and no record of droughts is available.

5.3 Water Quality

River Water Quality[1] at Te Kuha, 1993

Date	Jan 19	Feb 16	Mar 18	Apr 20	May 18	Jun 22	Jul 27	Aug 19	Sep 21	Oct 21	Nov 25	Dec 14
pH	7.41	7.55	7.60	7.63	7.48	7.48	7.29	7.65	7.65	7.58	7.69	7.60
BOD [g/m^3]	0.95	0.7	0.4	0.35	0.15	0.9	0.7	0.05	2.15	0.55	0.35	0.2
Conductivity [µ/S/cm]	49.4	73.1	66.1	75.8	63.2	54.7	36.4	72.7	76.1	51.5	66.3	71.6
Turbidity [FTU]	16	0.75	1.6	0.48	5.0	6.7	18	3.3	1.2	39	2.3	0.6
Total N [ppb]	205	135	110	75	235	250	165	85	235	280	180	105
Total P [ppb]	38	5	5	5	28	26	40	3	10	120	12	2
Discharge 2) [m^3/s]	1 090	161	170	137	508	782	1 030	230	226	1 140	316	214

1) Observed once a month on a dry day normally several days after rainfall.
2) Discharge on the observation date.

6. Socio-cultural Characteristics

During the early period of European settlement (1840s through to the 1860s), the Buller and its main tributaries were used by explorers, surveyors and mineral prospectors for access routes. Subsequently, they have provided the routes for the few roads and the single rail-line that penetrate this sparsely settled part of New Zealand. The principal settlements, Reefton, Inangahua, and Murchison are located beside the river or its tributaries; Westport at the mouth of the river is a small port for coastal shipping. Other settlements have existed in the past, such as Lyell and Owen River, but these have largely been abandoned as their reason for existence - gold - ceased.

Because of remoteness from population centres and the unstable and earthquake-prone nature of the landscape, the Buller's water resources have never been developed on a large scale. The river is now highly regarded as a recreational fishery and for recreational activities such as kayaking and rafting. Its scenic value, particularly in the Upper and Lower Gorges, is also significant. The river was proposed for, and has received, protection under the Resource Management Act, through the mechanism of a National Water Conservation Order. Effectively, this Order ensures that the Buller and its major tributaries will remain in a largely pristine condition.

7. References, Databooks and Bibliography

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