Burdekin River

Map of River

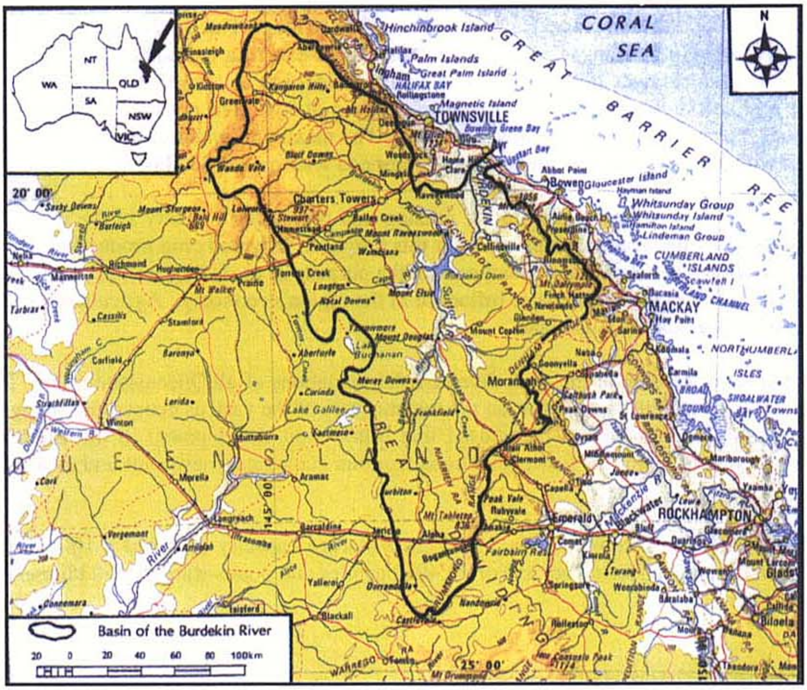


Table of Basic Data

Name: Burdekin River		**Serial No.:** Australia-1
Location: North Queensland, Australia	S 18° 0′ ~ 25° 0′	E 144° 0′ ~ 149° 0′
Area: 130 000 km^2	**Length of main stream:** 732 km	
Origin: Seaview (745 m), Gorge Ranges (926 m)	**Highest point:** Commissioners Cap, Great Dividing Range (1028 m)	
Outlet: Coral Sea, South Pacific Ocean	**Lowest point:** River mouth (0 m)	
Main geological features: Pre-Cambrian to Cainozoic; Mudstone, Granite, Alluvium, Gravels and Conglomerate, Limestone, Sandstone, Siltstone.		
Main tributaries: Clarke River (6 760 km^2), Star River (1 990 km^2), Basalt River (2 900 km^2), Suttor River (73 700 km^2), Belyando River (tributary of the Suttor River) (35 720 km^2), Bowen-Broken River (9 530 km^2), Bogie River (2 250 km^2)		
Main lakes: None		
Main reservoirs: Burdekin Falls Dam (1 860 x 10^6 m^3, 1987), Eungella Dam (131 x 10^6 m^3, 1969)		
Mean annual precipitation: Basin average 670mm (1920~1969)		
Mean annual runoff: 322 m^3/s (at Clare, 1951~1992)		
Population: 23 400 (1991) (Main towns only)	**Main towns:** Charters Towers, Ayr, Home Hill, Collinsville	
Land use: Grazing (beef) 95%, Agriculture (sugar cane, maize, vegetables) 4%, Mining (coal, gold) 1% (1991)		

1. General Description

The Burdekin River is located in the drier part of the tropics on Queensland's east coast. Diverse landscapes are represented in this catchment. There is a high variability of rainfall within any one year, and from year to year. The average annual precipitation for the catchment is 670 mm. The catchment is 130 000 km^2 in area and approximately 732 km long. The Burdekin River has its source in the Seaview and Gorge Ranges and flows 550 km south-east to a latitude of approximately S 20° 40'. The river then changes direction to flow a further 150 km in a northerly direction then turns almost due east before discharging into the Pacific Ocean at Ayr. The coastal plains are narrow and discontinuous, but widen toward the lower reaches. The maximum width of the coastal region is 56 km and lies within the delta plain - an area that is prone to widespread flooding.

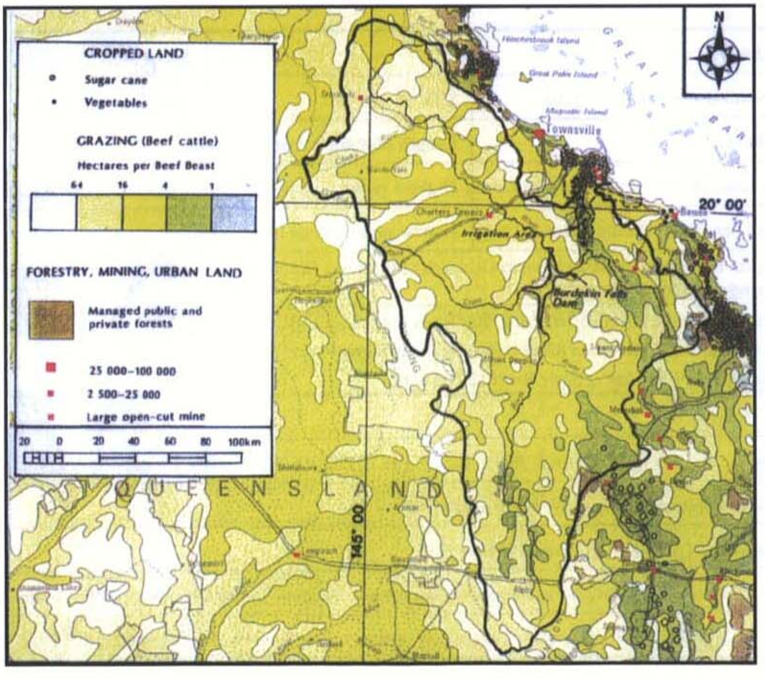
Beef cattle is the most widespread form of grazing and is a major industry in the upper Burdekin region with much of the available land used for this purpose. Irrigated crop production in this region is generally restricted to small scale operations for the purpose of providing feed for cattle. Mining of gold and coal continues to have a major influence in the region's economy. Agricultural development in the delta is predominantly sugarcane.

The Burdekin River has one of the most diverse fish populations of all Queensland rivers. Protection of the fish and invertebrate fauna relies on the maintenance of the various ecosystems along the river. The Queensland Government has recognised that future weir development in the Burdekin River should include consideration of fish populations from an ecological viewpoint and as a recreational resource.

The Burdekin Falls Dam, completed in 1987, has a storage capacity of 1 860 x 10^6 m^3. The Dam forms Lake Dalrymple, covering an area of 22 400 hectares and ponds water for 50 kilometres up the Burdekin River.

