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WATER RESOURCES
COUNCIL

DEPARTMENT OF
NATIONAL RESOURCES

Review of Australia's Water Resources 1975

REVIEW OF AUSTRALIA'S WATER RESOURCES 1975

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Australian Water Resources Council

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Plate 1: Satellite Photograph of Southern Central Victoria

Colours have been modified to obtain the greatest contrast between various natural features. The major topographic feature is the Great Dividing Range (forested parts are portrayed in reddish-brown). It separates the South-East Coast Drainage Division (II) from the Murray-Darling Drainage Division (IV) in the north. Lake Eildon, a major reservoir on the upper Goulburn River is shown just above the centre of the frame. From Eildon the Goulburn flows west, then north to the irrigation areas of the Goulburn Valley. These appear as the faint orange region in the top left hand corner of the frame. The Waranga Basin is also shown – an off-river water storage for irrigation. Melbourne, Australia's second largest city, surrounds the head of Port Phillip Bay at the lower left of the frame.

PREFACE

This review has been designed to provide a concise and balanced assessment of Australia's water resources. It supersedes an earlier publication, *Review of Australia's Water Resources (Streamflow and Underground Resources) 1963*, and is similar in approach and format. The 1963 review, which was the first national assessment of water resources, brought together in one volume information not previously accessible and highlighted inadequacies in the measurement and collection of water resources data within Australia. Since that time, the Australian and State governments have conducted an expanded program of water resources measurement and the present review contains much new and improved data.

The review is confined to giving broad indications of the occurrence, yield and quality of surface water and groundwater within Australia. Descriptions are brief and where possible, quantitative information is summarised in tabular or graphical form and supported by maps. Treatment and presentation are uniform throughout, although completeness has not been possible due to insufficient data from some areas, particularly arid and sparsely populated regions of the continent.

Responsibility for the control, conservation, measurement and assessment of Australia's water resources is vested in Australian and State government authorities. The six State governments are responsible for water resources within their own areas accounting for 82.4 per cent of Australia's land surface. Water resources management and assessment in the Australian Capital Territory, the Northern Territory, and the small island territories is the responsibility of the Australian Government. The Australian Government, through its Bureau of Meteorology, is responsible for the provision of meteorological and some flood warning services on a nation-wide basis.

In 1962, the Australian Water Resources Council was formed to promote and co-ordinate water resources measurement and research. Its main objective is to provide: 'a comprehensive assessment, on a continuing basis, of Australia's water resources and the extension of measurement and research, so that future planning can be carried out on a sound scientific basis'. The Council comprises the minister in each State primarily responsible for water resources, the Australian Minister for National Resources and the Minister for the Northern Territory. It is serviced by a standing committee supported by five formal committees comprising a water research and education steering committee, a research advisory committee and technical committees on surface water, groundwater and water quality. These are aided by a number of special panels and working groups.

This review is the outcome of the Australian Water Resources Council Project 73/52 - Review of Australia's Water Resources. It was compiled by Mr. P. M. McLennan and Mr. I. D. Moore of Economic Research Unit Pty. Ltd., with the guidance and assistance of a reference panel comprising:

Mr. D. B. Collett (Chairman), Public Works Department, Western Australia
Mr. B. L. Credlin, Irrigation and Water Supply Commission, Queensland
Mr. D. J. Lane, Engineering and Water Supply Department, South Australia
Mr. T. W. Plumb, Division of National Mapping, Department of National Resources

Mr. H.J. Rose, Water Resources Branch, Department of National Resources, acted as project co-ordinator and secretary to the reference panel.

The publication was reviewed in its draft stages by the water authorities in each State, co-ordinated through a State liaison officer. Maps have been prepared by the Division of National Mapping of the Department of National Resources.

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Note: For Division XII only two tables are given – XII(e) and XII(f). Data is insufficient to compile the surface water tables XII(a) – XII(d).

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1. INTRODUCTION

Australia's water resources are scanty and unevenly distributed in relation to its area. In addition, water availability in general is highly variable. Rainfall, the primary source of surface and underground water varies considerably from place to place, from season to season and from year to year. These factors limit the scope for easy management of the country's water resources. Nevertheless, although Australia is the world's driest continent in terms of average annual runoff per unit area, domestic and industrial water consumption per head of population is comparable to that of other prosperous nations, despite the economic costs associated with the provision of water supplies in such an environment.

Australia is a highly urbanised country. 80 per cent of its population lives in towns and cities lying mostly on the temperate coastal fringes of the continent. Nevertheless only about 15 per cent of water diversions are for non-agricultural purposes. Most of the remainder are for irrigation and stock watering. Irrigation is widely practised and compared to other countries, Australia has one of the highest irrigated areas per head of population (see Section 6). Australia's development has been greatly influenced by the nature and extent of its water resources and with continued growth in demand successful water management will require careful and co-ordinated planning. This review is designed with that end in mind, as a contribution to the better understanding and management of Australia's water resources.

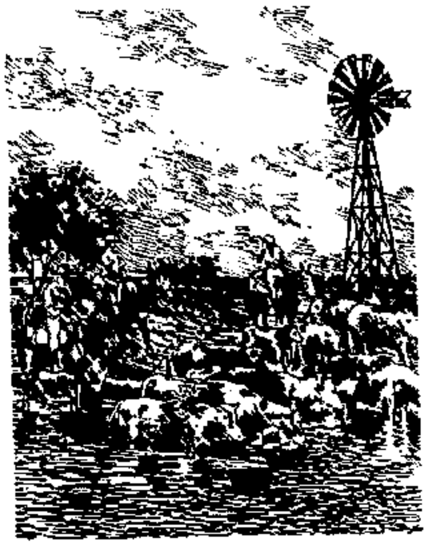
Australia is a continent of low relief with a land surface which is generally highly weathered and flat. Its most prominent topographic feature is the Great Dividing Range, a chain of low mountains and tablelands along the eastern and south-eastern seaboard. Rainfall is most regular along the coastal fringes, especially on the populous south-east coast and in Tasmania. Elsewhere rainfall is more seasonally variable. Northern Australia, for example, experiences monsoonal conditions and tropical cyclones which may cause extensive flooding in rivers that have little or no flow for most of the year. Inland, the continent is arid, and rain is sparse and infrequent.

Evaporation is high throughout most of Australia and, on average, consumes 87 per cent of all moisture that reaches the ground, compared to about 60 per cent for North America and Europe. High evaporation coupled with the variability of streamflow make conservation and development of surface water resources more expensive and less effective than in many other countries.

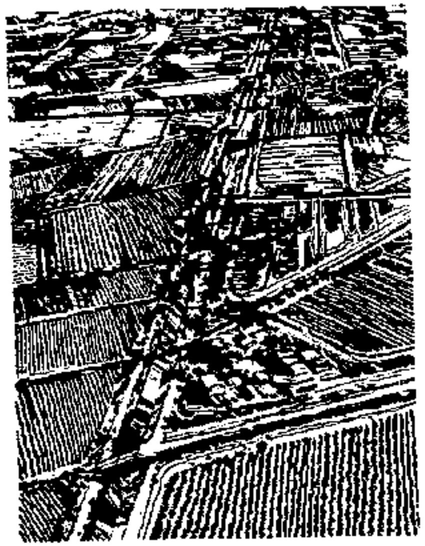
Water may also be drawn from underground sources, and Australia is fortunate in the widespread occurrence of groundwater, even in arid and semi-arid areas. The most concentrated use of groundwater at present is from unconsolidated sediments, particularly alluvial and aeolian (windblown) deposits. These are generally high yielding and from a major source of groundwater for irrigation, industrial and domestic use. In addition, major sedimentary basins underlie 60 per cent of the continent, and one, the Great Artesian Basin, is among the largest in the world. Groundwater from this basin has sustained much of Australia's inland pastoral industry since the late nineteenth century.

Figures 1 and 2 show topography, rainfall and evaporation along two cross-sections of the Australian continent. The illustrations show the diversity of water resource occurrence and use.

In the past, groundwater and surface water have tended to be viewed as separate resources, as a result, no doubt, of inherent differences in their modes of occurrence, assessment and development.



1. Stock watering in the Kimberleys



2. Murrumbidgee Irrigation Area, N.S.W.

3. Tumut 3 – Snowy Mountains Hydro-electric Authority

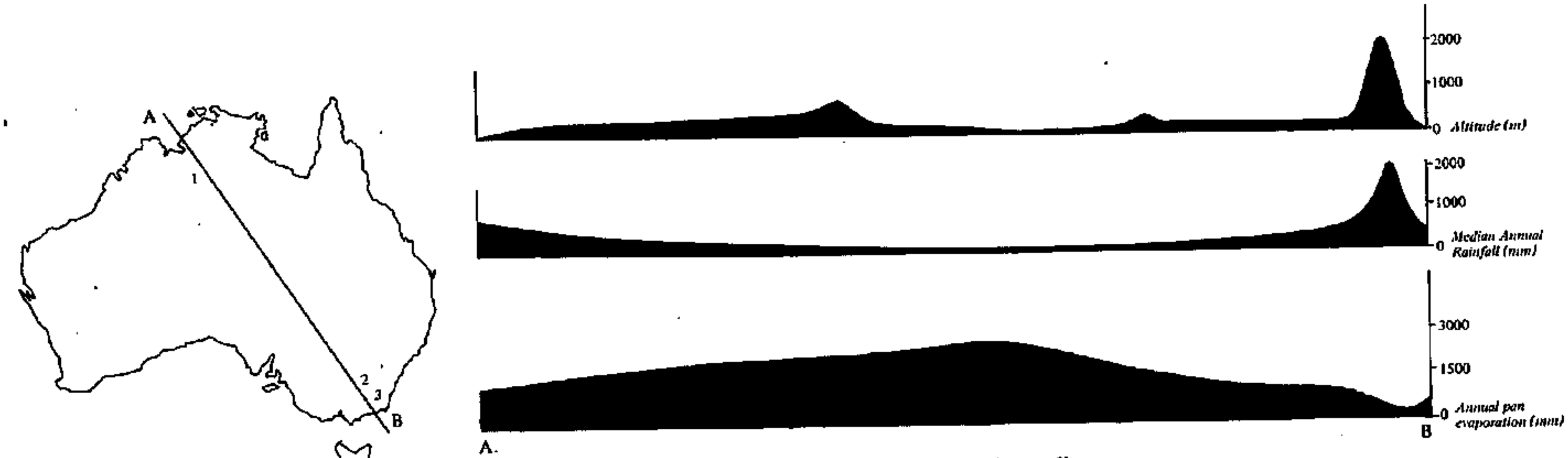
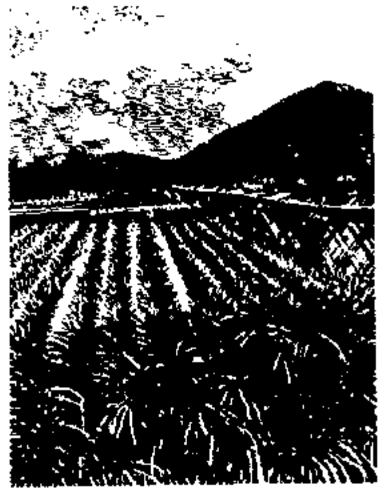


Figure 1: North-west, South-east Section of Australia

1. Darling Escarpment looking west

2. Krichauff Range, Central Australia.



3. Sugar cane, North Queensland coast.

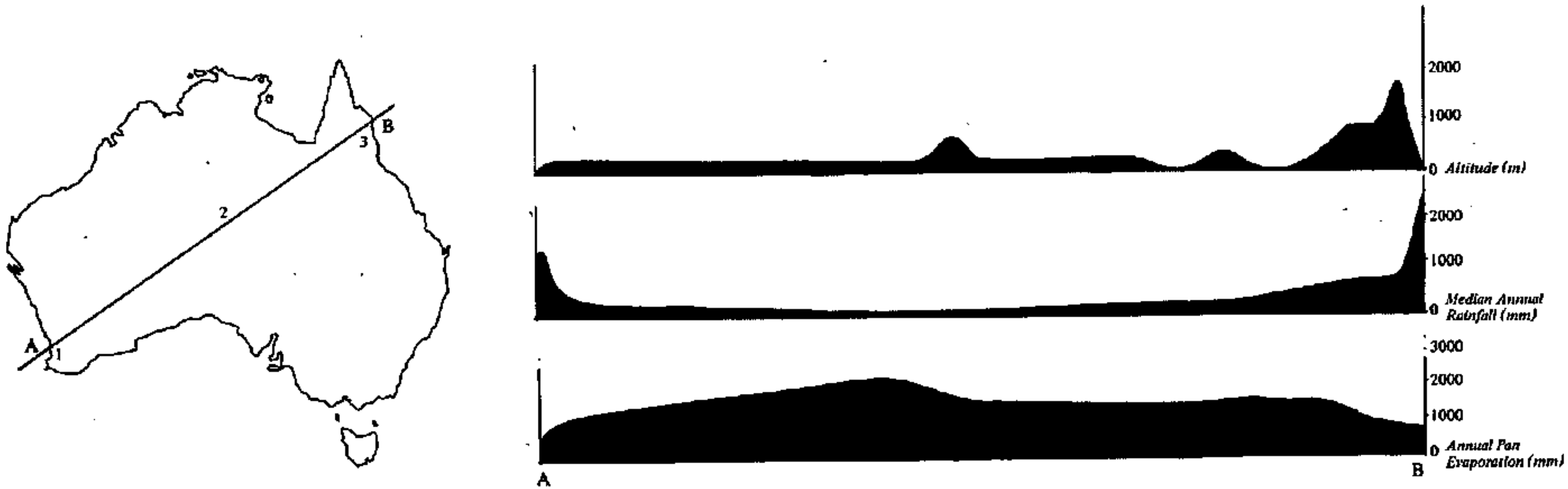


Figure 2: North-east, South-west Section of Australia

Yet they are often hydraulically connected, and in any event, are complementary components of a single larger system, the hydrologic cycle. Thus, in assessing the water resources of a region, independent measurements of groundwater and surface water yield are not necessarily additive.

To promote a unified approach so far as possible, river basins or groups of river basins have been adopted as the primary units of assessment for both surface and groundwater resources. This is straightforward for groundwater basins based on unconsolidated sediments as they generally occur within river basin boundaries. However, boundaries of the major sedimentary basins do not coincide with river basin boundaries and because of their importance, groundwater data on these are also presented separately, with each sedimentary basin being treated as an individual unit. Hence these groundwater data are included twice, first within the unified assessment, then under the separate assessment of sedimentary basins.

For purposes of assessment, 244 areas have been adopted as river basins. These have been grouped into twelve drainage divisions (Map 1), mostly according to their location along major physical divides, or their place in major river systems. Brief descriptions of the characteristics of the twelve divisions are given in Section 5. These descriptions are confined to illustrating typical conditions and do not cover the complete range that might occur within each division. As much of Australia is of low relief, the boundaries of some river basins and drainage divisions are ill-defined and are revised as more reliable information comes to hand. For this reason some boundaries in this review differ from those in earlier publications. Map 5 shows these boundaries and the general pattern of drainage on the Australian continent. The Western Plateau Drainage Division is flat and rainfall is so infrequent that drainage is largely unco-ordinated. The Lake Eyre and Bulloo-Bancannia Divisions have no point of ocean discharge and surface water is dissipated through evaporation or seepage. Although these three divisions cover 48.5 per cent of Australia's area, they contribute very little to total surface runoff.

Data on surface water resources are presented in tables which give estimates for each river basin of total yield, possible exploitable yield and commitments, together with the range of discharges and salinities for selected rivers throughout Australia.

Groundwater is more difficult to assess than surface water. Quality and yield vary markedly with depth, location and geological environment and its behaviour is complex. Since the 1963 review, information on groundwater has improved considerably and this is reflected in the data included in this review. Groundwater storages will be depleted if water is withdrawn at a greater rate than can be sustained by recharge. Thus estimates are given for each river basin of total possible annual yields allowing extraction from storage, and yields from recharge alone. In addition, a table is included which details major aquifer characteristics, including the range of common aquifer depths and thicknesses, the range of common bore yields, the estimated number of bores and the range of common salinities.

Throughout this review, the accuracy and availability of data vary. Generally, data are most comprehensive for areas where water resources are most fully utilised. For much of the continent however, data are incomplete or the result of only superficial measurement. For example, surface water data at the river basin level is not available for the Western Plateau Division which covers much of the arid area of Australia. In many of the tables, indicators of reliability are presented. River basin discharges and runoff are given alongside the number of flow measurement stations and their type. Estimated river salinities are given together with the period over which samples have been taken and the number of samples from which the estimates have been calculated. In addition, qualitative indices of reliability have been attached to groundwater yields.


VIII
TIMOR SEA
IX
GULF OF
CARPENTARIA
I
NORTH-EAST
COAST
VII
INDIAN OCEAN
XII
WESTERN PLATEAU
X
LAKE EYRE
XI
BULLOO-
BANCANNIA
IV
MURRAY-DARLING
VI
SOUTH-WEST
COAST
V
SOUTH AUSTRALIAN
GULF
II
SOUTH-EAST
COAST
III
TASMANIAN
RELIEF AND DRAINAGE DIVISIONS
SCALE 1: 15 000 000
100 0 100 200 300 400 500
Kilometres

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2. HYDROLOGIC CYCLE IN AUSTRALIA

About 97 per cent of the earth's water is held in the oceans and seas. Of the remaining 3 per cent, three-quarters is trapped in polar ice caps and glaciers as fresh water, and about one-quarter is stored as soil moisture and groundwater of varying salinity. A small proportion is held as vapour in the atmosphere. Only one-hundredth of one percent of water at the earth's surface occurs as fresh water in lakes and rivers. Thus, in proportion to the total volume of terrestrial water, the amount of fresh water available for consumption is very small.

Fresh water is replenished in an endless cycle by evaporation of surface waters of the sea and land, using the radiant energy of the sun, with eventual precipitation back to earth. The earth's rotation and differential heating of air masses by the sun are the driving forces behind the transport of water vapour in the atmosphere. Water vapour condenses to form clouds and if meteorological conditions are favourable, water will be precipitated, often great distances from its source. This transfer of water between the oceans, the atmosphere and the land is called the hydrologic cycle. Its main features are shown in Figure 4.

Precipitation is caused by the lifting of moist air and subsequent cooling and condensation to form rain, hail or snow. There are three main mechanisms - mechanical or orographic lifting in which moist air is forced to rise over mountain barriers, thermal or convective lifting caused by air being heated from below, and dynamic lifting associated with the movement of high and low pressure wind systems.

The land phase of the hydrologic cycle is illustrated in Figure 3. It is complex and vital in its effect on the disposition and distribution of all plant and animal communities.

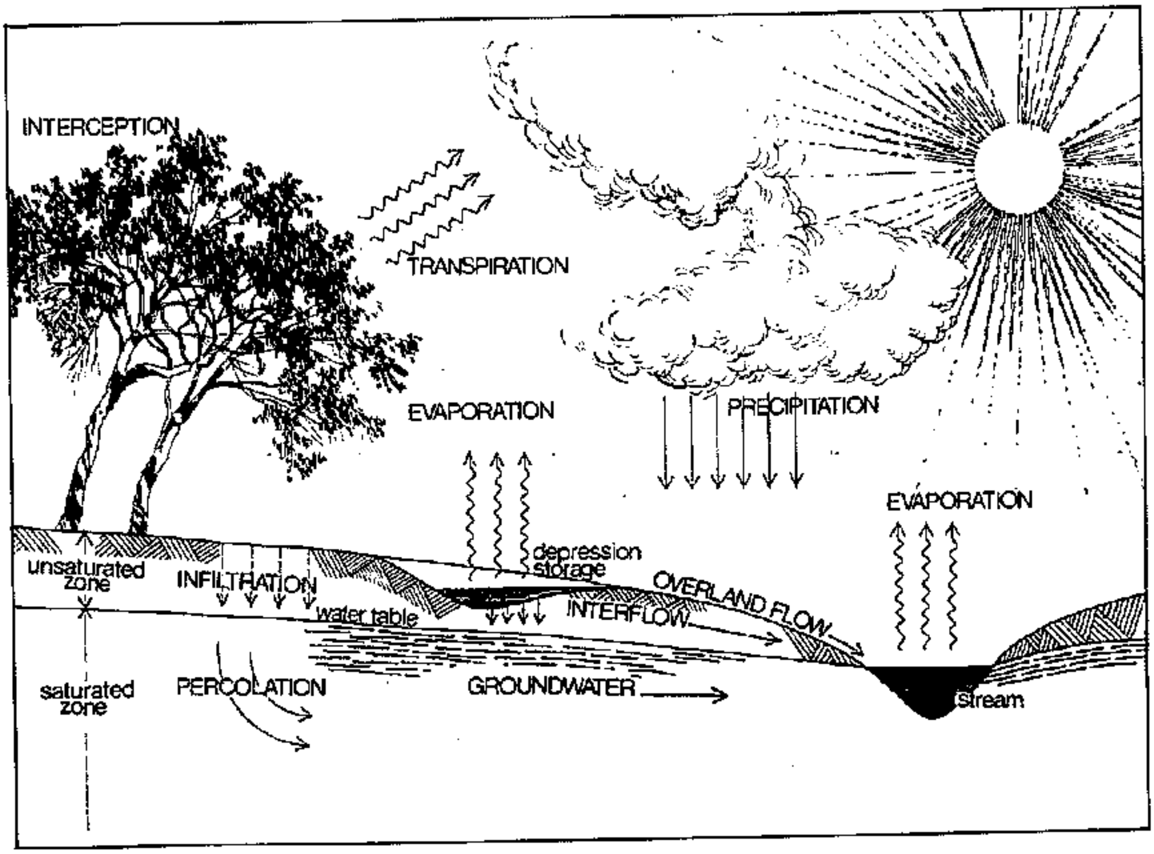


Figure 3: The Land Phase of the Hydrologic Cycle

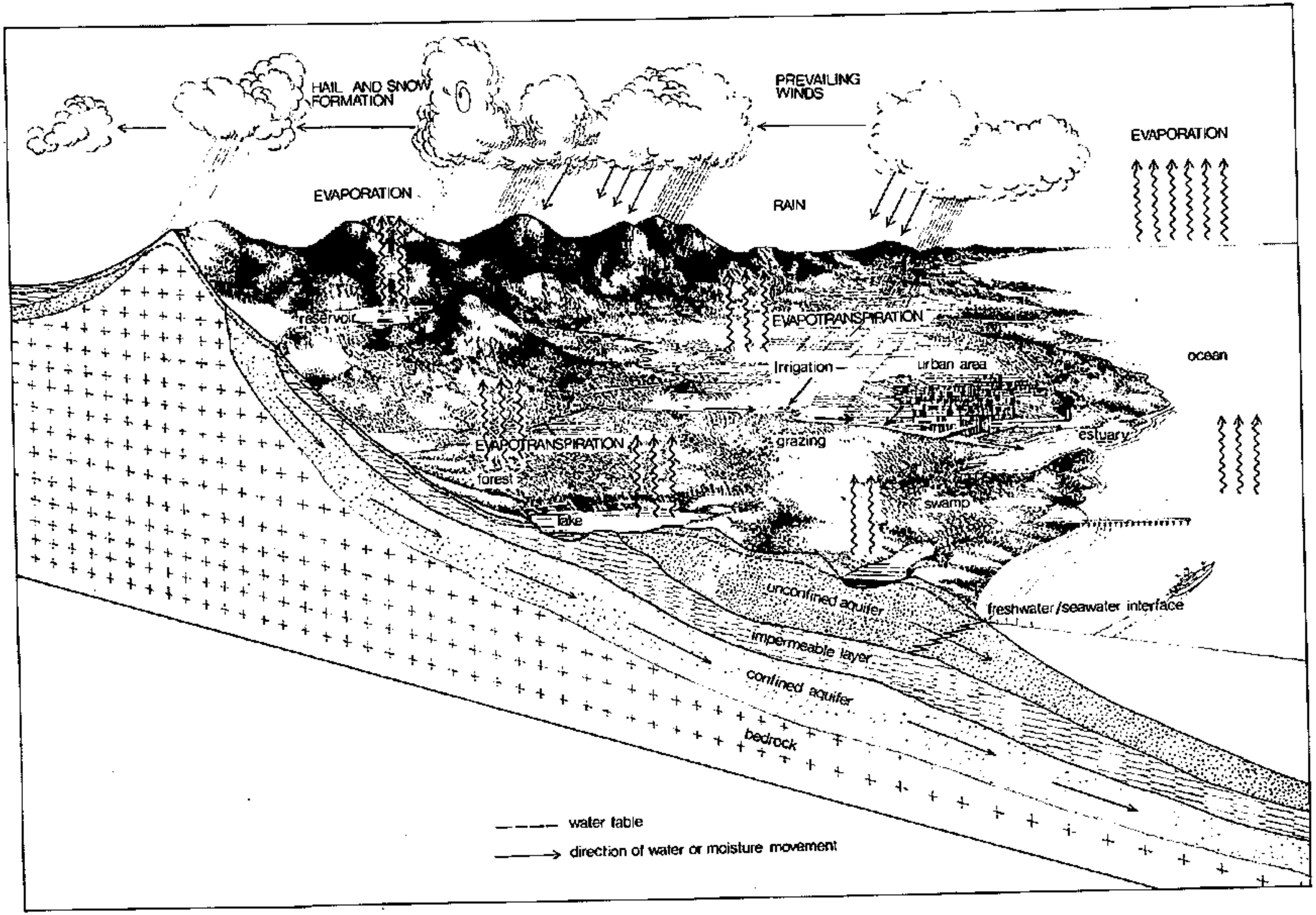


Figure 4 : The Hydrologic Cycle

Evaporation and transpiration are major components of the hydrologic cycle in Australia. Potential evaporation (i.e., the evaporation that would occur from an open water surface and estimated from standard pan measurements) is high throughout the greater part of the continent. Average annual standard pan evaporation exceeds 3000 mm in central Australia and exceeds 1000 mm in all but the most southerly parts of the continent. Thus average annual precipitation is less than potential evaporation over most of Australia. However, actual evaporation is considerably less than potential evaporation, being limited by both rainfall and the available moisture stored in the soil.

All soils are capable of storing moisture although the quantity varies greatly with soil type. Soil moisture is lost through percolation and evapotranspiration and is naturally replenished by rainfall. Together with temperature, the level of available soil moisture significantly affects the soil's potential for growing crops. As the availability of soil moisture to plants drops, transpiration decreases and plant growth is retarded and eventually may cease. With seasonal changes in soil moisture, most of Australia has a growing season of less than five months and almost 70 per cent of Australia has a growing season of less than four months. The only areas with annual moisture surpluses are the western highlands of Tasmania, the Snowy Mountains in south-eastern Australia and some parts of the north-east coast. In northern Australia, there is a seasonal moisture surplus during the wet season, but in many places, soil moisture adequate for plant growth does not persist through the dry season.

Australia is situated in the mid-latitudes of the southern hemisphere and its climate is governed by the characteristic high and low pressure wind systems of this region. Except for the Great Dividing Range, the prevailing movement of these systems from west to east across the continent is relatively unimpeded by topography.

The pressure systems have a marked seasonal incidence. In winter (May to October), high pressure systems prevail across the interior of the continent bringing mild dry south-east trade winds to northern Australia and cool moist westerly winds to southern Australia. The westerly winds and frontal systems (associated with low pressure systems), bring fairly reliable light to moderate rains to south-western Australia, the agricultural regions of South Australia and most of Victoria and Tasmania. Higher winter rainfall occurs where orographic lifting is more pronounced.

In summer months, high pressure systems are further south directing easterly winds generally over the continent and bringing fine, warm to hot weather to southern Australia. The tropical north comes under the influence of moist north-west monsoons and tropical cyclones bringing heavy and often widespread rains to the north-west, much of the Northern Territory and inland north Queensland.

The climate of coastal regions is influenced by the proximity of the sea and in general, rainfall decreases inland with distance from the coast. Orographic lifting produces high rainfall along the Great Divide bordering the east coast, in the western highlands of Tasmania, and in the ranges and escarpments of south-western Australia. Moist south-east winds in winter bring heavy rains to the coastal ranges of north Queensland augmenting summer rainfall from the monsoons and tropical cyclones. The wettest part of Australia is in this region at elevations above 1500 m. The influence of the south-east winds also extends into northern New South Wales.

In Australia, only a small proportion of precipitation subsequently becomes surface runoff. Much precipitation reaching the ground either evaporates or is transpired by vegetation. Some of the water infiltrates into the soil where it is taken up by vegetation or percolates underground. Groundwater may reappear on the surface as spring flow and this, augmented with seepage through

river banks and beds, comprises the baseflow of streams. The bulk of surface runoff flows to the sea; the remainder flows inland and is dissipated by evaporation or infiltrates to groundwater storage. The development of Australia's water resources is tied closely to rainfall and runoff patterns which are shown in Maps 2 and 3. Australia's surface water resources are described in more detail in Section 3.1.

In contrast to surface water, groundwater is more widely available in Australia. Groundwater resources are generally replenished by infiltration from rainfall or surface streams. Storages are generally large and water flow rates are slow, ranging from less than a metre to a few thousand metres per year. In the larger groundwater basins, water may remain in aquifers for very long periods. An example of this is the Great Artesian Basin. Here it has been estimated that the time taken for water to move through the main aquifers from intake areas in Queensland to mound springs in South Australia is three million years *(Groundwater Resources of Australia,* 1975*)*. Australia's groundwater resources are described in more detail in Section 3.2.

3. CHARACTERISTICS OF AUSTRALIA'S WATER RESOURCES

3.1 Surface Water Resources

The limited extent of Australia's surface water resources can be seen in Table 1 below, where rainfall and runoff are compared for the six continents. Australia has not only the lowest rainfall and runoff in proportion to its area, but also the lowest percentage of runoff to rainfall. That is, even the proportion of water available for use from Australia's low level of precipitation is less than in other continents. However, this is at least partly because runoff is disproportionately low in areas of low rainfall and high evaporation.

Table 1: Rainfall and Runoff of the Continents

	Area (km² x 10³)	*Average annual rainfall* (mm)*	*Evaporation and transpiration as a percentage of rainfall*	*Runoff as a percentage of rainfall*
Africa	30 210	660	76	24
North America	24 260	660	60	40
South America	17 790	1 350	64	36
Asia	44 030	610	64	36
Europe	9 710	580	60	40
Australia	7 690	420	87	13

* Median figures are given for annual rainfall in all other instances in this review, except in Table 2 below.
Source: adapted from J. Andrews, *Australia's Water Resources and their Utilisation*, pp 11 - 14; J. E. McDonald, 'On the ratio of evaporation to precipitation,' *J. Met.*, vol. 42 (1961), no. 3, p 186.

Although the average percentage of runoff to rainfall is low, its variability across Australia is considerable. Table 2 gives rainfall and runoff for three Australian rivers to show the effects of distinct climatic and topographic characteristics.

Table 2: Rainfall and Runoff in Three Australian River Catchments

	Area (km² x 10³)	*Average annual rainfall (mm)*	*Evaporation and transpiration as a percentage of rainfall*	*Runoff as a percentage of rainfall*
King River (at Crotty)	0.45	3 000	20	80
Shoalhaven River (at Welcome Reef)	2.77	875	71	29
North Para River (at Yaldara)	0.38	540	92	8

Source: State water authorities

The King River is in the mountainous western highlands of Tasmania (Drainage Division III), where the climate is cool and temperate, and rainfall is high and regular the year round. The upper Shoalhaven River is on the south-east coast of New South Wales between the Great Divide and a coastal mountain range (Drainage Division II). The climate is warm and temperate, and rainfall is fairly uniform throughout the year, although annual runoff has varied from about 3 percent to 65 per cent of rainfall in individual years. The catchment of the North Para River includes the Barossa Valley of South Australia (Drainage Division V), and the climate is mediterranean with winter rains predominating. The catchment has an average annual runoff of only 8 per cent, but this has varied

from 0.4 to 21 per cent.

The distribution of rainfall and runoff in Australia is illustrated on Maps 2 and 3. Except for a more marked decline in runoff towards the inland, rainfall and runoff patterns are quite similar.

