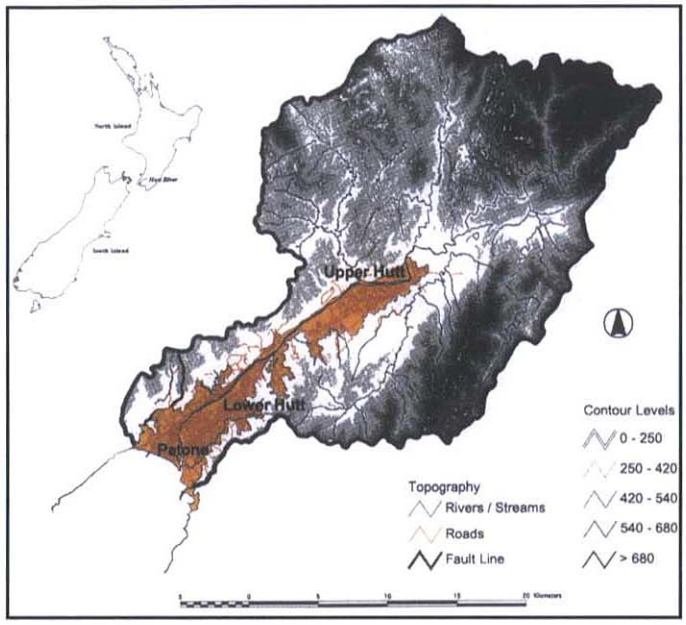
Hutt River

Map of River



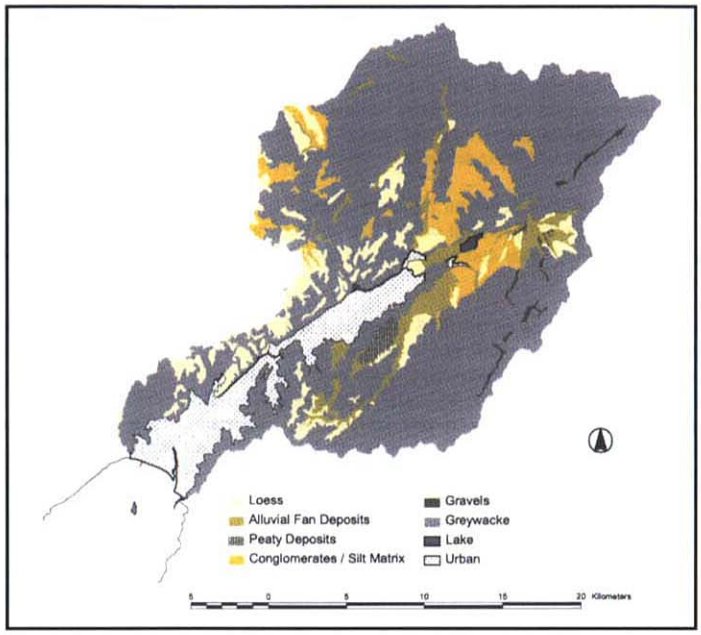
Hutt River catchment: Geographic setting
(Source: Wellington Regional Council)

Table of Basic Data

Name: Hutt River		**Serial No.:** New Zealand-3
Location: North Island, New Zealand	S 40° 58' ~ 41° 15'	E 174° 54' ~ 175° 19'
Area: 656 km^2	**Length of main stream:** 55 km	
Origin: Tararua Ranges	**Highest point:** Mt. Aston (1 376 m)	
Outlet: Wellington Harbour	**Lowest point:** River mouth (0 m)	
Main geological features: The Hutt catchment is formed in well-indurated upper Paleozoic and Mesozoic greywacke-argillites (sandstones and siltstones). The drainage pattern is controlled largely by a major NE-SW trending dextral strike-slip fault and a series of associated N-S trending splinter faults.		
Main tributaries: Akatarawa River (116 km^2), Mangaroa River (104 km^2), Pakuratahi River (81 km^2), Whakatiki River (82 km^2)		
Main lakes: None		
Main reservoirs: Te Marua storage lakes (capacity 2.93 x 10^6 m^3)		
Mean annual precipitation: 2 933 mm at Phillips (elevation 300 m), 1972~1996		
Mean annual runoff: 25 m^3/s at Taita Gorge (556 km^2) (1979~1996)		
Population: 101 216 (1996)	**Main settlements:** Lower Hutt, Upper Hutt	
Land use: Forest (49.8%), Pasture (13.8%), Shrubland (27.0%), Other (9.4%) (1995)		

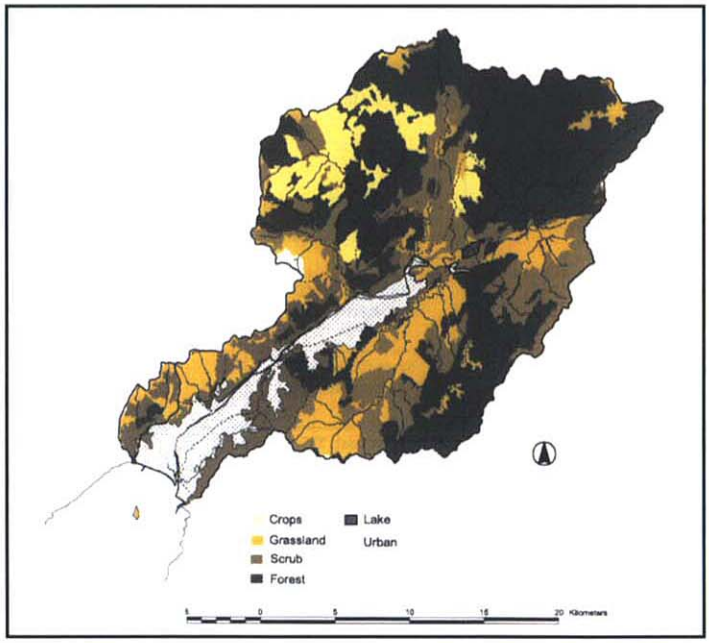
2. Geographical Information

2.1 Geological Map



Hutt River catchment: geology
(Source: Wellington Regional Council)