2. Geographical Information

2.2 Land Use Map

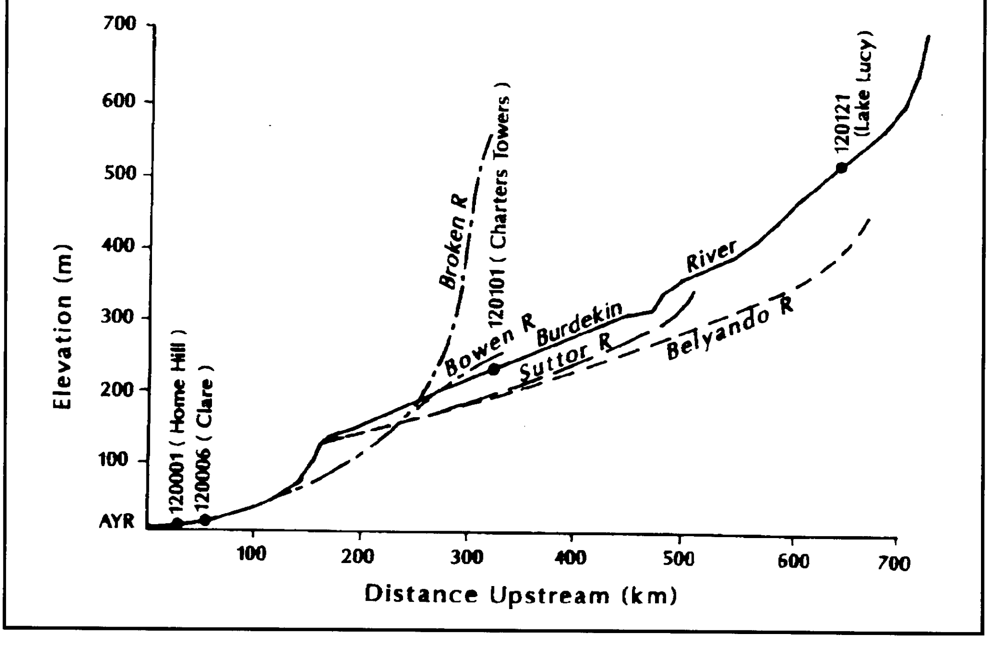


2.3 Characteristics of River and Main Tributaries

No.	Name of river	Length [km] Catchment area [km^2]	Highest peak [m] Lowest point [m]	Cities Population (1991)	Land use [%] (1991)
1	**Burdekin** (Main river)	732 130 000	Commissioners Cap, 1 028 Sea level, 0	Ayr 8 637 Home Hill 3 197 Charters Tower 9 016	G(95%), A(4%) U&M(1%)
2	**Clarke** (Tributary)	190 6 470	1012 400		G(100%)
3	**Star** (Tributary)	81 2 010	Paluma Range, 1 030 365		G(100%)
4	**Basalt** (Tributary)	160 2 900	857 300		G(100%)
5	**Suttor** (Tributary)	337 73 303	Denham Range, 590 150		G(100%)
6	**Belyando** (Tributary of the Suttor River)	393 35 720	Drummond Range, 680 200		G(100%)
7	**Bowen-Broken** (Tributary)	208 9 530	Clarke Range, 950 50	Collinsville 2 552	G(90%), M(10%)
8	**Bogie** (Tributary)	130 2 250	720 45		G(100%)

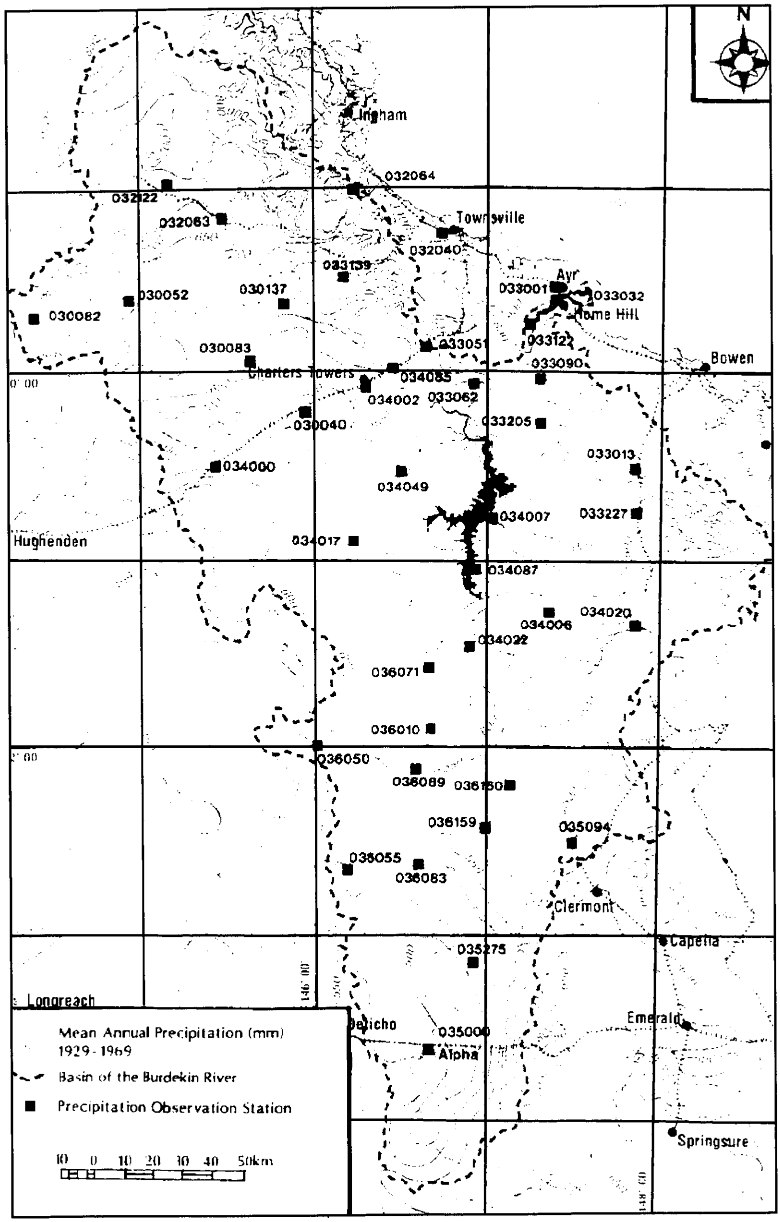
A: Agriculture (sugar cane), F: Forest, G: Grazing (cattle), M: Mining, U: Urban.

2.4 Longitudinal Profiles



3 Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



Based on the data of Department of Primary Industries, Water Resources, Queensland. Isohyetal map was made by interpolating 42 long term stations in the catchment between 1920~1969 taking into account topography and synoptic variations.