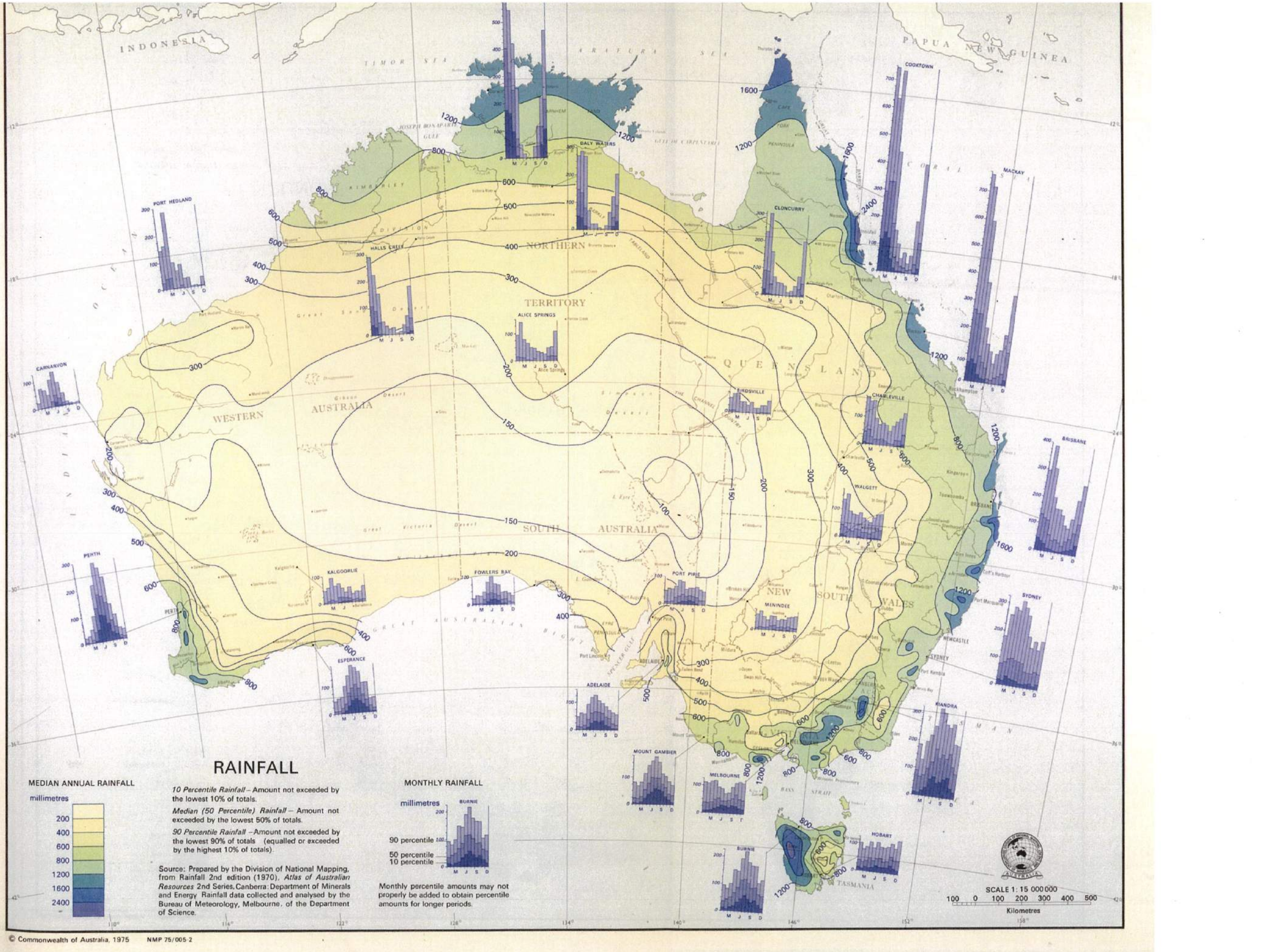
The average annual runoff for the continent as a whole is only 45 mm and less than 5 per cent of Australia has an average annual runoff of more than 250 mm. Average annual runoff exceeds 1250 mm in only three major areas: on the east coast of north Queensland near Cairns, the Snowy Mountains in the southern part of the Great Divide and in western Tasmania. Table A. *Drainage division areas, gauging stations and average annual discharges,* shows the sharp variations in the distribution of runoff in Australia. Drainage Divisions I, II, III, VIII and IX comprise only 26 per cent of Australia, yet they contribute more than 88 per cent of total runoff.

Much of Australia experiences large seasonal and annual variations in streamflow. In the north, runoff is more pronounced during summer while in the south it is more pronounced during winter. Most streams are both seasonally and annually variable. However, seasonal variability is more pronounced in the north whereas annual variability is more pronounced in areas of low average rainfall. Extensive flooding and prolonged periods of low or zero flow occur in most Australian streams.

Flow variability provides a basis for classifying streams and three classes have been identified on Map 5. Many Australian streams are either seasonal or ephemeral. Most perennial streams are confined to the relatively well-watered coastal fringes of the continent in the east, south-east and south-west, and the Murray-Darling system. Most streams in Tasmania are perennial.

In many parts of the world, snowfields play an important role in regulating the spring and summer flow of rivers through snow melt. Australia's snowfields however, are limited and none of them are permanent. The major snowfields are confined to the higher mountains in the south-east of the continent and to the central highlands of Tasmania. Rivers with their headwaters in these areas tend to be perennial but this is as much due to high and regular rainfall as to the effects of snow melt. As an example, Table IV(b). *Range of discharges for selected rivers,* shows that the only significant rivers in the Murray-Darling Division that have flowed continuously during the period of record, are those with headwaters in the snowfields of the Snowy Mountains or the north-eastern highlands of Victoria.

The period of record for many Australian streams is insufficient to justify full statistical analysis of streamflow variability. To facilitate meaningful comparisons therefore, the range of discharges for selected rivers has been used to indicate variability. These are shown in Table B and Tables I(b) - XI(b). In most cases, those streams which are free from substantial modification by regulation works, have been selected for inclusion in the tables. Two important points should be kept in mind. Firstly, no one stream will be truly representative of a river basin in which there are a number of streams, nor can the variation of discharge for a stream be taken as truly typical of a drainage division. Secondly, the length of streamflow record can significantly influence the range of discharge. The longer the record, the more likely it is that the record encompasses a greater range of flow conditions.



RAINFALL
MEDIAN ANNUAL RAINFALL
millimetres
200
400
600
800
1200
1600
2400
10 Percentile Rainfall – Amount not exceeded by the lowest 10% of totals.
Median (50 Percentile) Rainfall – Amount not exceeded by the lowest 50% of totals.
90 Percentile Rainfall – Amount not exceeded by the lowest 90% of totals (equalled or exceeded by the highest 10% of totals).
Source: Prepared by the Division of National Mapping, from Rainfall 2nd edition (1970), Atlas of Australian Resources 2nd Series, Canberra: Department of Minerals and Energy. Rainfall data collected and analysed by the Bureau of Meteorology, Melbourne, of the Department of Science.
MONTHLY RAINFALL
millimetres
BURNIE
90 percentile
50 percentile
10 percentile
M J S D
Monthly percentile amounts may not properly be added to obtain percentile amounts for longer periods.
SCALE 1: 15 000 000
100 0 100 200 300 400 500
Kilometres
INDONESIA
PAPUA NEW GUINEA
TIMOR SEA
ARAFURA SEA
CORAL SEA
TASMAN SEA
INDIAN OCEAN
GREAT AUSTRALIAN BIGHT
BASS STRAIT
WESTERN AUSTRALIA
NORTHERN TERRITORY
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
PORT HEDLAND
HALLS CREEK
DALY WATERS
CLONCURRY
COOKTOWN
MACKAY
ALICE SPRINGS
CARNARVON
BIRDSVILLE
CHARLEVILLE
BRISBANE
WALGETT
PERTH
KALGOORLIE
FOWLERS BAY
PORT PIRIE
MENINDEE
SYDNEY
ESPERANCE
ADELAIDE
KIANDRA
MOUNT GAMBIER
MELBOURNE
HOBART

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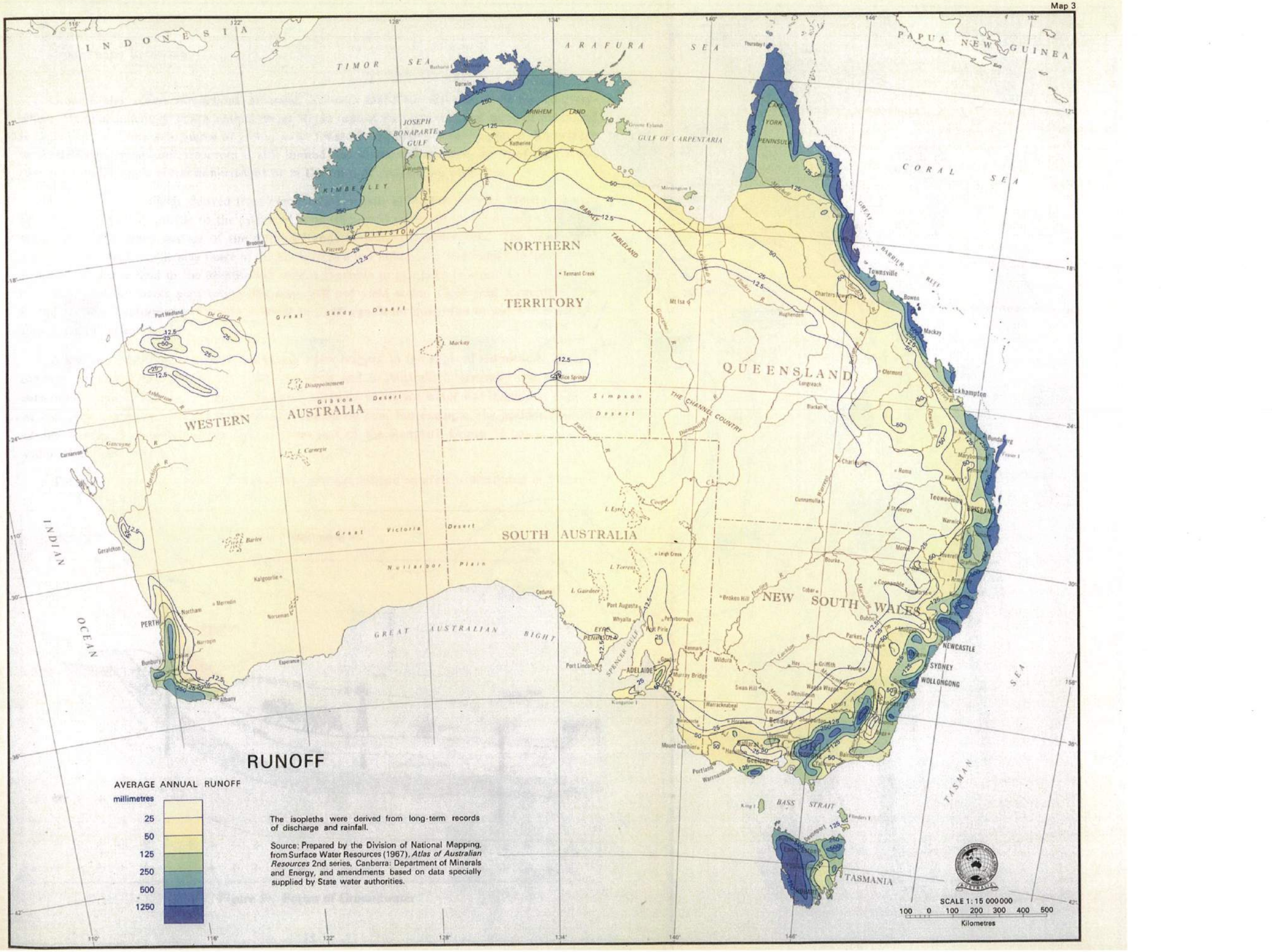

RUNOFF
AVERAGE ANNUAL RUNOFF
millimetres
25
50
125
250
500
1250
The isopleths were derived from long-term records of discharge and rainfall.
Source: Prepared by the Division of National Mapping, from Surface Water Resources (1967), Atlas of Australian Resources 2nd series, Canberra: Department of Minerals and Energy, and amendments based on data specially supplied by State water authorities.
INDONESIA
TIMOR SEA
ARAFURA SEA
PAPUA NEW GUINEA
CORAL SEA
GULF OF CARPENTARIA
JOSEPH BONAPARTE GULF
INDIAN OCEAN
GREAT AUSTRALIAN BIGHT
TASMAN SEA
BASS STRAIT
WESTERN AUSTRALIA
NORTHERN TERRITORY
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
TASMANIA
KIMBERLEY
ARNHEM LAND
CAPE YORK PENINSULA
BARKLY TABLELAND
THE CHANNEL COUNTRY
GREAT BARRIER REEF
Great Sandy Desert
Gibson Desert
Great Victoria Desert
Simpson Desert
Nullarbor Plain
Darwin
Broome
Port Hedland
Carnarvon
Geraldton
PERTH
Kalgoorlie
Esperance
Albany
Townsville
Mackay
Rockhampton
BRISBANE
NEWCASTLE
SYDNEY
WOLLONGONG
ADELAIDE
Port Augusta
Whyalla
Port Lincoln
Broken Hill
Mount Gambier
Mt Isa
Tennant Creek
Alice Springs
Ceduna
SCALE 1:15 000 000
Kilometres

3.2 Groundwater Resources

Groundwater occurs throughout Australia, although useful supplies cannot be tapped everywhere. Major sedimentary basins extend under 60 per cent of the continent and much of the inland is dependent on these as a source of groundwater for stock and domestic consumption. Knowledge of Australia's groundwater resources is still limited and as the tables show, much of the needed data for this section is either non-existent or in the form of preliminary estimates.

Groundwater is mainly derived from precipitation, mostly in the form of rain. Moisture percolates through the soil profile to the saturated zone (Figure 5) where all rock interstices are filled with water. The upper surface of the saturated zone is called the water table. The unsaturated zone above the water table may range in thickness from a few millimetres to several hundred metres. Although moisture held in the unsaturated zone is available to plants and subject to depletion by evapotranspiration, bores penetrating this zone will not yield water. Geological formations containing sufficient saturated permeable material to yield significant quantities of water to bores and springs are called aquifers.

A less important source of groundwater is water trapped in the voids of sedimentary rocks at the time of deposition. This is called connate water and in Australia is generally too saline for consumptive use. It is found in some regions of Australia where sea water was trapped at the time of sediment deposition and not subsequently flushed by rain. For example, the northern portion of the Murray Sedimentary Basin which forms part of the Renmark Group of basins contains water of connate origin.

The occurence of groundwater in confined and unconfined aquifers is illustrated in Figure 5.

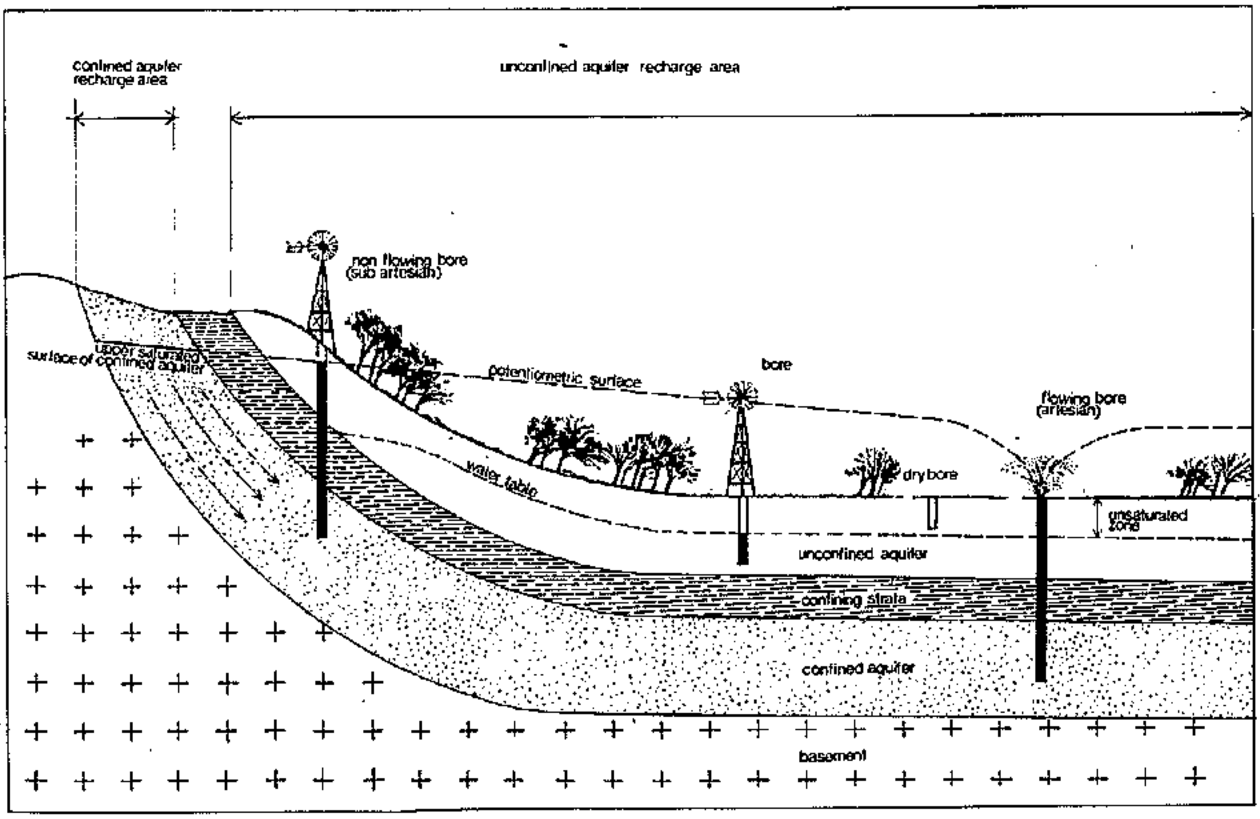


Figure 5: Forms of Groundwater

Confined groundwater is held under pressure in an aquifer overlain by relatively impermeable material. When a confined aquifer is penetrated by a bore and the pressure is sufficient, water will rise above the ground and flow freely from the bore. This is known as artesian water. If the pressure is insufficient to cause water in the bore to rise to the surface, the bore is said to be sub-artesian. Unconfined groundwater however, is only under atmospheric pressure and its upper surface defines the water table. When an unconfined aquifer is penetrated by a bore, water stands in the bore at the level at which it was encountered.

For this review, the assessment of groundwater has been divided according to its occurrence in the three main classes of aquifer: unconsolidated sediments, sedimentary rocks and fractured rocks.

Unconsolidated sediments comprise alluvial sediments in river valleys, deltas and basins, aeolian (windblown) sediments which generally occur in coastal areas, and lacustrine (lake) sediments. These sediments are often highly permeable and porous. Permeability and porosity may vary markedly according to orientation. Unconsolidated aquifers of this group generally occur at depths less than 150 m and are often readily accessible to sources of water for recharge. Marked seasonal variations in water level are common.

Sedimentary rocks are generally made up of consolidated sediments. The aquifers owe their porosity to small voids between the grains, which are often well compacted and cemented. They often cover significant areas, being continuous and of appreciable thickness. Rock strata usually dip quite gently. Nevertheless, over the full extent of the larger sedimentary basins, aquifers may reach great depths. Areas where recharge takes place may be small in relation to the extent of the aquifer. Water quality in individual aquifers may be quite good and fairly uniform over large areas. Some sediments contain a number of permeable and impermeable layers, creating a vertical sequence of separate aquifers, and water quality may vary greatly between them.

Fractured rocks comprise hard igneous and metamorphosed rocks which have been subjected to disturbance and deformation. Aquifers resulting from the weathering of any rock type are also included in this group. Water is transmitted mainly through joints, bedding planes, faults, caverns, solution cavities and other spaces in the rock mass.

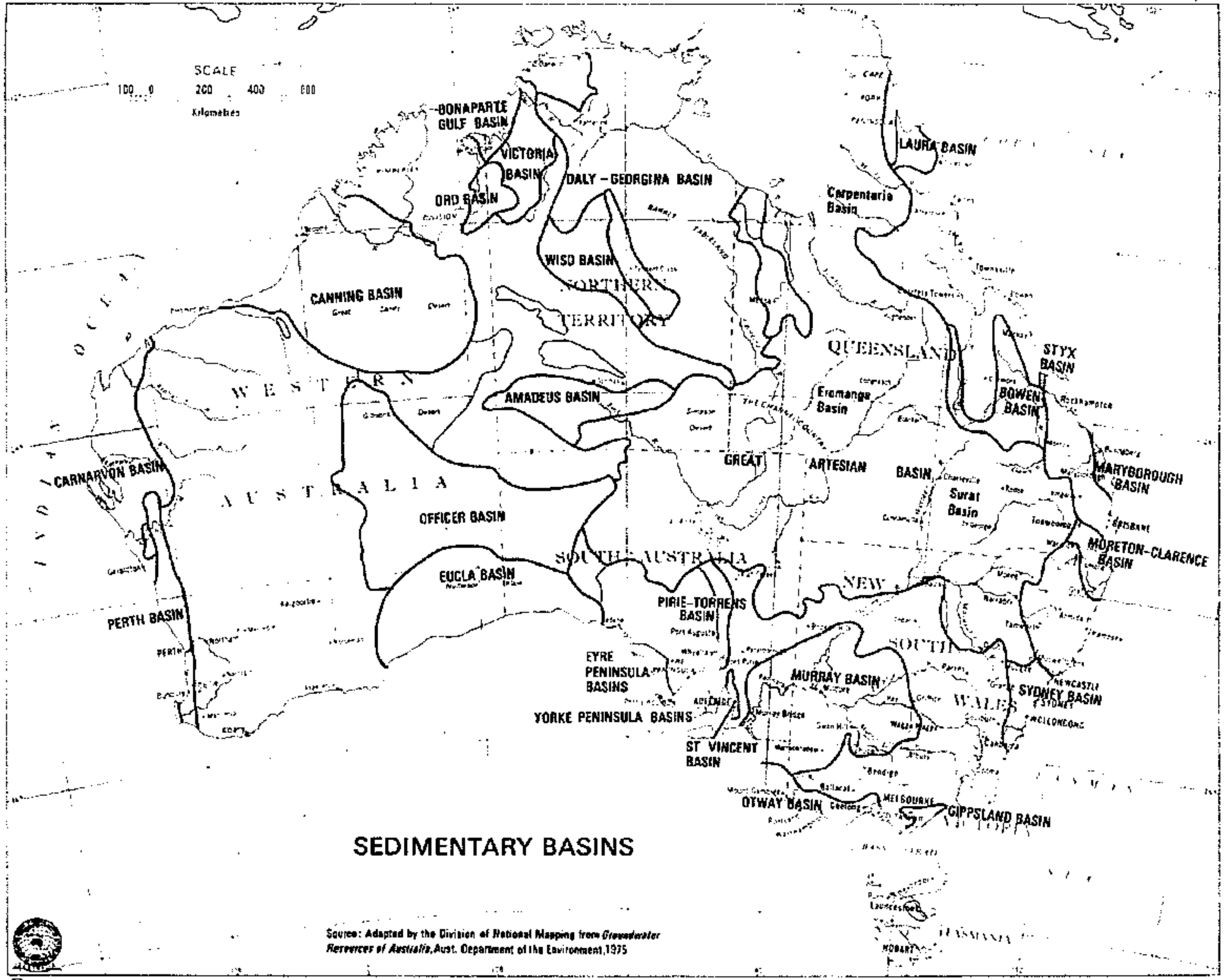
Map 4 shows the major sedimentary basins of Australia, and the groundwater resources of each are detailed in Table F, *Aquifer characteristics of sedimentary basins* and Table G, *Groundwater yields of sedimentary basins.* These and other data are included in Tables I(e) - XII(e), Tables I(f) - XII(f) and the divisional summaries, Tables D and E. In these tables, groundwater resources are given according to the three classes of aquifer described above.

3.3 Droughts

A drought is a period of severe water shortage resulting from extended periods of lower than average precipitation. 'Drought' is a relative term because what are considered drought conditions in one area may be normal in another. Thus its definition depends on land use and the average availability of water in a particular area.

Two broad types of drought can be defined. An agricultural drought occurs when soil moisture is so depleted that the growth of crops and pasture is sufficiently affected to result in

Map 4



SEDIMENTARY BASINS

Source: Adapted by the Division of National Mapping from *Groundwater Resources of Australia*, Aust. Department of the Environment, 1975

 NMP 75/005-4

substantially reduced yields and stock losses. A water supply drought occurs when the supply of water from a river or storage is threatened, with commensurate effects on irrigation districts, industrial and populated areas.

Droughts are common in Australia and no part of the continent is exempt. The most severe drought on record lasted from 1895 to 1903, the severest year being 1902. It affected almost the whole of the country but was most persistent on the Queensland coast, in inland New South Wales, South Australia and in central Australia. Overall, sheep numbers declined by more than 50 per cent and cattle by more than 40 per cent. Crop yields were also substantially reduced.

The most recent severe and widespread drought persisted for a decade from 1958 to 1968. Between 1957 and 1968 most of the country was affected with varying intensity. From 1965 to 1968, but especially in 1967, acute drought conditions prevailed over southern and western New South Wales, most of South Australia, Victoria, Tasmania and south-western Queensland. Restrictions on both industrial and domestic water use were imposed in many urban centres, including Canberra, Newcastle and the Melbourne metropolitan area. Restrictions were also placed on irrigation, particularly in New South Wales.

Further information and references on droughts are provided in the *Official Year Book of the Commonwealth of Australia for 1968.*

3.4 Floods

All Australian streams flood, but the effects of flooding are more significant on the shorter streams of the east coast, which rise in the Great Dividing Range. Flooding of rivers in northern Australia is probably more pronounced but its effects are less severe as the area has little population. Many major rivers on the east coast are prone to serious flooding. Flooding on these rivers almost always results from tropical cyclones or their remnant rain depressions. They occur chiefly in summer, but may occur at any time of the year. Flooding can be very destructive as major population centres and areas of intensive agriculture are often found on lower river valleys and plains.

Cyclonic and monsoonal rainfall also cause heavy flooding in the upper reaches of rivers flowing towards Lake Eyre, but high seepage and evaporation losses mean that water rarely reaches the lake itself. In January 1974, however, a monsoonal trough gave most of Queensland its heaviest recorded January rains. The Diamantina River and Cooper Creek reached Lake Eyre and Lake Eyre North was filled for the first time since 1949/50. Large areas of the Lake Eyre Drainage Division were inundated and rivers were up to 30 km wide in places.

Later in January 1974, rain following a cyclone caused widespread flooding in coastal regions of southern Queensland. Floodwaters in the Brisbane, Ipswich and Gold Coast areas reached their highest levels in 80 years and damage to the cities of Brisbane and Ipswich was heavy. Peak discharge of the Brisbane River reached 9540 cubic metres a second.

In southern Australia, flooding usually occurs between late autumn and spring, but summer thunderstorms such as occurred in Melbourne in February 1972, can cause severe local flooding. In the south-west of Australia, flood peaks are relatively small and severe flooding is rare.

Floods on coastal streams usually rise rapidly and follow immediately on heavy rainfall. In

contrast, flooding of the lower reaches of inland river systems in the Murray-Darling and Lake Eyre Drainage Divisions follows up to three months after heavy rain in their headwaters. As a result, precise flood warnings and flood level predictions can often be made.

3.5 Water Quality

Unlike 'water quantity' which may be characterised in terms of volume per unit time passing a given point in a given direction, the term 'water quality' encompasses a large number of characteristics, as may be seen from Table 3 below, which shows the range of water quality characteristics adopted by the Australian Water Resources Council in developing its water quality assessment program. This is not a complete list of water quality characteristics, but covers those of greatest general significance in Australia.

Table 3: Range of Characteristics Measured at Selected Surface Water and Groundwater Quality Stations

algae counts	E. coli	pH
alkalinity	faecal streptococci	potassium
ammonia	fluoride	silica
boron	iron	sodium
cadmium	magnesium	sulphate
calcium	manganese	surfactants
chemical oxygen demand	mercury	suspended solids
chloride	nitrate	temperature
chlorophyll	nitrite	total dissolved solids
coliforms	nitrogen	total hardness
colour	orthophosphate	turbidity
dissolved oxygen	pesticides	

Water quality may be highly variable over time. In the short term, runoff resulting from rainfall may pick up a whole range of contaminants in passing over and through the soil, thus adding to the pollutant load of streams, lakes and groundwater. Evaporation from streams and lakes results in concentration of the dissolved solids while, on the other hand, stormwater may dilute the concentration of pollutants in receiving water bodies.

Thus while it can generally be said that water quality is related to the quantity of flow of a water body, this relationship between quantity and quality may vary with depth and across the breadth of a water body.

Over the long run, changes in land use generally affect the quality of runoff and also groundwater in situations where runoff enters aquifers. An example of a long term change in water quality produced by changing land use is the situation in south-west Western Australia where the replacement of deep rooted trees by shallow rooting grasses in the clearing of native forest for agriculture has disturbed the natural water and salt balance, increasing stream salinity. Where land use changes from, for example, farming to urban purposes, the rate and quantity of runoff tends to increase; the runoff in passing over paved and other surfaces in residential, commercial and industrial areas picks up contaminants such as oil, animal and vegetable waste material, garden chemicals and fertiliser and a host of other substances used by modern man in urban living.

Agricultural chemicals such as herbicides, pesticides and fertilisers may enter surface and groundwater resources with consequent degradation of their quality. The effects of such chemicals may be complex and are influenced by the pathways and food chains through which they pass. For instance, algae growth in rivers and lakes may be stimulated by an increase in the level of nitrates and phosphates derived from fertilisers. This growth may occur to an extent that threatens the existence of other forms of life in the water. Such waters may be difficult to treat for human consumption particularly in respect to taste, odour and colour requirements.

Effects of the discharge of industrial and domestic effluents can be severe. In many parts of Australia, discharge of untreated effluents from food processing works such as sugar mills, fruit canneries and abattoirs has led to heavy, although localised water quality degradation. Australia's largest cities are coastal and widespread degradation of inland water resources by urban, industrial and domestic effluents does not occur as most waste water is discharged, generally after some treatment, to the sea.

Aside from man-induced changes to the concentration of chemical substances in water, most dissolved and suspended material in water originates from the erosion of soils and the leaching of weathered rock masses. Depending on location, rainwater may also add significant amounts of sea salt, dust and atmospheric pollutants to runoff.

The water quality of a stream in its natural state may vary considerably over time. During floods, salinity generally decreases with increased flow, but suspended sediment concentration, bed load and turbidity may increase significantly. Suspended material may subsequently be deposited downstream where velocities are lower. This process is the main mechanism in the formation of flood plains and deltas. During low flow periods, the reverse occurs; suspended sediment concentration decreases while salinity increases.

The increasing salinity of the River Murray in recent years is a source of concern, as the river is vital for irrigation and domestic water and provides much of Adelaide's water supply. The problem results from groundwater inflow and saline drainage discharge from irrigation areas, compounded by concentration through evaporation. This is in addition to the river's quite high natural salt load. Figure 6 shows average salinity levels for the year 1966/67 and their steady increase downstream from the Hume Weir. Salinity levels however, vary seasonally. During the irrigation season, drought periods and following prolonged floods, the concentration of salts may increase significantly, approaching the salt tolerance limits of many crops. Present control measures include the provision of evaporation basins for the disposal of highly saline drainage water and the regulation of river flow to control water quality by dilution.

In general, groundwater is more saline than surface water as it has been in contact with soil and rock for longer periods and has been concentrated by plants through transpiration. Groundwater contribution to streamflow is often significant, particularly during low flow periods and may increase the salinity of streams at these times.

Although groundwater salinity may be affected by land use practices, it is largely determined by four factors: its origin, distance from areas of recharge, solubility of aquifer formations and extent of concentration of salts by evapotranspiration. Map 6 shows the occurrence and salinity of the principal groundwater aquifers in Australia and gives broad indications of the yield of individual bores in the areas of lower salinity. In many places, especially in north-eastern and central Australia, the quantity and salinity of groundwater is unknown. Water of lowest salinity is generally found in

the eastern half of Australia and the Great Artesian Basin where relatively high rainfall and surface runoff are available for recharge. Brackish and saline ground water is more prevalent in the arid western half of the continent.

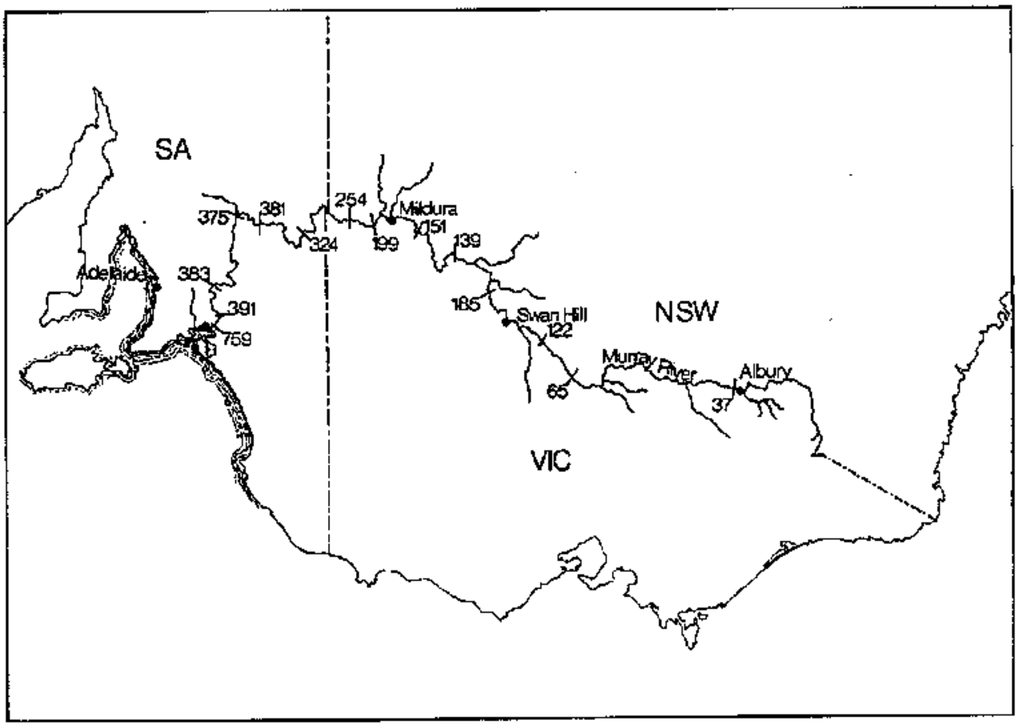


Figure 6: Average Salinity of the River Murray 1966/67 (mg/l T.D.S.)

Source: Gutteridge, Haskins & Davey, *Murray Valley Salinity Investigation*, 1970, p 77.

Water quality is an important factor in determining the potential uses of a particular water resource. In compiling Australian water quality criteria (Hart 1974), the following groupings of beneficial uses of water were adopted:

- water used for domestic supplies;
- water used for the preservation of aquatic ecosystems;
- water used for agricultural purposes including irrigation, livestock and farm water supplies;
- water used by industry;
- water used for recreational and aesthetic purposes.

Water quality management is essentially aimed at maintaining each particular water resource in a condition appropriate to the beneficial use or uses considered by the community as being appropriate to the particular water resource. For instance, a water resource to be used for drinking and other domestic uses must be maintained such that with normal water treatment processes it is capable of being transformed into a safe, palatable and aesthetically pleasing supply.

Water quality data presently available are limited in scope, except in a few specific areas where detailed studies have been carried out. In this review only one measure of water quality has been given — total dissolved solids content (T.D.S.) or 'salinity'. Overall, this is the most convenient single parameter of water quality for practical purposes.