2.2 Land Use Map



Hutt River catchment: vegetation
(Source: Wellington Regional Council)

1 General Description

The Hutt River is a major water resource for the Wellington region, a major population center in New Zealand. The area of the catchment is 656 km^2. The main stem of the river is 55 km long from the most upstream point in the catchment in the Tararua Ranges. The river flows southwestward into Wellington Harbour and the Cook Strait. The catchment includes agricultural, scrubland, residential, commercial, and industrial land uses in the lower portions, and predominantly forest and scrubland in hill and mountainous terrain in the upper areas. The channel is aligned generally with the Wellington fault and has been influenced by both tectonic activity and significant human modification. In its lower reaches the river flows across an extensive coarse-grained alluvial gravel floodplain formed during past glacial phases and these are being currently degraded in many reaches.

Precipitation varies widely over the catchment, primarily depending on altitude and orographic effects. Rainfall is distributed relatively evenly over the year, but with a maximum in winter. Mean annual precipitation varies from about 1,200 mm/year in low lying areas and near the river mouth, to over 5,000 mm/year in some headwater areas of the Tararua Ranges.

The Hutt catchment has a population of 101,216 (1996). Land uses include residential, commercial, industrial, agricultural, scrubland, and native and exotic forest. Water uses of the Hutt River are primarily for water supply for residential, commercial, industrial, and agricultural activities. The Hutt River is hydraulically connected with the Hutt Aquifer, which is also used extensively for water supply purposes. Recreational uses of the river, such as for fishing, swimming, and picnicking, are becoming increasingly important. Flow recorders and meteorological stations are located throughout the catchment. Because of the potential for significant flooding along the lower reaches of the river, an advanced flood warning system using both rainfall-runoff models and telemetered recording stations has been established in the catchment.

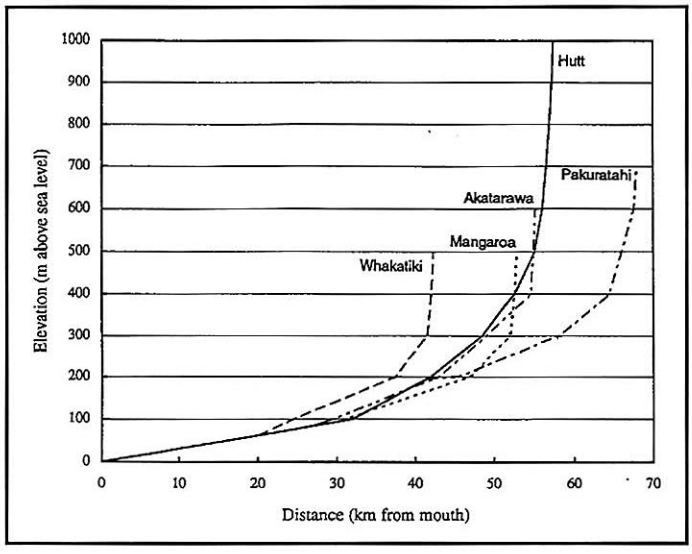
The primary water resource management issues in the Hutt catchment are the continued supply of high quality water for municipal and commercial purposes, as well as the increased use of the river for recreational activities and aquatic habitat. Flooding, channel bank erosion, and bed degradation are also significant and continual management issues.

2.3 Characteristics of the River and Main Tributaries

No.	Name of River	Catchment Area (km^2)	Highest Peak (m) Lowest Point (m)	Settlements (population in 1996)	Land Use (%) (1995)
1	**Hutt**	656	Mt. Aston, 1 376 River Mouth, 0	Lower Hutt (incl Petone) 64 809 Upper Hutt 36 407	F (66.2) G (10.1) SL (11.5) SA (0.5) U (11.7)
2	**Akatarawa**	116	Mt. Kakanui, 822 Hutt confluence, 80		F (77) G (7.8) SL (15.2)
3	**Mangaroa**	104	North Climie, 880 Hutt confluence, 100		F (48.2) G (38.4) SL (13.4)
4	**Pakuratahi**	81	North Climie, 880 Hutt confluence, 180		F (59) G (14.2) SL (26.8)
5	**Whakatiki**	82	Mt. Wainui, 722 Hutt confluence, 60		F (66.1) G (6.8) SL (27.1)

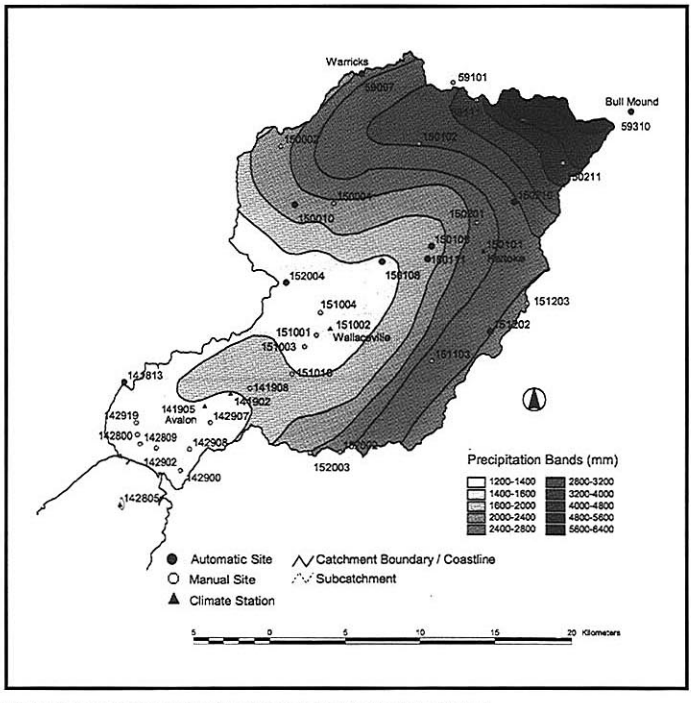
F: Forest G: Grazing (or Pasture) SA: Sub-alpine vegetation (above forest limit) SL: Shrubland U: Urban/developed