3.2 List of Meteorological Observation Stations

No.	Station	Elevation [m]	Location	Observation period	Mean annual precipitation [mm]	Mean annual evaporation [mm]	Observation items [1]
030040	Pentland	403	S 20° 31′ E 145° 24′	1885~1993	673	2 210	P
030052	Wando Vale	560	S 19° 40′ E 144° 53′	1890~1993	675	2 200	P
030082	Gregory Springs	732	S 19° 43′ E 144° 23′	1927~1993	735	2 300	P(TSP)
030083	Toomba	380	S 19° 58′ E 145° 35′	1960~1993	620	2 110	P
030137	Hillgrove	300	S 19° 38′ E 145° 47′	1899~1993	544	2 100	P
032040	Townsville	4	S 19° 15′ E 146° 46′	1940~1993	1 137	2 395	T,P,E,SR,DS
032063	Blue Range	348	S 19° 10′ E 145° 25′	1953~1993	681	2 050	P(TSP)
032064	Paluma	892	S 19° 00′ E 146° 12′	1969~1993	2 618	2 000	P(TSP)
032122	Greenvale	427	S 18° 59′ E 145° 07′	1890~1993	643	2 150	P
033001	Ayr	11	S 19° 34′ E 147° 24′	1886~1993	1 083	2 071	T,P,E,DS
033013	Collinsville	187	S 20° 30′ E 147° 13′	1939~1993	726	1 931	T,P(TSP),E
033032	Home Hill	20	S 19° 40′ E 147° 25′	1924~1993	952	2 130	
033051	Mingela	289	S 19° 53′ E 146° 38′	1899~1993	655	2 050	P
033062	Ravenswood	249	S 20° 06′ E 146° 53′	1871~1993	683	2 000	P
033090	Millaroo	45	S 20° 03′ E 147° 16′	1965~1985 1991~1993	841	1 841	T,P,E,DS
033122	Clare	26	S 19° 47′ E 147° 13′	1895~1993	833	2 100	P
033139	Paynes Lagoon	305	S 19° 28′ E 146° 07′	1969~1993	593	2 100	P
033205	Dalbeg	60	S 20° 16′ E 147° 18′	1954~1993	764	1 980	P
033227	Havilah	140	S 20° 48′ E 147° 50′	1935~1993	637	1 980	P
034000	Balfes Creek	327	S 20° 13′ E 145° 55′	1889~1993	630	2 120	P
034002	Charters Towers	310	S 20° 05′ E 146° 16′	1882~1992	660	2 035	T,P,E
034006	Mt. Coolon	240	S 21° 23′ E 147° 20′	1925~1993	580	2 000	P
034007	Mt. McConnell	457	S 20° 48′ E 146° 59′	1899~1993	647	2 050	P
034017	Broadleigh Downs	244	S 20° 55′ E 146° 11′	1962~1993	614	2 150	P
034020	Wollombi	274	S 21° 21′ E 147° 50′	1965~1993	516	2 000	P
034022	Mt Douglas	170	S 21° 31′ E 146° 53′	1912~1993	603	2 140	P
034049	Doongara	300	S 20° 34′ E 146° 29′	1968~1993	652	2 120	P
034085	Sellheim	240	S 20° 01′ E 146° 25′	1897~1993	613	2 050	P
034087	Scartwater	190	S 21° 06′ E 146° 53′	1949~1993	609	2 100	P
035000	Alpha	350	S 23° 39′ E 146° 38′	1886~1993	564	2 350	P(TSP)
035094	Carrols Creek	305	S 22° 30′ E 147° 31′	1962~1993	584	2 170	P
035275	Islay Plains	300	S 23° 13′ E 146° 53′	1988~1993	596	2 310	P
036010	Bulliwallah	305	S 21° 57′ E 146° 38′	1912~1993	601	2 200	P
036050	Ulcanbah	270	S 22° 02′ E 145° 59′	1887~1993	559	2 320	P
036055	Dunrobin	340	S 22° 41′ E 146° 09′	1972~1993	511	2 360	P
036071	Moray Downs	210	S 21° 37′ E 146° 38′	1914~1993	563	2 230	P
036083	Albro	255	S 22° 42′ E 146° 34′	1970~1993	573	2 300	P
036089	Bygana	270	S 22° 12′ E 146° 33′	1946~1993	581	2 290	P
036159	Beresford	280	S 22° 30′ E 146° 56′	1987~1993	471	2 260	P
036160	Frankfield	240	S 22° 16′ E 147° 06′	1987~1993	541	2 200	P

The table of meteorological stations above is a selection of the main stations in the catchment.
All rainfall stations shown are operated by the Australin Bureau of Meteorology.
1) T: Temperature TSP: Tilting syphon pluviograph with recording chart P: Precipitation TB: Tipping bucket with digital data logger E: Evaporation SR: Solar radiation DS: Duration of sunshine

3.3 Monthly Climate Data

The tables below show climatic data for selected stations in and adjacent to the Burdekin catchment. The Townsville station is just outside the catchment but is included because of the full range of data recorded.

Station: Townsville (032040)

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	27.6	27.1	26.6	25.0	22.4	19.9	19.2	20.4	22.3	25.0	26.8	27.7	24.2	1941~1993
Precipitation [mm]	274	291	205	66	37	22	15	12	11	23	54	127	1 137	1940~1993
Evaporation [mm]	257	226	217	202	174	158	164	195	248	282	291	285	2 700	1970~1973
Solar radiation [$MJ/m^2/d$]	21.4	20.0	20.0	17.2	15.2	14.7	15.8	18.2	22.0	24.3	24.6	23.4	19.7	1971~1991
Duration of sunshine [hr]	242	223	229	239	226	245	260	282	295	304	291	26	3 112	1958~1993

Station: Ayr (033001)

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	27.4	27.0	26.0	24.2	21.9	20.4	18.2	19.4	21.4	23.7	25.8	26.9	23.6	1952~1993
Precipitation [mm]	264	262	186	63	38	32	19	15	21	23	44	116	1 083	1886~1993
Evaporation [mm]	205	192	177	155	130	118	124	146	167	211	223	223	2 071	1970~1993
Duration of sunshine [hr]	248	220	220	226	223	236	248	267	279	291	273	264	2 995	1965~1993

Station: Collinsville (033013)

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	27.3	27.1	25.8	23.4	20.4	17.5	16.7	18.6	21.4	24.5	26.7	27.3	23.1	1956~1981 1991~1993
Precipitation [mm]	136	155	107	46	37	27	22	14	11	21	53	97	726	1939~1993
Evaporation [mm]	189	180	167	146	112	90	102	133	167	205	223	217	1 931	1972~1993

Station: Millaroo (033090)

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	28.1	27.4	26.4	24.2	21.4	18.3	17.7	19.5	21.7	24.2	26.8	27.5	23.6	1965~1985 1991~1993
Precipitation [mm]	191	165	127	49	47	20	16	10	9	25	57	125	841	1953~1993
Evaporation [mm]	180	161	152	130	109	96	105	130	158	195	214	211	1 841	1970~1985 1991~1993
Duration of sunshine [hr]	233	217	214	229	229	245	254	267	282	295	291	254	3 010	1965~1985 1991~1993