Tables I(c) - XI(c), *Salinity of selected rivers,* give surface water salinity divided into four

classes:

less than 500 mg/l	fresh;
500 to 1000 mg/l	marginal;
1000 to 3000 mg/l	brackish;
greater than 3000 mg/l	saline.

In Table E , Table G and Tables I(f) - XII(f), estimated possible annual groundwater yields have been grouped according to salinity. Groundwater salinity has been divided into five classes for the purposes of tabulation and mapping (Map 6):

less than 1000 mg/l	usually potable and suitable for stock and most domestic, industrial and irrigation uses;
1000 to 3000 mg/l	suitable for some domestic and limited industrial uses, and for irrigation of salt tolerant crops under favourable conditions;
3000 to 7000 mg/l	suitable for some stock;
7000 to 14000 mg/l	suitable for some sheep and cattle, under certain conditions;
greater than 14000 mg/l	unsuitable for stock.

4. MANAGEMENT OF AUSTRALIA'S WATER RESOURCES

During the last two decades, Australian attitudes to water resources management have changed substantially. Water management is no longer seen just in terms of storing water and regulating streams for consumptive use, but also in terms of conserving unregulated streams in an unmodified landscape for wildlife preservation or recreation purposes, or for possible social or economic use by future generations. In addition, agricultural, industrial and urban development has led to greater attention being paid to water quality management. Increased public awareness of non-consumptive and on-site uses of water has been expressed in enviromental enquiries associated with several major water storage projects in Australia in recent years.

Increasingly Australians have perceived that water and other resources need to be managed as an integral part of national and regional planning in relation to social, ecologic and economic goals. This change in attitude is reflected in the statement, *Proposed national approach to water resources management,* adopted by the Australian and State governments in October 1975.

In general the high variability of streamflow, which is characteristic of Australia's surface water resources, coupled with the generally high rates of potential evaporation, has required the construction of large storage reservoirs for many water supply and irrigation projects. However the geology and topography are such that many catchments lack good sites for the construction of large dams for water storage.

In arid and semi-arid regions, rainfall is variable and unreliable and in most places, the absence of relief means that only wide, shallow storages are possible. This compounds the problem of evaporation. In tropical latitudes however, seasonal flows may be sufficiently large and reliable to makes storages feasible. Although suitable confined dam sites exist, the demands of evaporation are enormous. For example, in Drainage Division IX, the Moondarra Dam on the Leichhardt River which serves the mining community of Mount Isa, has annual evaporation losses of almost twice the assured annual supply for consumptive use. Overall, the proportion of storage evaporation losses to present annual water diversions ranges from 66 per cent (Drainage Division IX) in the tropical north, to practically zero in cool, temperate Tasmania (Drainage Division III).

Another factor associated with the geology of a site is the ability of a storage to contain water without excessive seepage. In many areas while flow conditions and topography may favour damming, foundation conditions may lead to excessively expensive dam construction as a consequence of the requirement for both structural stability and seepage reduction.

In this review, an attempt has been made to assess the possible exploitable yield of surface water for each river basin at the point of lowest practical downstream development, using the type of hydraulic structure considered technically feasible by Australian and State government water authorities. These estimates take into account average annual flow, variability of flow, water quality and the availability of suitable sites for storage, but do not take into account economic factors.

The estimates are presented in Table C and Tables I(d) - XI(d), *Present, authorised and planned annual commitments of fresh and marginal water.* In these tables details are also given of the estimated total yield of fresh and marginal water for each river basin and drainage division. These should be distinguished from total yields shown in Table A and Tables I(a) - XI(a), which refer to fresh, marginal, brackish and saline waters. A summary of the key components of Table C is given in Table 4 below.

Table 4: Possible Exploitable Yield of Fresh and Marginal Water

	Drainage Division												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Australia
Possible exploitable yield as a percentage of total yield	34	43	71	83	31	37	13	22	21	4	...(a)	0(b)	39
Total commitment as a percentage of possible exploitable yield	13	24	5	91	61	20	15	19	2	7	...(a)	0(b)	24

(a) No data available
(b) On a divisional basis, surface water resources are insignificant.

Source: State water authorities

The total annual commitment of surface water in Australia is about 29700 million cubic metres. This represents 24 per cent of the possible exploitable yield, or only 9 per cent of the total runoff of all Australian streams. The reasons for this low overall commitment are threefold. Firstly, the economic resources of the country are as yet by no means fully developed. Secondly, as noted above, many potential developments which are technically feasible are expensive due to topographic and climatic limitations. Thirdly, the bulk of Australia's surface water resources are in fact remote from centres of population, being found mostly in the tropical north and Tasmania. Two tropical drainage divisions (VIII and IX) and Tasmania (III), account for 50 per cent of Australia's total average annual exploitable water yield but only 17 per cent of Australia's total surface water commitments.

Table 5 provides a summary of large dams and storages in each drainage division according to purpose, capacity and regulated discharge. Although most dams are used for water supply, the

Table 5: Large Dams and Storages - Existing and Under Construction

			Main Purpose					
	Drainage Division	*Total Number*	*Irrigation*	*Hydro-Electricity*	*Water Supply*	*Flood Control Recreation*	*Total Capacity ($m^3 \times 10^6$)*	*Regulated Discharge ($m^3 \times 10^6$/ year)*
I	North-East Coast	33	12	1	20	-	4 100	1 300
II	South-East Coast	99	5	5	87	2	10 700	2 700
III	Tasmania	43	1	31	11	-	19 500	8 700
IV	Murray-Darling	104	34	15	53	2	20 700	10 500
V	South Australian Gulf	24	-	-	23	1	240	150
VI	South-West Coast	24	8	-	15	1	870	360
VII	Indian Ocean	1	-	-	1	-	*	*
VIII	Timor Sea	8	5	-	3	-	6 100	1 900
IX	Gulf of Carpentaria	4	-	-	4	-	140	10
X	Lake Eyre	2	1	-	1	-	*	*
XI	Bulloo-Bancannia	-	-	-	-	-	-	-
XII	Western Plateau	-	-	-	-	-	-	-
	Australia	342	66	52	218	6	62 350	25 620

* Negligible

Notes: Three storages counted as mainly for hydro-electricity in the South-East Coast Division and eight storages in the Murray-Darling Division, are part of the Snowy Mountains Hydro-electric Scheme, which as a whole makes a major contribution to irrigation.

Source: *Water Use commentary, Atlas of Australian Resources, Second Series,* 1975, p. 12.

greatest volume of water is reserved for irrigation. Many storages serve the irrigation areas of the Murray and its tributaries in the Murray-Darling Drainage Division. The surface water resources of this Division are the most highly developed in Australia with 91 per cent of the possible exploitable yield currently committed for use. Where annual rainfall exceeds potential evaporation and where there are no marked seasonal water deficits, such as in Tasmania, the east coast, and the far south-west coast, the need for irrigation storage is reduced. In these areas, irrigation is either unnecessary or required only during periods of protracted drought.

Surface water resources can be developed for consumptive or non-consumptive uses. Consumptive use refers to domestic, industrial and agricultural uses and involves the removal of water from the stock of usable resources. Non-consumptive use on the other hand comprises instream use of water and includes hydro-electric power generation, recreation and transportation.

The commitments of water detailed in Table C and Tables I(d) - XI(d) are mostly for consumptive use in irrigation. Water for hydro-electric purposes is a commitment but it has not been listed as such in the tables as it is still available for further use downstream. In Tasmania almost 10000 million cubic metres of water are committed annually for hydro-electric power generation at present, but only 1722 million cubic metres are committed for other uses.

Groundwater is an important substitute for surface water in many parts of Australia. Over much of the arid interior, the Great Artesian Basin provides the only reliable continuous supply of water for stock and domestic purposes. Historically, the availability of groundwater facilitated the spread of settlement inland and contributed to the establishment of an extensive pastoral industry. The Great Artesian Basin underlies 22 per cent of the continent and since the 1880's, over 20000 bore holes have obtained water from its sandstone aquifers. Of these, about 4500 flowed when originally constructed: the remainder were sub-artesian. 2900 of the artesian bores were still flowing in 1975. Groundwater from the Great Artesian Basin has the inestimable advantage of being mostly fresh in those areas where surface water, if it is found at all, is brackish or saline.

Table 6: Important Areas of Concentrated Use of Groundwater in Australia

Area	*Quantity (m^3/year)*	*Use*
Burdekin Delta (Qld)	320×10^6	Irrigation of sugar cane
Namoi Valley (N.S.W.)	108×10^6	Irrigation of small crops
Condamine Valley (Qld)	100×10^6	Irrigation of grain crops
South-eastern South Aust.	98×10^6	Irrigation, town supplies and industry
Bundaberg (Qld)	94×10^6	Irrigation of sugar cane, industrial and domestic use
Lockyer Valley (Qld)	70×10^6	Irrigation of small crops and fodder
Perth (W.A.)	66×10^6	Irrigation of market gardens, domestic gardens and urban water supply
Hunter Valley (N.S.W.)	53×10^6	Irrigation of small crops
Callide Valley (Qld)	35×10^6	Irrigation of fodder and grain crops
Tomago Sands (N.S.W.)	31×10^6	Urban water supply and industrial use
Pioneer Valley (Qld)	31×10^6	Irrigation of sugar cane and domestic use
North Adelaide Plains (S.A.)	21×10^6	Irrigation of market gardens
Botany Sands (N.S.W.)	20×10^6	Industrial use

Source: *Groundwater Resources of Australia*, 1975, p 124, supplemented by information from State water authorities.

Groundwater is increasing in importance as a source of water for irrigation, industry and domestic supply. There are many areas of intensive groundwater development in Australia. Although these are quite small, in 1974 they accounted for about 40 per cent of groundwater withdrawals.

Table 6 above details some of the more important areas of concentrated groundwater use in Australia. Except for the south-east of South Australia and the North Adelaide Plains which extract some water from limestone aquifers, all these areas rely exclusively on groundwater from unconsolidated sediments.

More attention is now being given to the integrated management of Australia's water resources. For example, the potential of conjunctive use – the complementary development of surface and groundwater resources – is being examined. In the drier regions of Australia, with high evaporation and variable streamflow, it is not often possible to build economic storages that will provide water reliably throughout the dry season. However, where groundwater supplies can be tapped to make up this surface water deficiency, smaller economic storages may be quite adequate. Such developments are being considered as a means of water supply to the new mining towns of the north-west. In the Burdekin delta, groundwater aquifers are being artificially recharged during the summer wet season enabling water to be stored at low cost with negligible evaporation.

5. DRAINAGE DIVISIONS

Introduction

The data for this review has been assembled for 244 adopted river basins and aggregated into twelve drainage divisions (Map 5). Tables A to E summarise both surface water and groundwater resources by drainage division. Tables F and G detail the groundwater resources of Australia's major sedimentary basins. Data for each drainage division are then given in greater detail, in groups of six tables (Tables (a) to (f) for each division) together with a brief illustrated exposition.

In most tables, indicators are given of data reliability. These may be in the form of length of record, number and type of streamflow measuring (gauging) stations, number of samples from which salinity data are calculated, etc. They are important to any interpretation of the figures.

The uniform presentation means that data for river basins where records are short are given equal prominence to data for river basins for which records are comprehensive and detailed. In some instances, the period of record or the number of measurements is so small that average figures are only indicative and have no statistical validity. In other instances, no data is available at all and this is signified at each entry by the notation ". . .". Throughout the tables, a blank space signifies "not applicable".

To help with their interpretation, relevant features of the tables are briefly described below.

Table A (divisional summary) and Tables I(a) - XI(a): *Drainage division areas/River basin areas, gauging stations and annual average discharges and salinities.* The number of gauging stations and their type give an indication of data reliability (columns 4 and 5). Records from automatic gauging stations are generally more reliable and uninterrupted than those obtained from manual measurement. Estimated total yields (column 10) are calculated from streamflow records and where these are lacking, from rainfall records and other data. The yields shown in column 10 include brackish and saline water and thus should be distinguished from estimated total yields given in Table C and Tables I(d) - XI(d) at column 13, which refer only to fresh and marginal water and correspond in fact to column 8 of Table A and Tables I(a) - XI(a).

Table B (divisional summary) and Tables I(b) - XI(b): *Range of discharges for selected rivers.* For each river basin, rivers were chosen that are so far as possible in their natural state, avoiding the effects that regulation works would have on flow variability. Variability is indicated for each river by figures recording maximum and minimum discharge as a percentage of average discharge (columns 8 to 13).

Tables I(c) - XI(c): *Salinities of selected rivers.* For the most part (there are some exceptions) rivers selected for these tables are the same as those chosen for Table B and Tables I(b) - XI(b). The reliability of the salinity figures is dependent on the period of sampling and the number of samples taken (columns 7 and 8). The average salinity of each stream (column 9) is calculated from the sample of measurements weighted according to the volume of streamflow at the time of each measurement. The remaining three measures (columns 10 to 12) provide an indicator of variability of salinity. With all samples taken ranked in order of increasing salinity, the 10 percentile measure gives the salinity of the sample at the head of the lowest 10 per cent of samples; the 50 percentile measure gives the salinity of the sample at the head of the lower 50 per cent of samples; the 90

percentile measure gives the salinity of the sample at the head of the lower 90 per cent of the group of samples.

Table C (divisional summary and Tables I(d) - IX(d): *Present, authorised and planned annual commitments of fresh and marginal surface water.* This table gives no details of brackish and saline water, which in general is not suitable for consumptive use. Columns 3 and 7 refer to annual water volumes which are actually available for use. In this respect, water used for hydro-electric purposes is not shown as a commitment but annual volumes used for such purposes are given in the footnotes to the tables. Columns 5 and 9 refer to leakage and water allocated through riparian rights to landholders adjacent to streams.

Table D (divisional summary), Table F (major sedimentary basins) and Tables I(e) - XII(e): *Aquifer characteristics.* Table F gives the aquifer characteristics of the major sedimentary basins. Tables I(e) - XII(e) give characteristics of the three major aquifer types as they occur in each adopted river basin. Note that data given in Table F is broken up to form the major part of the assessment for each river basin in Tables I(e) - XII(e) for the aquifer type 'sedimentary rocks'.

Table E (divisional summary), Table G (major sedimentary basins) and Tables I(f) - XII(f): *Groundwater yields.* Estimated possible annual yields from each aquifer are presented in two ways for each aquifer type and for each salinity class, viz., total yields and yields from recharge alone. Total yields are calculated on the basis of available recharge plus a notional rate of withdrawal from aquifer storage. The annual yields from storage for aquifers in the 0 - 30 m depth range are calculated on a notional withdrawal rate of 1 per cent of storage per annum. For aquifers in the 30 - 150 m depth range, the assumed withdrawal rate is ½ per cent of storage per annum. For aquifers at a depth greater than 150 m, a notional withdrawal rate is calculated which would give a reduction in pressure head of water at a discharge point equivalent to 1 m per annum.

Table A

Drainage division areas, gauging stations and average annual discharges

DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 \times 10^6$)				Estimated Total Yield ($m^3 \times 10^6$)	Average Annual Runoff (mm)
	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
I North-East Coast	450 705	77	317	486	32 220	50 280	75 620	6 880	82 500	183
II South-East Coast	273 553	65	726	899	30 846	8 550	37 499	1 897	39 396	144
III Tasmania	68 200	60	244	339	31 429	18 370	49 799	0	49 799	730
IV Murray-Darling	1 062 530	83	693	1 006	21 937	324	22 204	57	22 261	21
V South Australian Gulf	82 300	19	42	46	357	623	913	67	980	11.9
VI South-West Coast	314 090	62	175	178	4 820	2 470	4 935	2 355	7 290	23
VII Indian Ocean	518 570	65	38	38	2 627	1 533	3 815	345	4 160	8.0
VIII Timor Sea	547 050	46	266	422	27 860	46 400	74 260	0	74 260	136
IX Gulf of Carpentaria	638 460	10	155	212	3 290	54 940	49 180	9 050	58 230	91
X Lake Eyre	1 170 000	38	56	80	1 598	1 662	3 180	80	3 260	3
XI Bulloo-Bancannia	100 570	16	3	4	460	80	540	0	540	5.4
XII Western Plateau	2 455 000				0	0	0	0	0	0
AUSTRALIA	7 680 000	37	2 715	3 710	157 444	185 232	321 945	20 731	342 676	44.6

Range of discharges for selected rivers

DRAINAGE DIVISION	Adopted Drainage Area (km^2)	Selected River	Selected Gauging Station: Station Name	Selected Gauging Station: Area above Gauge (km^2)	Selected Gauging Station: Record Length (years)	Selected Gauging Station: Average Annual Discharge (m^3/sec)	Maximum Discharge as a Percentage of Average (a): Instantaneous	Maximum Discharge as a Percentage of Average (a): Monthly	Maximum Discharge as a Percentage of Average (a): Annual	Minimum Discharge as a Percentage of Average (a): Instantaneous	Minimum Discharge as a Percentage of Average (a): Monthly	Minimum Discharge as a Percentage of Average (a): Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
I North-East Coast	450 705	Fitzroy	Yaamba	136 648	54	189.7	17 200	5 910	838	0	0	1
II South-East Coast	273 553	Nepean	Penrith	11 000	80	45.0	34 600	2 440	520	0	0	2
III Tasmania	68 200	Huon	Frying Pan Creek	2 090	27	90.6	2 380	350	130	6.5	8.5	45
IV Murray Darling	1 062 530	Murrumbidgee	Gundagai	21 750	84	108	5 770	860	350	5	11	28
V South Australian Gulf	82 300	North Para	Yaldara	383	36	0.58	19 000	1 570	325	0	0	2
VI South-West Coast	314 090	Blackwood	Darradup	20 500	5	19.7	1 560	980	188	0.75	1.18	30
VII Indian Ocean	518 570	Gascoyne	Fishy Pool	70 200	8	12.8	20 500	1 330	250	0	0	3.6
VIII Timor Sea	547 050	Ord	Coolibah Pocket	46 100	15	137	19 900	2 640	259	0	0	5.0
IX Gulf of Carpentaria	638 460	Gregory	Gregory Downs	12 846	11	9.7	14 600	850	152	13	21	41
X Lake Eyre	1 170 000	Diamantina	Birdsville	115 200	19	25.3	5 760	2 290	491	0	0	2
XI Bulloo-Bancannia	100 570	Bulloo	Quilpie	15 385	5	8.5	7 360	1 650	225	0	0	50
XII Western Plateau	2 455 000											

(a) In total period of gauging station record.

Table C

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

DRAINAGE DIVISION	Adopted Drainage Area (km^2)	Present Annual Commitments				Authorised and Planned Annual Commitments				Total Commitments	Possible Exploitable Yield	Estimated Total Yield of Drainage Area
		Designed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total	Proposed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
I North-East Coast	450 705	1 527	312	756	2 595	703	56	2	761	3 346	25 566	75 620
II South-East Coast	273 553	1 882	152	624	2 658	1 107	69	111	1 287	3 945	15 992	37 499
III Tasmania	68 200	1 722	0	0	1 722	73	0	0	73	1 795	35 495	49 799
IV Murray-Darling	1 062 530	11 728	1 184	3 029	15 941	605	94	94	793	16 734	18 372	22 204
V South Australian Gulf	82 300	112	20.8	1.6	135	33.6	4.2	0.1	37.9	173	283	913
VI South-West Coast	314 090	331	8.3	4.2	343	26.0	0.25	0.25	26.5	370	1 841	4 935
VII Indian Ocean	518 570	0	0	0	0	40	35	0	75	75	490	3 815
VIII Timor Sea	547 050	1 953	1 128	2.0	3 083	44.4	0.8	0	45.2	3 128	16 423	74 260
IX Gulf of Carpentaria	638 460	35	23	18	76	53	32	1	86	162	10 094	49 180
X Lake Eyre	1 170 000	2	0	7	9	0	0	0	0	9	129	3 180
XI Bulloo-Bancannia	100 570	0	0	3	3	0	0	0	0	3	...	540
XII Western Plateau	2 455 000	0	0	0	0	0	0	0	0	0	0	0
AUSTRALIA	7 680 000	19 292	2 828	4 445	26 565	2 685	291	208	3 185	29 730	124 635	321 945

Summary of aquifer characteristics

DRAINAGE DIVISION	Adopted Drainage Area (km²)	Aquifer Type (a)	Area of Aquifer (km²)	Range of Common Depth to Aquifer (m)	Range of Common Thickness of Aquifer (m)	Estimated Number of Bores (1974)	Range of Common Bore Yields (m³/day)	Range of Common T.D.S. (mg/l)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I North-East Coast	450 705	US	27 000	0–30	2–40	8 780	10–5 400	30–70 000
		SR	38 700	6–600	3–160	1 050	10–2 000	200–20 000
		FR	217 500	3–120	1–150	4 560	10–550	30–20 000
II South-East Coast	273 553	US	36 600	3–50	1–50	9 410	8–3 000	120–10 000
		SR	121 800	0–1 000	0.5–300	59 400	8–7 000	150–20 000
		FR	150 200	5–50	0.2–60	25 400	8–800	100–7 000
III Tasmania	68 200	US	5 500	2	10	290	9	1 000
		SR	9 400	30	30	120	173	700
		FR	52 800	10	30	430	26	500
IV Murray-Darling	1 062 530	US	495 500	4–75	1–65	86 120	8–5 000	100–30 000
		SR	647 500	20–800	0.5–170		8–2 700	300–30 000
		FR	270 100	5–450	0.3–100	33 790	8–1 500	300–20 000
V South Australian Gulf	82 300	US	7 300	5–20	5–10	5 160	40–1 000	500–20 000
		SR	28 200	30–150	10–120	13 710	500–2 500	700–30 000
		FR	27 300	50–200	20–120	13 180	50–1 800	1 000–15 000
VI South-West Coast	314 090	US	14 000	3–30	15–50	23 800	10–500	300–14 000
		SR	36 600	20–600	500–1 000	6 380	20–4 000	300–2 000
		FR	275 000	6–30	5–10	27 250 (b)	5–800	500–14 000
VII Indian Ocean	518 570	US	130 000	3–60	5–60	5 860	10–1 000	100–20 000
		SR	123 000	20–600	6–500	5 490	20–4 000	300–30 000
		FR	294 000	10–60	5–20	1 210	5–800	300–10 000
VIII Timor Sea	547 050	US	44 500	1–50	5–40	280	20–2 000	100–14 000
		SR	305 200	2–450	5–500	2 070	20–4 500	30–15 000
		FR	211 300	3–80	5–60	680	20–900	200–1 500
IX Gulf of Carpentaria	638 460	US	67 300	1–65	1–15	250	5–3 000	50–3 000
		SR	343 000	1–350	5–150	1 210	40–5 500	50–7 000
		FR	46 500	2–150	1–50	300	15–200	50–2 200
X Lake Eyre	1 170 000	US	96 400	5–120	2–20	2 050	10–400	250–15 000
		SR	981 400	10–1 500	0.3–300	4 780	10–40 000	300–14 000
		FR	109 900	10–75	0.3–250	970	0.5–400	150–14 000
XI Bulloo-Bancannia	100 570	US	32 100	5–120	0.3–6	150	5–100	350–14 000
		SR	90 100	15–500	0.3–160	380	30–400	500–7 000
		FR	3 700	9–90	0.3–6	40	20–140	1 000–7 000
XII Western Plateau	2 455 000	US	253 000	5–40	5–40	7 490	10–10 000	100–20 000
		SR	1 399 000	10–200	5–500	2 020	0.1–4 000	500–25 000
		FR	760 000	5–150	5–100	1 920	20–250	100–25 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) This figure includes estimates not allocated to rock type.

Table D

Summary of groundwater yields

DRAINAGE DIVISION	Aquifer Type (a)	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge					Total				
				< 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	< 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I North-East Coast	US	703	2 703	2 186	357	80	28	51	2 894	683	137	37	71
	SR	9.0	602	100	416	66	9	12	105	471	82	17	24
	FR	31	2 256	664	979	420	147	45	820	1 254	469	169	59
	Total	743	5 561	2 950	1 752	566	184	108	3 819	2 408	688	223	154
II South-East Coast	US	172	653	384	162	58	50	0	1 051	467	180	100	0
	SR	269	1 847	1 087	582	120	58	0.2	2 502	1 700	481	198	5.2
	FR	25	806	470	323	14	0	0	609	453	156	0	0
	Total	466	3 306	1 941	1 067	192	108	0.2	4 162	2 620	817	298	5.2
III Tasmania	US	1.1	1 843	1 502	291	50	0	0	1 588	346	62	0	0
	SR	0.4	1 180	1 066	104	10	0	0	1 061	116	10	0	0
	FR	1.7	13 561	13 454	97	10	0	0	13 458	97	10	0	0
	Total	3.2	16 584	16 022	492	70	0	0	16 107	559	82	0	0
IV Murray-Darling	US	433	826	486	258	50	19	14	2 232	1 912	2 465	1 660	4 344
	SR	301	323	58	147	67	51	0	883	1 112	758	410	1 480
	FR	153	853	383	412	49	6.2	2.3	458	687	170	27	16
	Total	950 (b)	2 002	927	817	166	76	16	3 572	3 721	3 393	2 097	5 840
V South Australian Gulf	US	6.1	7.4	3.4	2.1	1.1	0.5	0.3	5.1	3.4	4.3	2.9	2.0
	SR	22	33	13	10.2	5.4	2.5	1.4	15.2	16.7	14.6	3.5	2.0
	FR	21	22	5.6	9.6	1.8	4.4	0.8	12.8	11.6	5.0	4.4	0.8
	Total	49	62	22	21.9	8.3	7.4	2.5	33.1	31.7	23.9	10.8	4.8
VI South-West Coast	US	67	497	447	41	8	...	...	705	106	35	10	...
	SR	69	704	618	63	16	3.1	2.0	1 080	179	85	20	15
	FR	24	1 030	832 (b)	126	49	16	11	917	148	63	35	20
	Total	160	3 130 (b)	2 800 (b)	230	73	19	13	3 690 (b)	433	183	65	35
VII Indian Ocean	US	45	515	223	197	77	11	8	372	375	160	28	23
	SR	28	154	77	27	21	17	11	232	170	135	40	23
	FR	6.4	163	55	75	27	3	3	86	112	51	8.1	8.1
	Total	79	832	355	299	125	31	22	690	657	346	76	54
VIII Timor	US	2.0	1 210			1 210					1 220		
	SR	30	19 700			19 700					24 600		
	FR	2.9	2 930			2 930					3 190		
	Total	35	24 000 (b)			24 000 (b)					29 500 (b)		
IX Gulf of Carpentaria	US	53.4	3 923			3 923					4 058		
	SR	73.0	9 262			9 262					9 277		
	FR	1.8	1 197			1 197					1 199		
	Total	128.2	14 382			14 382					14 534		
X Lake Eyre	US	1.8	172			172					569		
	SR	77	609			609					2 078		
	FR	1.5	94			94					169		
	Total	80	875			875					2 816		

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) For some river basins estimates are given without reference to aquifer type. These are included in totals.

Table E contd.

Summary of groundwater yields

DRAINAGE DIVISION	Aquifer Type (a)	Abstraction During 1974 (m³ x 10⁶)	Estimated Annual Recharge (m³ x 10⁶)	Estimated Possible Annual Yield (m³ x 10⁶) From Recharge <1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	>14 000 mg/l	Total <1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	>14 000 mg/l
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
XI Bulloo-Bancannia	US	0.8	16.5	9	5.0	1	0.2	1.0	10	41	1.2	35	289
	SR	14.4	10.8	6.5	3.2	1	0.1	0	43.7	49	11.1	0.23	0
	FR	0.2	2.2	0	2.1	0.03	0.02	0.05	0	3.7	0.08	0.07	0.6
	Total	15.4	29.5	16	10.3	2	0.3	1.1	54	94	12.4	36	290
XII Western Plateau	US	11	267			267					10 500		
	SR	8.5	909			909					17 500		
	FR	1.4	105			105					227		
	Total	21	1 281			1 281					28 200		
AUSTRALIA	US	1 500	12 630			12 630					38 780		
	SR	900	35 330			35 330					67 010		
	FR	270	23 020			23 020					25 180		
	Total	2 730 (b)	72 000 (b)			72 000 (b)					132 000 (b)		

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR- fractured rocks

(b). For some river basins estimates are given without reference to aquifer type. These are included in totals.

Table F

Aquifer characteristics of sedimentary basins

SEDIMENTARY BASINS (1)	Area of Aquifer (km^2) (2)	Range of Common Depth to Aquifer (m) (3)	Range of Common Thickness of Aquifer (m) (4)	Estimated Number Bores (1974) (5)	Range of Common Bore Yields (m^3/day) (6)	Range of Common T.D.S. (mg/l) (7)
1. Laura Basin	22 000	250–350	50–150	10	...	1 000–3 000
2. Bowen Basin	93 700	30–600	15–300	900	20–1 000	200–20 000
3. Maryborough Basin	9 000	50–150	50–150	300	0.1–0.3	1 000–3 000
4. Moreton-Clarence Basin	82 400	10–85	0.5–55	2 100	10–1 300	140–15 000
5. Great Artesian Basin	1 611 000	20–1 500	0.3–1 500	22 770	0.4–5 200	100–14 000
6. Sydney Basin	30 300	25–80	0.1–15	610	10–2 000	300–6 000
7. Gippsland Basin	7 800	30–600	30–150	650	50–1 500	500–1 500
8. Western Port Basin	940	40–200	30–45	400	8–800	1 500–4 000
9. Port Phillip Basin	2 150	50–90	6–40	250	170–800	500–1 000
10. Otway Basin	24 070	5–1 000	25–300	51 700	8–10 000	400–10 000
11. Tasmanian Basin	9 280	10	30	120	2	700
12. Murray Basin	279 600	20–300	1–110	18 200	0.3–2 700	300–30 000
13. St Vincent Basin	4 000	5–150	10–120	7 500	100–2 500	700–25 000
14. Willochra & Walloway Basins	1 700	10–100	5–70	200	50–1 600	1 000–7 000
15. Pirie-Torrens Basin	10 000	5–80	10–150	850	150–1 500	1 000–30 000
16. Eyre Basins	750	3–25	5–45	40	500–4 000	500–2 000
17. Eucla Basin	181 500	30–150	50–150	130	5–250	1 000–25 000
18. Officer Basin	274 500	10–180	5–120	90	0.1–100	500–25 000
19. Perth Basin	58 900	5–300	500–1 000	35 000	20–4 000	300–5 000
20. Carnarvon Basin	128 000	10–600	6–30	800	20–4 000	900–12 000
21. Canning Basin	468 500	20–600	100–500	1 000	20–6000	200–14 000
22. Bonaparte Gulf Basin	10 500	10–80	5–100	130	40–700	200–7 000
23. Ord Basin	19 500	10–150	5–50	120	10–900	100–8 000
24. Victoria Basin	44 000	5–120	5–100	420	40–300	50–1 500
25. Daly Georgina Basin	289 400	35–200	10–100	1 600	100–400	250–6 000
26. Arnhem-McArthur Province	200 000	1–120	5–100	1 000	40–4 300	50–15 000
27. Wiso Basin	140 000	10–80	5–50	100	40–400	500–5 000
28. Ngalia Basin	15 000	30–50	50–200	40	40–1 000	500–5 000
29. Amadeus Basin	120 000	50–500	30–300	500	40–5 000	500–10 000

Groundwater yields of sedimentary basins

SEDIMENTARY BASINS	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge: < 1 000 mg/l	From Recharge: 1 000–3 000 mg/l	From Recharge: 3 000–7 000 mg/l	From Recharge: 7 000–14 000 mg/l	From Recharge: > 14 000 mg/l	Total: < 1 000 mg/l	Total: 1 000–3 000 mg/l	Total: 3 000–7 000 mg/l	Total: 7 000–14 000 mg/l	Total: > 14 000 mg/l	Reliability of Estimate (a)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1. Laura Basin	...	22	0	22	0	0	0	0	24.5	0	0	0	(iii)
2. Bowen Basin	8	2 160	454	1 089	272	182	163	500	1 200	300	200	180	(ii)
3. Maryborough Basin	0.4	1.5	0	1.5	0	0	0	0	1.7	0	0	0	(iii)
4. Moreton-Clarence Basin	4.1	50.2	48.6	1.1	0.2	0.3	0	55	1.3	0.26	0.4	0	(ii)
5. Great Artesian Basin	526	410	217	187	5.6	0.6	0	872	900	56	1.6	0	(i)
6. Sydney Basin	3.3	166	106	54	4.4	2.2	0.2	230	180	15	21	4.8	(ii)
7. Gippsland Basin	18	404	191	213	0	0	0	276	261	0	0	0	(ii)
8. Western Port Basin	4.5	7.6	1.5	6.1	0	0	0	50	18	15	0	10	(ii)
9. Port Phillip Basin	1.2	29.4	21	8.4	0	0	0	74	24	59	0	0	(ii)
10. Otway Basin	223	922	654	152		116		1 540	714		373		(ii)
11. Tasmanian Basin	4.3	1 179	1 054	104	19	0	0	1 061	116	20	0	0	(ii)
12. Murray Basin	124	451	220	121		110		1 030	1 300		2 650		(ii)
13. St Vincent Basin	30	16	8	8	0	0	0	9.5	15	0	0	0	(i)
14. Willochra & Walloway Basins	0.3	0.6	0	0.6	0	0	0	0	10	0	0	0	(ii)
15. Pirie-Torrens Basin	10	8	0	1	3	3	1	0	2	20	8	5	(ii)
16. Eyre Basins	4.9	14	14	0	0	0	0	20	2	0	0	0	(ii)
17. Eucla Basin	0.01	50	0.01	...	...	...	50	0.01	0.1	1	10	5 400	(iii)
18. Officer Basin	0.001	50	...	...	...	...	...	...	...	...	...	...	(iii)
19. Perth Basin	130	1 200	1 060	120	20	1	0.5	1 800	400	140	50	5	(ii)
20. Carnarvon Basin	20	50	2	6	16	16	...	2	10	35	20	...	(iii)
21. Canning Basin	10	1 200	1 000	200	...	...	...	10 000	10 000	...	...	...	(iii)
22. Bonaparte Gulf Basin	2	810	810	0	0	0	0	810	0	0	0	0	(iii)
23. Ord Basin	0.3	650	...	...	...	...	...	...	...	...	...	...	(iii)
24. Victoria Basin (b)	2	4 000			4 000					4 000			(iii)
25. Daly Georgina Basin	13.1	3 375			3 375					3 410			(iii)
26. Arnhem-McArthur (b) Province	5	20 000			20 000					20 000			(iii)
27. Wiso Basin	0.5	60		60		0	0		300		0	0	(iii)
28. Ngalia Basin	0.3	10		10		0	0		150		0	0	(iii)
29. Amadeus Basin	5	80		80		0	0		500		0	0	(iii)

(a) Reliability of estimate: (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(b) Yields from storage negligible in comparison to yields from recharge.