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Mean Annual Isohyetal Map and Observation Stations



Hutt River catchment: mean annual rainfall and rainfall observation stations
(Source: Wellington Regional Council)

3.2 List of Meteorological Observation Stations

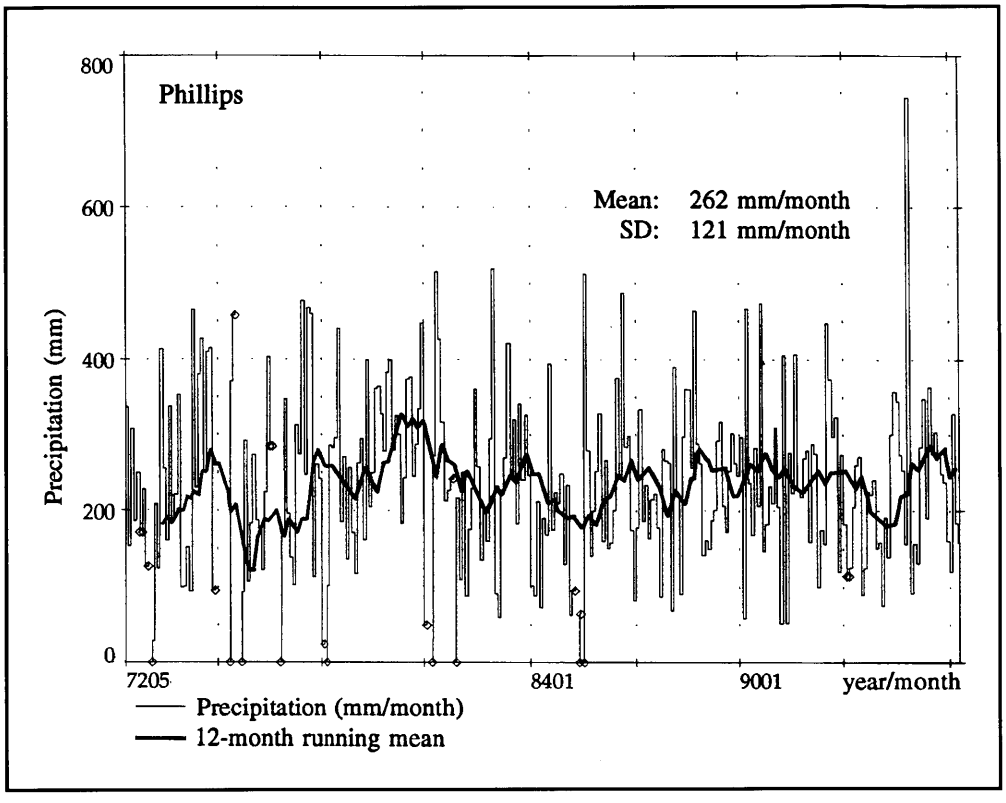
No.[1]	Station	Elevation [m]	Location[2]	Observation Period	Mean Annual Precipitation [mm]	Observation Items
141902	**Taita**	65	2674800E 6001100N	1957~1992	1,340	Climate station
141905	**Avalon**	15	2672800E 6000100N	1962~1992	1,301	Climate station
142805	**Somes Island**	43	2666200E 5992600N	1975~present	1,109	Climate station
142900	**Gracefield**	34	2670900E 5995200N	1958~1992	1,244	Climate station
150101	**Kaitoke**	223	2694100E 6012000N	1957~present	1,896	Climate station
150210	**Phillips**	300	2696400E 6015800N	1972~present	2,933	Precipitation intensity
151002	**Wallaceville**	56	2682300E 6006100N	1939~present	1,306	Climate station
59007	**Warricks**	345	2684800E 6025600N	1980~present	2,388	Precipitation intensity
59310	**Bull Mound**	1 000	2705300E 6022700N	1976~present	4,547	Precipitation intensity
141813	**Wayne's Mistake**	335	2666500E 6002000N	1978~present	1,353	Precipitation intensity
150010	**Blue Gum Spur**	335	2679700E 6015600N	1981~present	1,996	Precipitation intensity
150108	**Cemetery**	100	2686300E 6011200N	1988~present	1,687	Precipitation intensity
150109	**Treatment Plant**	150	2690100E 6012400N	1993~present	2,085	Precipitation intensity
150111	**Twin Lakes**	92	2689800E 6011400N	1984~present	1,594	Precipitation intensity
151202	**Centre Ridge**	510	2694600E 6005900N	1984~present	2,136	Precipitation intensity
152004	**Tasman Vaccine**	229	2679000E 6009600N	1980~present	1,406	Precipitation intensity

1) Wellington Regional Council site number.
2) New Zealand map reference NZMS260.