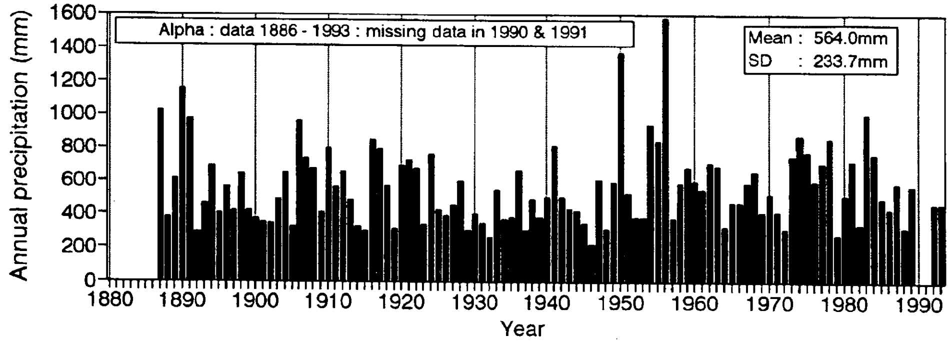
Station: Charters Towers (034002)

Observation item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	28.0	27.4	26.1	24.0	21.1	18.4	17.8	20.0	22.1	25.1	27.2	28.0	23.8	1907~1992
Precipitation [mm]	137	130	104	43	24	27	17	13	15	22	41	87	660	1882~1992
Evaporation [mm]	210	170	175	150	130	105	115	140	170	210	230	230	2 035	1970~1992

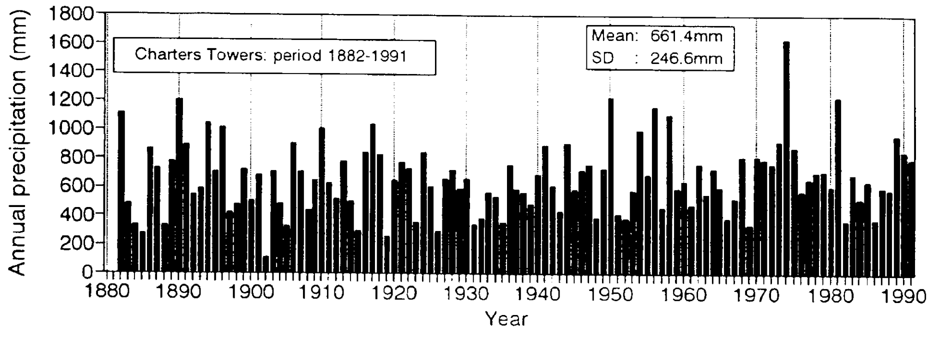
Evaporation pan used: - US Class A (48 inch dia)

3.4 Long-term Variation of Annual Precipitation

a) Alpha (Station 035000)

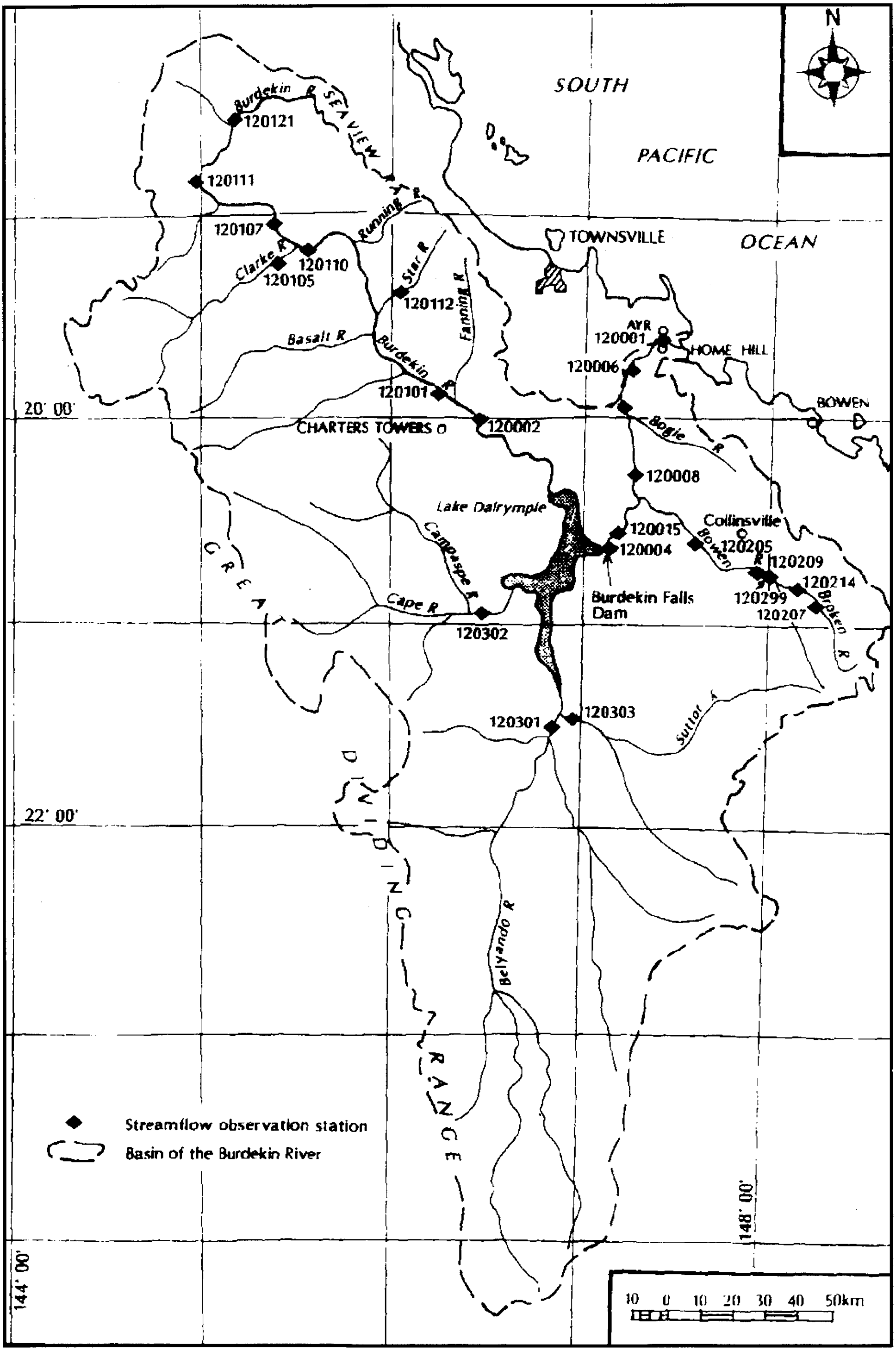


b) Charters Towers (Station 034002)



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



4.2 List of Hydrological Observation Stations

The table of hydrological stations below is a selection of the main stations in the catchment.