Drainage Division I - North-East Coast

This Division stretches along the coast of Queensland from Cape York to the southern state border. It is bounded on the west by the Great Dividing Range which by its varying topography and proximity to the coast, governs rainfall patterns in the Division.

The climate of the Division is typically sub-tropical to tropical with hot, wet summers and cooler dry winters. Median annual rainfall varies from about 500 mm in the most westerly regions to over 3800 mm at Tully (River Basin 13), the wettest town in Australia. The monsoon front in summer moves on occasions the whole length of the Division, but usually stays north of latitude 18° south bringing heavy summer rainfall. In winter, the south-east trades bring orographic rainfall primarily to the escarpments from 14° south to 30° south. Summer rainfall is more reliable in the north than the south. Winter rainfall on the other hand is more reliable in the south.

Plate 2: Barren River Valley – River Basin 10

Plate 3: Black Creek – River Basin 25

Average annual runoff is high along the coast. In most places it is greater than 500 mm and in the Mulgrave and Russell River catchments (River Basin 11) exceeds 2000 mm. Inland, average annual runoff declines rapidly to 50 mm or less (Map 3). The three largest river systems in this Division, the Burdekin (River Basin 20), the Fitzroy (River Basin 30) and the Burnett (River Basin 36), drain large inland areas. Except for a fairly narrow passage to the sea, they are confined by low coastal ranges and miss the orographic rain that falls on the seaward slopes. Average annual runoff in these three basins is the lowest in the Division. Nevertheless, because of their extent, the Burdekin and Fitzroy systems have the greatest average annual yields of any basins in the Division.

Streamflow is seasonally variable. Most streams have ceased to flow at some time since records have been kept. Annual variability is also high, but is least in the group of river basins near Tully (River Basins 9 to 16). Here the Divide is close to the coast, and orographic rainfall is concentrated over a small area.

The shorter streams, although mostly in higher runoff areas, are more variable as they have small catchments. Peak discharge after storms can be enormous. The Boyne River has recorded a peak flow of over 900 times its average annual flow. The extent of the Burdekin, Fitzroy and Burnett river systems mitigates somewhat their flow variability, although flow in individual tributaries is highly variable. In the south, river valleys tend to be flatter and more extensive; streams are slower moving and subject to severe seasonal flooding.

The economic wealth of this Division is largely derived from agricultural and pastoral activities. The main products are sugar, dairy products and general agricultural produce including tobacco, sorghum, maize, fodder crops, pineapples, peanuts, wheat and barley. Minerals, particularly coal and mineral sands, are becoming increasingly important, and tourism in recent times has emerged as one of the major industries. Most large Queensland towns, as well as the capital, Brisbane, are in this Division.

Development of surface water resources in this Division is made difficult by the variability of flows and high evaporation rates. Moreover, on many of the short, fast flowing streams, suitable dam sites to allow sufficient storage capacity to trap high flows are lacking.

Rivers within the extensive catchments of the Fitzroy, Burdekin and Burnett river basins have been dammed for irrigation and municipal water supply. The southern river basins (River Basins 41 to 46) have also been extensively regulated to service the populous Moreton region. Overall, 13 per cent of the possible exploitable surface water yield of the Division has been committed.

Groundwater resources are important to the Division and in some of the major river basins, abstractions approach the level of surface water diversions. Total groundwater abstractions during 1974, most of which were from unconsolidated sediments, reached nearly 750 million cubic metres, which is almost half the level of present annual surface water diversions.

The major known sources of good quality groundwater are alluvial sediments in the main river valleys, coastal sands and sand dune islands. Groundwater is utilised for irrigation, domestic and industrial consumption in sections of the Burdekin and Haughton Deltas, Lower Don, Pioneer, Fitzroy, Boyne, Burnett and the Brisbane river valleys. Overdraft conditions have limited withdrawals in some valleys and in a few areas such as the Burdekin Delta, artificial recharge schemes have been implemented in an attempt to rectify the situation. Coastal sands commonly contain small supplies of good quality water. The dune islands (Fraser, Moreton, Bribie and North and South Stradbroke Islands) have excellent resources of good quality groundwater but in some cases it is slightly acidic from dissolved iron salts and carbon dioxide.

There are a number of small sedimentary basins within the Division, including the Laura, Bowen, Maryborough and the Moreton-Clarence Basins, yielding locally important supplies of groundwater for domestic and stock use. Apart from sections of the Moreton-Clarence Basin, water salinity is generally greater than 1000 mg/1 T.D.S. and the water is unsuitable for irrigation. Fractured rocks underlie much of the Division and water from them is variable in quality. Small stock and domestic supplies are available and larger supplies are used for irrigation.

Table I(a)

River basin areas, gauging stations, average annual discharges and salinities

I NORTH-EAST COAST DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 x 10^6$)				Estimated Total Yield ($m^3 x 10^6$)	Average Annual Runoff (mm)	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Jacky Jacky Creek	2 770	0	0	0	0	2 110	1 540	570	2 110	762	...
2. Olive-Pascoe Rivers	4 350	0 (a)	2	2	0	2 870	2 730	140	2 870	660	fresh
3. Lockhart River	2 825	0	0	0	0	1 700	1 500	200	1 700	602	...
4. Stewart River	2 795	0 (a)	1	1	0	1 360	1 120	240	1 360	486	fresh
5. Normanby River	24 605	4	8	9	170	7 360	7 510	20	7 530	306	fresh
6. Jeannie River	3 755	0 (a)	3	3	0	2 550	1 900	650	2 550	679	fresh
7. Endeavour River	2 200	0 (a)	2	2	0	1 870	1 740	130	1 870	850	fresh
8. Daintree River	2 125	0(a)	2	3	0	3 340	3 230	110	3 340	1 572	fresh
9. Mossman River	490	23	1	1	300	510	750	60	810	1 653	fresh
10. Barron River	2 175	89	8	15	840	180	970	50	1 020	469	fresh
11. Mulgrave-Russell Rivers	2 020	51	9	15	2 570	1 860	4 170	260	4 430	2 193	fresh
12. Johnstone River	2 330	59	3	6	2 540	2 480	4 470	550	5 020	2 155	fresh
13. Tully River	1 685	16	3	6	450	3 030	3 180	300	3 480	2 065	fresh
14. Murray River	1 140	0 (a)	1	1	0	1 720	1 220	500	1 720	1 509	fresh
15. Hinchinbrook Island	415	0 (a)	0	1	0	600	600	0	600	1 446	...
16. Herbert River	10 125	91	11	17	3 350	1 160	4 050	460	4 510	445	fresh
17. Black River	1 075	0 (a)	2	3	0	600	540	60	600	558	fresh
18. Ross River	1 815	45	3	5	250	240	400	90	490	270	fresh
19. Haughton River	3 650	47	5	7	380	360	610	130	740	203	fresh
20. Burdekin River	129 860	99	18	64	8 690	80	8 520	250	8 770	68	fresh
21. Don River	3 885	16	2	2	90	470	480	80	560	144	fresh (b)
22. Proserpine River	2 485	11	2	4	80	1 180	1 140	120	1 260	507	fresh (b)
23. Whitsunday Island	115	0	0	0	0	50	50	0	50	434	...

(contd.)

(a) Short period of record only.
(b) Marginal at low flows.

Table I(a) contd.

River basin areas, gauging stations, average annual discharges and salinities

I NORTH-EAST COAST DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 \times 10^6$)				Estimated Total Yield	Average Annual Runoff	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water	($m^3 \times 10^6$)	(mm)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
24. O'Connell River	2 435	0 (a)	2	2	0	1 580	1 500	80	1 580	649	fresh (b)
25. Pioneer River	1 490	92	6	7	810	90	870	30	900	604	fresh
26. Plane Creek	2 670	17	3	3	120	1 270	1 270	120	1 390	520	fresh (c)
27. Styx River	3 055	0	0	0	0	670	630	40	670	219	. . .
28. Shoalwater Creek	3 705	0	0	0	0	730	650	80	730	197	. . .
29. Water Park Creek	1 840	0 (a)	2	2	0	660	540	120	660	359	fresh
30. Fitzroy River	142 645	97	68	90	5 310	680	5 940	50	5 990	42	fresh
31. Curtis Island	570	0	0	0	0	50	50	0	50	88	. . .
32. Calliope River	2 255	58	2	2	150	110	250	10	260	115	marginal
33. Boyne River	2 540	88	3	4	470	30	490	10	500	197	fresh
34. Baffle Creek	3 860	0 (a)	2	2	0	930	790	140	930	240	fresh (b)
35. Kolan River	2 980	44	6	9	230	320	530	20	550	185	fresh
36. Burnett River	33 150	97	27	42	1 700	170	1 830	40	1 870	56	fresh (b)
37. Burrum River	3 340	7	10	10	40	610	530	120	650	194	fresh (b)
38. Mary River	9 595	75	14	23	1 690	720	2 290	120	2 410	251	fresh
39. Fraser Island	1 685	0	0	0	0	720	720	0	720	427	. . .
40. Noosa River	1 915	0 (a)	1	2	0	940	600	340	940	490	fresh
41. Maroochy River	1 410	2	3	6	40	830	630	240	870	617	marginal
42. Pine River	1 555	41	9	10	210	240	380	70	450	289	fresh
43. Brisbane River	13 560	86	35	59	1 090	270	1 310	50	1 360	100	fresh
44. Stradbroke Island	270	0 (a)	2	2	0	190	190	0	190	704	fresh
45. Logan-Albert Rivers	4 195	48	26	29	370	410	670	110	780	186	fresh (d)
46. South Coast	1 295	32	10	15	280	380	540	120	660	510	fresh (e)
TOTALS	450 705	77	317	486	32 220	50 280	75 620	6 880	82 500	183	

(a) Short period of record only.
(b) Marginal at low flows.
(c) Low flows may consist entirely of sewerage plant effluent.
(d) Logan River marginal at low flows.
(e) Coomera River marginal at low flows.

Table I(b)

Range of discharges for selected rivers

I NORTH-EAST COAST DRAINAGE DIVISION River basins	Adopted Drainage Area (km^2)	Selected River	Selected Gauging Station: Station Name	Area above Gauge (km^2)	Record Length (years)	Average Annual Discharge (m^3/sec)	Maximum Discharge as a Percentage of Average (a): Instantaneous	Monthly	Annual	Minimum Discharge as a Percentage of Average (a): Instantaneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Jacky Jacky Creek	2 770	...	...	...	...	...	...	...	...	...	...	...
2. Olive-Pascoe Rivers	4 350	...	...	...	...	...	...	...	...	...	...	...
3. Lockhart River	2 825	...	...	...	...	...	...	...	...	...	...	...
4. Stewart River	2 795	...	...	...	...	...	...	...	...	...	...	...
5. Normanby River	24 605	Hann	Kalinga	1 088	10	5.5	3 840	1 230	210	2	3	11
6. Jeannie River	3 755	...	...	...	...	...	...	...	...	...	...	...
7. Endeavour River	2 200	...	...	...	...	...	...	...	...	...	...	...
8. Daintree River	2 125	...	...	...	...	...	...	...	...	...	...	...
9. Mossman River	490	Nth. Mossman	Mossman	114	6	9.4	5 870	620	139	0	13	71
10. Barron River	2 175	Barron	Mareeba	844	56	11.8	1 350	1 100	279	0	6	30
11. Mulgrave-Russell Rivers	2 020	Mulgrave	Gordonvale	554	38	27.6	12 300	1 460	265	0	3	33
12. Johnstone River	2 330	Nth. Johnstone	Goondi	958	39	55.9	6 230	630	178	6	7	38
13. Tully River	1 685	Tully	Tully Falls	275	35	14.9	4 260	815	182	0	2	52
14. Murray River	1 140	...	...	...	...	...	...	...	...	...	...	...
15. Hinchinbrook Island	415	...	...	...	...	...	...	...	...	...	...	...
16. Herbert River	10 125	Herbert	Ingham	8 806	40	106.8	3 590	1 450	234	1	1	15
17. Black River	1 075	...	...	...	...	...	...	...	...	...	...	...
18. Ross River	1 815	Ross	Gleesons Weir	790	44	8.9	51 200	2 040	409	0	0	0
19. Haughton River	3 650	Haughton	Stockham	1 748	16	11.1	13 200	1 590	274	0	0	11
20. Burdekin River	129 860	Burdekin	Clare-Home Hill	129 448	49	273.2	14 500	2 320	332	0	0	2
21. Don River	3 885	Don	Ida Creek	712	14	1.8	134 000	4 020	669	0	0	0
22. Proserpine River	2 485	Proserpine	Damsite	259	16	2.3	202 000	3 920	352	0	0	0
23. Whitsunday Island	115	...	...	...	...	...	...	...	...	...	...	...

(contd.)

(a) In total period of gauging station record.

Range of discharges for selected rivers

I NORTH-EAST COAST DRAINAGE DIVISION River basins	Adopted Drainage Area (km^2)	Selected River	Selected Gauging Station: Station Name	Area above Gauge (km^2)	Record Length (years)	Average Annual Discharge (m^3/sec)	Maximum Discharge as a Percentage of Average (a): Instantaneous	Monthly	Annual	Minimum Discharge as a Percentage of Average (a): Instantaneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
24. O'Connell River	2 435	...	...	...	...	...	...	...	...	...	...	...
25. Pioneer River	1 490	Pioneer	Pleystowe Mill	1 373	53	27.5	35 800	2 830	352	0	0	9
26. Plane Creek	2 670	Sandy Creek	Homebush	337	4	2.7	11 200	1 030	216	0	0	17
27. Styx River	3 055	...	...	...	...	...	...	...	...	...	...	...
28. Shoalwater Creek	3 705	...	...	...	...	...	...	...	...	...	...	...
29. Water Park Creek	1 840	...	...	...	...	...	...	...	...	...	...	...
30. Fitzroy River	142 645	Fitzroy	Yaamba	136 648	54	189.7	17 200	5 910	838	0	0	1
31. Curtis Island	570	...	...	...	...	...	...	...	...	...	...	...
32. Calliope River	2 255	Calliope	Castlehope	1 308	30	4.7	85 900	2 660	456	0	0	2
33. Boyne River	2 540	Boyne	Annondale	2 238	21	9.4	91 200	2 770	388	0	0	5
34. Baffle Creek	3 860	...	...	...	...	...	...	...	...	...	...	...
35. Kolan River	2 980	Kolan	Molangul	544	7	2.5	50 000	1 590	242	0	0	0
36. Burnett River	33 150	Burnett	Walla	32 219	63	52.1	17 800	3 800	583	0	0	1
37. Burrum River	3 340	Elliott	Elliott	228	21	1.7	58 600	1 950	314	0	1	5
38. Mary River	9 595	Mary	Miva	4 830	63	37.1	13 300	2 090	338	0	0	10
39. Fraser Island	1 685	...	...	...	...	...	...	...	...	...	...	...
40. Noosa River	1 915	...	...	...	...	...	...	...	...	...	...	...
41. Maroochy River	1 410	Sth. Maroochy	Kiamba	34	29	1.3	37 200	1 540	390	0	0	24
42. Pine River	1 555	Nth. Pine	Young's Crossing	357	56	4.5	18 400	1 420	272	0	0	4
43. Brisbane River	13 560	Brisbane	Savage's Crossing	10 179	63	27.2	20 500	2 320	387	0	0	10
44. Stradbroke Island	270	...	...	...	...	...	...	...	...	...	...	...
45. Logan-Albert Rivers	4 195	Logan	Beaudesert	1 476	47	7.3	18 200	1 960	287	0	0	12
46. South Coast	1 295	Nerang	Nerang	238	50	5.1	22 100	1 210	287	0	0	20

(a) In total period of gauging station record.

Table I(c)

Salinities of selected rivers

I NORTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Selected River (3)	Selected Gauging Station: Station Name (4)	Selected Gauging Station: Area above Gauge (km^2) (5)	Selected Gauging Station: Average Annual Discharge ($m^3 \times 10^6$) (6)	Period of Sampling (years) (7)	Number of Samples (8)	Salinity (mg/l T.D.S.): Weighted Average of Samples (9)	Salinity (mg/l T.D.S.): 10 Percentile of Samples (10)	Salinity (mg/l T.D.S.): 50 Percentile of Samples (11)	Salinity (mg/l T.D.S.): 90 Percentile of Samples (12)
1. Jacky Jacky Creek	2 770	...	...	...	...	...	...	...	...	...	...
2. Olive-Pascoe Rivers	4 350	Pascoe	Fall Creek	668	532	3	5	61	59	80	102
3. Lockhart River	2 825	...	...	...	...	...	...	...	...	...	...
4. Stewart River	2 795	Stewart	Telegraph Road	363	255	2	2			78	
5. Normanby River	24 605	Normanby	Battle Camp Cross.	2 466	752	4	5	116	111	116	128
6. Jeannie River	3 755	McIvor	Elderslie	194	...	3	4	105	98	114	123
7. Endeavour River	2 200	Endeavour	Flaggy	337	...	3	6	56	57	70	76
8. Daintree River	2 125	Daintree	Baird's	824	...	3	6	33	31	34	36
9. Mossman River	490	Nth. Mossman	Mossman	114	299	3	7	21	20	23	25
10. Barron River	2 175	Barron	Mareeba	844	375	14	49	47	38	59	101
11. Mulgrave-Russell Rivers	2 020	Mulgrave	The Fisheries	363	486	4	14	30	26	30	38
12. Johnstone River	2 330	Nth. Johnstone	Glen Allyn	179	158	4	10	32	23	34	63
13. Tully River	1 685	Tully	Euramo	1 471	...	2	12	23	19	25	42
14. Murray River	1 140	Murray	Upper Murray	155	...	4	15	26	24	32	38
15. Hinchinbrook Island	415	...	...	...	...	...	...	...	...	...	...
16. Herbert River	10 125	Herbert	Abergowrie	7 472	2 151	7	14	40	37	51	77
17. Black River	1 075	Black	Main Road	264	...	2	3	59	54	66	93
18. Ross River	1 815	Ross	Gleeson's Weir	790	281	1	1			74	
19. Haughton River	3 650	Haughton	Powerline	1 735	382	5	20	41	31	46	87
20. Burdekin River	129 860	Burdekin	Clare	129 448	8 687	17	67	68	60	120	211
21. Don River	3 885	Don	Ida Creek	712	57	7	9	214	169	348	401
22. Proserpine River	2 485	Proserpine	Damsite	259	72	4	14	104	90	268	419
23. Whitsunday Island	115	...	...	...	...	...	...	...	...	...	...

(contd.)

Table I(c) contd.

Salinities of selected rivers

I NORTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Selected River (3)	Selected Gauging Station: Station Name (4)	Area above Gauge (km^2) (5)	Average Annual Discharge ($m^3 x 10^6$) (6)	Period of Sampling (years) (7)	Number of Samples (8)	Salinity (mg/l T.D.S.): Weighted Average of Samples (9)	10 Percentile of Samples (10)	50 Percentile of Samples (11)	90 Percentile of Samples (12)
24. O'Connell River	2 435	O'Connell	Caping Siding	370	...	4	23	104	76	201	330
25. Pioneer River	1 490	Pioneer	Pleystowe Mill	1 373	869	2	29	55	33	87	146
26. Plane Creek	2 670	Sandy Creek	Homebush	337	85	5	16	136	99	252	327
27. Styx River	3 055	...	...	...	...	...	...	...	...	...	...
28. Shoalwater Creek	3 705	...	...	...	...	...	...	...	...	...	...
29. Water Park Creek	1 840	Water Park Ck.	Byfield	241	148	11	11	76	56	73	124
30. Fitzroy River	142 645	Fitzroy	The Gap	135 430	1 706	11	16	59	44	95	200
31. Curtis Island	570	...	...	...	...	...	...	...	...	...	...
32. Calliope River	2 255	Calliope	Castlehope	1 308	151	14	36	41	34	595	784
33. Boyne River	2 540	Boyne	21.2 km.	2 238	297	11	21	139	124	270	302
34. Baffle Creek	3 860	Baffle Creek	Mimvale	1 191	129	4	27	85	79	195	491
35. Kolan River	2 980	Kolan	Molangul	544	79	11	27	75	76	187	321
36. Burnett River	33 150	Burnett	Walla	32 219	1 658	16	70	161	125	359	640
37. Burrum River	3 340	Elliott	Elliott	228	54	10	27	73	55	84	106
38. Mary River	9 595	Mary	Miva	4 830	1 171	13	22	138	130	309	436
39. Fraser Island	1 685	...	...	...	...	...	...	...	...	...	...
40. Noosa River	1 915	Tewah Creek	Coop's Corner	39	54	5	15	49	35	46	53
41. Maroochy River	1 410	Sth. Maroochy	Kianba	34	42	11	14	118	100	473	719
42. Pine River	1 555	Nth. Pine	Young's Crossing	357	144	12	20	177	163	218	253
43. Brisbane River	13 560	Brisbane	Savage's Crossing	10 179	865	13	31	102	96	256	392
44. Stradbroke Island	270	...	...	...	...	...	...	...	...	...	...
45. Logan-Albert Rivers	4 195	Logan	Round Mountain	1 269	189	14	34	131	145	333	609
46. South Coast	1 295	Nerang	Glenhurst	238	163	12	29	42	50	93	164

Table I(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

I NORTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Present Annual Commitments Designed Diversions (3)	Storage Evaporation Losses (4)	River Losses and Requirements (5)	Total (6)	Authorised and Planned Annual Commitments Proposed Diversions (7)	Storage Evaporation Losses (8)	River Losses and Requirements (9)	Total (10)	Total Commit-ments (11)	Possible Exploitable Yield (12)	Estimated Total Yield of Drainage Area (13)
1. Jacky Jacky Creek	2 770	0	0	0	0	0	0	0	0	0	110	1 540
2. Olive-Pascoe Rivers	4 350	0	0	0	0	0	0	0	0	0	970	2 730
3. Lockhart River	2 825	0	0	0	0	0	0	0	0	0	620	1 500
4. Stewart River	2 795	0	0	0	0	0	0	0	0	0	450	1 120
5. Normanby River	24 605	0	0	1	1	0	0	0	0	1	1 360	7 510
6. Jeannie River	3 755	0	0	1	1	0	0	0	0	1	990	1 900
7. Endeavour River	2 200	0	0	1	1	1	...	...	1	2	670	1 740
8. Daintree River	2 125	0	0	1	1	1	...	...	1	2	1 200	3 230
9. Mossman River	490	0	0	3	3	0	0	0	0	3	220	750
10. Barron River	2 175	239 (a)	14	4	257	0	0	0	0	257	620	970
11. Mulgrave-Russell Rivers	2 020	31	...	18	49	0	0	0	0	49	940	4 170
12. Johnstone River	2 330	0	0	10	10	0	0	0	0	10	2 000	4 470
13. Tully River	1 685	203	...	2	205	0	0	1	1	206	830	3 180
14. Murray River	1 140	0	0	3	3	0	0	0	0	3	520	1 220
15. Hinchinbrook Island	415	0	0	0	0	0	0	0	0	0	50	600
16. Herbert River	10 125	0	0	17	17	0	0	0	0	17	1 860	4 050
17. Black River	1 075	0	0	24 (b)	24	0	0	0	0	24	200	540
18. Ross River	1 815	17	...	2	19	30	...	...	30	49	40	400
19. Haughton River	3 650	0	0	10	10	9	...	0	3	9	100	610
20. Burdekin River	129 860	122 (c)	9	192	323	321	22	...	343	666	3 970	8 520
21. Don River	3 885	0	0	4	4	0	0	0	0	4	40	480
22. Proserpine River	2 485	0	0	14	14	0	0	0	0	14	50	1 140
23. Whitsunday Island	115	0	0	0	0	0	0	0	0	0	2	50

(contd.)

(a) 35 $m^3 \times 10^6$ diverted to the Mitchell River Basin.
(b) 22 $m^3 \times 10^6$ diverted to the Ross River Basin.
(c) 22 $m^3 \times 10^6$ diverted to the Ross River Basin.

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

I NORTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Present Annual Commitments: Designed Diversions (3)	Present Annual Commitments: Storage Evaporation Losses (4)	Present Annual Commitments: River Losses and Requirements (5)	Present Annual Commitments: Total (6)	Authorised and Planned Annual Commitments: Proposed Diversions (7)	Authorised and Planned Annual Commitments: Storage Evaporation Losses (8)	Authorised and Planned Annual Commitments: River Losses and Requirements (9)	Authorised and Planned Annual Commitments: Total (10)	Total Commit-ments (11)	Possible Exploitable Yield (12)	Estimated Total Yield of Drainage Area (13)
24. O'Connell River	2 435	0	0	20	20	0	0	0	0	20	520	1 500
25. Pioneer River	1 490	7	1	34	42	73 (a)	8	0	81	123	310	870
26. Plane Creek	2 670	1	...	10	11	0	0	0	0	11	440	1 270
27. Styx River	3 055	0	0	1	1	0	0	0	0	1	150	630
28. Shoalwater Creek	3 705	0	0	1	1	0	0	0	0	1	210	650
29. Water Park Creek	1 840	0	0	2	2	0	0	0	0	2	90	540
30. Fitzroy River	142 645	228	169	45	442	30	23	1	54	496	2 900	5 940
31. Curtis Island	570	0	0	0	0	0	0	0	0	0	2	50
32. Calliope River	2 255	0	0	2	2	0	0	0	0	2	50	250
33. Boyne River	2 540	19	...	2	21	39	...	0	39	60	100	490
34. Baffle Creek	3 860	0	0	5	5	0	0	0	0	5	380	790
35. Kolan River	2 980	237	63	102	402	0	0	0	0	411	60	530
36. Burnett River	33 150					9	...	...	9		500	1 830
37. Burrum River	3 340	2	...	8	10	0	0	0	0	10	210	530
38. Mary River	9 595	60	...	47	107	0	0	0	0	107	370	2 290
39. Fraser Island	1 685	0	0	0	0	0	0	0	0	0	20	720
40. Noosa River	1 915	1	...	2	3	0	0	0	0	3	270	600
41. Maroochy River	1 410	9	...	12	21	11	...	0	11	32	270	630
42. Pine River	1 555	62	14	12	88	3	...	0	3	91		380
43. Brisbane River	13 560	226	42	83	351	5	3	0	8	359	890	1 310
45. Logan-Albert Rivers	4 195	47	...	28	75	138	...	0	138	213		670
46. South Coast	1 295	16	0	13	29	33	...	0	33	62		540
44. Stradbroke Island	270	0	0	20	20	0	0	0	0	20(b)	2	190
TOTALS	450 705	1 527	312	756	2 595	703	56	2	761	3 346	25 566	75 620

(a) 73 $m^3 \times 10^6$ to be diverted to the Plane Creek Basin.
(b) Water taken from spring fed lagoon.

Table I(d) contd.

Table I(e)

Aquifer characteristics

I NORTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type(a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Jacky Jacky Creek	2 770	US	310	5–10	5–10	. . .	. . .	. . .
		SR	2 771	. . .	. . .	. . .	. . .	. . .
		FR	0					
2. Olive-Pascoe Rivers	4 350	US	193	5–10	2–10	. . .	. . .	. . .
		SR	0					
		FR	172	30–90	30–60	. . .	. . .	. . .
3. Lockhart River	2 825	US	76	5–10	2–10	. . .	. . .	. . .
		SR	0					
		FR	166	30–90	30–60	. . .	. . .	. . .
4. Stewart River	2 795	US	116	5–10	2–10	. . .	. . .	. . .
		SR	0					
		FR	158	30–90	30–60	. . .	. . .	. . .
5. Normanby River	24 605	US	536	5–10	2–10	. . .	. . .	. . .
		SR	101	5–10	5–10	. . .	. . .	. . .
		FR	644	30–90	30–60	. . .	. . .	. . .
6. Jeannie River	3 755	US	369	5–10	5–10	. . .	. . .	. . .
		SR	55	5–10	5–10	. . .	. . .	. . .
		FR	173	30–90	30–60	. . .	. . .	. . .
7. Endeavour River	2 200	US	83	5–10	5–10	. . .	. . .	. . .
		SR	0					
		FR	125	30–90	30–60	. . .	. . .	. . .
8. Daintree River	2 125	US	7	5–10	5–10	. . .	. . .	. . .
		SR	0					
		FR	204	30–90	30–60	. . .	. . .	. . .
9. Mossman River	490	US	9	5–10	5–10	. . .	. . .	. . .
		SR	0					
		FR	49	30–90	30–60	. . .	. . .	. . .
10. Barron River	2 175	US	33	5–15	5–10	35	30–2 500	60–300
		SR	0					
		FR	159	30–90	30–60	150	70–550	100–1 000
11. Mulgrave-Russell Rivers	2 020	US	59	10–30	5–10	170	30–1 600	30–150
		SR	0					
		FR	154	30–90	30–60	10	20–110	30–1 000
12. Johnstone River	2 330	US	58	5–30	5–10	. . .	. . .	. . .
		SR	0					
		FR	190	30–90	30–90	. . .	. . .	. . .

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Aquifer characteristics

I NORTH-EAST COAST DRAINAGE DIVISON River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type[a] (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
13. Tully River	1 685	US	48	5–30	5–10	...	...	...
		SR	0					
		FR	119	30–90	30–90	...	...	...
14. Murray River	1 140	US	10	5–30	5–10	...	...	...
		SR	0					
		FR	103	30–90	30–90	...	...	...
15. Hinchinbrook Island	415	US	0					
		SR	0					
		FR	23	40–50	45–50	...	...	...
16. Herbert River	10 125	US	980	6–14	3–15	340	27–1 360	150–700
		SR	0					
		FR	860	4–25	1–7	10	15–80	300–1 000
17. Black River	1 075	US	290	4.5–12	3–9	150	327–2 000	130–650
		SR	0					
		FR	80	6–52	1.5–9	4	20–100	200–700
18. Ross River	1 815	US	540	5–11	2.5–6	30	21–65	200–1 100
		SR	0					
		FR	130	4–40	1.5–8	6	20–80	200–700
19. Haughton River	3 650	US	1 570	2–15	3–40	1 000	100–4 300	200–7 000
		SR	0					
		FR	142	3–35	1.5–7	6	15–75	300–900
20. Burdekin River	129 860	US	780	1–6	5–40	500	110–4 320	200–7 000
		SR	15 385	30–120	3–50	140	20–100	1 200–20 000
		FR	11 137	10–90	3–25	350	11–260	400–15 000
21. Don River	3 885	US	740	4–12	4–18	400	440–2 730	300–3 600
		SR	0					
		FR	3 110	6–25	2–10	20	30–110	200–800
22. Proserpine River	2 485	US	480	3–22	2–7.5	100	100–2 700	350–2 200
		SR	0					
		FR	1 980	9–26	2–10	30	11–110	200–800
23. Whitsunday Island	115	US	9	0–15	10–20	...	0–110	100–1 000
		SR	0					
		FR	106	0–100	50–150	...	0–110	100–1 000
24. O'Connell River	2 435	US	380	4–6	1–6	24	550–2 000	250–600
		SR	0					
		FR	1 640	10–30	0.5–2	4	50–100	250–1 000

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table I(e) contd.

Table I(e) contd.

Aquifer characteristics

I NORTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type[a] (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m^3/day) (8)	Range of Common T.D.S. (mg/l) (9)
25. Pioneer River	1 490	US	147	5–7	1–7	350	50–2 000	150–600
		SR	0					
		FR	180	6–16	2–6	122	50–150	200–800
26. Plane Creek	2 670	US	692	6–13	3–7	750	50–2 000	150–700
		SR	0					
		FR	1 500	6–15	2–7	156	60–270	200–650
27. Styx River	3 055	US	93	15–25	5–15	...	...	...
		SR	59	40–50	10–15	...	...	...
		FR	98	40–50	45–50	...	...	...
28. Shoalwater Creek	3 705	US	1 248	9–18	1.5–6	30	110–2 200	1 500–3 000
		SR	0					
		FR	2 456	12–30	1–10	5	20–50	1 000–3 000
29. Water Park Creek	1 840	US	65	6–10	1–6	25	20–200	1 000–3 000
		SR	0					
		FR	1 763	15–25	2–10	120	20–200	300–3 000
30. Fitzroy River	142 645	US	8 160	6–25	1–15	920	10–5 000	200–70 000
		SR	6 700	60–600	10–150	70	100–2 000	200–3 000
		FR	126 932	15–50	1–10	1 000	20–500	200–20 000
31. Curtis Island	570	US	0					
		SR	0					
		FR	32	10–50	45–50	...	...	...
32. Calliope River	2 255	US	202	9–12	1–3	20	20–400	500–3 000
		SR	0					
		FR	2 051	12–25	1–10	50	20–50	1 000–4 000
33. Boyne River	2 540	US	74	9–15	2–6	60	200–2 000	500–2 500
		SR	0					
		FR	2 464	12–25	1–10	10	20–50	1 000–4 000
34. Baffle Creek	3 860	US	0					
		SR	0					
		FR	2 590	...	...	...	...	...
35. Kolan River	2 980	US	123	10–13	4–7	460	108–5 400	160–550
		SR	0					
		FR	2 600	15–30	0.5–3	...	20–50	300–1 000
36. Burnett River	33 150	US	1 095	5–15	1–7	500	120–4 300	500–3 000
		SR	569	6–8	100–160	...	20–50	3 000–6 000
		FR	31 500	6–10	1–4	...	30–75	500–7 000

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table I(e) contd.