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]	Wallaceville	16.7	16.7	15.3	12.7	10.3	8.2	7.4	8.2	10.1	11.8	13.4	15.4	12.2	1939~1994
Precipitation [mm]	Wallaceville	86	78	91	93	137	133	136	124	105	118	102	105	1,306	1939~1994
Duration of Sunshine [hr]	Wallaceville	229	196	180	144	112	91	98	122	143	171	189	209	1,886	1939~1994

3.4 Long-term Variation in Monthly Precipitation



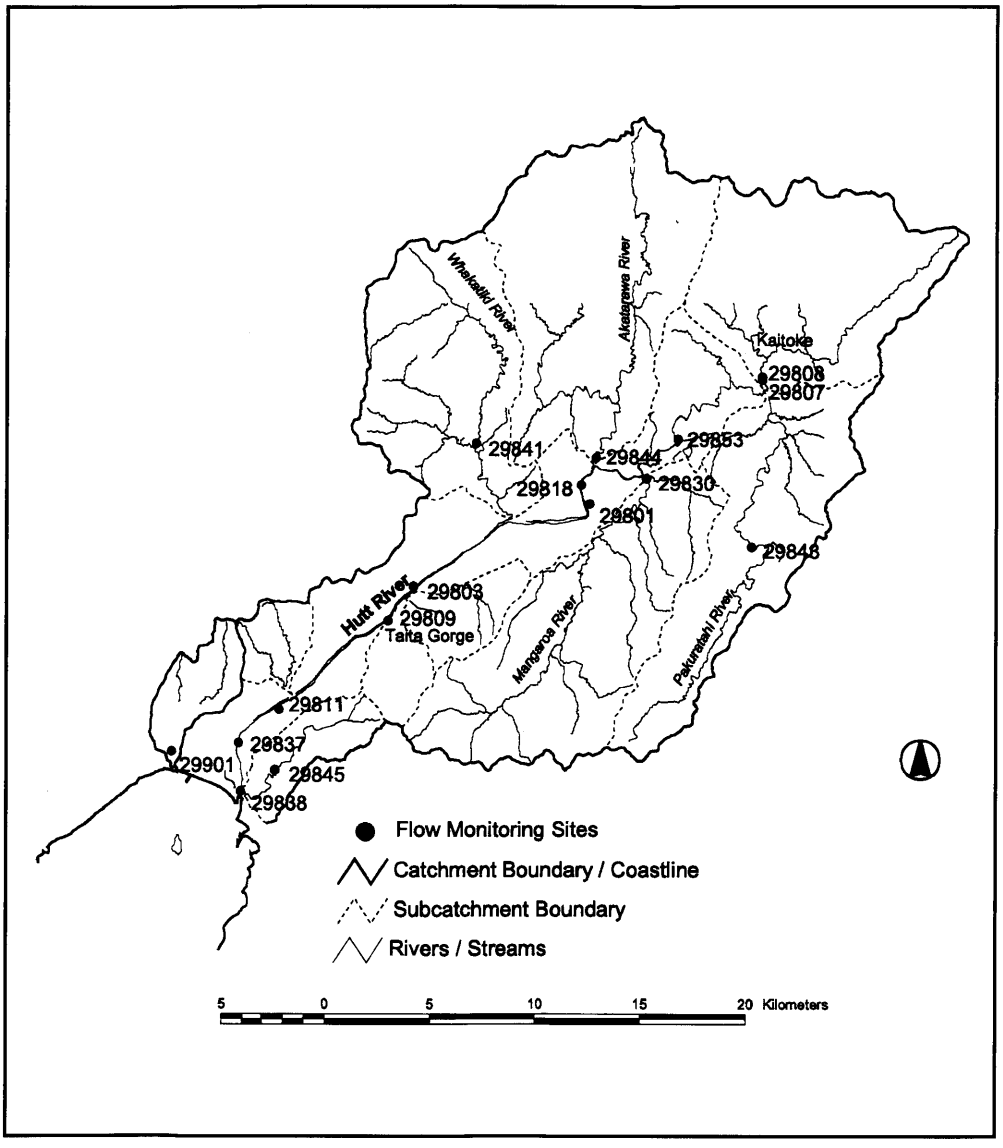
3.5 Precipitation Intensity

Phillips (150210) High Intensity Precipitation Frequency (mm)

Return Period [years]	Average Annual Probability (%)	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr
2	50	23	34	41	71	98	130
5	20	30	45	57	92	135	179
10	10	35	51	65	106	157	207
20	5	39	58	73	119	179	237
50	2	45	66	84	136	208	273
100	1	49	72	92	149	229	301

4. Hydrological Information

4.1 Map of Streamflow Observation Stations



Hutt River catchment: discharge observation stations
(Source: Wellington Regional Council)

4.2 List of Hydrological Observation Stations

No.[1]	Station	Location[2]	Catchment Area (A) [km^2]	Observation Period	Observation Items (frequency)
29808	**Hutt @ Kaitoke weir**	2694200E 6015000N	89	1967~present	Q (15 min.), S (periodic)[3]
29809	**Hutt @ Taita Gorge**	2676400E 6003400N	556	1979~present	Q (15 min.), S (periodic)
29818	**Hutt @ Birchville**	2685600E 6009900N	427	1970~present	Q (15 min.), S (periodic), WQ (m)[4]
29830	**Mangaroa @ Te Marua**	2688700E 6010200N	102	1977~present	Q (15 min.), S (periodic), WQ (m)
29841	**Whakatiki @ Dude Ranch**	2680600E 6011900N	46	1976~present	Q (15 min.), S (periodic), WQ (m)
29843	**Pakuratahi @ Truss Bridge**	2693700E 6006900N	37	1978~present	Q (15 min.), S (periodic), WQ (m)
29844	**Akatarawa @Cemetery**	2686300E 6011200N	114	1979~present	Q (15 min.), S (periodic), WQ (m)
29845	**Waiwhetu @ Bell Road**	2671000E 5996300N	12	1969~present	Q (15 min.), S (periodic), WQ (m)
29901	**Korokoro @ Mill weir**	2666000E 5997200N	16	1980~present	Q (15 min.), S (periodic), WQ (m)