No.	Station	Location	Elevation [m]	Catchment area (A) [km²]	Observation period	Observation items 1)
120001	Burdekin River at Home Hill	S 19° 40′ E 147° 21′	3	130 000	1922~1956	H2, Q
120002	Burdekin River at Sellheim	S 20° 00′ E 146° 26′	215	36 400	1947~1968 1968~1994	H2, Q H1, Q
120004	Burdekin River at Falls (D/S)	S 20° 39′ E 147° 09′	120	114 220	1948~1967 1967~1985	H2,Q H1,Q
120006	Burdekin River at Clare	S 19° 46′ E 147° 15′	9	129 500	1950~1975 1975~1994	H2, Q H1, Q
120008	Burdekin River at Dalbeg	S 20° 19′ E 147° 18′	34	126 000	1954~1975 1975~1994	H2, Q H1, Q
120010	Burdekin River at 64.4 km	S 19° 58′ E 147° 15′	19	129 000	1959~1986	H1, Q
120015	Burdekin River at Hydro Site	S 20° 38′ E 147° 10′	79	114 000	1977~1994	H1, Q
120101	Burdekin River at Charters Towers	S 19° 58′ E 146° 18′	227	35 000	1915~1952	H2, Q
120105	Clarke River at Telegraph Station	S 19° 13′ E 145° 26′	344	6 720	1949~1975	H2, Q
120107	Burdekin River at Blue Range	S 19° 10′ E 145° 25′	348	10 500	1952~1982 1982~1989	H2, Q H1, Q
120110	Burdekin River at Mount Fullstop	S 19° 12′ E 145° 30′	336	17 420	1965~1990	H1, Q
120111	Burdekin River at Lucky Downs	S 18° 53′ E 144° 58′	11	6 130	1967~1988	H1, Q
120112	Star River at Laroona	S 19° 23′ E 146° 03′	295	1 205	1967~1989	H1, Q
120121	Burdekin River at Lake Lucy Dam Site	S 18° 31′ E 145° 11′	22	2 270	1973~1994	H1, Q
120205	Bowen River at Myuna	S 20° 35′ E 147° 36′	83	7 200	1960~1990	H1, Q
120207	Broken River at Urannah	S 20° 55′ E 148° 19′	221	1 100	1962~1993	H1, Q
120209	Bowen River at 89km	S 20° 45′ E 147° 53′	116	4 660	1964~1990	H1, Q
120214	Broken River at Mount Sugarloaf	S 20° 50′ E 148° 08′	150	2 280	1969~1993	H1, Q
120299	Bowen River at Pump Station	S 20° 45′ E 147° 57′	118	4 495	1968~1991	H1, Q
120301	Belyando River at Gregory Dev Rd	S 21° 32′ E 146° 52′	172	35 530	1949~1976 1976~1993	H2, Q H1, Q
120302	Cape River at Inland Highway	S 21° 00′ E 146° 26′	186	15 850	1948~1968 1968~1994	H2, Q H1, Q
120303	Suttor River at St Annes	S 21° 14′ E 146° 55′	20	49 800	1948~1967 1967~1994	H2, Q H1, Q

No.	$\overline{Q}$ 2) [m³/s]	Q max 3) [m³/s]	$\overline{Q}$ max 4) [m³/s]	$\overline{Q}$ min 5) [m³/s]	$\overline{Q}$ / A [m³/s/100km²]	Q max / A [m³/s/100km²]	C_v 6)	Period of statistics
120001	292	40 400	10 500	0.992	0.23	31.1	0.86	1922~1956
120002	143	23 300	6 210	0.412	0.39	64.0	1.15	1948~1992*
120004	297	29 900	9 780	0.987	0.26	26.2	1.17	1968~1984
120006	322	36 000	11 600	0.720	0.25	27.7	1.05	1951~1992
120008	257	39 300	8 980	2.55	0.20	31.2	1.03	1955~1992*
120010	268	26 300	8 410	1.03	0.21	20.4	1.20	1960~1986
120015	142	13 400	4 320	0.658	0.12	11.8	0.99	1978~1992
120101	100	25 700	5 480	0.020	0.29	73.4	0.91	1922~1949*
120105	23.8	7 560	2 010	0	0.35	112.5	0.91	1950~1971*
120107	37.8	8 450	2 110	0.410	0.36	80.5	1.17	1953~1987*
120110	59.7	9 600	2 970	0.387	0.34	55.1	1.25	1966~1988

No.	$\overline{Q}$ 2) [m³/s]	Q max 3) [m³/s]	$\overline{Q}$ max 4) [m³/s]	$\overline{Q}$ min 5) [m³/s]	$\overline{Q}$ / A [m³/s/100km²]	Q max / A [m³/s/100km²]	C_v 6)	Period of statistics
120111	21.9	3 300	1 100	0.769	0.36	53.8	1.20	1968~1987
120112	12.8	8 640	1 590	0	1.06	717	1.06	1968~1988
120121	12.4	1 600	474	0.004	0.55	70.5	1.29	1974~1988
120205	24.6	15 200	2 690	0.082	0.34	211	0.93	1961~1989
120207	10.8	3 820	1 120	0.159	0.98	347	0.87	1963~1992*
120209	21.7	12 600	2 690	0.157	0.47	270	0.94	1965~1989
120214	21.0	9 400	2 510	0.215	0.92	412	0.90	1970~1992*
120299	29.2	5 750	2 680	0.191	0.65	128	0.80	1969~1982
120301	28.0	2 040	698	0.008	0.08	5.74	1.05	1950~1989*
120302	26.2	2 770	1 020	0	0.17	17.5	1.18	1949~1993*
120303	57.8	10 100	1 720	0	0.12	58.0	1.15	1968~1993

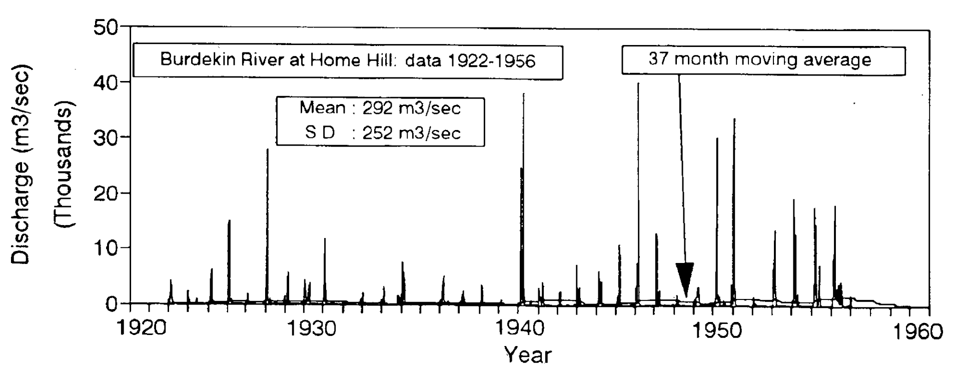
1) H1: Water level in recording chart or data logger
H2: Water level by manual reading (normally daily)
Q: Discharge

2) Mean annual discharge
3) Maximum discharge
4) Mean annual maximum discharge
5) Mean annual minimum discharge
6) Coefficient of variation of annual total discharge

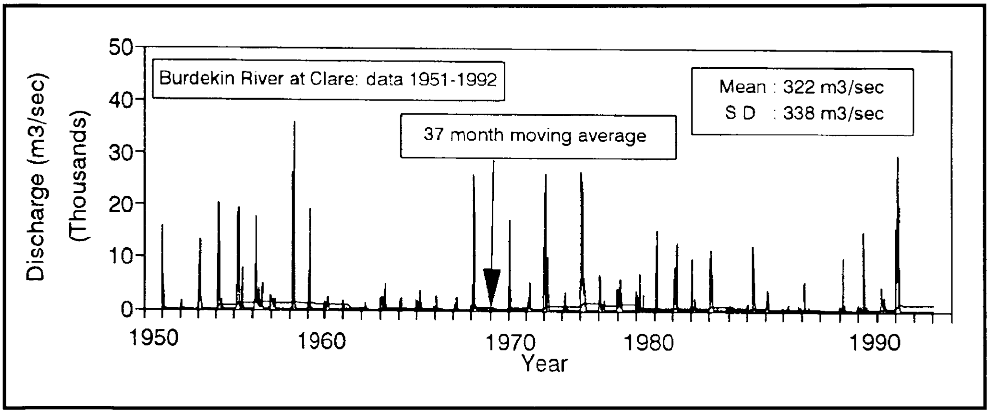
Note: *indicates missing data in some years. These years were excluded from the statistical analyses.
Details of missing data for each station are; 120002: 1953~54; 120008: 1973~75; 120101: 1923~24 & 1941~48; 120105: 1969~70, 120107: 1982; 120207: 1990~1991, 120214: 1990~91 120301: 1958 & 1969~76; 120302: 1957~68.