Aquifer characteristics

I NORTH-EAST COAST DRAINAGE DIVISION River basins *(1)*	Adopted Drainage Area (km²) *(2)*	Aquifer Type[(a)] *(3)*	Area of Aquifer (km²) *(4)*	Range of Common Depth to Aquifer (m) *(5)*	Range of Common Thickness of Aquifer (m) *(6)*	Estimated Number of Bores (1974) *(7)*	Range of Common Bore Yields (m³/day) *(8)*	Range of Common T.D.S. (mg/l) *(9)*
37. Burrum River	3 340	US	1 538	0–30	3–6	20	100–300	100–1 000
		SR	2 460	0–90	15–45	10	10–150	100–1 000
		FR	900	0–90	15–45	10	10–150	100–5 000
38. Mary River	9 595	US	895	0–30	3–6	60	100–300	100–1 000
		SR	3 100	0–90	15–45	55	10–150	100–5 000
		FR	6 475	0–90	15–45	150	10–150	100–5 000
39. Fraser Island	1 685	US	1 632	0–100	30–150	...	...	50–300
		SR	0					
		FR	0					
40. Noosa River	1 915	US	1 295	15–30	5–30	25	50–300	100–1 000
		SR	620	30–100	15–45	25	50–300	100–1 000
		FR	0					
41. Maroochy River	1 410	US	550	15–30	5–30	35	50–300	100–1 000
		SR	650	30–100	15–45	35	50–300	100–1 000
		FR	205	50–100	15–45	20	15–200	100–2 000
42. Pine River	1 555	US	230	8–30	10–30	10	30–55	150–750
		SR	595	9–50	50–150	15	10–110	100–1 200
		FR	958	7–90	50–150	25	0–110	200–1 250
43. Brisbane River	13 560	US	860	9–18	3–11	2 200	110–1 300	450–3 500
		SR	2 350	3–95	1.5–55	500	20–1 300	50–15 000
		FR	10 700	25–60	1–5	2 000	10–50	300–3 500
44. Stradbroke Island	270	US	285	0–75	30–150	50	300–2 150	50–300
		SR	...	...	...			...
		FR	...	...	...			...
45. Logan-Albert Rivers	4 195	US	155	10–18	2.0–6.5	520	150–980	500–2 000
		SR	3 268	3–65	1.5–40	200	10–300	300–6 000
		FR	2 350	10–80	1–8	300	10–300	100–9 000
46. South Coast	1 295	US	32	0–20	5–10	...	...	...
		SR	2	15–90	15–90	...	...	...
		FR	94	15–90	30–90	...	...	...
TOTALS	450 705	US	27 000	0–30	2–40	8 780	10–5 400	30–70 000
		SR	38 700	6–600	3–160	1 050	10–2 000	200–20 000
		FR	217 500	3–120	1–150	4 560	10–550	30–20 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table I(f)

Groundwater yields

I NORTH-EAST COAST DRAINAGE DIVISION River Basins	Aquifer Type(a)	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge: < 1 000 mg/l	From Recharge: 1 000– 3 000 mg/l	From Recharge: 3 000– 7 000 mg/l	From Recharge: 7 000– 14 000 mg/l	From Recharge: > 14 000 mg/l	Total: < 1 000 mg/l	Total: 1 000– 3 000 mg/l	Total: 3 000– 7 000 mg/l	Total: 7 000– 14 000 mg/l	Total: > 14 000 mg/l	Reliability of Estimate(b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Jacky Jacky Creek	US	0	100	100	0	0	0	0	105	0	0	0	0	(iii)
	SR	0	2	2	0	0	0	0	2.12	0	0	0	0	(iii)
	Total	0	102	102	0	0	0	0	107	0	0	0	0	
2. Olive-Pascoe Rivers	US	0	64.2	64.2	0	0	0	0	65.3	0	0	0	0	(iii)
	FR	0	3.7	3.7	0	0	0	0	3.9	0	0	0	0	(iii)
	Total	0	67.9	67.9	0	0	0	0	69.2	0	0	0	0	
3. Lockhart River	US	0	23.4	23.4	0	0	0	0	23.8	0	0	0	0	(iii)
	FR	0	2.5	2.5	0	0	0	0	2.7	0	0	0	0	(iii)
	Total	0	25.9	25.9	0	0	0	0	26.5	0	0	0	0	
4. Stewart River	US	0	29.6	29.6	0	0	0	0	30.4	0	0	0	0	(iii)
	FR	0	2.6	2.6	0	0	0	0	2.8	0	0	0	0	(iii)
	Total	0	32.2	32.2	0	0	0	0	33.2	0	0	0	0	
5. Normanby River	US	0	221.1	221.1	0	0	0	0	226.2	0	0	0	0	(iii)
	SR	0	1.4	1.4	0	0	0	0	1.5	0	0	0	0	(iii)
	FR	0	9.0	9.0	0	0	0	0	9.7	0	0	0	0	(iii)
	Total	0	231.5	231.5	0	0	0	0	237.4	0	0	0	0	
6. Jeannie River	US	0	122.7	122.7	0	0	0	0	125.4	0	0	0	0	(iii)
	SR	0	0.9	0.9	0	0	0	0	1.0	0	0	0	0	(iii)
	FR	0	2.9	2.9	0	0	0	0	3.1	0	0	0	0	(iii)
	Total	0	126.5	126.5	0	0	0	0	129.5	0	0	0	0	(iii)
7. Endeavour River	US	0	27.4	27.4	0	0	0	0	38	0	0	0	0	(iii)
	FR	0	2.1	2.1	0	0	0	0	2.3	0	0	0	0	(iii)
	Total	0	29.5	29.5	0	0	0	0	40	0	0	0	0	
8. Daintree River	US	0	2.6	2.6	0	0	0	0	2.7	0	0	0	0	(iii)
	FR	0	3.4	3.4	0	0	0	0	3.6	0	0	0	0	(iii)
	Total	0	6.0	6.0	0	0	0	0	6.3	0	0	0	0	
9. Mossman River	US	0	3.2	3.2	0	0	0	0	3.3	0	0	0	0	(ii)
	FR	0	0.9	0.9	0	0	0	0	1.0	0	0	0	0	(iii)
	Total	0	4.1	4.1	0	0	0	0	4.3	0	0	0	0	
10. Barron River	US	0	10.6	10.6	0	0	0	0	11.1	0	0	0	0	(ii)
	FR	...	2.5	2.5	0	0	0	0	2.6	0	0	0	0	(ii)
	Total	0	13.1	13.1	0	0	0	0	13.7	0	0	0	0	
11. Mulgrave-Russell Rivers	US	9	29.5	29.5	0	0	0	0	30	0	0	0	0	(i)
	FR	0.07	3.9	3.9	0	0	0	0	4	0	0	0	0	(ii)
	Total	9	33.4	33.4	0	0	0	0	34	0	0	0	0	
12. Johnstone River	US	...	30.7	30.7	0	0	0	0	31.2	0	0	0	0	(iii)
	FR	...	5.0	5	0	0	0	0	5.2	0	0	0	0	(iii)
	Total	...	35.7	36	0	0	0	0	36.4	0	0	0	0	(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table I(f) contd.

Groundwater yields

I NORTH-EAST COAST DRAINAGE DIVISION River Basin	Aquifer Type(a)	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) From Recharge < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Total < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Reliability of Estimate(b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
13. Tully River	US	...	42.9	42.9	0	0	0	0	43.2	0	0	0	0	(iii)
	FR	...	5.2	5.2	0	0	0	0	5.4	0	0	0	0	(iii)
	Total	...	48.1	48.1	0	0	0	0	48.6	0	0	0	0	
14. Murray River	US	...	4.6	4.6	0	0	0	0	4.7	0	0	0	0	(iii)
	FR	...	12.4	12.4	0	0	0	0	12.5	0	0	0	0	(iii)
	Total	...	17.0	17.0	0	0	0	0	17.2	0	0	0	0	
15. Hinchinbrook Island	US	0	0	0	0	0	0	0	0	0	0	0	0	
	FR	...	0.1	0.1	0	0	0	0	0.13	0	0	0	0	(iii)
	Total	...	0.1	0.1	0	0	0	0	0.13	0	0	0	0	
16. Herbert River	US	2.5	118.9	118.9	0	0	0	0	161.2	0	0	0	0	(iii)
	FR	0.05	86.6	86.6	0	0	0	0	87.1	0	0	0	0	(iii)
	Total	2.6	205.5	205.5	0	0	0	0	248.3	0	0	0	0	
17. Black River	US	8.2	29.8	29.8	0	0	0	0	32.1	0	0	0	0	(i)
	FR	0.02	4.0	4.0	0	0	0	0	4.02	0	0	0	0	(iii)
	Total	8.2	33.8	33.8	0	0	0	0	36.1	0	0	0	0	
18. Ross River	US	0.5	33.0	30.5	2.5	0	0	0	32	2.7	0	0	0	(iii)
	FR	0.04	6.6	6.6	0	0	0	0	6.63	0	0	0	0	(iii)
	Total	0.5	39.6	37.1	2.5	0	0	0	39	2.7	0	0	0	
19. Haughton River	US	170	149.4 (c)	106.5 (c)	29	10.9	3	0	127.1	37.7	14.2	3.9	0	(iii)
	FR	0.02	7.2	7.2	0	0	0	0	7.3	0	0	0	0	(iii)
	Total	170	156.6	113.7	29	10.9	3	0	134.4	37.7	14.2	3.9	0	
20. Burdekin River	US	123	118.2	83.7	23.1	9.2	2.2	0	84.1	23.3	9.3	2.3	0	(i)
	SR	0.09	92	0	55.7	15.8	8.2	12.3	0	109	31	16	24	(iii)
	FR	1.7	846	46.5	376	296.9	98.9	27.7	47	380	300	100	28	(iii)
	Total	125	1 056	130.2	455	321.9	109.3	40.0	131	512	340	118	52	
21. Don River	US	10.1	15	10	2	3	0	0	10.5	2.10	3.2	0	0	(ii)
	FR	0.4	24	24	0	0	0	0	24.1	0	0	0	0	(iii)
	Total	10.5	39	34	2	3	0	0	34.6	2.1	3.2	0	0	
22. Prosperpine River	US	14.2	5	5	0	0	0	0	5.5	0	0	0	0	(ii)
	FR	0.25	10	10	0	0	0	0	10.6	0	0	0	0	(iii)
	Total	14.5	15	15	0	0	0	0	16.1	0	0	0	0	
23. Whitsunday Island	US	0.01	0.25	0.25	0	0	0	0	0.4	0	0	0	0	(iii)
	FR	0.02	0.05	0	0.05	0	0	0	0	0.3	0	0	0	(iii)
	Total	0.03	0.3	0 25	0 05	0	0	0	0.4	0.3	0	0	0	
24. O'Connell River	US	0.4	4	4	0	0	0	0	6	0	0	0	0	(iii)
	FR	0.1	16.4	16.4	0	0	0	0	16.5	0	0	0	0	(iii)
	Total	0.5	20	20	0	0	0	0	23	0	0	0	0	(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(c) Includes $37 \times 10^6 m^3$ from artificial recharge.

Table I(f) contd.

Groundwater yields

I NORTH-EAST COAST DRAINAGE DIVISION River Basins	Aquifer Type(a)	Abstraction During 1974 (m³ x 10⁶)	Estimated Annual Recharge (m³ x 10⁶)	Estimated Possible Annual Yield (m³ x 10⁶) From Recharge					Total					Reliability of Estimate(b)
				< 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	< 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
25. Pioneer River	US	24	31	31	0	0	0	0	34	0	0	0	0	(i)
	FR	2.4	3.5	3.5	0	0	0	0	3.51	0	0	0	0	(ii)
	Total	26	35	35	0	0	0	0	38	0	0	0	0	
26. Plane Creek	US	12.5	158	158	0	0	0	0	161	0	0	0	0	(ii)
	FR	3	15	15	0	0	0	0	15 05	0	0	0	0	(iii)
	Total	16	173	173	0	0	0	0	176	0	0	0	0	
27. Styx River	US	0	0.9	0.9	0	0	0	0	1.8	0	0	0	0	(iii)
	SR	0	0.5	0	0.5	0	0	0	0	0.6	0	0	0	(iii)
	FR	0	0.1	0	0.1	0	0	0	0	0.3	0	0	0	(iii)
	Total	0	1.5	0.9	0.6	0	0	0	1.8	0.9	0	0	0	
28. Shoalwater Creek	US	1.0	12	1.8	8.9	1.3	0	0	46	231	35	0	0	(iii)
	FR	0.02	24	4.3	17.1	2.6	0	0	5	20	3	0	0	(iii)
	Total	1.0	36	6.1	26	3.9	0	0	51	251	38	0	0	
29. Water Park Creek	US	0.8	12	0	12	0	0	0	0	12.7	0	0	0	(ii)
	FR	1.8	18	3.4	12.6	2	0	0	4	15	2.5	0	0	(ii)
	Total	2.6	30	3.4	25	2	0	0	4	28	2.5	0	0	
30. Fitzroy River	US	100	365	50	198	46	21	50	70	275	64	28	70	(i)
	SR	4	450	79.8	349.3	20.9	0	0	80	350	21	0	0	(ii)
	FR	7.3	645	196	345	58	29	17	340	600	100	50	30	(ii)
	Total	111	1460	326	892	125	50	67	490	1 230	185	78	100	
31. Curtis Island	FR	...	0.14	0.14	0	0	0	0	0	0.18	0	0	0	(iii)
	Total	...	0.14	0.14	0	0	0	0	0	0.18	0	0	0	
32. Calliope River	US	0.2	6	0.48	4.6	0.92	0	0	0.5	5	1	0	0	(iii)
	FR	0.2	10.5	2.2	7.2	1.1	0	0	3.0	10	1.5	0	0	(iii)
	Total	0.4	17	2.7	11.8	2.0	0	0	3.5	15	2.5	0	0	
33. Boyne River	US	8.2	17	4.8	9.4	2.8	0	0	5	10	3	0	0	(ii)
	FR	0.05	12.5	3.6	7.8	1.1	0	0	5	11	1.5	0	0	(iii)
	Total	8.3	30	8.4	17.2	3.9	0	0	10	21	4.5	0	0	
34. Baffle Creek	US	...	...	...	...	...	...	...	...	...	...	...	...	
	FR	...	...	...	...	...	...	...	...	...	...	...	...	
	Total													
35. Kolan River	US	20.3	5.6	5.6	0	0	0	0	7.3	0	0	0	0	(i)
	FR	...	18.2	18.2	0	0	0	0	18.3	0	0	0	0	(iii)
	Total	20.3	23.8	23.8	0	0	0	0	25.6	0	0	0	0	
36. Burnett River	US	95.4	38.4	15.4	17.3	3.8	1.5	0.4	19.5	21.9	4.8	1.9	0.6	(i)
	SR	...	39.8	3.9	7.9	28	0	0	4.0	8.0	28.2	0	0	(iii)
	FR	...	315	111	141.4	47.2	15.4	0	111.3	141.8	47.3	15.5	0	(iii)
	Total	95.4	393	130	166.6	79	17	0.4	135	172	80.3	17	0.6	

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table I(f) contd.

Groundwater yields

I NORTH-EAST COAST DRAINAGE DIVISION River basins	Aquifer Type (a)	Abstraction During 1974 (m³ x 10⁶)	Estimated Annual Recharge (m³ x 10⁶)	Estimated Possible Annual Yield (m³ x 10⁶) From Recharge < 1 000 mg/l	From Recharge 1 000–3 000 mg/l	From Recharge 3 000–7 000 mg/l	From Recharge 7 000–14 000 mg/l	From Recharge > 14 000 mg/l	Total < 1 000 mg/l	Total 1 000–3 000 mg/l	Total 3 000–7 000 mg/l	Total 7 000–14 000 mg/l	Total > 14 000 mg/l	Reliability of Estimate (b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
37. Burrum River	US	30	45	45	0	0	0	0	52.5	0	0	0	0	(ii)
	SR	...	3	3	0	0	0	0	4.8	0	0	0	0	(iii)
	FR	...	0.5	0.5	0	0	0	0	1.1	0	0	0	0	(iii)
	Total	30	49	49	0	0	0	0	58.4	0	0	0	0	
38. Mary River	US	0.7	22.5	17.7	2	2	0.4	0.4	22	2.5	2.5	0.5	0.5	(ii)
	SR	0.3	3	1.7	0.6	0.5	0.2	0	2.8	1.1	0.8	0.4	0	(ii)
	FR	0.8	3.25	1.45	0.3	1.2	0	0.3	3.6	0.9	2.75	0	0.9	(ii)
	Total	1.8	29	20.9	3	4	0.6	0.7	28	3.5	6.1	0.9	1.4	
39. Fraser Island	US	0.04	500	500	0	0	0	0	967	0	0	0	0	(ii)
	Total	0.04	500	500	0	0	0	0	967	0	0	0	0	
40. Noosa River	US	0.26	32.5	16.25	16.25	0	0	0	19	19	0	0	0	(ii)
	SR	0.11	0.6	0.3	0.3	0	0	0	0.9	0.9	0	0	0	(ii)
	Total	0.37	33.1	16.6	16.6	0	0	0	20	20	0	0	0	
41. Maroochy River	US	0.36	13.75	6.88	6.87	0	0	0	12	12	0	0	0	(ii)
	SR	0.36	0.2	0.2	0	0	0	0	0.25	0	0	0	0	(ii)
	FR	0.12	0.1	0.1	0	0	0	0	0.15	0	0	0	0	(ii)
	Total	0.84	14.1	7.2	6.87	0	0	0	12	12	0	0	0	
42. Pine River	US	0.02	6.2	3.1	3.1	0	0	0	5.5	5.5	0	0	0	(ii)
	SR	0.05	0.6	0.6	0	0	0	0	0.65	0	0	0	0	(ii)
	FR	0.09	0.5	0.5	0	0	0	0	0.55	0	0	0	0	(ii)
	Total	0.16	7.3	4.2	3.1	0	0	0	6.7	5.5	0	0	0	
43. Brisbane River	US	58.1	69	51	18	0	0	0	54	18.4	0	0	0	(i)
	SR	2.5	1.7	1.2	0.3	0.2	0	0	2.5	0.6	0.4	0	0	(iii)
	FR	10.0	107	40	64	3	0	0	40.4	67.3	3.3	0	0	(iii)
	Total	70.6	178	92	82	3.2	0	0	97	86.3	3.7	0	0	
44. Stradbroke Island	US	3.6	166	166	0	0	0	0	206	0	0	0	0	(i)
	SR	...	...	...	...	...	...	...	...	...	...	...	...	(iii)
	FR	...	...	...	...	...	...	...	...	...	...	...	...	(iii)
	Total	3.6	166	166	0	0	0	0	206	0	0	0	0	
45. Logan-Albert Rivers	US	10	12	7.7	4.3	0	0	0	8.1	4.6	0	0	0	(i)
	SR	1.6	6.2	4.1	1.0	0.8	0.3	0	4.2	1.1	0.9	0.4	0	(iii)
	FR	2.4	23.5	4.6	7.9	7.2	3.8	0	4.84	8.3	7.56	4.0	0	(iii)
	Total	14	42	16.4	13.2	8.0	4.1	0	17.1	14.0	8.46	4.4	0	
46. South Coast	US	...	3.7	3.7	0	0	0	0	4	0	0	0	0	(iii)
	SR	...	0.5	0.5	0	0	0	0	0.55	0	0	0	0	(iii)
	FR	...	1.9	1.9	0	0	0	0	2.0	0	0	0	0	(iii)
	Total	...	6.1	6.1	0	0	0	0	6.6	0	0	0	0	
TOTALS	US	703	2 703	2 186	357	80	28	51	2 894	683	137	37	71	
	SR	9.0	602	100	416	66	9	12	105	471	82	17	24	
	FR	31	2 256	664	979	420	147	45	820	1 254	469	169	59	
	Total	743	5 561	2 950	1 752	566	184	108	3 819	2 408	688	223	154	

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Drainage Division II - South-East Coast

The South-East Coast Division comprises the seaward slopes of the Great Dividing Range and their coastal plains. It covers the populous south-eastern corner of the continent stretching in an arc from the Queensland border to the valley of the River Murray in South Australia. Two climatic influences predominate – the proximity of the coast which moderates extremes of weather, and the Great Divide which, through the process of orographic lifting, gives the Division a moderate and generally reliable rainfall. These influences are superimposed on the effects of the seasonal movement of the major atmospheric systems which determine the broad pattern of rainfall in Australia. Thus the Division experiences warm temperate conditions which merge into a more mediterranean type climate in the south and south-west. Median annual rainfall varies from about 1800 mm in the north to less than 750 mm in parts of the south and south-west. Summer rainfall predominates in the north and there is a gradual transition to a winter or spring peak in the south-west.

Streams generally are short. From headwaters in the Great Divide they tend to flow directly to the sea. Four streams are exceptions to this pattern. The Clarence, Hunter, Hawkesbury and Shoalhaven Rivers on the east coast rise between the main part of the Great Divide and coastal ranges, flowing parellel to the Divide until they turn towards the coast cutting narrow passages to the sea. The first three form the largest river systems in the Division.

Plate 4: Hawkesbury River – River Basin 12.

Flow patterns of streams in this Division are influenced predominantly by the climate and topography of their headwaters. Streamflow may cease during dry seasons: the main group of streams where flow has never ceased during the period of record is found in the Gippsland region of eastern Victoria, (River Basins 21 to 29). Here peak winter rainfall is augmented by moderate summer rainfall from the Southern Ocean. In general, the seasonal variability of flow is more pronounced in river basins on the east coast (River Basins 1 to 20), than on the south coast (River

Basins 21 to 39). Average annual runoff for most streams east and north of Melbourne is greater than 200 mm and water is of good quality (River Basins 1 to 29). West of Melbourne, runoff declines. Streams in this region tend to be smaller, slower and more annually variable, reflecting the low, more undulating relief which contributes to the drier conditions. Streams are marginal to brackish. The only exception is the Otway Coast Basin, where local ranges create rainfall and run-off patterns similar to those in parts of Gippsland.

This Division contains the most densely settled regions of Australia. It supports Australia's two largest cities, Sydney and Melbourne, and the major industrial centres of Newcastle, Port Kembla, the Latrobe Valley and Geelong. Agriculture is varied and more intensive than in non-irrigated regions further inland. Much of the continent's timber resources are found in the Division.

Apart from streams north of Newcastle (River Basins 1 to 9), all river basins with a possible annual exploitable yield greater than 500 million cubic metres have been substantially committed. These river basins include the Hunter (41 per cent committed), Hawkesbury (61 per cent), Shoalhaven (51 per cent), Snowy (75 per cent), Thomson (92 per cent), Latrobe (100 per cent) and Yarra (91 per cent). Except for the brackish Lake Corangamite (River Basin 34), a pocket of internal drainage, the surface water resources of all other river basins are committed to at least some degree.

When planned diversions in the Thomson, Latrobe and Yarra River catchments are completed (River Basins 25, 26 and 29), the main streams in this Division close to Melbourne will have been almost full committed. River basins surrounding Sydney are extensively though not completely committed (River Basins 12 and 13).

The greatest single commitment by far in the Division is the diversion of 1130 million cubic metres annually from the Snowy River inland for hydro-electric purposes to augment flow in the Murray and Murrumbidgee Rivers (Drainage Division IV). The Eucumbene River, a tributary of the Snowy, is dammed to form a storage with a gross capacity of 4798 million cubic metres. The Snowy itself is dammed at Jindabyne (688 million cubic metres).

Annual abstractions of groundwater comprise only a small proportion of total water consumption in the Division. However there are many areas with aquifers capable of yielding excellent quality groundwater suitable for irrigation, domestic, stock and industrial purposes. The most intensive development of groundwater resources to date has been in the alluvium of the Hunter Valley and to a lesser extent, that of the Richmond and Hawkesbury Valleys. Also the Tomago (Newcastle) and Botany (Sydney) aeolian sand beds are used for town water supply.

In the Moreton-Clarence Basin, which straddles the Queensland-New South Wales border, there is a rock sequence containing aquifers with both high and low salinity waters, and moderate use of the latter is made for rural stock and domestic purposes. In the Sydney Basin, the widespread Hawkesbury sandstone contains aquifers with generally low salinity waters and comprises a very important source for stock and domestic needs. Yields sufficient for small scale irrigation are available in some localities. Other sedimentary rocks in the Sydney Basin yield small quantities of groundwater but the salinity is variable and in many cases, too high for domestic use.

In the south, groundwater of the Gippsland Basin is used mainly for industrial purposes and often is of high temperature (up to 64° C) with high bicarbonate and fluoride content. The quality of groundwater from the Otway Basin in the south-west is extremely variable. Areas with low

regional permeability may contain connate waters with salinities up to 27000 mg/l T.D.S., but salinities for the most part are less than 1000 mg/l T.D.S. The better quality water, particularly in the far south-east of South Australia, is used extensively for irrigation, stock and domestic purposes. Fractured rock aquifers underlie extensive areas in the southern highlands and in the New England area of New South Wales, as well as in the greater part of southern Victoria. The quality of groundwater in these aquifers is best in areas where rainfall and relief are the greatest. These aquifers are widely used for stock watering. In fact the sedimentary rocks of the Millicent Coast (River Basin 39) account for 57 per cent of the total of 94000 bores in the Division and for 47 per cent of total groundwater abstractions.

Table II(a)

River basin areas, gauging stations, average annual discharges and salinities

II SOUTH-EAST COAST DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 \times 10^6$)				Estimated Total Yield ($m^3 \times 10^6$)	Average Annual Runoff (mm)	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Tweed River	1 110	33	10	11	258	160	418	0	418	377	fresh
2. Brunswick River	492	7	1	1	43	203	246	0	246	500	fresh
3. Richmond River	6 940	36	32	42	1 130	790	1 920	0	1 920	277	fresh
4. Clarence River	22 660	82	55	61	4 420	500	4 920	0	4 920	217	fresh
5. Bellinger River	3 440	48	8	11	906	244	1 150	0	1 150	334	fresh
6. Macleay River	11 450	88	21	29	1 960	190	2 150	0	2 150	188	fresh
7. Hastings River	4 530	43	10	11	910	540	1 450	0	1 450	320	fresh
8. Manning River	8 420	85	18	19	2 150	120	2 270	0	2 270	270	fresh
9. Karuah River	4 480	34	6	8	800	500	1 300	0	1 300	290	fresh
10. Hunter River	22 020	96	70	101	1 610	70	1 680	0	1 680	76	fresh
11. Macquarie-Tuggerah L.	1 630	36	9	9	136	230	366	0	366	225	fresh
12. Hawkesbury River	21 730	83	51	71	2 400	610	3 010	0	3 010	139	fresh
13. Sydney Coast-Georges River	1 890	19	7	10	103	254	357	0	357	189	fresh
14. Wollongong Coast	751	8	10	13	17	159	176	0	176	234	fresh
15. Shoalhaven River	7 300	90	32	34	1 540	248	1 788	0	1 788	245	fresh
16. Clyde River-Jervis Bay	3 260	44	7	7	664	268	932	0	932	286	fresh
17. Moruya River	1 550	74	4	4	315	55	370	0	370	239	fresh
18. Tuross River	2 180	46	6	7	241	254	495	0	495	227	fresh
19. Bega River	2 850	52	23	24	400	170	570	0	570	200	fresh
20. Towamba River	2 200	39	4	4	206	278	484	0	484	220	fresh

Table II(a) contd.

River basin areas, gauging stations, average annual discharges and salinities

II SOUTH-EAST COAST DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 \times 10^6$)				Estimated Total Yield ($m^3 \times 10^6$)	Average Annual Runoff (mm)	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
21. East Gippsland	6 040	57	12	13	378	222	600	0	600	99	fresh
22. Snowy River	15 799	89	53	62	2 208	188	2 396	0	2 396 (a)	152	fresh
23. Tambo River	4 170	72	8	10	278	92	370	0	370	89	fresh
24. Mitchell River	5 646	69	11	12	924	110	1 034	0	1 034	183	fresh
25. Thomson River	5 905	70	22	33	1 130	70	1 200	0	1 200	203	fresh
26. Latrobe River	4 662	89	34	46	974	21	995	0	995	213	fresh
27. South Gippsland	6 786	26	24	27	510	758	1 268	0	1 268	187	fresh
28. Bunyip River	4 118	43	20	22	331	219	550	0	550	134	fresh
29. Yarra River	4 066	69	15	26	1 100	93	1 193	0	1 193	293	fresh
30. Maribyrnong River	1 450	90	15	16	102	6	106	2	108	74	marginal
31. Werribee River	1 994	70	16	19	104	15	119	0	119	60	fresh
32. Moorabool River	2 176	70	8	10	86	16	100	2	102	47	marginal
33. Barwon River	3 626	89	8	17	230	59	179	110	289	80	brackish
34. Lake Corangamite	4 222	31	4	4	73	145	15	203	218	52	brackish
35. Otway Coast	3 963	50	28	30	465	364	829	0	829	209	fresh
36. Hopkins River	9 946	95	11	13	390	55	30	415	445	45	brackish
37. Portland Coast	4 144	50	8	9	158	227	98	287	385	93	brackish
38. Glenelg River	12 380	96	29	34	775	47	210	612	822	66	brackish
39. Millicent Coast	41 577	18	16	19	421	0 (b)	155	266	421	10	brackish
TOTALS	273 553	65	726	899	30 846	8 550	37 499	1 897	39 396	144	

(a) Includes 1 130 $m^3 \times 10^6$ which is diverted to the Murray-Darling Drainage Division.
(b) Ungauged area drains internally to swamps.

Table II(b)

Range of discharges for selected rivers

II SOUTH-EAST COAST DRAINAGE DIVISION River basins	Adopted Drainage Area (km^2)	Selected River	Selected Gauging Station: Station Name	Area above Gauge (km^2)	Record Length (years)	Average Annual Discharge (m^3/sec)	Maximum Discharge as a Percentage of Average (a): Instantaneous	Monthly	Annual	Minimum Discharge as a Percentage of Average (a): Instantaneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Tweed River	1 110	Oxley	Eungella	213	20	6.17	23 000	1 290	208	0	0.5	16
2. Brunswick River	492	Brunswick	Durrumbul	34	12	1.76	9 200	1 050	180	0	0.4	20
3. Richmond River	6 940	Richmond	Casino	1 790	26	23.5	18 100	1 300	233	0	0.3	15
4. Clarence River	22 660	Clarence	Lilydale	16 690	50	118	16 800	1 440	398	0	0.3	16
5. Bellinger River	3 440	Bowra	Bowraville	539	9	7.86	16 200	1 380	254	0	1.7	7.7
6. Macleay River	11 450	Macleay	Turners Flat	9 980	21	53.0	27 000	1 560	270	0	0.7	9
7. Hastings River	4 530	Hastings	Ellenborough	1 610	21	25.2	19 300	1 020	246	0.7	1	16
8. Manning River	8 420	Manning	Killawarra	6 550	24	72.4	9 200	1 450	295	0.2	2	12
9. Karuah River	4 480	Karuah	Monkerai	202	28	5.15	21 000	1 670	290	0	0.8	11
10. Hunter River	22 020	Hunter	Singleton	16 440	55	28.0	44 800	2 390	550	0	0	7
11. Macquarie-Tuggerah Lakes	1 630	Wyce Creek	Wyee	20	12	0.14	24 900	1 070	290	0	0	24
12. Hawkesbury River	21 730	Nepean	Penrith	11 000	80	45.0	34 600	2 440	520	0	0	2
13. Sydney Coast-Georges River	1 890	O'Hares Creek	Wedderburn	75	27	1.2	67 600	1 900	392	0	0	2.3
14. Wollongong Coast	751	Macquarie Rvt.	Albion Park	30	18	1.09	59 800	1 970	320	0	0	17
15. Shoalhaven River	7 300	Shoalhaven	Welcome Reef	2 770	58	17.4	50 900	2 420	430	0	0	8
16. Clyde River-Jervis Bay	3 260	Clyde	Brooman	881	13	17.8	22 600	1 120	355	0	0.1	3
17. Moruya River	1 550	Moruya	Wamban	1 150	13	11.2	23 800	1 700	330	0	0	5
18. Tuross River	2 180	Tuross	Belowra	531	12	6.21	12 800	920	260	0	1	6
19. Bega River	2 850	Bemboka	Morans Crossing	385	24	4.50	40 300	1 790	360	0	0.02	9
20. Towamba River	2 200	Towamba	New Building Bridge	295	13	2.37	73 900	2 250	460	0	0.3	3

(contd.)

(a) In total period of gauging station record.

Table II(b) contd.