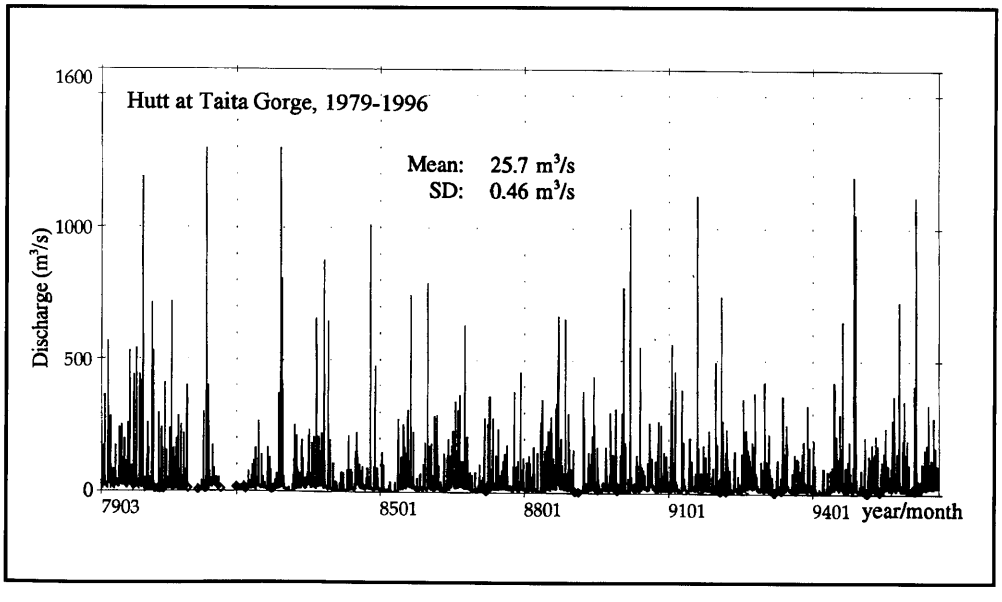
1) Wellington Regional Council site number.
2) New Zealand map reference NZMS260.
3) Data collected periodically (in excess of monthly) for specific projects
4) Monthly

No.	Name	Q [m^3/s]	Q_{sd} [m^3/s]	Q_{max} [m^3/s]	Q_{max} [m^3/s]	Q_{min} [m^3/s]	Q /A [$m^3/s/100km^2$]	Q_{max}/A [$m^3/s/100km^2$]	Period
29808	**Hutt @ Kaitoke weir**	7.6	12.6	258.4	393.5	1.38	8.54	290.3	1967~ present
29818	**Hutt @ Birchville**	22.4	36.9	697.7	1227.2	2.03	5.25	163.4	1970~ present
29809	**Hutt @ Taita Gorge**	24.9	43.6	864.6	1298.5	3.00	4.48	155.5	1979~ present
29843	**Pakuratahi @ Truss Bridge**	2.1	4.4	85.9	135.0	0.20	2.59	106.0	1978~ present
29844	**Akatarawa @ Cemetery**	5.7	11.2	291.7	480.6	1.09	4.91	251.5	1979~ present
29830	**Mangaroa @ Te Marua**	3.6	6.3	120.8	245.5	0.33	3.46	116.2	1977~ present
29841	**Whakatiki @ Dude Ranch**	1.7	3.0	72.2	139.6	0.32	2.07	88.0	1976~ present
29901	**Korokoro @ Mill weir**	0.3	0.3	8.6	30.9	0.06	1.88	53.8	1980~ present
29845	**Waiwhetu @ Bell Road**	0.3	0.7	10.7	16.1	0.02	1.58	56.3	1978~ present

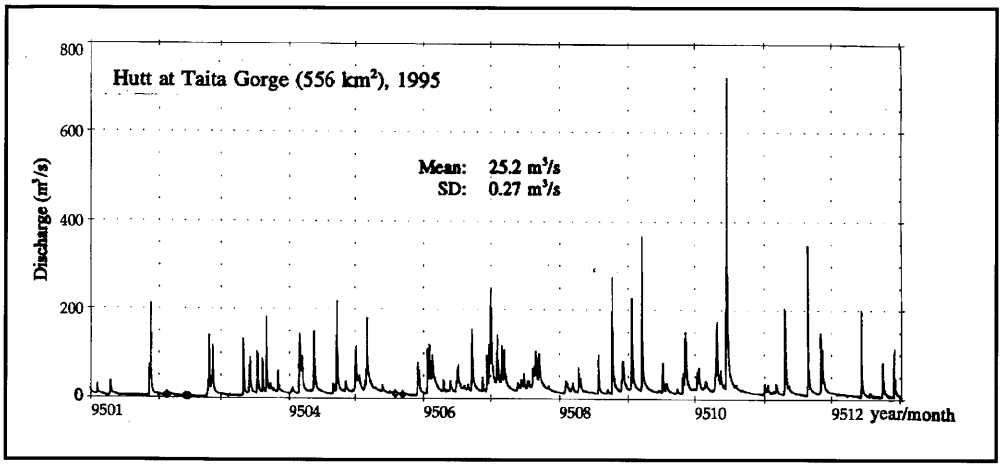
1) Wellington Regional Council site code number.
2) New Zealand map reference.