4.3 Long-term Variation of Monthly Discharge

a) Burdekin River at Home Hill (Station 120001)



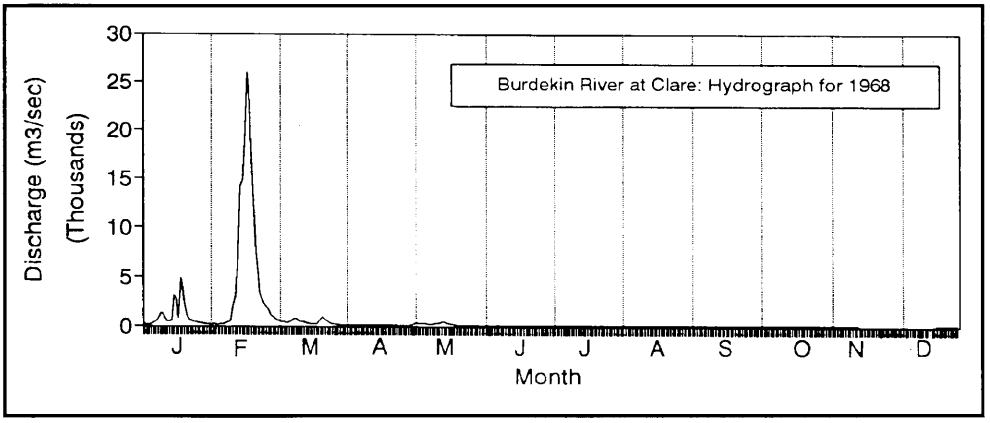
b) Burdekin River at Clare (Station 120006)



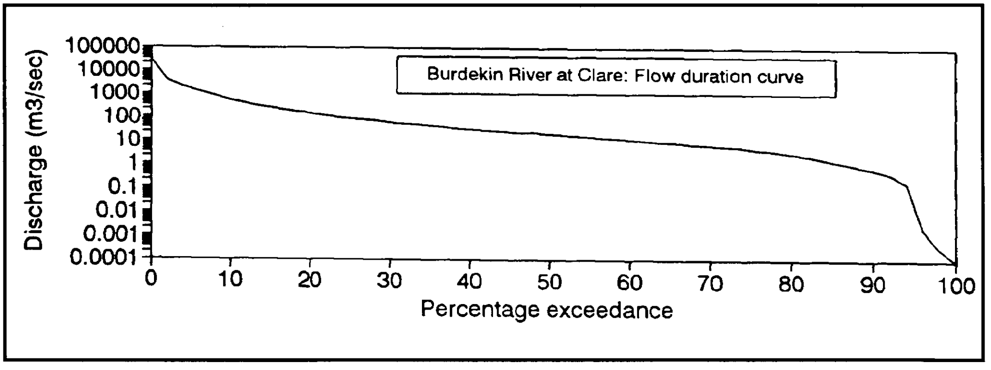
4.4 Annual Pattern of Discharge

Graphs of the discharge series for a selected year and the flow duration curve for the Burdekin River at Clare (Station 120006) are shown below:

a) Discharge series for 1968



b) Flow duration curve



4.5 Unique Hydrological Features

The Australian Institute of Marine Science (AIMS), Townsville is currently involved in the recovery of past hydrological data by utilising the fluorescent properties of coral samples taken from the Great Barrier Reef.

The development of an underwater drilling rig by AIMS has enabled coral samples of greater than 6 meters in length to be obtained from massive Porites corals. When taken from corals growing within approximately 50 kilometres of the shore, these samples exhibit bands of organic compound (fulvic acid) that are displayed as yellow-green fluorescence when exposed to long-wave ultraviolet light. It is suggested that these bands are the result of decaying plant matter that was deposited on the coral dome by nearby river outlets.

The yellow-green bands occur in the high density sections of the coral skeleton which are usually deposited in the summer or monsoon season. In the more recent coral deposits, fluctuations in the density of these sections have corresponded to documented El Nino episodes. In the western Pacific, El Nino episodes are indicative of dry or poor wet seasons.

AIMS have also developed an analytical instrument that is able to extract fluorescence data with a temporal resolution of 20 days. The process passes 700-800 mm long slices of coral 7 mm thick through a fluoromicrodensiometer and exposes them to a far ultraviolet (360 mm wavelength) source. An ultraviolet light-stable uranyl glass block is used as a calibration standard, and the resultant fluorescence is recorded at 0.5 mm intervals along the coral core.

Analysis of the outflow plume from the Burdekin River has shown that the principal plume track is in a northerly direction over the Pandora and Magnetic Island Reefs. However, because the Magnetic Island Reef is also subject to direct runoff from Magnetic Island and the core sample is relatively short, most of the study has concentrated on the Pandora Reef core.

The Queensland Department of Primary Industries, Water Resources, Business Group (formerly the Queensland Water Resource Commission) has supported AIMS by conducting preliminary and further studies of coral core samples. The fluorescence data obtained has been compared with historical rainfall and streamflow records, namely from the Clare and Home Hill gauging stations, to determine the quality of the relationship. Results to date indicate a high degree of correlation between the two sets of data. Analysis is continuing on establishing the form of a transfer function or model for the estimation of streamflow data from fluorescence data. Future studies will involve the analysis of longer term data sets and the examination of a shorter (monthly) time step.