Range of discharges for selected rivers

II SOUTH-EAST COAST DRAINAGE DIVISION River basins	Adapted Drainage Area (km^2)	Selected River	Selected Gauging Station				Maximum Discharge as a Percentage of Average [a]			Minimum Discharge as a Percentage of Average [a]		
			Station Name	Area above Gauge (km^2)	Record Length (years)	Average Annual Discharge (m^3/sec)	Instan-taneous	Monthly	Annual	Instan-taneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
21. East Gippsland	6 040	Cann	Weeragua	311	13	1.77	3 020	753	206	3.3	11	23
22. Snowy River	15 799	Snowy	Orbost/ Jurrahmond (c)	13 421	42 (b)	65.3	10 600	514	193	2.4	4.9	46
23. Tambo River	4 170	Tambo	Bruthen/ Ramrod Creek (c)	2 727	29	6.94	8 160	887	321	4.1	5.3	28
24. Mitchell River	5 646	Mitchell	Glenaladale	3 903	32	29.1	3 620	750	237	0.05	0.16	21
25. Thomson River	5 905	Thomson	Coopers Creek	906	36	11.5	5 430	470	182	3.8	5.7	32
26. Latrobe River	4 662	Latrobe	Rosedale	4 144	55	29.6	11 850	998	345	4.6	5.2	29
27. South Gippsland	6 786	Tarwin	Meeniyan	1 067	14	8.95	2 570	589	164	0.92	1.0	26
28. Bunyip River	4 118	Bunyip	Bunyip/Iona (c)	697	47	4.82	23 500	675	198	8.8	14	45
29. Yarra River	4 066	Yarra	Warrandyte	2 328	41 (b)	28.2	2 230	610	167	7.3	14	46
30. Maribyrnong River	1 450	Maribyrnong	Keilor	1 303	39	3.36	14 300	2 330	306	0	0	3.6
31. Werribee River	1 994	Werribee	Ballan	101	26	0.68	15 200	1 130	287	0	0	2.2
32. Moorabool River	2 176	Moorabool	Batesford	1 114	24	2.21	10 600	1 640	315	0	0	2.1
33. Barwon River	3 626	Barwon	Winchelsea/ Inverleigh (c)	1 052	33	4.46	8 410	1 520	359	0.13	0.37	22
34. Lake Corangamite	4 222	Woady Yaloak	Cressy	1 158	15	1.96	13 900	1 000	295	0.29	0.69	11
35. Otway Coast	3 963	Curdies	Curdie	790	14	4.00	9 650	1 230	218	0	0	4.1
36. Hopkins River	9 946	Hopkins	Wickliffe	1 347	38	1.00	8 410	1 920	400	0	0	2.7
37. Portland Coast	4 144	Moyne	Toolong	570	13	1.25	6 620	1 400	240	0	0	6.0
38. Glenelg River	12 380	Wannon	Dunkeld	671	38	1.02	6 720	1 480	369	0	0	0.11
39. Millicent Coast	41 577	Reedy Creek-Mt Hope Dr.	South End	425	3	1.12	2 340	978	196	0	0.8	51

(a) In total period of gauging station record.
(b) Record prior to the construction of diversion works.
(c) Combined record of two gauging stations.

Table II(c)

Salinities of selected rivers

II SOUTH-EAST COAST DRAINAGE DIVISION River basins	Adopted Drainage Area (km^2)	Selected River	Selected Gauging Station: Station Name	Area above Gauge (km^2)	Average Annual Discharge ($m^3 \times 10^6$)	Period of Sampling (years)	Number of Samples	Salinity (mg/l T.D.S.): Weighted Average of Samples	10 Percentile of Samples	50 Percentile of Samples	90 Percentile of Samples
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Tweed River	1 110	Oxley	Eungella	213	195	6	38	110	66	98	140
2. Brunswick River	492	Brunswick	Durrumbul	34	55.5	5	30	70	69	78	88
3. Richmond River	6 940	Richmond	Casino	1 790	741	4	27	80	116	171	234
4. Clarence River	22 660	Clarence	Lilydale	16 690	3 720	5	21	89	72	108	145
5. Bellinger River	3 440	Bowra	Bowraville	539	248	5	20	78	66	80	99
6. Macleay River	11 450	Macleay	Turners Flat	9 980	1 670	3	17	62	54	68	89
7. Hastings River	4 530	Hastings	Ellenborough	1 610	795	5	20	64	56	68	90
8. Manning River	8 420	Manning	Killawarra	6 550	2 280	3	17	86	74	96	107
9. Karuah River	4 480	Karuah	Monkerai	202	162	4	11	224	67	135	380
10. Hunter River	22 020	Hunter	Singleton	16 440	883	6	53	298	275	450	580
11. Macquarie-Tuggerah L.	1 630	Wyee Creek	Wyee	20	4.41	3	16	148	80	180	630
12. Hawkesbury River	21 730	Nepean	Penrith	11 000	1 420	2	9	96	82	110	154
13. Sydney Coast-Georges River	1 890	...	...	...	...	...	...	...	...	...	...
14. Wollongong Coast	751	Macquarie Rvt.	Albion Park	30	34.4	3	17	91	71	97	182
15. Shoalhaven River	7 300	Shoalhaven	Welcome Reef	2 770	549	2	13	59	53	67	82
16. Clyde River-Jervis Bay	3 260	Clyde	Brooman	881	561	2	10	67	45	60	98
17. Moruya River	1 550	Moruya	Wamban	1 150	353	1	5	66	67	74	80
18. Tuross River	2 180	Tuross	Belowra	531	196	7	35	32	27	35	50
19. Bega River	2 850	Bemboka	Morans Crossing	385	142	7	38	71	51	72	105
20. Towamba River	2 200	Towamba	New Building Bridge	295	74.7	7	45	48 (a)	68	98	132

(contd.)

(a) Heavily influenced by one flood.

Table II(c) contd.

Salinities of selected rivers

II SOUTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Selected River (3)	Selected Gauging Station: Station Name (4)	Area above Gauge (km²) (5)	Average Annual Discharge ($m^3 \times 10^6$) (6)	Period of Sampling (years) (7)	Number of samples (8)	Salinity (mg/l T.D.S.): Weighted Average of Samples (9)	10 Percentile of Samples (10)	50 Percentile of Samples (11)	90 Percentile of Samples (12)
21. East Gippsland	6 040	Cann	Weeragua	311	56	11	99	58	49	69	100
22. Snowy River	15 799	Snowy	Orbost/ Jarrahmond (a)	13 421	2 075	11	100	67	50	77	116
23. Tambo River	4 170	Tambo	Bruthen/ Ramrod Creek (a)	2 727	220	9	90	86	75	105	155
24. Mitchell River	5 646	Mitchell	Glenaladale	3 903	924	11	84	40	28	45	74
25. Thomson River	5 905	Thomson	Coopers Creek	906	364	11	100	40	26	36	60
26. Latrobe River	4 662	Latrobe	Rosedale	4 144	936	3	56	184	147	220	260
27. South Gippsland	6 786	Tarwin	Meeniyan	1 067	284	11	105	177	128	260	395
28. Bunyip River	4 118	Bunyip	Bunyip/Iona (a)	697	148	11	129	116	110	160	210
29. Yarra River	4 066	Yarra	Warrandyte	2 328	896	11	100	111	60	90	160
30. Maribyrnong River	1 450	Maribyrnong	Keilor	1 303	100	11	80	249	220	770	1 590
31. Werribee River	1 994	Werribee	Ballan	101	21	11	44	121	88	150	360
32. Moorabool River	2 176	Moorabool	Batesford	1 114	71	11	87	293	220	600	1 500
33. Barwon River	3 626	Barwon	Winchelsea/ Inverleigh (a)	1 052	139	11	87	394	332	1 100	2 040
34. Lake Corangamite	4 222	Woady Yaloak	Cressy	1 158	60	11	75	817	908	2 400	4 255
35. Otway Coast	3 963	Curdies	Curdie	790	127	11	116	301	317	630	949
36. Hopkins River	9 946	Hopkins	Wickliffe	1 347	32	11	97	1 445	1 263	3 681	6 028
37. Portland Coast	4 144	Moyne	Toolong	570	40	11	102	550	493	1 670	2 338
38. Glenelg River	12 380	Wannon	Dunkeld	671	32	11	96	363	249	497	2 470
39. Millicent Coast	41 577	Reedy Creek-Mt Hope Dr.	South End	425	35	6	220	890	680	940	1 110

(a) Combined record of two gauging stations.

Table II(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

II SOUTH-EAST COAST DRAINAGE DIVISION	*Adopted Drainage Area*	*Present Annual Commitments*				*Authorised and Planned Annual Commitments*				*Total Commit-ments*	*Possible Exploitable Yield*	*Estimated Total Yield of Drainage Area*
River basins	*(km^2)*	*Designed Diversions*	*Storage Evaporation Losses*	*River Losses and Requirements*	*Total*	*Proposed Diversions*	*Storage Evaporation Losses*	*River Losses and Requirements*	*Total*			
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*
1. Tweed River	1 110	0	0	6	6	0	0	0	0	6	150	418
2. Brunswick River	492	0	0	2	2	0	0	0	0	2	40	246
3. Richmond River	6 940	18	0	16	34	0	0	0	0	34	350	1 920
4. Clarence River	22 660	0	0	150 (a)	150	0	0	0	0	150	2 500	4 920
5. Bellinger River	3 440	0	0	2	2	0	0	0	0	2	500	1 150
6. Macleay River	11 450	5 (b)	0	9	14	0	0	0	0	14	1 100	2 150
7. Hastings River	4 530	0	0	34	34	0	0	0	0	34	500	1 450
8. Manning River	8 420	0	0	26	26	0	0	0	0	26	1 200	2 270
9. Karuah River	4 480	0	0	5	5	0	0	0	0	5	300	1 300
10. Hunter River	22 020	222	4	103	329	0	0	0	0	329	800	1 680
11. Macquarie-Tuggerah Lakes	1 630	0	0	10	10	0	0	0	0	10	60	366
12. Hawkesbury River	21 730	596	29	106	731	0	0	0	0	731	1 200	3 010
13. Sydney Coast-Georges River	1 890	19	1	17	37	0	0	0	0	37	40	357
14. Wollongong Coast	751	0	0	4	4	0	0	0	0	4	6	176
15. Shoalhaven River	7 300	0	0	15	15	473	69	0	542	557	1 100	1 788
16. Clyde River-Jervis Bay	3 260	0	0	8	8	0	0	0	0	8	400	932
17. Moruya River	1 550	0	0	1	1	0	0	0	0	1	200	370
18. Tuross River	2 180	0	0	3	3	0	0	0	0	3	200	495
19. Bega River	2 850	0 (c)	0	10	10	9	0	1	10	20	250	570
20. Towamba River	2 200	0	0	1	1	0	0	0	0	1	150	484

(contd.)

(a) In addition 250 $m^3 \times 10^6$ is used for hydro-electric purposes.
(b) In addition 35 $m^3 \times 10^6$ is used for hydro-electric purposes.
(c) In addition 12 $m^3 \times 10^6$ is used for hydro-electric purposes.

Table II(d) contd.

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

II SOUTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Present Annual Commitments: Designed Diversions (3)	Present Annual Commitments: Storage Evaporation Losses (4)	Present Annual Commitments: River Losses and Requirements (5)	Present Annual Commitments: Total (6)	Authorised and Planned Annual Commitments: Proposed Diversions (7)	Authorised and Planned Annual Commitments: Storage Evaporation Losses (8)	Authorised and Planned Annual Commitments: River Losses and Requirements (9)	Authorised and Planned Annual Commitments: Total (10)	Total Commitments (11)	Possible Exploitable Yield (12)	Estimated Total Yield of Drainage Area (13)
21. East Gippsland	6 040	0.2	0	2.8	3	0	0	0	0	3	300	600
22. Snowy River	15 799	1 130(a)	62	3	1 195	0	0	0	0	1 195	1 600	2 396
23. Tambo River	4 170	2	0	0	2	0	0	0	0	2	100	370
24. Mitchell River	5 646	14	0	0	14	14	0	12	26	40	100	1 034
25. Thomson River	5 905	200	6	0	206	292	0	8	300	506	550	1 200
26. Latrobe River	4 662	140	7	90	237	161	0	90	251	488	488	995
27. South Gippsland	6 786	15	0	0	15	0	0	0	0	15	400	1 268
28. Bunyip River	4 118	48	0	0	48	5	0	0	5	53	150	550
29. Yarra River	4 066	400	0	0	400	100	0	0	100	500	550	1 193
30. Maribyrnong River	1 450	44	0	0	44	3	0	0	3	47	60	106
31. Werribee River	1 994	49	7	0	56	3	0	0	3	59	65	119
32. Moorabool River	2 176	26	0	0	26	14	0	0	14	40	50	100
33. Barwon River	3 626	33	4	0	37	5	0	0	5	42	100	179
34. Lake Corangamite	4 222	0	0	0	0	0	0	0	0	0	50 (b)	15
35. Otway Coast	3 963	17	0	0	17	27	0	0	27	44	100	829
36. Hopkins River	9 946	2	0	0	2	1	0	0	1	3	50 (b)	30
37. Portland Coast	4 144	2	0	0	2	0	0	0	0	2	10	98
38. Glenelg River	12 380	95(c)	32	0	127	0	0	0	0	127	127	210
39. Millicent Coast	41 577	25	0	0	25	0	0	0	0	25	96	155
TOTALS (d)	273 553	1 882	152	624	2 658	1 107	69	111	1 287	3 945(d)	15 992	37 499

(a) 1130 $m^3 \times 10^6$ diverted to Division IV.
(b) Includes brackish water.
(c) Includes 90 $m^3 \times 10^6$ diverted to Mallee and Wimmera-Avon river basins (Division IV).
(d) The diversions from the Snowy River Basin and the Glenelg River Basin to Division IV are included in the totals for Table IV (d).

Aquifer characteristics

II SOUTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Aquifer Type(a) (3)	Area of Aquifer (km^2) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m^3/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Tweed River	1 110	US	150	3–20	1–2	40	10–200	500–2 000
		SR	670	...	...	2	...	...
		FR	1 006	10–20	1–3	10	50–100	500–2 000
2. Brunswick River	492	US	120	1–20	0.5–7	20	20–200	500–2 000
		FR	370	10–20	3–6	7	50–100	500–2 000
3. Richmond River	6 940	US	1 735	2–20	0.6–6	1 000	10–100	100–3 000
		SR	7 294	10–30	0.6–6	250	10–100	1 000–3 000
		FR	3 063	10–30	0.3–4	1 000	10–80	500–1 000
4. Clarence River	22 660	US	1 070	3–20	1–8	37	30–900	700–4 000
		SR	7 800	20–45	0.5–5	36	10–200	140–3 000
		FR	15 090	15–30	1–3	4	10–100	1 000–3 000
5. Bellinger River	3 440	US	600	2–8	1–3	35	30–550	500–2 000
		SR	240	...	...	...	...	...
		FR	2 625	10–50	...	3	20–50	1 000–3 000
6. Macleay River	11 450	US	410	5–25	1–12	60	30–2 200	150–300
		SR	0					
		FR	10 830	15–50	1–10	150	15–110	150–1 400
7. Hastings River	4 530	US	390	5–10	1–10	150	20–1 000	500–10 000
		SR	375	...	...	0	...	...
		FR	3 770	6–30	2–3	6	20–50	<7 000
8. Manning River	8 420	US	480	3–8	5–10	390	400–3 000	500–8 000
		SR	0					
		FR	8 110	6–12	...	7	10–90	...
9. Karuah River	4 480	US	380	3–10	1–3	55	200–1 500	500–2 000
		SR	403	...	...	...	...	...
		FR	3 861	7–18	0.5–3	5	200–600	200–500
10. Hunter River	22 020	US	2 200	2–20	0.5–15	625	100–4 000	100–2 000
		SR	14 900	5–35	0.5–10	95	5–325	300–6 000
		FR	9 000	5–30	0.5–10	110	5–100	300–4 000

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table II(e) contd.

Aquifer characteristics

II SOUTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Aquifer Type[(a)] (3)	Area of Aquifer (km^2) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m^3/day) (8)	Range of Common T.D.S. (mg/l) (9)
11. Macquarie-Tuggerah L.	1 630	US	150	3–6	3–6	53	400–600	250–1 000
		SR	1 480	20–40	0.5–15	50	400–2 000	1 000–5 000
		FR	0					
12. Hawkesbury River	21 730	US	520	3–35	0.3–10	100	50–2 000	500–700
		SR	14 300	20–80	0.3–15	330	30–1 000	500–3 000
		FR	7 000	15–60	0.1–1	108	10–300	500–14 000
13. Sydney Coast-Georges River	1 890	US	155	5–30	1–10	500	10–2 000	100–2 000
		SR	1 915	10–50	0.5–10	30	10–300	100–4 000
		FR	0					
14. Wollongong Coast	751	US	115	3–20	0.5–5	40	60–900	300–2 000
		SR	750	10–50	0.1–5	22	10–100	500–5 000
		FR	50	10–30	0.1–2	6	10–150	200–1 500
15. Shoalhaven River	7 300	US	1 030	3–30	0.5–15	55	10–500	500–4 000
		SR	2 400	20–50	0.2–10	60	10–300	200–5 000
		FR	4 300	20–60	0.1–5	20	10–300	200–2 000
16. Clyde River-Jervis Bay	3 260	US	150	3–7	0.5–3	24	15–220	300–450
		SR	1 600	10–45	0.5–4	25	20–65	200–300
		FR	1 900	10–30	1–2	20	10–75	1 000–3 000
17. Moruya River	1 550	US	45	2–5	0.5–3	14	0–50	>200
		SR	5	...	...	0	...	...
		FR	1 550	7	...	1	10	...
18. Tuross River	2 180	US	40	1–7	1–7	35	10–80	300–10 000
		SR	20	...	...	...	...	...
		FR	2 180	15–25	2–8	1	...	...
19. Bega River	2 850	US	110	6–30	2–5	18	22–3 300	150–700
		SR	0					
		FR	2 740	15–60	1–5	35	10–160	300–1 500
20. Towamba River	2 200	US	30	3–10	1–2	9	10–1 500	500–1 000
		SR	100	8–70	2–5	2	50–80	...
		FR	1 670	15–45	...	2	10–260	...

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table II(e) contd.

Aquifer characteristics

II SOUTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type(a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
21. East Gippsland	6 040	US	50	5–10	3–15	20	8–500	120–550
		SR	500	5–50	10–100	50	8–50	1 000–10 000
		FR	5 300	5–25	2–25	20	8–25	100–1 500
22. Snowy River	15 799	US	150	5–10	3–30	120	8–500	150–600
		SR	800	10–50	10–100	50	8–50	1 000–20 000
		FR	14 600	5–50	1–25	80	8–300	100–1 500
23. Tambo River	4 170	US	50	5–10	3–20	20	8–500	150–600
		SR	700	20–300	30–150	55	1 000–1 200	500–1 500
		FR	3 200	5–25	2–25	20	5–25	100–1 500
24. Mitchell River	5 646	US	100	5–10	5–7	150	8–500	120–600
		SR	350	50–300	10–60	60	1 000–1 200	150–1 500
		FR	5 000	5–25	2–25	20	8–25	100–1 500
25. Thomson River	5 905	US	150	5–10	5–10	200	8–500	120–600
		SR	2 000	100–200	10–200	75	1 200–1 500	150–1 500
		FR	4 000	5–25	2–25	20	8–25	100–1 500
26. Latrobe River	4 662	US	850	5–10	3–20	150	8–500	300–700
		SR	2 200	50–600	10–80	220	100–1 500	300–1 000
		FR	2 200	5–25	2–25	20	8–25	1 000–3 000
27. South Gippsland	6 786	US	500	5–10	5–7	80	8–500	300–1 000
		SR	3 300	50–200	10–200	100	1 000–1 200	300–1 500
		FR	2 200	5–25	2–25	30	8–25	500–2 000
28. Bunyip River	4 118	US	2 600	30–50	20–50	1 700	8–1 700	1 000–25 000
		SR	1 000	30–200	45	0	. . .	. . .
		FR	3 900	5–25	2–25	40	8–25	500–4 000
29. Yarra River	4 066	US	. . .	. . .	. . .	. . .	. . .	. . .
		SR	230	15–200	2–25	0	(b)	. . .
		FR	2 700	15–50	2–40	200	80–800	500–4 000
30. Maribyrnong River	1 450	US	. . .	. . .	. . .	. . .	. . .	. . .
		SR	120	15–200	2–25	10	8–500	2 000–3 500
		FR	1 300	15–50	2–50	500	80–800	2 000–5 000

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table II(e) contd.

Aquifer characteristics

II SOUTH-EAST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type (a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
31. Werribee River	1 994	US	320	5–10	15	50	8–100	1 000–2 000
		SR	1 050	60–200	10–40	< 5	8–500	2 000–3 500
		FR	1 600	5–25	2–50	3 000	80–800	1 000–5 000
32. Moorabool River	2 176	US	800	5–10	15	50	8–25	2 500–6 000
		SR	900	15–180	15–80	50	8–800	3 000–7 000
		FR	1 800	5–25	12–60	1 800	80–800	500–5 000
33. Barwon River	3 626	US	940	3–10	15–30	0	8–25	5 000–10 000
		SR	1 900	0–500	3–150	50	8–25	500–3 500
		FR	3 200	5–25	25–60	3 000	80–800	500–5 000
34. Lake Corangamite	4 222	US	430	3–30	10–30	...	...	5 000–7 000
		SR	2 750	150–300	5–20	...	...	500–2 000
		FR	2 250	5–25	25–60	5 000	80–800	500–3 000
35. Otway Coast	3 963	US	390	3–30	10–30	0	...	5 000–7 000
		SR	2 300	0–700	30–300	520	8–2 700	300–2 000
		FR	800	5–25	25–60	20	8–25	1 000–3 000
36. Hopkins River	9 946	US	630	3–30	10–30	10	80–1 600	700–1 500
		SR	4 100	20–800	30–150	200	25–1 700	500–2 000
		FR	7 600	5–25	25–60	8 000	80–800	2 000–6 000
37. Portland Coast	4 144	US	2 000	15–35	20–30	25	8–25	500–2 000
		SR	4 850	0–1 000	30–300	2 510	2 600–7 000	500–2 000
		FR	2 250	5–25	25–60	2 000	80–800	500–5 000
38. Glenelg River	12 380	US	3 000	15–35	20–30	25	8–25	500–4 000
		SR	4 700	0–1 000	30–300	1 000	8–600	500–7 000
		FR	7 200	5–25	2–25	100	8–25	400–7 000
39. Millicent Coast	41 577	US	13 800	5–35	5–50	3 550	8–10 000	1 000–10 000
		SR	33 800	15–250	5–150	53 500	25–5 000	400–10 000
		FR	0					
TOTALS	273 540	US	36 640	3–50	1–50	9 410	8–3 000	120–10 000
		SR	121 800	0–1 000	0.5–300	59 400	8–7 000	150–20 000
		FR	150 200	5–50	0.2–60	25 400	8–800	100–7 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table II(f)

Groundwater yields

II SOUTH-EAST COAST DRAINAGE DIVISION River basins	Aquifer Type[a]	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$): From Recharge < 1 000 mg/l	From Recharge 1 000–3 000 mg/l	From Recharge 3 000–7 000 mg/l	From Recharge 7 000–14 000 mg/l	From Recharge > 14 000 mg/l	Total < 1 000 mg/l	Total 1 000–3 000 mg/l	Total 3 000–7 000 mg/l	Total 7 000–14 000 mg/l	Total > 14 000 mg/l	Reliability of Estimate[b]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Tweed River	US	0.1	32	29	3.3	0	0	0	31	4.1	0	0	0	
	SR	0	1.3	0	1.0	0	0.3	0	0	1.9	0	4.2	0	
	FR	0.02	2.2	1.2	1.0	0	0	0	2.2	1.3	0	0	0	
	Total	0.1	36	30	5.3	0	0.3	0	33	7.3	0	4.2	0	(iii)
2. Brunswick River	US	0.06	49	49	0	0	0	0	52	0	0	0	0	
	FR	0.02	3.0	1.0	2.0	0	0	0	1.1	2	0	0	0	
	Total	0.1	52	50	2.0	0	0	0	53	2	0	0	0	(iii)
3. Richmond River	US	3.0	35	27	7.8	0	0	0	32	17	0	0	0	
	SR	0.8	33	26	6.0	0	1.3	0	44	19	0	24	0	
	FR	3.0	33	33	0	0	0	0	37	0	0	0	0	
	Total	6.8	101	86	14	0	1.3	0	113	36	0	24	0	(iii)
4. Clarence River	US	0.6	31	29	1.8	0	0	0	31	3.0	0	0	0	
	SR	0.1	38	21	14	0	3.8	0	33	32	0	33	0	
	FR	0.01	66	3.4	62	0	0	0	3.7	79	0	0	0	
	Total	0.7	135	53	78	0	3.8	0	68	114	0	33	0	(iii)
5. Bellinger River	US	0.1	90	85	5.0	0	0	0	87	6.4	0	0	0	
	SR	0	1.0	0	1.0	0	0	0.03	0	1.8	0	0	0.4	
	FR	0.01	16	3.2	13	0	0	0	14	16	0	0	0	
	Total	0.1	107	88	19	0	0	0.03	101	24	0	0	0.4	(iii)
6. Macleay River	US	0.4	38	34	3.5	0	0	0	36	4.9	0	0	0	
	FR	0.4	53	11	42	0	0	0	12	55	0	0	0	
	Total	0.8	91	45	46	0	0	0	48	60	0	0	0	(iii)
7. Hastings River	US	1.1	19	17	1.5	0	0	0	18	1.9	0	0	0	
	SR	0	3.0	0	3.0	0	0	0	0	3.5	0	0	0	
	FR	0.02	22	0	22	0	0	0	0	23	0	0	0	
	Total	1.1	44	17	27	0	0	0	18	28	0	0	0	(iii)
8. Manning River	US	3.7	20	14	6.0	0	0	0	16	8.0	0	0	0	
	FR	0.02	64	18	46	0	0	0	18	47	0	0	0	
	Total	3.7	84	32	52	0	0	0	34	55	0	0	0	(iii)
9. Karuah River	US	32	31	29	1.8	0	0	0	31	4.2	0	0	0	
	SR	0	0[c]	0	0	0	0	0	0	2.0	0	0	0	
	FR	0.01	16	0	16	0	0	0	0	17	0	0	0	
	Total	32	47	29	18	0	0	0	31	23	0	0	0	(iii)
10. Hunter River	US	59	19	17	2.1	0	0	0	63	5.0	0	0	0	
	SR	0.3	30	0[d]	29	0	1.1	0	22	108	0	14	0	
	FR	0.3	51	26	25	0	0	0	35	32	0	0	0	
	Total	60	100	43	56	0	1.1	0	120	145	0	14	0	(iii)

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(c) Sedimentary rocks completely obscured by alluvium.

(d) Sedimentary rock completely obscured by basalt.

Table II(f) contd.

Groundwater yields

II SOUTH-EAST COAST DRAINAGE DIVISION River basins	Aquifer Type (a)	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge: < 1 000 mg/l	From Recharge: 1 000–3 000 mg/l	From Recharge: 3 000–7 000 mg/l	From Recharge: 7 000–14 000 mg/l	From Recharge: > 14 000 mg/l	Total: < 1 000 mg/l	Total: 1 000–3 000 mg/l	Total: 3 000–7 000 mg/l	Total: 7 000–14 000 mg/l	Total: > 14 000 mg/l	Reliability of Estimate (b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
11. Macquarie-Tuggerah L.	US	0.2	2.1	2.1	0	0	0	0	2.3	0	0	0	0	
	SR	0.2	7.5	2.2	4.6	0	0.7	0	3.0	11	0	5.2	0	
	Total	0.4	9.6	4.3	4.6	0	0.7	0	5.3	11	0	5.2	0	(iii)
12. Hawkesbury River	US	0.6	5.1	5.1	0	0	0	0	5.7	0	0	0	0	
	SR	2.3	87	76	7.5	3.3	0.4	0.1	152	22	9.3	1.6	2.7	
	FR	0.3	23	3.4	20	0	0	0	3.8	26	0	0	0	
	Total	3.2	115	84	27	3.3	0.4	0.1	161	48	9.3	1.6	2.7	(iii)
13. Sydney Coast-Georges Coast	US	3.0	0.8	0.5	0.3	0	0	0	3.5	0.9	0	0	0	
	SR	0.1	16	16	0	0	0	0.1	33	0	0	0	2.1	
	Total	3.1	17	17	0.3	0	0	0.1	37	0.9	0	0	2.1	(iii)
14. Wollongong Coast	US	0.1	1.7	0	1.7	0	0	0	0	1.7	0	0	0	
	SR	0.1	7.6	6.5	0	1.1	0	0	9.8	0	5.6	0	0	
	FR	0.02	0.3	0.3	0	0	0	0	0.4	0	0	0	0	
	Total	0.2	9.6	6.8	1.7	1.1	0	0	10.2	1.7	5.6	0	0	(iii)
15. Shoalhaven River	US	0.3	7.1	1.4	5.7	0	0	0	2.2	8.1	0	0	0	
	SR	0.2	11	5.0	5.5	0	0	0	10	18	0	0	0	
	FR	0.1	19	7.9	11	0	0	0	8.1	12	0	0	0	
	Total	0.6	37	14	23	0	0	0	20	38	0	0	0	(iii)
16. Clyde River-Jervis Bay	US	0.07	1.0	0	1.0	0	0	0	0	1.4	0	0	0	
	SR	0.07	6.8	0	6.8	0	0	0	0	20	0	0	0	
	FR	0.06	7.0	0	7.0	0	0	0	0	9.2	0	0	0	
	Total	0.2	15	0	15	0	0	0	0	31	0	0	0	(iii)
17. Moruya River	US	0.04	0.6	0.6	0	0	0	0	1.1	0	0	0	0	
	FR	0	6.7	2.0	4.7	0	0	0	2.1	5.0	0	0	0	
	Total	0.04	7.3	2.6	4.7	0	0	0	3.2	5.0	0	0	0	(iii)
18. Tuross River	US	0.1	0.5	0.2	0.3	0	0	0	0.3	0.4	0	0	0	
	FR	0	11	6.0	4.7	0	0	0	6.2	5.0	0	0	0	
	Total	0.1	11	6.2	5.0	0	0	0	6.5	5.4	0	0	0	(iii)
19. Bega River	US	1.4	3.2	3.2	0	0	0	0	3.9	0	0	0	0	
	FR	0.1	21	16	4.4	0	0	0	18	5.9	0	0	0	
	Total	1.5	24	19	4.4	0	0	0	22	5.9	0	0	0	(iii)
20. Towamba River	US	0.5	0.3	0.3	0	0	0	0	0.4	0	0	0	0	
	FR	0	12	8.5	3.9	0	0	0	8.7	4.1	0	0	0	
	Total	0.5	13	8.8	3.9	0	0	0	9.1	4.1	0	0	0	(iii)

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table II(f) contd.

Groundwater yields

II SOUTH-EAST COAST DRAINAGE DIVISION River basins	Aquifer Type(a)	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) From Recharge < 1 000 mg/l	From Recharge 1 000–3 000 mg/l	From Recharge 3 000–7 000 mg/l	From Recharge 7 000–14 000 mg/l	From Recharge > 14 000 mg/l	Total < 1 000 mg/l	Total 1 000–3 000 mg/l	Total 3 000–7 000 mg/l	Total 7 000–14 000 mg/l	Total > 14 000 mg/l	Reliability of Estimate(b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
21. East Gippsland	US	0.7	0.1	0.06	0.06	0	0	0	0.6	0.6	0	0	0	(ii)
	SR	0.07	0.2	0.2	0	0	0	0	16	0	0	0	0	(ii)
	FR	0.02	26	19	7.3	0	0	0	22	15	0	0	0	(iii)
	Total	0.8	26	19	7.4	0	0	0	39	16	0	0	0	
22. Snowy River	US	3.3	14	8.7	5.8	0	0	0	11	7.6	0	0	0	(ii)
	SR	0.07	66	0	66	0	0	0	0	95	0	0	0	(ii)
	FR	0.4	166	164	2	0	0	0	198	2.7	0	0	0	(iii)
	Total	3.8	246	173	73	0	0	0	209	105	0	0	0	
23. Tambo River	US	1.0	0.05	0	0.05	0	0	0	0	1.1	0	0	0	(ii)
	SR	0.4	123	0	123	0	0	0	0	141	0	0	0	(ii)
	FR	0.02	22	18	3.7	0	0	0	23	12	0	0	0	(iii)
	Total	1.4	145	18	127	0	0	0	23	154	0	0	0	
24. Mitchell River	US	9.8	1.6	1.6	0	0	0	0	3.4	0	0	0	0	(ii)
	SR	0.5	27	0	27	0	0	0	0	29	0	0	0	(ii)
	FR	0.02	57	57	0	0	0	0	86	0	0	0	0	(ii)
	Total	10	86	59	27	0	0	0	89	29	0	0	0	
25. Thomson River	US	6.4	0.7	0.7	0	0	0	0	1.0	0	0	0	0	(ii)
	SR	4.9	95	95	0	0	0	0	117	0	0	0	0	(ii)
	FR	0.02	9.1	0	9.1	0	0	0	0	32	0	0	0	(iii)
	Total	11	105	96	9.1	0	0	0	118	32	0	0	0	
26. Latrobe River	US	6.6	0.2	0.2	0	0	0	0	31	0	0	0	0	(ii)
	SR	7.6	2.2	2.2	0	0	0	0	5.4	0	0	0	0	(ii)
	FR	0.02	4.9	0	4.9	0	0	0	0	19	0	0	0	(iii)
	Total	14	7.3	2.4	4.9	0	0	0	36	19	0	0	0	
27. South Gippsland	US	2.0	2.7	1.4	1.3	0	0	0	5.9	5.9	0	0	0	(ii)
	SR	5.5	94	94	0	0	0	0	137	0	0	0	0	(ii)
	FR	0.02	7.1	4.0	3.2	0	0	0	5.0	13	0	0	0	(iii)
	Total	7.5	104	99	4.5	0	0	0	148	19	0	0	0	
28. Bunyip River	US	9.5	11	11	0	0	0	0	111	100	0	0	0	(i)
	SR	5.5	8.8	5.8	3.0	0	0	0	68	21	12	0	0	(ii)
	FR	0.03	19	13	5.0	1.0	0	0	15	13	3.9	0	0	(iii)
	Total	15	39	30	8.0	1.0	0	0	194	134	16	0	0	
29. Yarra River	US	...	...	...	...	...	...	...	...	...	...	...	...	(iii)
	SR	0	0.5	0.5	0	0	0	0	1.0	2.7	0	0	0	(ii)
	FR	0.4	24	23	0	0.9	0	0	34	0	6.2	0	0	(ii)
	Total	0.4	25	24	0	0.9	0	0	35	2.7	6.2	0	0	
30. Maribyrnong River	US	...	...	...	...	...	...	...	...	...	...	...	...	(iii)
	SR	0.3	0.5	0	0.5	0	0	0	0	1.5	2.0	0	0	(ii)
	FR	0.5	0.6	0	0	0.6	0	0	0	0	8.4	0	0	(ii)
	Total	0.8	1.1	0	0.5	0.6	0	0	0	1.5	10	0	0	(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table II(f) contd.