Q : Mean discharge
Q_{sd} : Standard deviation of discharge
Q_{max} : Mean annual flood
Q_{max} : Maximum instantaneous discharge
Q_{min} : Mean annual minimum discharge

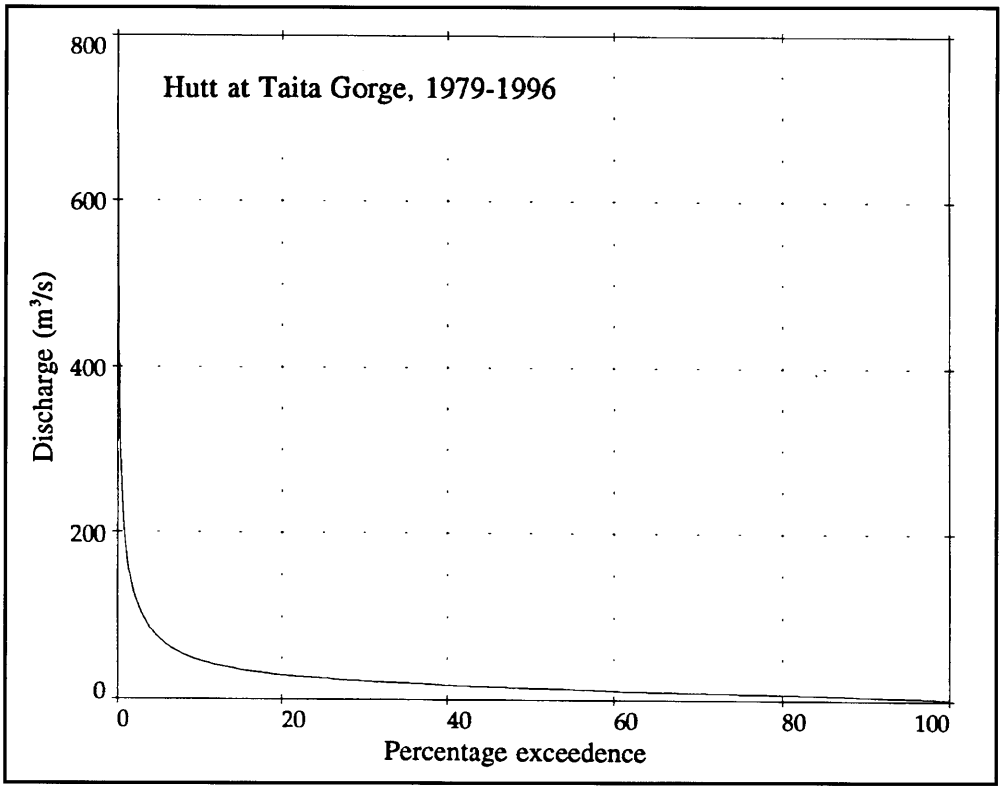
4.3 Long-term Variation of 15-minute Instantaneous Discharge



4.4 (a) Annual Pattern of Discharge



4.4 (b) Flow Duration Curve



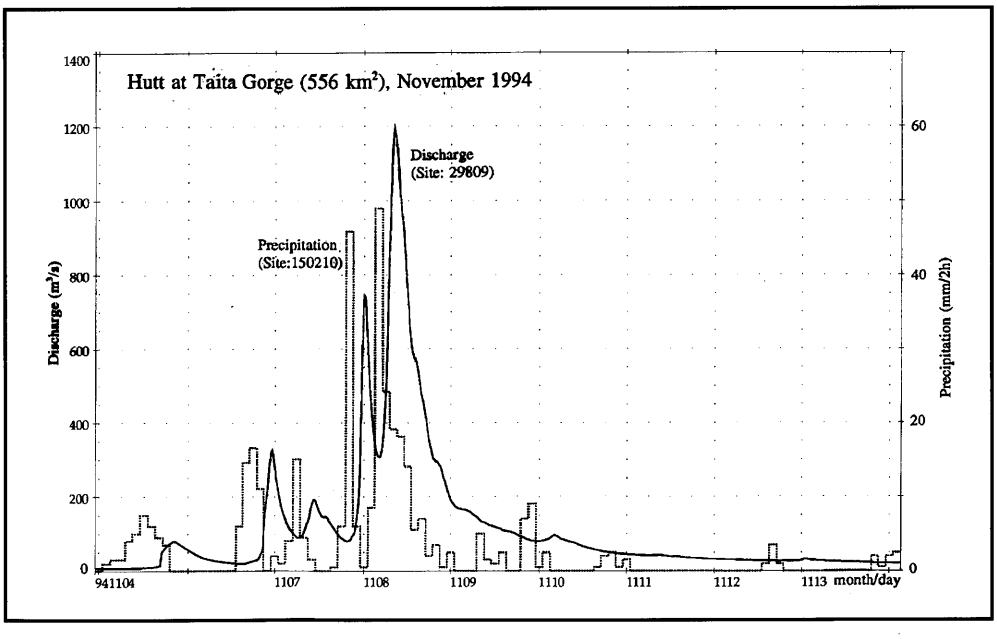
4.6 Annual Maximum and Minimum Discharges

Hutt at Taita Gorge (556 km²)