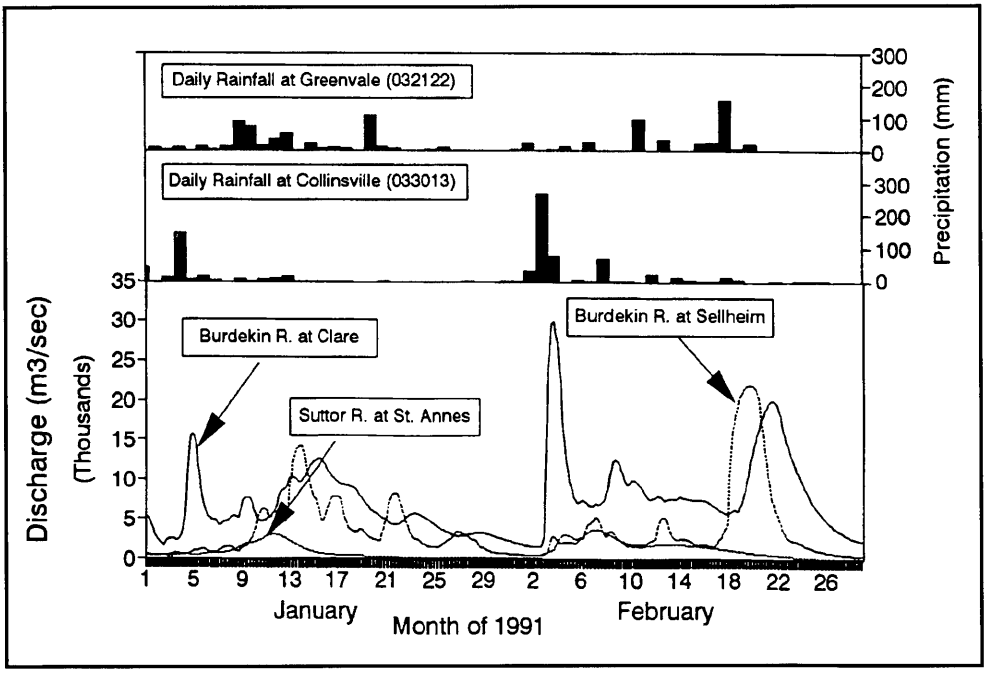
Coral core sample of 6 metres in length may contain up to 800 years of weather history. Thus, the corals contain a veritable data-bank of Australian hydrological data for many centuries past. The research also has potential application in many of the tropical west Pacific countries where cyclones and destructive floods are a regular summer hazard and long term data on such occurrences are scarce.

4.6 Annual Maximum and Minimum Discharges

At Burdekin River at Clare [129 500 km²]

Year	Maximum 1)		Minimum 2)		Year	Maximum 1)		Minimum 2)	
	Date	[m³/s]	Month	[m³/s]		Date	[m³/s]	Month	[m³/s]
1951	1.12	15 900	11&12	0	**1972**	1.11	26 100	12	0
1952	1.25	1 600	1&9~11	0	**1973**	12.20	5 800	1	0
1953	2.15	13 300	11&12	0	**1974**	1.23	26 600	11&12	5.14
1954	2.08	20 300	1	0	**1975**	1.18	6 750	9	4.95
1955	3.19	19 500	12	0.32	**1976**	2.10	5 990	10	1.96
1956	3.09	17 700	1	6.20	**1977**	3.11	7 110	11	0.14
1957	1.11	2 180	12	0	**1978**	2.01	15 300	10	0.98
1958	4.03	36 000	1&12	0	**1979**	3.12	12 800	12	0
1959	2.17	19 100	10	0.29	**1980**	1.07	9 910	11	0.39
1960	3.15	2 580	10&11	0	**1981**	1.23	11 530	10	1.96
1961	1.06	1 950	10&11	0	**1982**	1.28	899	10	0.05
1962	3.10	1 470	9~11	0	**1983**	5.02	12 400	3	0.02
1963	4.08	5 030	12	0.18	**1984**	2.21	3 840	10	0.27
1964	2.13	2 440	9	0	**1985**	3.16	1 160	10	0.11
1965	3.14	3 620	9~12	0	**1986**	2.05	5 440	12	1.12
1966	1.29	2 700	5~9	0	**1987**	12.31	922	9	2.34
1967	3.11	2 460	10	0	**1988**	3.02	10 000	6	1.34
1968	2.17	26 000	11&12	0	**1989**	4.05	14 900	9	10.48
1969	12.29	515	7~12	0	**1990**	12.28	7 560	1	6.59
1970	1.20	17 200	9&10	0	**1991**	2.04	29 800	7	3.39
1971	12.26	12 300	12	0	**1992**	12.06	672	3	3.34

4.7 Hyetographs and Hydrographs of Major Floods



NOTE: The hydrograph at the Burdekin Dam has not been shown on the figure above. The following information was sourced from Fleming and Loofs, 1991.

During major runoff-producing events, the Burdekin River rarely, if ever, responds as a simple catchment. Most major floods have been generated by the passage of tropical cyclones coupled with local topographic effects, particularly during the heaviest rainfall events. The unpredictable nature of major events in the Burdekin catchment is highlighted by the flood events of January/February 1991.

The Bowen-Broken River system is so placed that it produces topographic enhancement of rainfalls. Further, it is in a naturally high rainfall region and so in most wet seasons has a high level of antecedent wetness (Fleming, et. al., 1981). The hydrograph peak at Clare on January 3 follows immediately from a hyetograph peak at Collinsville (station 033013) which is located on the lower reaches of the Bowen River. As there was no corresponding hydrograph peak at the dam, most of the streamflow at Clare would have originated from the Bowen-Broken River system. This basin, on its own or in conjunction with other basins, has contributed to a majority of significant flood events (Fleming, et. al., 1981).

Heavy rainfall in the upper Burdekin, as shown by the Greenvale hyetograph, and Cape-Campaspe catchments that started on January 8 and continued for a week resulted in the peak flow at Sellheim on January 13 and a corresponding large steady flow over the dam. As the combined flows at Sellheim and St. Anne's do not add up to the flow over the dam, most of the runoff must have originated from the Cape-Campaspe catchment.

A tropical low triggered high rainfall in the Bowen-Broken catchment on February 2. The peak of 29,800 m^3/s at Clare occurred almost immediately after this. Again, the lack of corresponding peaks in the Burdekin Dam hydrograph suggests that runoff from the Bowen-Broken River catchment was the primary source of this peak. Flows at Sellheim and St. Anne's at about this time indicate that floods in the upper Burdekin and Suttor Catchments were quite low. Consequently, the high flows at the dam suggest the significant contribution of the Cape-Campaspe catchment.

During mid-February, a trough lay across the top of the catchment resulting in heavy rainfalls and record river heights upstream of Greenvale (station 032122). The hyetograph at Greenvale indicates this high rainfall immediately preceding the hydrograph peak at Sellheim. This peak would have entered the dam pondage whilst the major Cape-Campaspe flood was still being discharged resulting in the flood peak being transmitted to Clare with little change.

The total flow recorded at Clare during January and February was 33 x $10^9 m^3$. Of this, 27 x $10^9 m^3$ was discharged over the dam wall, which is 14 times the dam's capacity. About 20 x $10^9 m^3$ or 73 percent of the flow into the dam originated from the Upper Burdekin River catchment.