Groundwater yields

II SOUTH-EAST COAST DRAINAGE DIVISION River basins	Aquifer Type [a]	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) From Recharge < 1 000 mg/l	From Recharge 1 000–3 000 mg/l	From Recharge 3 000–7 000 mg/l	From Recharge 7 000–14 000 mg/l	From Recharge > 14 000 mg/l	Total < 1 000 mg/l	Total 1 000–3 000 mg/l	Total 3 000–7,000 mg/l	Total 7 000–14 000 mg/l	Total > 14 000 mg/l	Reliability of Estimate [b]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
31. Werribee River	US	0.5	6.8	0	0	6.8	0	0	0	0	21	0	0	
	SR	0.05	8.8	0	0	8.8	0	0	0	0	42	0	0	
	FR	2.8	0.7	0	0	0.7	0	0	0	0	10	0	0	
	Total	3.3	16	0	0	16	0	0	0	0	73	0	0	(iii)
32. Moorabool River	US	0.4	2.7	0	2.0	0.7	0	0	0	6.0	29	0	0	(ii)
	SR	0.1	11	0	0	11	0	0	0	0	36	0	0	(iii)
	FR	1.8	3.6	2.9	0	0.7	0	0	5.4	0	8.8	0	0	(iii)
	Total	2.3	17	2.9	2.0	12	0	0	5.4	6.0	74	0	0	
33. Barwon River	US	0	2.2	0	2.2	0	0	0	0	12	12	0	0	
	SR	0.04	29	0	29	0	0	0	0	33	0	0	0	
	FR	2.8	1.6	0	0	1.6	0	0	0	0	21	0	0	
	Total	2.8	33	0	31	1.6	0	0	0	45	33	0	0	(ii)
34. Lake Corangamite	US	0	1.5	0	1.5	0	0	0	0	19	0	0	0	
	SR	0	16	0	0	16	0	0	0	0	16	16	0	
	FR	3.0	9.2	8.5	0	0.7	0	0	15	0	7	0	0	
	Total	3.0	27	8.5	1.5	17	0	0	15	19	23	16	0	(iii)
35. Otway Coast	US	0	1.3	1.3	0	0	0	0	3.3	9.0	0	0	0	
	SR	2.0	117	117	0	0	0	0	216	0	0	0	0	
	FR	0.2	2.4	0	2.4	0	0	0	0	6.9	0	0	0	
	Total	2.2	121	118	2.4	0	0	0	219	16	0	0	0	(iii)
36. Hopkins River	US	0.04	0.3	0.3	0	0	0	0	9.3	0	0	0	0	
	SR	3.2	49	30	19	0	0	0	289	102	0	0	0	
	FR	7.0	11	7.3	0	4.1	0	0	13	0	44	0	0	
	Total	10	61	38	19	4.1	0	0	311	102	44	0	0	(ii)
37. Portland Coast	US	0.02	0.9	0.9	0	0	0	0	9.1	27	14	0	0	(ii)
	SR	15	126	117	8.4	0	0	0	118	218	108	0	0	(ii)
	FR	1.9	12	12	0	0.3	0	0	22	0	3.7	0	0	(iii)
	Total	17	139	130	8.4	0.3	0	0	140	245	126	0	0	
38. Glenelg River	US	0.02	11	6	4.9	0	0	0	21	10	2.0	0	0	(ii)
	SR	2.1	168	95	73	0	0	0	273	105	30	0	0	(ii)
	FR	0.1	3.7	0	0	3.7	0	0	0	0	43	0	0	(iii)
	Total	2.3	183	101	78	3.7	0	0	294	115	75	0	0	
39. Millicent Coast	US	25	210	8.0	102	50	50	0	428	202	102	100	0	
	SR	217	663	378	155	80	50	0	955	713	220	100	0	
	Total	242	873	386	257	130	100	0	1,383	915	322	200	0	(ii)
TOTALS	US	172	653	384	162	58	50	0	1 051	467	180	100	0	
	SR	269	1 847	1 087	582	120	58	0.2	2 502	1 700	481	198	5.2	
	FR	25	806	470	323	14	0	0	609	453	156	0	0	
	Total	466	3 306	1 941	1 067	192	108	0.2	4 162	2 620	817	298	5.2	(iii)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Drainage Division III - Tasmania

This Division comprises the whole island State of Tasmania. It has a cool temperate climate and abundant water resources. The State is generally rugged and mountainous. Lowlands and coastal plains are of limited extent and are located for the most part in the north-west and north-east.

Mountains rising to over 1500 m can be divided into two types: in the centre, east and south-east, they are plateau-like in character; while in the west, they are more rugged and serrated. A striking feature of the topography in the centre and east is its stepped character which has facilitated hydro-electric power development.

Rainfall in this Division is reliable. Heavy rainfall in excess of 3500 mm per annum occurs over the western highlands reducing to 1500 mm over the north-eastern highlands, and 500 mm in the rain shadow of the central, eastern and south-eastern districts. Potential evaporation in the Division is the lowest in Australia. It is generally higher around the coast than inland and reduces to less than 600 mm per annum in the western highlands. Snow may occur on the highlands any time during the year, but the heaviest falls occur in late winter and early spring.

Vegetation is varied, ranging from closed forests and alpine complexes in the western highlands to open woodlands in the east. The State has good agricultural land and timber reserves. These support intensive primary production and a large wood processing industry, including pulp and paper manufacture.

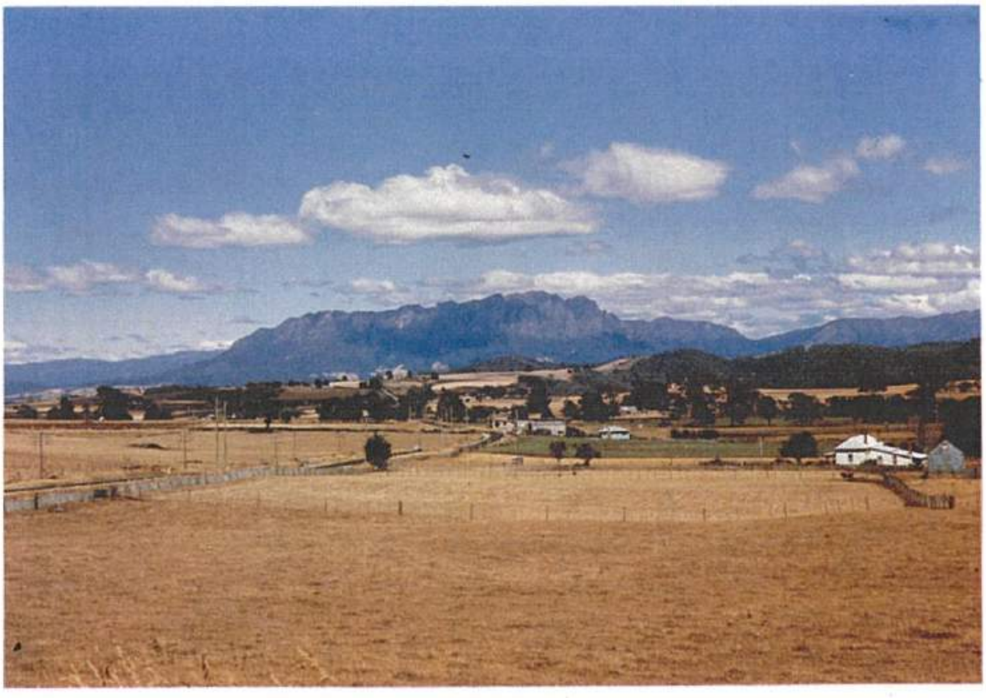


Plate 5: Farm country near Mt. Roland – River Basin 16.

Overall, annual streamflow in the Division is the most reliable and least variable of all divisions in Australia. As streams are short and summer rainfall is light, seasonal variations in streamflow may be high. However, only a few streams on the east coast (River Basins 2 and 3) and the Bass Strait islands (River Basins 1 and 13) are intermittent. All streams are fresh and salinities only exceed 400 mg/l T.D.S. where flow is intermittent (Coal River, River Basin 3). In fact, the salinity

of many is less than 100 mg/l T.D.S. The surface waters of Tasmania have been widely regulated for hydro-electric power generation which is the major use of water within the Division. As Table III(d) shows, water diversions between river basins for hydro-electric developments are extensive. Lake Gordon is the largest water storage in Australia (11670 million cubic metres). Other major hydro-electric storages include Lake Pedder (2690 million cubic metres), and Great Lake (2390 million cubic metres). On the other hand the consumptive use of water is small. Runoff is so great that only 5 per cent of the Division's exploitable surface water resources are committed for consumptive purposes.

Groundwater from unconsolidated sediments mainly occurs in coastal sand aquifers and to a lesser extent in glacial deposits, but little use is made of them, as surface water supplies are generally abundant. There are two locally important sedimentary basins, the Longford and the Scottsdale, producing water of variable quality. The most common source of groundwater is from fractured rocks which underlie about 80 per cent of the Division. Individual bores in these rocks yield up to 350 cubic metres per day of a salinity generally better than 1000 mg/l T.D.S.

Plate 6: Mountain River, with Collins Bonnet in background – River Basin 6.

Table III(a)

River basin areas, gauging stations, average annual discharges and salinities

III TASMANIAN DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 \times 10^6$)				Estimated Total Yield ($m^3 \times 10^6$)	Average Annual Runoff (mm)	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Flinders-Cape Barren Is.	2 072	1	1	1	6	210	216	0	216	104	fresh
2. East Coast	6 842	47	11	11	426	1 400	1 826	0	1 826	267	fresh
3. Coal River	736	50	3	3	31	15	46	0	46	63	fresh (a)
4. Derwent River	9 160 (b)	81	64	101	3 456	296	3 752	0	3 752	410	fresh
5. Kingston Coast	777	17	3	3	7	181	188	0	188	242	fresh
6. Huon River	3 250	66	6	14	2 890	530	3 420	0	3 420	1 052	fresh
7. South-West Coast	5 465	16	2	2	1 340	5 250	6 590	0	6 590	1 206	fresh
8. Gordon River	5 672	81	22	23	7 910	1 440	9 350	0	9 350	1 648	fresh
9. King-Henty Rivers	1 813	31	6	8	1 355	2 060	3 415	0	3 415	1 884	fresh
10. Pieman River	4 175	69	11	15	5 106	1 713	6 819	0	6 819	1 633	fresh
11. Sandy Cape Coast	881	0	0	0	0	620	620	0	620	704	fresh
12. Arthur River	2 499	64	3	3	1 779	785	2 564	0	2 564	1 026	fresh
13. King Island	1 101	0	0	0	0	290	290	0	290	263	fresh
14. Smithton-Burnie Coast	4 688	59	19	22	1 220	1 380	2 600	0	2 600	555	fresh
15. Forth River	1 124	95	21	23	1 281	21	1 302	0	1 302	1 158	fresh
16. Mersey River	1 963	82	23	25	1 432	184	1 616	0	1 616	823	fresh
17. Rubicon River	686	57	2	2	80	130	210	0	210	306	fresh
18. Tamar River	11 670 (b)	86	40	72	2 970	645	3 615	0	3 615	310	fresh
19. Piper-Ringarooma Rivers	3 626	36	7	11	140	1 220	1 360	0	1 360	375	fresh
TOTALS	68 200	60	244	339	31 429	18 370	49 799	0	49 799	730	

(a) Approaching fresh/marginal.
(b) Basin modified by the transfer of the Great Lake catchment (396 km^2) from the Derwent River Basin to the Tamar River Basin.

Table III(b)

Range of discharges for selected rivers

III TASMANIAN DRAINAGE DIVISION	Adopted	Selected	Selected Gauging Station				Maximum Discharge as a Percentage of Average[a]			Minimum Discharge as a Percentage of Average[a]		
River basins	Drainage Area (km^2)	River	Station Name	Area above Gauge (km^2)	Record Length (years)	Average Annual Discharge (m^3/sec)	Instan-taneous	Monthly	Annual	Instan-taneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Flinders-Cape Barren Is.	2 072	Pats	East Branch	23	5	0.19	30 000	453	143	0	0	35
2. East Coast	6 842	Apsley	U/S Coles Bay Rd.	155	6	2.43	12 000	747	168	0	0	14
3. Coal River	736	Coal	U/S White Kangaroo Rvt.	303	11	0.84	10 450	1 670	243	0	0	5.2
4. Derwent River	9 160	Tyenna	Newbury	205	8	5.66	1 300	349	145	8.8	16	71
5. Kingston Coast	777	Browns	Summerleas Rd. Br.	9	11	0.13	5 210	497	181	2.7	3.9	49
6. Huon River	3 250	Huon	Frying Pan Creek	2 090	27	90.6	2 380	350	130	6.5	8.5	45
7. South-West Coast	5 465	Davey	D/S Crossing River	686	11	42.5	1 070	295	140	3.0	14	74
8. Gordon River	5 672	Franklin	D/S Jane River	1 590	17	96.1	1 650	341	148	3.0	7.6	61
9. King-Henty Rivers	1 813	King	Crotty	446	51	33.1	2 580	367	145	2.6	6.7	56
10. Pieman River	4 175	Pieman	Heemskirk	2 529	18	146.8	1 660	339	155	2.7	5.8	62
11. Sandy Cape Coast	881	...	...	...	...	...	...	...	...	...	...	...
12. Arthur River	2 499	Arthur	D/S Rapid River	1 592	18	57.9	2 180	409	154	5.2	6.4	56
13. King Island	1 101	...	...	...	...	...	...	...	...	...	...	...
14. Smithton-Burnie Coast	4 688	Flowerdale	Moorleah	168	9	4.0	2 590	347	147	10	11	50
15. Forth River	1 124	Forth	Luttrells Bridge	712	30	26.5	3 460	429	167	2.3	4.8	63
16. Mersey River	1 963	Mersey	Liena	754	43	30.0	2 270	381	161	2.4	2.5	62
17. Rubicon River	686	Rubicon	Tidal Limit	259	7	2.5	4 140	570	145	0	0.3	35
18. Tamar River	11 670	South Esk	Launceston	9 156	71	69.4	6 100	841	237	1.5	4.4	30
19. Piper-Ringarooma Rivers	3 626	Brid	U/S Tidal Limit	140	9	1.6	3 360	470	166	7.5	11	51

(a) In total period of gauging station record.

Table III(c)

Salinities of selected rivers

III TASMANIAN DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Selected River (3)	Selected Gauging Station: Station Name (4)	Area above Gauge (km^2) (5)	Average Annual Discharge ($m^3 \times 10^6$) (6)	Period of Sampling (years) (7)	Number of Samples (8)	Salinity (mg/l T.D.S.): Weighted Average of Samples (9)	10 Percentile of Samples (10)	50 Percentile of Samples (11)	90 Percentile of Samples (12)
1. Flinders-Cape Barren Is.	2 072	...	...	...	...	...	...	...	...	...	...
2. East Coast	6 842	Prosser	...	725	113	1	4	210	192	202	238
3. Coal River	736	Coal	Craigbourne Road Bridge	247	13	1	9	420	184	348	873
4. Derwent River	9 160	Derwent	Bryn Estyn	8 000	(a)	1	4	54	40	58	69
5. Kingston Coast	777	...	...	...	...	...	...	...	...	...	...
6. Huon River	3 250	Huon	Frying Pan Creek	2 090	2 859	6	23	85	56	81	92
7. South-West Coast	5 465	...	...	...	...	...	...	...	...	...	...
8. Gordon River	5 672	Gordon	U/S Franklin	2 961	4 840	4	12	61	36	64	80
9. King-Henty Rivers	1 813	Henty	...	116	307	1	8	58	38	58	76
10. Pieman River	4 175	Pieman	Heemskirk	2 529	4 634	8	10	65	50	66	84
11. Sandy Cape Coast	881	...	...	...	...	...	...	...	...	...	...
12. Arthur River	2 499	...	...	...	...	...	...	...	...	...	...
13. King Island	1 101	...	...	...	...	...	...	...	...	...	...
14. Smithton-Burnie Coast	4 688	Pet	Highclere Road Bridge	11	9	1	4	70	45	55	125
15. Forth River	1 124	Forth	...	1 103	(a)	4	14	43	30	40	69
16. Mersey River	1 963	Mersey	Latrobe	1 620	1 330	5	15	95	50	102	120
17. Rubicon River	686	...	...	...	...	...	...	...	...	...	...
18. Tamar River	11 670	South Esk	Longford	7 143	2 178 (b)	1	4	78	18	97	103
19. Piper-Ringarooma Rivers	3 626	Great Forester	Sth. Springfield	...	(a)	1	4	45	38	43	51

(a) Sampling points are at water supply intakes, not at gauging stations.
(b) Controlled discharge.

Table III(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

III TASMANIAN DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Present Annual Commitments: Designed Diversions (3)	Storage Evaporation Losses (4)	River Losses and Requirements (5)	Total (6)	Authorised and Planned Annual Commitments: Proposed Diversions (7)	Storage Evaporation Losses (8)	River Losses and Requirements (9)	Total (10)	Total Commitments (11)	Possible Exploitable Yield (12)	Estimated Total Yield of Drainage Area (13)
1. Flinders-Cape Barren Is.	2 072	0.05	0	0	0.05	0	0	0	0	0.05	62	216
2. East Coast	6 842	10.1	0	0	10.1	0	0	0	0	10.1	316	1 826
3. Coal River	736	0.35	0	0	0.35	0	0	0	0	0.35	10	46
4. Derwent River (b)	9 160	375	0	0	375	32	0	0	32	407	3 062	3 752
5. Kingston Coast	777	3.0	0	0	3.0	0	0	0	0	3.0	58	188
6. Huon River (c)	3 250	439	0	0	439	0	0	0	0	439	2 924	3 420
7. South-West Coast	5 465	1.95	0	0	1.95	0	0	0	0	1.95	3 288	6 590
8. Gordon River (d)	5 672	–417	0	0	–417	0	0	0	0	–417	8 350	9 350
9. King-Henty Rivers	1 813	77.7	0	0	77.7	0	0	0	0	77.7	2 209	3 415
10. Pieman River (e)	4 175	827	0	0	827	0	0	0	0	827	5 705	6 819
11. Sandy Cape Coast	881	0	0	0	0	0	0	0	0	0	191	620
12. Arthur River	2 499	0	0	0	0	0	0	0	0	0	2 440	2 564
13. King Island	1 101	9.5	0	0	9.5	0	0	0	0	9.5	52	290
14. Smithton-Burnie Coast	4 688	54.3	0	0	54.3	0	0	0	0	54.3	1 018	2 600
15. Forth River (f)	1 124	–834	0	0	–834	0	0	0	0	–834	1 200	1 302
16. Mersey River (g)	1 963	861	0	0	861	41	0	0	41	902	1 378	1 616
17. Rubicon River	686	3.6	0	0	3.6	0	0	0	0	3.6	119	210
18. Tamar River (h)	11 670	83	0	0	83	0	0	0	0	83	2 702	3 615
19. Piper-Ringarooma Rivers	3 626	227	0	0	227	0	0	0	0	227	411	1 360
TOTALS	68 200	1 722	0	0	1 722	73	0	0	73	1 795	35 495	49 799

(a) Diversions prefixed by (–) indicate diversions into the basin by hydro-electric development.

(b) Basin modified by the transfer of Great Lake catchment (396 km^2) to the Tamar Basin.
Present commitment includes 265 $m^3 \times 10^6$ diverted to Great Lake for hydro-electric operations.
13 $m^3 \times 10^6$ diverted from Gordon River catchment.
The yield of this basin upstream of Meadowbank Dam (6208 km^2 and approximately 3100 $m^3 \times 10^6$ per annum) committed for power production.

(c) 430 $m^3 \times 10^6$ diverted from Huon catchment to Gordon catchment via Lake Pedder.

(d) 430 $m^3 \times 10^6$ diverted from the Huon catchment via Lake Pedder.
13 $m^3 \times 10^6$ diverted to Derwent River catchment.
1910 $m^3 \times 10^6$ committed for hydro-electric power production upstream of Serpentine River junction.

(e) The yield of this basin upstream of Stringer Creek (approximately 5000 $m^3 \times 10^6$) committed for authorised hydro-power development.

(f) 845 $m^3 \times 10^6$ diverted from Mersey catchment. 1095 $m^3 \times 10^6$ committed for hydro-electric power production upstream from Paloona.

(g) 845 $m^3 \times 10^6$ diverted to the Forth catchment. 917 $m^3 \times 10^6$ committed for power production upstream of Parangana Dam.

(h) Basin modified by the transfer of Great Lake catchment (396 km^2) from the Derwent Basin. 2180 $m^3 \times 10^6$ committed for hydro-electric power production at Trevallyn.

Table III(e)

Aquifer characteristics

III TASMANIAN DRAINAGE DIVISION *River basins* *(1)*	*Adopted Drainage Area (km²)* *(2)*	*Aquifer Type(a)* *(3)*	*Area of Aquifer (km²)* *(4)*	*Range of Common Depth to Aquifer (m)* *(5)*	*Range of Common Thickness of Aquifer (m)* *(6)*	*Estimated Number of Bores (1974)* *(7)*	*Range of Common Bore Yields (m³/day)* *(8)*	*Range of Common T.D.S. (mg/l)* *(9)*
1. Flinders-Cape Barren Is	2 072	US	1 244	2	10	50	9	1 500
		SR	103	10	30	0	...	...
		FR	725	10	30	0	...	...
2. East Coast	6 842	US	684	2	10	20	9	800
		SR	0					
		FR	6 159	10	30	10	9	1 000
3. Coal River	736	US	73	2	10	20	9	600
		SR	146	20	30	48	17	3 000
		FR	515	10	30	50	17	500
4. Derwent River	9 160	US	0					
		SR	1 832	10	10	10	17	1 000
		FR	7 328	10	30	20	35	800
5. Kingston Coast	777	US	0			0		
		SR	0			0		
		FR	777	10	30	10	35	800
6. Huon River	3 250	US	325	2	10	4	43	500
		SR	0					
		FR	2 925	10	30	35	17	800
7. South-West Coast	5 465	US	547	2	10	0	...	...
		SR	0					
		FR	4 918	10	30	0	...	...
8. Gordon River	5 672	US	0					<1 000
		SR	567	...	...	0	...	...
		FR	5 105	10	30	0	...	
9. King-Henty Rivers	1 813	US	362	2	10	0	...	...
		SR	181	...	...	0	...	<1 000
		FR	1 270	10	30	0	...	...
10. Pieman River	4 175	US	209	2	10	0	...	...
		SR	0					
		FR	3 966	10	30	0	...	...

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table III(e) contd.

Aquifer characteristics

III TASMANIAN DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Aquifer Type(a) (3)	Area of Aquifer (km^2) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m^3/day) (8)	Range of Common T.D.S. (mg/l) (9)
11. Sandy Cape Coast	881	US	132	2	10	0	...	...
		SR	0					
		FR	149	10	30	0	...	...
12. Arthur River	2 499	US	124	2	10	0	...	...
		SR	0					
		FR	2 375	10	30	0	...	...
13. King Island	1 101	US	166	4	10	50	173	700
		SR	0					
		FR	935	10	30	10	17	800
14. Smithton-Burnie Coast	4 688	US	938	2	4	107	86	500
		SR	468	10	30	4	26	500
		FR	3 282	10	30	193	17	200
15. Forth River	1 124	US	112	2	4	18	9	600
		SR	112	10	...	0	...	...
		FR	900	10	30	10	26	500
16. Mersey River	1 963	US	196	2	4	17	9	600
		SR	197	10	10	7	43	600
		FR	1 570	10	30	17	86	500
17. Rubicon River	686	US	0					
		SR	0					
		FR	686	10	30	19	43	500
18. Tamar River	11 670	US	0					
		SR	4 666	30	30	40	130	700
		FR	7 002	10	30	60	26	800
19. Piper-Ringarooma Rivers	3 626	US	362	2	10	2	130	500
		SR	1 088	4	15	8	259	150
		FR	2 176	10	30	14	86	100
TOTALS	68 200	US	5 500	2	10	290	9	1 000
		SR	9 400	30	30	120	173	700
		FR	52 800	10	30	450	26	500

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table III(f)

Groundwater yields

III TASMANIAN DRAINAGE DIVISION River basins	Aquifer Type[(a)]	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) From Recharge < 1 000 mg/l	From Recharge 1 000–3 000 mg/l	From Recharge 3 000–7 000 mg/l	From Recharge 7 000–14 000 mg/l	From Recharge > 14 000 mg/l	Total < 1 000 mg/l	Total 1 000–3 000 mg/l	Total 3 000–7 000 mg/l	Total 7 000–14 000 mg/l	Total > 14 000 mg/l	Reliability of Estimate[(b)]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Flinders-Cape Barren Is	US	0.2	450	200	200	50	0	0	220	220	62	0	0	
	SR	0	37	20	17	0	0	0	20	17	0	0	0	
	FR	0	262	262	0	0	0	0	262	0	0	0	0	
	Total	0.2	749	482	217	50	0	0	502	237	62	0	0	(ii)
2. East Coast	US	0.1	171	100	71	0	0	0	134	105	0	0	0	
	FR	0	1 538	1 538	0	0	0	0	1 538	0	0	0	0	
	Total	0.1	1 709	1 638	71	0	0	0	1 672	105	0	0	0	(iii)
3. Coal River	US	0.1	12	10	2	0	0	0	10	2.3	0	0	0	
	SR	0.2	24	4	10	10	0	0	4.1	20	10	0	0	
	FR	0.2	84	50	24	10	0	0	50	24	10	0	0	
	Total	0.5	120	64	36	20	0	0	64	46	20	0	0	(ii)
4. Derwent River	SR	0	21	21	0	0	0	0	23	0	0	0	0	
	FR	0.1	84	84	0	0	0	0	84	0	0	0	0	
	Total	0.1	105	105	0	0	0	0	107	0	0	0	0	(iii)
5. Kingston Coast	FR	0	178	178	0	0	0	0	178	0	0	0	0	
	Total	0	178	178	0	0	0	0	178	0	0	0	0	(ii)
6. Huon River	US	0	70	70	0	0	0	0	72	0	0	0	0	
	FR	0.1	631	600	31	0	0	0	600	31	0	0	0	
	Total	0.1	701	670	31	0	0	0	672	31	0	0	0	(iii)
7. South-West Coast	US	0	188	188	0	0	0	0	193	0	0	0	0	
	FR	0	1 691	1 691	0	0	0	0	1 691	0	0	0	0	
	Total	0	1 879	1 879	0	0	0	0	1 884	0	0	0	0	(iii)
8. Gordon River	SR	0	21	21	0	0	0	0	22	0	0	0	0	
	FR	0	1 924	1 924	0	0	0	0	1 924	0	0	0	0	
	Total	0	1 945	1 945	0	0	0	0	1 946	0	0	0	0	(iii)
9. King-Henty Rivers	US	0	108	108	0	0	0	0	112	0	0	0	0	
	SR	0	55	55	0	0	0	0	55	0	0	0	0	
	FR	0	383	383	0	0	0	0	383	0	0	0	0	
	Total	0	546	546	0	0	0	0	550	0	0	0	0	(iii)
10. Pieman River	US	0	56	56	0	0	0	0	58	0	0	0	0	
	FR	0	1 057	1 057	0	0	0	0	1 058	0	0	0	0	
	Total	0	1 113	1 113	0	0	0	0	1 116	0	0	0	0	(iii)

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table III(f) contd.

Groundwater yields

III TASMANIAN DRAINAGE DIVISION River basins	Aquifer Type[(a)]	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge: < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Total: < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Reliability of Estimate[(b)]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
11. Sandy Cape Coast	US	0	113	113	0	0	0	0	114	0	0	0	0	
	FR	0	640	640	0	0	0	0	640	0	0	0	0	
	Total	0	753	753	0	0	0	0	754	0	0	0	0	(iii)
12. Arthur River	US	0	67	67	0	0	0	0	68	0	0	0	0	
	FR	0	1 267	1 267	0	0	0	0	1 268	0	0	0	0	
	Total	0	1 334	1 334	0	0	0	0	1 336	0	0	0	0	(iii)
13. King Island	US	0.2	40	22	18	0	0	0	23	19	0	0	0	
	FR	0	330	330	0	0	0	0	330	0	0	0	0	
	Total	0.2	370	352	18	0	0	0	353	19	0	0	0	(ii)
14. Smithton-Burnie Coast	US	0.4	282	282	0	0	0	0	291	0	0	0	0	
	SR	0	141	141	0	0	0	0	141	0	0	0	0	
	FR	0.8	984	984	0	0	0	0	985	0	0	0	0	
	Total	1.2	1 407	1 407	0	0	0	0	1 417	0	0	0	0	(ii)
15. Forth River	US	0.1	108	108	0	0	0	0	110	0	0	0	0	
	SR	...	...	...	...	...	...	...	...	...	...	...	...	
	FR	0	432	432	0	0	0	0	432	0	0	0	0	
	Total	0.1	540	540	0	0	0	0	542	0	0	0	0	(ii)
16. Mersey River	US	0	41	41	0	0	0	0	43	0	0	0	0	
	SR	0	41	41	0	0	0	0	41	0	0	0	0	
	FR	0	330	330	0	0	0	0	330	0	0	0	0	
	Total	0	412	412	0	0	0	0	414	0	0	0	0	(ii)
17. Rubicon River	FR	0.1	282	282	0	0	0	0	283	0	0	0	0	
	Total	0.1	282	282	0	0	0	0	283	0	0	0	0	(iii)
18. Tamar River	SR	0.2	428	342	77	9	0	0	343	79	10	0	0	
	FR	0.2	642	600	42	0	0	0	600	42	0	0	0	
	Total	0.4	1 070	942	119	9	0	0	943	121	10	0	0	(ii)
19. Piper-Ringarooma Rivers	US	0	137	137	0	0	0	0	140	0	0	0	0	
	SR	0	411	411	0	0	0	0	412	0	0	0	0	
	FR	0.1	822	822	0	0	0	0	822	0	0	0	0	
	Total	0.1	1 370	1 370	0	0	0	0	1 374	0	0	0	0	(ii)
TOTALS	US	1.1	1 843	1 502	291	50	0	0	1 588	346	62	0	0	
	SR	0.4	1 180	1 066	104	10	0	0	1 061	116	10	0	0	
	FR	1.7	13 561	13 454	97	10	0	0	13 458	97	10	0	0	
	Total	3.2	16 584	16 022	492	70	0	0	16 107	559	82	0	0	(ii)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Drainage Division IV - Murray-Darling

The Murray-Darling Division contains Australia's largest river system. It is fed mainly by rainfall over the inland slopes of the Great Divide, which form the eastern and southern borders of the Division. Rainfall in these headwaters catchments is generally reliable and the main rivers are perennial. The principal river is the Murray, which through its tributaries, drains the whole Division and is its only outlet to the sea. As much downstream flow is through dry country, the major rivers have allowed intensive agricultural development in places where cultivation would not otherwise be possible. In its lower reaches the River Murray provides a major back-up water supply for Adelaide, the capital of South Australia, which is located in the adjacent Drainage Division V. It also provides the major part of water supplies to towns to the east and north of the South Australian Gulf in the drier part of the same Division.

Three main groups of rivers can be identified within the Division. River basins 16 to 25 comprise the Darling and its tributaries, and these drain the northern regions. Rainfall in their headwaters occurs predominantly in summer under the influence of the monsoons, and severe flooding in these reaches is common. Further downstream, the Darling flows through the most arid parts of the Division. Flow in this group of rivers is highly variable and the Darling itself ceases to flow in some dry years. In fact, although the Darling system drains over half the area of this Division, its contribution to flow in the River Murray itself is relatively small.

River Basins 10 and 12 comprise the Murrumbidgee and its tributaries, and these drain central and southern New South Wales (River Basin 11 is Lake George which drains internally). Median annual rainfall in the headwaters reaches 1500 mm in places, under the influence of winter low pressure systems, and the Murrumbidgee River at Gundagai has never ceased to flow over the period of record.

Plate 7: Valley of the King River – River Basin 3.

River Basins 1 to 9 comprise the River Murray and its tributaries upstream from the Murray-Murrumbidgee junction, and these drain central and northern Victoria and parts of southern New South Wales. Runoff from the headwaters catchments is reliable and in spring includes snow melt. Streams in this system contribute the bulk of flow to the lower reaches of the Murray. Other river basins, (13, 14, 15 and 26) are in the south-west of the Division where for the most part, drainage is intermittent and less co-ordinated.

Plate 8: River Murray West of Mildura – River Basins 14 and 26.

In Table IV(d) present and planned commitments of surface water are combined for those areas under the control of the River Murray Commission. These comprise River Basins 1 to 9 discussed above, and also river basins adjacent to the lower reaches of the Murray (13, 25 and 26).

Unlike coastal rivers which tend to be short, independent and fast flowing, these inland rivers are generally meandering and slow due to the low gradients of the inland plains of the Division. The Murray and many of its tributaries have formed extensive alluvial flood plains which support the principal irrigation districts of Australia. The Goulburn River provides irrigation for an intensive dairying and fruit growing industry in north-central Victoria. Water is drawn from the Murray for much of its length, the biggest close settlement area for agricultural purposes being Mildura. Along the Murray, grapes and fruit growing are important agricultural activities. The Murrumbidgee Irrigation areas, centred on Griffith in New South Wales, grow a wide variety of primary produce of which rice, grapes and fruit are significant. Most of Australia's cotton is grown in the irrigated Namoi Valley of northern New South Wales.

The salinity of the Murray in its lower reaches is an increasing problem and its consequences for domestic and irrigation water supply are discussed in Section 3.5

The flow of many rivers is regulated, especially in their upper reaches, The Murray is regulated at intervals from the Hume Dam upstream of Albury-Wodonga to the salt water barrage on Lake Alexandrina at its mouth, a distance of 2200 km. As part of an extensive hydro-electric, irrigation and water supply scheme, the Snowy River (Drainage Division II) has been diverted inland to

supplement flow in the Murray. The Wimmera and Avon River Basin (15) receives water for north-western towns and farms by diversion from the Glenelg River Basin (Drainage Division II). The table below shows the principal water storages in the Division and their uses.