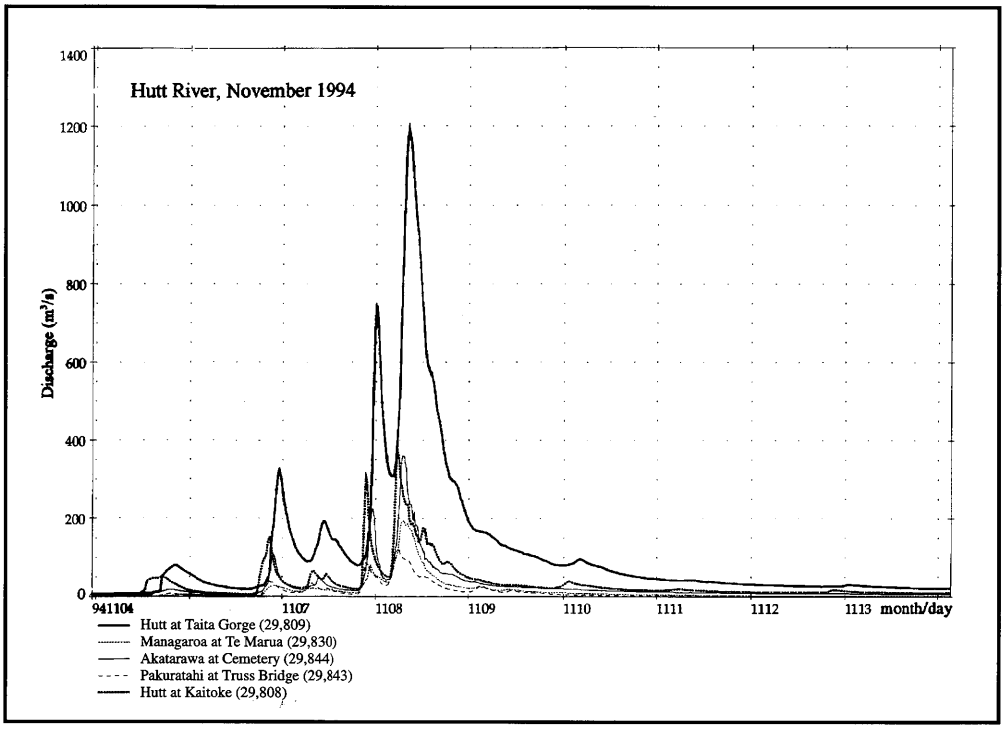
Year	Maximum[1]		Minimum[2]		Year	Maximum[1]		Minimum[2]	
	Date	[m³/s]	Date	[m³/s]		Date	[m³/s]	Date	[m³/s]
1979	5. 07	568	11.13	8.81	**1988**	9.13	669	5.08	3.20
1980	1.20	1 189	12.20	4.55	**1989**	6.12	438	3.20	1.63
1981	5.21	1 297	4.06	2.34	**1990**	3.03	1 071	3. 08	2.84
1982	12.11	1 298	2.17	2.09	**1991**	8.07	1 121	3.28	4.22
1983	11.05	879	3.07	2.17	**1992**	2.05	742	5.07	5.30
1984	10.18	1 011	3.03	3.44	**1993**	5.16	366	3.30	3.26
1985	12.23	790	4.17	1.86	**1994**	11.08	1 196	3.07	2.76
1986	10.05	633	12.21	3.90	**1995**	10.15	724	2.19	1.71
1987	12.04	456	1.12	2.42	**1996**	2.20	1 117	1.23	3.32

1), 2) Instantaneous observation from flow record

4.7 Hyetographs and Hydrographs of Major Flood



4.8 Hydrographs of Major Flood Showing Tributary Contributions



5. Water Resources

5.1 General description

The Hutt River catchment occupies about 0.6% of the North Island. The mean annual discharge is 25 m^3/s (specific discharge is 4.5 $m^3/s/100km^2$). Flood events are relatively frequent, and tend to be randomly distributed throughout the year. The maximum recorded flow is approximately 1,600 m^3/s. The highest monthly flows are in winter and spring, and the lowest monthly flows are in summer and early fall. This pattern is controlled by the distribution of effective precipitation through the year.

The forested areas of the upper catchment have a moderating effect on peak flows during most of the year and help to maintain higher baseflows. The river, however, exhibits periods of low flows, with a minimum 7-day low flow of 1.63 m^3/s (0.293 $m^3/s/100km^2$) being the lowest flow observed at Taita Gorge in March 1989.

5.2 Recharge of groundwater

The Hutt River between Taita Gorge and Kennedy-Good Bridge provides the most important and reliable source of water to recharge the aquifers of the Lower Hutt groundwater system. River recharge estimates show that during a mean annual low flow of 3.4 m^3/s the river loses 0.9 m^3/s over this reach. The concurrent gaugings on which this estimate is based were carried out while abstraction was occurring. Therefore the flow loss estimate also assumes pumping conditions in the Taita Alluvium Aquifer and Waiwhetu Artesian Aquifers. Return flow to the river is also evident below the Kennedy-Good Bridge. During the same mean annual low flow conditions discussed above the Hutt River gains 0.208 m^3/s from the groundwater system. Therefore the net river recharge to groundwater during mean annual low flow conditions is estimated to be 0.7 m^3/s. This loss to groundwater is, however, highly variable and ranges between 0.208 m^3/s and 1.6 m^3/s.

The annual rainfall of 1,094 mm is estimated to produce a potential annual rainfall recharge to the unconfined zone of 526 mm. When a 60% reduction for the effects of urbanisation is included, the average daily rainfall recharge is reduced to approximately 0.06 m^3/s.

5.3 List of Major Water Resource users

Major Surface Users in the Hutt Catchment

Consent Holder	L/s [1]	M^3/day [2]	Use	Location [3]	Status
Wellington Regional Council WGN 77010201	1,159	100,103	Public water supply	2694100E 6015000N	Notified use
Wellington Regional Council WGN 79001801	2,315	200,000	Public water supply	2690000E 6011900N	Granted
Tangney P. WGN 90000601	4.6	396	Irrigation	2669900E 5998600N	Granted
Te Marua Golf Club WGN 950008	20	1,728	Irrigation	2689100E 6010800N	Granted
Clark G and K WGN 92015301	1.4	121	Irrigation	2680900E 5998900N	Granted
Thurley DC and G WGN 88000501	1.3	112	Irrigation	2687100E 6012300N	Granted

1) Maximum instantaneous take stated on consent
2) Maximum total daily take stated on consent
3) New Zealand map reference NZMS260.

Major Groundwater Users in the Hutt Catchmnet

Consent No.	Consent Holder	Location [1]	Expiry	Allocated Take (m^3/day)	Purpose
WGN 76000801	**Lever Rexona**	2669000E 5995600N	1/10/2001	4,550	Cooling water
WGN 76000901	**Ajax Spurway Fastners NZ**	2669900E 5994800N	1/10/2001	1,750	Cooling water
WGN 76001301	**New Zealand Woolspinners**	2670600E 5995250N	1/10/2001	1,140	Wool industry
WGN 87000101	**Wellington Regional Council**	2673200E 5999100N	9/3/1997	88,000	Public water supply
WGN 87000201	**Wellington Regional Council**	2668900E 5995850N	9/3/1997	59,000	Public water supply
WGN 87000301	**Wellington Regional Council**	2667700E 5996300N	9/3/1997	12,500	Public water supply
WGN 91002401	**Seaview Wools**	2669200E 5993900N	9/3/1997	2,880	Wool industry
WGN 76002901	**Wellington Racing Club**	2681600E 6005500N	1/10/2001	1,140	Irrigation
WGN 76003901	**South Pacific Tyres**	2683400E 6006700N	1/10/2001	6,000	Chemical industry

1) New Zealand map reference NZMS260.