5. Water Resources

5.1 General Description

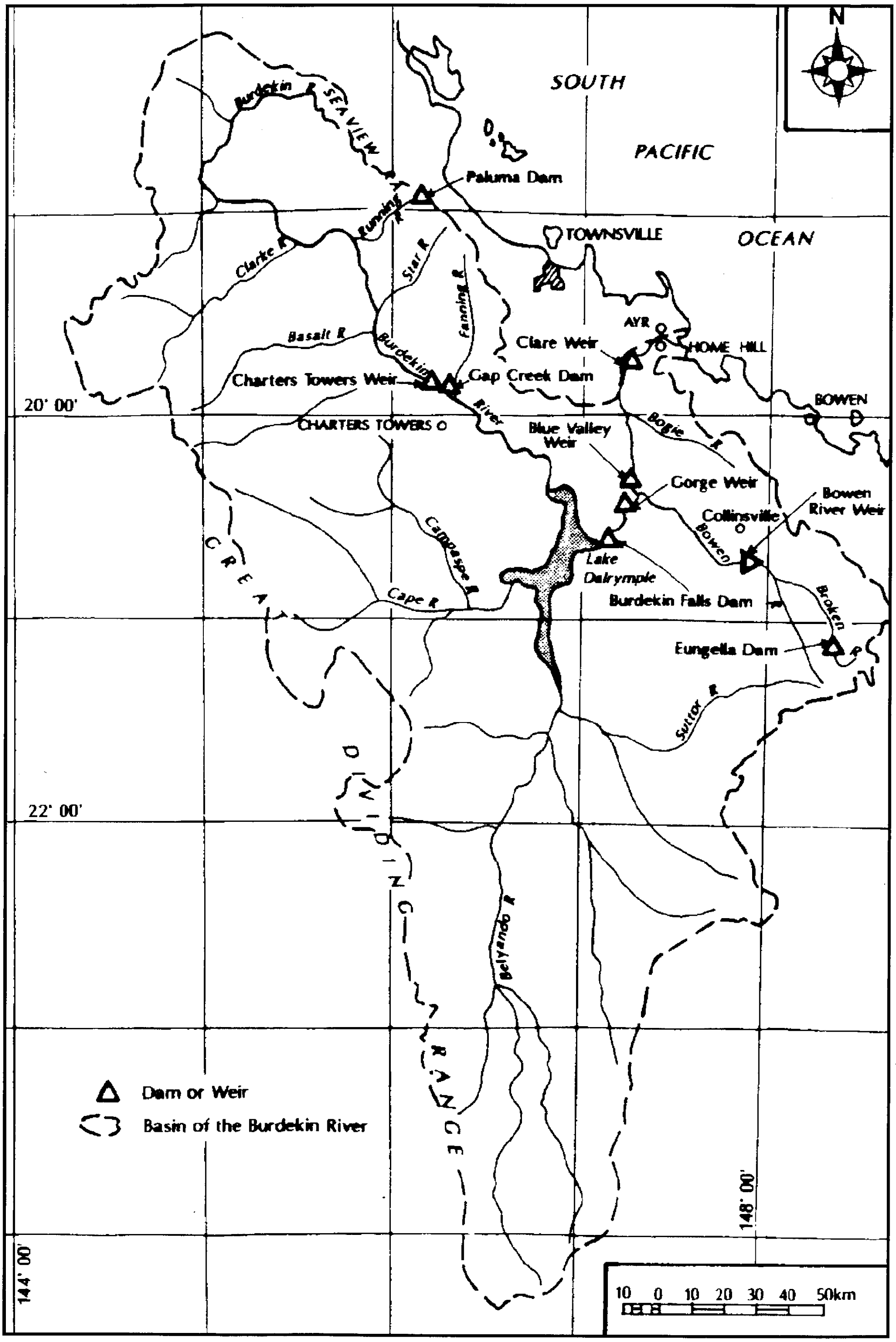
Most of the streams that feed the Burdekin River are subject to seasonal flows. In many months of the year the availability of water for plant growth is restricted and there is usually insufficient moisture available to attain potential evaporation. The surface water resources are also generally restricted with only 12% of the land area yielding about 60% of the average annual runoff. Despite the large catchment area, the Burdekin River has ceased to flow on a number of occasions, the longest period being in 1926 and lasting for seven months.

The largest volumes of runoff occur in the eastern highlands where the coastline has a marked north-south orientation which exposes it to the moisture bringing easterly winds. In the lowland of the central coastal region runoff is considerably lower as a result of lower precipitation and generally higher infiltration. One of the most striking features of the runoff is its rapid decrease westwards. This distribution is similar to that of rainfall but more pronounced due to the increase in evaporation. Exceptions to this general tendency are in the western highlands and tablelands where runoff rises slightly due to higher precipitation and lower evaporation, and in the rain shadow area of the middle Burdekin River catchment where the average annual runoff decreases to almost 254 mm a year.

There are nine major storages located within the catchment, the largest being Lake Dalrymple created on the Burdekin River as a result of the construction of the Burdekin Falls Dam. This storage has the capacity to provide extensive water supplies to Townsville (just outside the catchment) and the irrigation of existing farms in the lower Burdekin River region. In addition, Dam will be able to supply irrigation to 50 000 hectares of proposed new farmland in the lower area of the catchment. The Burdekin Falls Dam is the largest rural land and water conservation scheme ever undertaken in Queensland. It will also provide water supplies for future urban and industrial development in the major centres of the region well into the next century. The dam has been designed to be raised should plans to construct a hydro-electric power station at the site proceed. This will increase the storage capacity to at least 8.5×10^9 m^3. Based on its current capacity, the dam provides an additional 1×10^9 m^3 of water each year to the Lower Burdekin catchment area.

Before the completion of this dam, the Burdekin River frequently overtopped its banks in its lower reaches and most of the canelands of the delta and the towns of Home Hill and Ayr were subject to significant flood damage during major floods. Such events usually occurred during the first three months of the year. The Burdekin Falls Dam is designed to reduce the peak flow rates of major floods originating above the Falls by less than 10 percent, but would have no effect on the 30% of floods originating below the Falls. It has been recognised that the potential for flood damage in the left bank development area is significant and that the area should be designed and managed in a manner such as to minimise flood damage and ensure the maintenance of the wetland habitats (Fleming, et. al., 1981). Due to the warmer climate and higher wind conditions, moisture supplies are normally exhausted during the winter period. Recently, these losses have been replenished by irrigation.

5.2 Map of Water Resources Systems



5.3 List of Major Water Resources Facilities

Major Reservoirs

Name of River	Name of dam	Catchment area [km^2]	Gross capacity [$10^6 m^3$]	Effective capacity [$10^6 m^3$]	Purpose	Year of completion
Swamp Creek	**Paluma Dam**	8	12.3	12.3	I, W	1958
Gap Creek	**Gap Creek Dam**	5	3.7	3.3	M	1993
Burdekin River	**Charters Towers Weir**	34 980	1.9	1.8	W	1903
Burdekin River	**Burdekin Falls Dam**	114 200	1 860	1 850	A, I, F, W	1987
Burdekin River	**Gorge Weir**	115 620	7.9	7.9	A	1953
Burdekin River	**Blue Valley Weir**	125 240	3.8	-	A	1963
Broken River	**Eungella Dam**	142	131	126	A, I	1969
Burdekin River	**Clare Weir**	129 435	15.5	15.2	A, W	1978
Bowen River	**Bowen River Weir**	4 495	2.4	1.9	M, W	1983

A: Agricultural use, F: Flood control, I: Industrial use, M: Mining, W: Municipal water supply.

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