5.4 Major Floods and Droughts

The Wellington Regional Council has prepared a narrative chronology of the major flood events on the Hutt River and their consequences. Droughts are not common because of the maritime climate and the relatively high precipitation characteristic of the region. The damage resulting from major flood events includes extensive flooding in low-lying downstream areas, erosion of the channel and bank protection, log jams, washouts of road and bridges, and heavy loss of livestock. An advanced flood warning system has been established throughout the catchment.

There are no major lakes or reservoirs in the catchment, and no significant trans-basin diversions or structures. Two water storage reservoirs, containing 2.93 x 10^6 m^3, exist to ensure secure domestic water supply during periods of high suspended sediment loads. There are, however, many water extractions from both the river and the alluvial groundwater aquifer for municipal, industrial, and agricultural water supply purposes.

Major Floods on the Hutt River

Date	Peak discharge [1] [m^3/s]	Dead or missing	Damage
1849, Winter	1,000		Heaviest flooding for many years, heavy livestock losses.
1855, Winter	1,500		Extensive bridge damage and much livestock lost.
1858, January	2,000	9 dead	Extensive flooding and damage, heavy livestock losses.
1871, March	1,200		Bridge damage and log jam.
1878	1,500		Widespread flooding covering entire valley
1880, March	900	1 dead	Heavy flooding in low lying areas.
1893, March **1893, August**	1,500 1,700		Flooding in central Petone to top of boundary fences Flooding made road access to Wellington difficult
1896, February	1,350		Significant log jam, bridge instability, and flooding in low lying areas
1898, June **1898, November**	2,000 1,500		Extensive flooding and damage in Lower Hutt and Petone Water covering entire valley but less than June flood
1907, March	750		Bridge damage and erosion.
1915, July	1,350		Low lying areas partially flooded.
1922, July	1,000		Low lying areas partially flooded.
1931, April	1,400		Extensive flooding in low lying areas, erosion and damage to bank protection, and road and bridge damage.
1939, December	1,600		Extensive flood damage and erosion.
1948, May	1,200		Damage to roads and erosion.
1962, January	1,280		Erosion and damage to bank protection.
1965, November	1,300		Extensive flooding in Upper and Lower Hutt in low lying areas, and erosion and damage to bank protection.
1966, April	1,180		Erosion and damage to bank protection.
1980, January	1,188		Erosion and damage to bank protection.
1981, May	1,297		Erosion and damage to bank protection.
1982, December	1,298		Erosion and damage to bank protection.
1984, October	1,011		Erosion and damage to bank protection.
1990, March	1,071		Erosion and damage to bank protection.
1991, August	1,121		Erosion and damage to bank protection.
1994, November	1,196		Erosion and damage to bank protection.

1) Discharges are measured at Taita Gorge (556 km^2). Values prior to 1979 are best estimates using flow at other sites.

5.5 Water Quality

River water quality[1] at Birchville, 1995

Date	Jan 13	Feb 10	Mar 8	Apr 7	May 8	Jun 9	Jul 7	Aug 8	Sep 1	Oct 1	Nov 3	Dec 1
pH	7.35	7.41	7.5	7.11	7.12	7.14	6.96	7.01	7	7.1	7.1	7.2
BOD [mg/l]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Conductivity [mS/cm]	88	91	94	73	76	86	69	67	76	79	73	80
Turbidity [FTU]	0.3	0.35	0.35	5.1	1.5	0.7	4.2	3.9	1.4	0.95	1.1	0.7
DIN[2] [ppm]	0.25	0.23	0.25	0.24	0.27	0.41	0.29	0.27	0.33	0.27	0.19	0.28
DRP[3] [ppm]	<0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Discharge[4] (m^3/s)	4.13	3.25	3.01	28.70	27.25	19.37	44.92	14.03	22.12	20.63	13.96	10.95

1) Observed once a month.
2) Dissolved inorganic nitrogen.
3) Dissolved reactive phosphorus.
4) Average discharge on the observation date.

6. Socio-cultural Characteristics

Prior to European settlement in the 1840's, the Hutt catchment was primarily under dense native beech forest. The early explorers, surveyors, and settlers used the river and its floodplain for access to inland areas. The present main highway and railway follow the river, with other roads aligned with some of the tributaries. The principal settlements are Upper Hutt and Lower Hutt with adjacent suburbs located primarily along the flat river valley and floodplain of the main stem. The harbour towns of Petone and Seaview are located at the mouth of the river. Seaview is a major industrial area that has historically used the river for both water supply and wastewater discharge. Some urban development has also extended along the banks of the major tributaries.

The Hutt River serves as a major water supply for the Hutt Valley and the entire Wellington region. The river has been significantly affected by urban, residential, and industrial development along its banks and within the floodplain. Therefore the alignment of the lower reaches of the river has changed dramatically from its natural flow pattern. It is increasingly being used for recreational, aesthetic, and aquatic habitat purposes. However, the banks and gravel bed in some of the lower reaches of the main stem are being eroded as a result of reduced sediment supply from the upper catchment following a period of relative geomorphic quiescence. In addition, flood control and mitigation efforts to protect the developed areas along the banks of the river are ongoing management efforts.

7. References, Databooks and Bibliography

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