Principal storages in the Murray-Darling Drainage Division

Name	*River*	*Gross Capacity ($m^3 \times 10^6$)*	*River Basin*	*Purpose*
Dartmouth[(a)]	Mitta Mitta River	3700	1	Irrigation and hydro-electric
Eildon	Goulburn River	3390	4	Irrigation and hydro-electric
Hume	River Murray	3038	1	Irrigation and hydro-electric
Menindee Lakes	Darling River	1794	25	Irrigation and water supply
Burrendong	Macquarie River	1680	21	Irrigation and flood mitigation
Blowering	Tumut River	1628	10	Irrigation and hydro-electric
Copeton	Gwydir River	1364	18	Irrigation
Wyangala	Lachlan River	1220	12	Irrigation
Burrinjuck	Murrumbidgee River	1026	10	Irrigation

(a) Under construction
Source: State water authorities.

There are many other smaller storages and overall, 91 per cent of the exploitable surface water resources of the Division are now committed, a greater proportion than for any other division.

Apart from the irrigated regions, the Division supports widespread agricultural activity, from grazing to intensive cultivation, and many areas of natural vegetation have been cleared for pastures and crops, especially in the Riverina and central plains of New South Wales.

Groundwater supplies are extensively used throughout the Division. Many unconsolidated sediments have been tapped for good quality water and the most concentrated use of groundwater is from this source. The Namoi, Condamine-Culgoa and Macquarie-Bogan River Basins have intensive irrigated areas drawing from alluvial aquifers, which together account for nearly 40 per cent of all groundwater use within the Division. In the alluvial aquifers associated with inland streams, salinity tends to increase from east to west with increasing distance from source of recharge.

Elements of the Great Artesian Basin in the north and the Murray Basin in the south-west, are the two principal sedimentary basins within the Division. Groundwater from the former is extensively used for stock and some town supplies, but the quality deteriorates with distance from recharge areas. Bore pressures and discharges have declined since the Basin was first tapped but a static state is now being reached where discharge approximates recharge and pressure and water levels remain fairly steady. Recharge to the eastern part of the Murray Basin occurs from streamflow in the Murray, Murrumbidgee and Lachlan rivers and from underflow through valley-fill sediments. Large reserves of low salinity groundwater are available in these areas but the quality deteriorates westward due to the increasing length of time of contact with the aquifers and to the occurrence of marine sediments. In the western part of New South Wales, most aquifers contain water which is commonly too saline for stock. The best quality water supplies are obtained from the Duddo Limestone of western Victoria and its equivalent, the Morgan Mannum Limestone of the Murray Basin in South Australia. These formations are important and provide water for town, industrial, irrigation and stock purposes.

Table IV(a)

River basin areas, gauging stations, average annual discharges and salinities

IV MURRAY-DARLING DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 \times 10^6$)				Estimated	Average	
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water	Total Yield ($m^3 \times 10^6$)	Annual Runoff (mm)	Salinity of Major River
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Upper Murray River	15 281	100	77	91	3 590	0	3 590	0	3 590 (b)	235	fresh
2. Kiewa River	2 046	70 (a)	28	29	680	43	723	0	723	353	fresh
3. Ovens River	7 848	77 (a)	26	32	1 622	54	1 676	0	1 676	214	fresh
4. Broken River	7 330	68 (a)	11	14	313	12	325	0	325	44	fresh
5. Goulburn River	16 835	81 (a)	49	58	3 154	33	3 187	0	3 187	189	fresh
6. Campaspe River	4 014	85 (a)	11	13	258	6	264	0	264	66	fresh
7. Loddon River	15 359	32 (a)	27	35	260	31	291	0	291	19	fresh
8. Avoca River	11 992	22 (a)	8	8	76	5	40	41	81	6.8	brackish
9. Murray Riverina	16 270	100	15 (d)	32 (d)	123	0	123	0	123	7.6	fresh
10. Murrumbidgee River	84 020	100	127	187	3 200	0	3 200	0	3 200 (c)	38	fresh
11. Lake George	984	17	2	3	11	50	61	0	61	62	fresh
12. Lachlan River	84 670	100	49	90	1 330	0	1 330	0	1 330	16	fresh
13. Benanee	21 390	0	0	0	0	50	50	0	50	2.3	fresh
14. Mallee	52 033	0	2 (d)	5 (d)	0	0	0	0	0	0	...
15. Wimmera-Avon Rivers	23 388	23	16	20	232	2	218	16	234	10	marginal
16. Border Rivers	49 470	100	53	68	898	0	898	0	898	18	fresh
17. Moonie River	15 800	100	3	5	150	0	150	0	150	9.5	fresh
18. Gwydir River	25 930	100	28	36	785	0	785	0	785	30	fresh
19. Namoi River	43 050	100	39	53	762	0	762	0	762	18	fresh
20. Castlereagh River	17 720	100	5	15	283	0	283	0	283	16	fresh
21. Macquarie-Bogan Rivers	73 270	100	39	84	1 470	0	1 470	0	1 470	20	fresh
22. Condamine-Culgoa R.	150 220	100	59	93	1 930	0	1 930	0	1 930	13	fresh
23. Warrego River	72 780	100	4	7	435	0	435	0	435	6.0	fresh
24. Paroo River	76 150	100	2	3	282	0	282	0	282	3.7	fresh
25. Darling River	115 880	100	7	15	25	0	25	0	25	0.02	fresh
26. Lower Murray River	58 800	3	6 (d)	10 (d)	68	38	106	0	106	1.8	marginal
TOTALS	1 062 530	83	693	1 006	21 937	324	22 204	57	22 261	21	

(a) It should be noted that the contribution of this river basin to the River Murray is included in any flow gauged in that river below the point of entry of the river basin.
(b) An additional 580 $m^3 \times 10^6$ is diverted to this basin from the Snowy River Basin.
(c) An additional 550 $m^3 \times 10^6$ is diverted to this basin from the Snowy River Basin.
(d) Includes gauging stations on the River Murray.

Table IV(b)

Range of discharges for selected rivers

IV MURRAY-DARLING DRAINAGE DIVISION River basins	Adopted Drainage Area (km²)	Selected River	Selected Gauging Station				Maximum Discharge as a Percentage of Average (a)			Minimum Discharge as a Percentage of Average (a)		
			Station Name	Area above Gauge (km²)	Record Length (years)	Average Annual Discharge (m^3/sec)	Instantaneous	Monthly	Annual	Instantaneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Upper Murray River	15 281	Murray (Indi)	Biggara	1 170	24	17.8	1 873	471	258	3	3	32
2. Kiewa River	2 046	Kiewa	Mongan's Bridge	552	15	16.0	1 752	401	187	4.4	6.4	31
3. Ovens River	7 848	Ovens	Wangaratta	5 824	29	49.6	1 948	841	264	0.01	0.7	14
4. Broken River	7 330	Broken	Goorambat	1 924	84	7.79	6 153	1 193	442	0	0	7.7
5. Goulburn River	16 835	Delatite	Tonga Bridge	368	23	4.34	5 948	705	219	0.65	3.1	25
6. Campaspe River	4 014	Campaspe	Redesdale	629	12	2.37	8 321	908	210	0	0	6.4
7. Loddon River	15 359	Loddon	Vaughan	249	22	1.30	19 565	1 236	256	0	0	5.3
8. Avoca River	11 992	Avoca	Coonooer Weir	2 668	80	2.39	13 690	2 062	522	0	0	4.3
9. Murray Riverina	16 270	Murray	Barham	43 370 (b)	69	150	268	257	214	0.2	0.2	25
10. Murrumbidgee River	84 020	Murrumbidgee	Gundagai	21 750	84	108	5 770	860	350	5	11	28
11. Lake George	984	Mill Post Creek	Bungendore	15.5	14	0.05	149 000	1 160	210	0	0	9
12. Lachlan River	84 670	Lachlan	Cowra	11 070	77	26.9	20 000	2 370	550	0	0	4
13. Benanee	21 390	...	...	...	...	...	...	...	...	...	...	...
14. Mallee	52 033	...	...	...	...	...	...	...	...	...	...	...
15. Wimmera-Avon Rivers	23 388	Wimmera	Glynwyllyn	1 357	24	1.93	10 661	1 676	365	0	0.34	5.6
16. Border Rivers	49 470	Macintyre	Boggabilla	22 550	71	27.9	7 540	2 460	520	0	0	1
17. Moonie River	15 800	Moonie	Gundablouie	15 800	27	3.21	10 800	2 750	490	0	0	0.4
18. Gwydir River	25 930	Gwydir	Pallamallawa	12 310	58	24.1	11 400	2 620	440	0	0	1
19. Namoi River	43 050	Namoi	Gunnedah	17 100	77	22.0	15 300	1 450	560	0	0	5
20. Castlereagh River	17 720	Castlereagh	Gilgandra	6 210	15	3.69	76 700	3 720	860	0	0	7
21. Macquarie-Bogan Rivers	73 270	Macquarie	Dubbo	19 940	83	34.0	17 300	1 930	940	0	0	2
22. Condamine-Culgoa R.	150 220	Balonne	St. George	75 369	52	42.1	6 890	4 100	766	0	0	6
23. Warrego River	72 780	Warrego	Fords Bridge	60 580	51	2.44	4 330	2 880	900	0	0	0
24. Paroo River	76 150	...	...	...	...	...	...	...	...	...	...	...
25. Darling River	115 880	Darling	Menindee	14 200	88	102	2 790	2 200	911	0	0	0.04
26. Lower Murray River	58 800	Finniss	Yundi	194	4	0.89	5 910	685	214	0	0	38

(a) In total period of gauging station record.
(b) Distributary river system. Part of basin discharge occurs in other rivers.

Table IV(c)

Salinities of selected rivers

IV MURRAY-DARLING DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Selected River (3)	Selected Gauging Station: Station Name (4)	Area above Gauge (km²) (5)	Average Annual Discharge ($m^3 x 10^6$) (6)	Period of Sampling (years) (7)	Number of Samples (8)	Salinity (mg/l T.D.S.): Weighted Average of Samples (9)	10 Percentile of Samples (10)	50 Percentile of Samples (11)	90 Percentile of Samples (12)
1. Upper Murray River	15 281	Murray (Indi)	Biggara	1 170	561	9	48	21	18	26	52
2. Kiewa River	2 046	Kiewa	Mongan's Bridge	552	489	11	35	18	12	17	44
3. Ovens River	7 848	Ovens	Wangaratta	5 824	1 575	11	46	32	25	36	63
4. Broken River	7 330	Broken	Gooramibat	1 924	248	11	57	71	57	86	126
5. Goulburn River	16 835	Delatite	Tonga Bridge	368	137	11	77	40	34	47	61
6. Campaspe River	4 014	Campaspe	Redesdale	629	71	11	112	117	71	195	570
7. Loddon River	15 359	Loddon	Vaughan	249	41	11	94	168	100	225	615
8. Avoca River	11 992	Avoca	Coonooer Weir	2 668	76	11	60	602	171	1 179	4 314
9. Murray Riverina	16 270	Murray	Barham		4 730	9	51	61	37	53	80
10. Murrumbidgee River	84 020	Murrumbidgee	Gundagai	21 750	3 406	8	49	50	29	45	78
11. Lake George	984	Mill Post Creek	Bungendore	15.5	1.63	4	17	191	161	302	394
12. Lachlan River	84 670	Lachlan	Cowra	11 070	848	8	49	276	145	215	375
13. Benanee	21 390	...	...	...	...	...	...	...	...	...	...
14. Mallee	52 033	...	...	...	...	...	...	...	...	...	...
15. Wimmera-Avon Rivers	23 388	Wimmera	Glynwyllyn	1 375	62	12	129	416	330	1 011	2 425
16. Border Rivers	49 470	Macintyre	Boggabilla	22 550	880	7	28	145	90	150	235
17. Moonie River	15 800	Moonie	Gundablouie	15 800	101	6	12	71	51	82	114
18. Gwydir River	25 930	Gwydir	Pallamallawa	12 310	760	6	38	161	125	330	495
19. Namoi River	43 050	Namoi	Gunnedah	17 100	694	7	48	232	190	250	340
20. Castlereagh River	17 720	Castlereagh	Gilgandra	6 210	116	7	40	130	170	370	534
21. Macquarie-Bogan Rivers	73 270	Macquarie	Dubbo	19 940	1 072	7	39	147	140	190	275
22. Condamine-Culgoa R.	150 220	Balonne	Weribone	51 540	1 860	4	15	89	70	94	205
23. Warrego River	72 780	Warrego	Fords Bridge	60 580	76.9	7	23	78	65	85	105
24. Paroo River	76 150	Paroo		42 700	70	6	18	61	39	63	185
25. Darling River	115 880	Darling	Menindee	14 200	3 217	7	33	197	178	226	266
26. Lower Murray River	58 800	Finniss	Yundi	194	28.2	5	128	545	380	705	870

Present, authorised and planned annual commitments of fresh and marginal surface water (m³ x 10⁶)

IV MURRAY-DARLING DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Present Annual Commitments: Designed Diversions (3)	Present Annual Commitments: Storage Evaporation Losses (4)	Present Annual Commitments: River Losses and Requirements (5)	Present Annual Commitments: Total (6)	Authorised and Planned Annual Commitments: Proposed Diversions (7)	Authorised and Planned Annual Commitments: Storage Evaporation Losses (8)	Authorised and Planned Annual Commitments: River Losses and Requirements (9)	Authorised and Planned Annual Commitments: Total (10)	Total Commitments (11)	Possible Exploitable Yield (12)	Estimated Total Yield of Drainage Area (13)
1. Upper Murray River (a)	15 281											3 590
2. Kiewa River (a)	2 046											723
3. Ovens River (a)	7 848	29	0	0	29	0	0	0	0	29	600	1 676
4. Broken River (a)	7 330	150	37	0	187	0	0	0	0	187	187	325
5. Goulburn River (a)	16 835	1 530	92	512	2 134	138	0	38	176	2 310	2 310	3 187
6. Campaspe River (a)	4 014	96	35	32	163	0	0	0	0	163	163	264
7. Loddon River (a)	15 359	109	17	36	162	0	0	0	0	162	162	291
8. Avoca River (a)	11 992	8	0	0	8	0	0	0	0	8	8	40
9. Murray Riverina (a)	16 270											123
10. Murrumbidgee River (a)	84 020	2 114 (b)	6	679	2 799	234	65	33	332	3 131	3 200	3 200
11. Lake George	984	0	0	1	1	0	0	0	0	1	5	61
12. Lachlan River	84 670	418	72	196	686	5	1	3	9	695	700	1 330
13. Benanee (a)	21 390	0	0	0	0	0	0	0	0	0	0	50
14. Mallee	52 033	194 (c)	0	0	230	0	0	0	0	230	0	0
15. Wimmera-Avon Rivers	23 388		36	0		0	0	0	0		140	218
16. Border Rivers	49 470	53	11	112	176	103	5	13	121	297	550	898
17. Moonie River	15 800	0	0	2.3	2.3	0	0	0	0	2.3	19	150
18. Gwydir River	25 930	366	12	39	417	0	0	0	0	417	490	785
19. Namoi River	43 050	213	23	95	331	95	11	4	110	441	450	762
20. Castlereagh River	17 720	1	0	10	11	0	0	0	0	11	90	283
21. Macquarie-Bogan Rivers	73 270	356	44	180	580	18	9	3	30	610	660	1 470
22. Condamine-Culgoa R.	150 220	91	49	61	201	12	3	0	15	216 (d)	120	1 930
23. Warrego River	72 780	0	0	4	4	0	0	0	0	4	16	435
24. Paroo River	76 150	0	0	6	6	0	0	0	0	6 (d)	2	282
25. Darling River (e)	115 880			114	114					114		25
26. Lower Murray River (a)	58 800											106
RIVER MURRAY SYSTEM (f)		6 000	750	950	7 700	0	0	0	0	7 700	8 500	
TOTALS	1 062 530	11 728	1 184	3 029	15 941	605	94	94	793	16 734	18 372	22 204

(a) Records commitments only for use within river basin. Other commitments are included in the River Murray System below.

(b) Includes 550 m³ x 10⁶ from the Snowy River Basin (Division II), part of a total diversion into Division IV from that basin of 1130 m³ x 10⁶.

(c) Includes 90 m³ x 10⁶ diverted from the Glenelg River Basin (Division II). In addition there is a local commitment of 104 m³ x 10⁶ in the Wimmera-Avon River Basin.

(d) Based on an analysis which considers withdrawals without restrictions. The figure for total commitments includes yields from structures operating with restrictions.

(e) This river is essentially a carrier stream for surplus flows from River Basins 16 to 24. That part utilised upstream of Menindee is recorded here. That part utilised downstream of Menindee is included in the River Murray System below.

(f) Includes 580 m³ x 10⁶ from the Snowy River Basin (Division II), part of a total diversion into Division IV from that basin of 1130 m³ x 10⁶.

Table IV(e)

Aquifer characteristics

IV MURRAY-DARLING DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type (a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Upper Murray River	15 281	US	970	5–50	2–20	160	8–320	100–1 000
		SR	0					
		FR	15 000	5–70	0.3–25	160	8–90	100–2 000
2. Kiewa River	2 046	US	390	5–50	5–20	100	8–25	100–1 000
		SR	0					
		FR	1 850	5–25	2–25	10	8–25	100–2 000
3. Ovens River	7 848	US	3 180	5–60	5–20	500	8–800	300–2 000
		SR	0					
		FR	4 500	5–25	2–25	10	8–25	100–2 000
4. Broken River	7 330	US	6 000	5–75	2–65	1 500	8–2 700	500–2 000
		SR	2 200	120	5–15	0	. . .	500–2 000
		FR	1 900	5–25	2–25	20	8–25	2 000–5 000
5. Goulburn River	16 835	US	7 700	5–75	2–65	1 000	8–800	300–3 000
		SR	1 100	120	5–15	0	. . .	300–3 000
		FR	9 600	5–25	2–25	130	8–90	500–7 000
6. Campaspe River	4 014	US	1 250	5–75	2–65	1 000	8–2 700	500–2 000
		SR	310	120	5–15	0	. . .	. . .
		FR	2 600	5–25	2–50	50	8–800	800–5 000
7. Loddon River	15 359	US	11 000	5–75	2–65	500	25–2 700	1 000–5 000
		SR	4 100	120	5–15	0	. . .	. . .
		FR	6 000	5–25	5–60	1 500	8–800	800–7 000
8. Avoca River	11 992	US	10 000	5–60	2–50	200	8–100	4 000–20 000
		SR	7 500	100–300	2–30	0	. . .	4 000–30 000
		FR	2 400	5–25	2–25	100	8–25	5 000–9 000
9. Murray Riverina	16 270	US	16 240	20–90	3–10	1 050	40–620	200–14 000
		SR	13 500	30–150	3–20			
		FR	800	25–75	15–60	55	10–60	500–10 000
10. Murrumbidgee River	84 020	US	46 000	20–120	1–20	5 400	0.3–13 000	300–14 000
		SR	30 700	30–150	3–20			300–7 000
		FR	38 500	25–60	0.1–5	5 000	20–270	500–7 000

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table IV(e) contd.

Aquifer characteristics

IV MURRAY-DARLING DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type(a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
11. Lake George	984	US	200	5–50	2–10	60	60–330	200–400
		SR	0					
		FR	830	15–60	0.3–2.5	150	20–90	300–1 200
12. Lachlan River	84 670	US	46 000	20–120	3–10	5 850	50–13 000	400–14 000
		SR	26 000	30–150	3–20			400–14 000
		FR	57 000	15–100	0.5–6	5 550	15–300	800–6 000
13. Benanee	21 390	US	21 390	60–200	2–20	420	35–220	5 000–15 000
		SR	21 390					
		FR	0					
14. Mallee	52 033	US	27 500	10–35	5–45	892	8–200	2 000–30 000
		SR	46 500	20–250	10–110	8 500	8–2 700	700–30 000
		FR	0					
15. Wimmera-Avon Rivers	23 388	US	23 000	15–35	30–40	50	8–25	1 500–20 000
		SR	20 000	80–280	10–90	2 000	8–800	1 500–30 000
		FR	3 900	5–25	2–25	50	8–25	3 000–9 000
16. Border Rivers	49 470	US	13 200	4–100	0.3–10	820	12–1 090	250–14 000
		SR	29 800	40–1 200	0.5–50	1 765	10–5 200	300–10 000
		FR	21 660	10–80	0.2–5.5	1 000	8–760	300–7 000
17. Moonie River	15 800	US	3 450	20–50	1–2	8	120–960	500–1 000
		SR	15 300	50–1 100	0.6–70	305	0.4–1 500	100–4 000
		FR	0					
18. Gwydir River	25 930	US	12 710	10–40	1–5	3 140	20–1 400	350–15 000
		SR	14 500	30–110	1–30	860	26–1 520	300–3 000
		FR	11 970	22–80	1–4.5	1 000	8–220	500–7 000
19. Namoi River	43 050	US	19 000	15–90	1.5–9	19 700	55–15 000	200–15 000
		SR	30 000	30–900	6–30	3 200	20–2 750	500–1 200
		FR	14 300	10–60	0.6–6	6 300	10–300	800–2 000
20. Castlereagh River	17 720	US	10 100	3–20	1–8	1 350	30–130	300–15 000
		SR	17 720	25–900	1–30	2 250	20–1 250	300–3 000
		FR	2 180	20–55	0.2–6	300	10–220	500–7 000

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table IV(e) contd.

Aquifer characteristics

IV MURRAY-DARLING DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type[(a)] (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
21. Macquarie-Bogan Rivers	73 270	US	36 500	30–100	15–85	6 600	60–5 000	200–15 000
		SR	45 000	30–820	6–30	3 200	60–360	500–2 500
		FR	29 700	15–60	2–12	6 750	20–360	750–2 500
22. Condamine-Culgoa Rivers	150 220	US	34 140	30–100	3–17	4 551 (US, SR)	95–4 300	400–15 000
		SR	134 800	40–800	0.5–80		25–1 500	300–6 000
		FR	5 490	15–120	1.5–12	3 000	11–660	300–6 000
23. Warrego River	72 780	US	14 300	4.5–33	1.5–11	1 482 (US, SR)	160–1 600	200–15 000
		SR	71 700	120–600	1.5–170		20–1 500	300–7 000
		FR	0					
24. Paroo River	76 150	US	37 590	10–90	1.5–12	372	3–120	1 000–15 000
		SR	59 940	80–460	1–150	2 408	50–450	400–14 000
		FR	1 900	30–80	1.5–10	75	20–100	600–15 000
25. Darling River	115 880	US	84 300					3 750–30 000
		SR	39 000	20–90 (US, SR)	0.3–10	2 100	50–300 (US, SR)	3 000–> 15 000
		FR	28 970	45–80	0.3–6	310	25–100	2 000–17 000
26. Lower Murray River	58 800	US	9 400	5–100	0.3–20	517	10–1 000	2 000–20 000
		SR	43 400	20–220	1–100	2 311	5–2 000	1 000–20 000
		FR	9 000	50–150	20–100	2 270	10–200	1 000–20 000
TOTALS	1 062 530	US	495 500	4–75	1–65	86 120 (US, SR)	8–5 000	100–30 000
		SR	647 500	20–800	0.5–170		8–2 700	300–30 000
		FR	270 100	5–450	0.3–100	33 790	8–1 500	300–20 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Groundwater yields

IV MURRAY-DARLING DRAINAGE DIVISION River basins	Aquifer Type (a)	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) From Recharge < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Total < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Reliability of Estimate (b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Upper Murray River	US	0.4	3.3	3.3	0	0	0	0	19.2	5.5	0	0	0	(iii)
	FR	0.7	64.9	33.3	31.6	0	0	0	42.7	36.6	0	0	0	
	Total	1.1	68.2	36.6	31.6	0	0	0	61.9	42.1	0	0	0	
2. Kiewa River	US	0	1.8	1.8	0	0	0	0	14.8	0	0	0	0	(ii)
	FR	0.008	4.2	0	4.2	0	0	0	0	13.0	0	0	0	(iii)
	Total	0.008	6.0	1.8	4.2	0	0	0	14.8	13.0	0	0	0	
3. Ovens River	US	1.7	1.6	1.6	0	0	0	0	35.6	0	0	0	0	(ii)
	SR	0	0.5	0.5	0	0	0	0	0.7	0	0	0	0	(iii)
	FR	0.008	9.2	0	9.2	0	0	0	0	23.1	0	0	0	(iii)
	Total	1.7	11.3	2.1	9.2	0	0	0	36.3	23.1	0	0	0	
4. Broken River	US	3.9	16.4	16.4	0	0	0	0	394	0	0	0	0	(ii)
	SR	0	3	0	3	0	0	0	0	3	0	0	0	(ii)
	FR	0.2	1.4	0	0	1.4	0	0	0	0	8.9	0	0	(iii)
	Total	4.1	20.8	16.4	3	1.4	0	0	394	3	8.9	0	0	
5. Goulburn River	US	1.9	10.9	10.9	0	0	0	0	194	120	0	0	0	(ii)
	SR	0	1	0	1	0	0	0	0	1	0	0	0	
	FR	0.1	28.2	24.3	0	3.9	0	0	32	0	32.7	0	0	(iii)
	Total	2	40.1	35.2	1	3.9	0	0	226	121	32.7	0	0	
6. Campaspe River	US	2.9	10.9	0	10.9	0	0	0	0	41	0	0	0	(ii)
	SR	0	1	0	1	0	0	0	0	3.3	0	0	0	(ii)
	FR	0.04	9.2	8.5	0	0.7	0	0	13.9	0	8	0	0	(iii)
	Total	2.9	21.1	8.5	11.9	0.7	0	0	13.9	44	8	0	0	
7. Loddon River	US	2.25	2.7	0	2.7	0	0	0	0	230	115	0	115	(i)
	SR	0	0.6	0	0	0.6	0	0	0	0	35	0	0	(ii)
	FR	2.0	21.6	20	0	1.6	0	0	32.4	0	16	0	0	(iii)
	Total	4.3	24.9	20	2.7	2.2	0	0	32.4	230	166	0	115	
8. Avoca River	US	0.7	1	0	0.5	0.5	0	0	0	0.5	139.5	0	280.5	(ii)
	SR	0	2.3	0	2.2	0.05	0.05	0	0	2.2	2.7	24	24	
	FR	0.08	1	0	1.0	0	0	0	0	1.0	14.8	0	0	
	Total	0.8	4.3	0	3.7	0.6	0.05	0	0	3.7	157	24	305	
9. Murray Riverina	US	15.2	25.2	10.6	9.6	2.7	2.3	0	29.5	73.6	55.9	100	0	
	SR		0	0	0	0	0	0	0	3.2	16.6	0	0.4	(iii)
	FR	0.3	1.8	0	1.8	0	0	0	0	2.2	0	0	0	
	Total	15.5	27	10.6	11.4	2.7	2.3	0	29.5	79	72.5	100	0.4	
10. Murrumbidgee River	US	35.7	99.7	40.2	50.3	8.1	1.1	0	315.9	379	181	50	0	
	SR		0	0	0	0	0	0	7.0	27	8.6	0	0	
	FR	25.0	97.6	9.7	80.5	5.5	1.9	0	14.9	162	8.8	4.8	0	(contd.)
	Total	60.7	197.3	49.9	130.8	13.6	3.0	0	337.8	568	198	55	0	

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table IV(f) contd.

Groundwater yields

IV MURRAY-DARLING DRAINAGE DIVISION River basins	Aquifer Type (a)	Abstraction During 1974 (m³ x 10⁶)	Estimated Annual Recharge (m³ x 10⁶)	Estimated Possible Annual Yield (m³ x 10⁶) From Recharge < 1 000 mg/l	From Recharge 1 000–3 000 mg/l	From Recharge 3 000–7 000 mg/l	From Recharge 7 000–14 000 mg/l	From Recharge > 14 000 mg/l	Total < 1 000 mg/l	Total 1 000–3 000 mg/l	Total 3 000–7 000 mg/l	Total 7 000–14 000 mg/l	Total > 14 000 mg/l	Reliability of Estimate (b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
11. Lake George	US	0.7	1.6	1.6	0	0	0	0	3.6	0	0	0	0	(iii)
	FR	0.7	2.9	1.6	1.3	0	0	0	2.4	3	0	0	0	(iii)
	Total	1.4	4.5	3.2	1.3	0	0	0	6.0	3	0	0	0	
12. Lachlan River	US	28.5	71.2	34.0	25.9	7.5	3.0	0.8	215.4	167	195	139.6	134.4	
	SR	21.0	0	0	0	0	0	0	3.1	13	19.8	3.6	0.3	(iii)
	FR	27.8	68.1	7.4	55.9	1.3	2.9	0.6	10.8	116	2.5	7.9	4.0	
	Total	77.3	139.3	41.4	81.8	8.8	5.9	1.4	229.3	296	217	151	138.7	
13. Benanee	US	2.1	7.4	0	0	4.3	2.9	0.2	0	0	122.8	161.3	43.7	
	SR		0	0	0	0	0	0	0	0	3	25.1	4.1	(iii)
	Total	2.1	7.4	0	0	4.3	2.9	0.2	0	0	126	186.4	47.8	
14. Mallee	US	3.0	6.3	0.09	4	2.1	0	0.09	377	8	377	0	1500	
	SR	50.6	173.5	0	105	48.5	20	0	444	629	318	298	1433	
	Total	53.6	179.8	0.09	109	50.6	20	0.09	821	637	695	298	2933	
15. Wimmera-Avon Rivers	US	0.05	0.11	0	0.01	0.1	0	0	0	271	633	633	633	(ii)
	SR	2.06	7.3	0	4.8	2.5	0	0	0	265	263.4	0	0	(iii)
	FR	0.04	1.9	0	0.8	1.1	0	0	0	3.5	14.5	0	0	(iii)
	Total	2.15	9.3	0	5.6	3.7	0	0	0	540	911	633	633	
16. Border Rivers	US	4.6	80.3	69	10.5	0	0	0.8	8.6	65.5	0	0	81.3	(ii)
	SR	18.7	2.3	2.2	0.06	0.03	0.01	0	33.8	0.1	0.05	0.01	0	(ii)
	FR	6.1	129	78	51	0	0	0	84.9	58.7	0	0	0	(iii)
	Total	29.4	212	149	62	0.03	0.01	0.8	127.3	124.3	0.05	0.01	81.3	
17. Moonie River	US	0.1	23.4	23.2	0	0	0.1	0.1	30.1	0	0	1.9	15.2	(iii)
	SR	3.4	0.82	0.5	0.2	0.1	0.02	0	3.6	0.4	0.18	0.03	0	(ii)
	Total	3.5	24.2	23.7	0.2	0.1	0.1	0.1	33.7	0.4	0.18	1.9	15.2	
18. Gwydir River	US	19.9	26.8	11.3	14.2	0.4	0.3	0.6	60.9	91.6	6.4	9.4	71.3	(iii)
	SR	18.3	2.9	2.9	0	0	0	0	39.3	0	0	0	0	
	FR	5.0	51.2	15.5	35.7	0	0	0	18.3	41.8	0	0	0	
	Total	43.2	80.9	29.7	49.9	0.4	0.3	0.6	118.5	133.4	6.4	9.4	71.3	
19. Namoi River	US	204.6	63.2	46	14.7	1.3	0.6	0.6	246.7	95.1	22.4	19.3	64.6	
	SR	33.3	15.4	11.3	4.1	0	0	0	88.1	79.4	1.7	0	0	
	FR	31.5	64.4	21.5	42.9	0	0	0	26.1	49.8	0	0	0	(iii)
	Total	269.4	143.0	79	61.7	1.3	0.6	0.6	360.9	224.3	24.1	19.3	64.6	
20. Castlereagh River	US	8.5	12.5	5	6.6	0.9	0	0	10.7	45.4	103.1	0	0	
	SR	24.9	2.9	2.9	0	0	0	0	53.4	2.6	0	0	0	
	FR	1.5	16.3	16.3	0	0	0	0	19.8	0	0	0	0	(iii)
	Total	34.9	31.7	24	6.6	0.9	0	0	83.9	48.0	103.1	0	0	
21. Macquarie-Bogan Rivers	US	40.6	34.7	12.2	19.4	0	0	3.1	40.0	148.8	0	0	392.1	
	SR	26.6	3.6	3.6	0	0	0	0	78.7	14.5	37.5	0	0	
	FR	33.7	75.8	23.4	52.4	0	0	0	33.1	100.8	0	0	0	(iii)
	Total	100.9	114.1	39.2	71.8	0	0	3.1	151.8	264.1	37.5	0	392.1	(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table IV(f) contd.

Groundwater yields

IV MURRAY-DARLING DRAINAGE DIVISION River basins	Aquifer Type (a)	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge: < 1 000 mg/l	From Recharge: 1 000–3 000 mg/l	From Recharge: 3 000–7 000 mg/l	From Recharge: 7 000–14 000 mg/l	From Recharge: > 14 000 mg/l	Total: < 1 000 mg/l	Total: 1 000–3 000 mg/l	Total: 3 000–7 000 mg/l	Total: 7 000–14 000 mg/l	Total: > 14 000 mg/l	Reliability of Estimate (b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
22. Condamine-Culgoa R.	US	102	252.7	190	59.6	0.3	0.4	2.4	220	70	7.5	16.1	36.5	(i)
	SR	46	17.9	12	4.3	1.4	0.2	0	78	6.7	2.1	0.4	0	(iii)
	FR	16	165	120	24	21	0	0	122	24.4	21.3	0	0	(iii)
	Total	164	435.6	322	88	23	0.6	2.4	420	101	30.9	16.5	36.5	
23. Warrego River	US	2.9	18.7	8.5	5.8	3.0	0.7	0.7	16	12.5	19.1	1.4	116	(i)
	SR	15.8	31.8	18.7	9.5	3.2	0.4	0	42.3	19.4	4.8	0.6	0	(ii)
	Total	18.7	50.5	27.2	15.3	6.2	1.1	0.7	58	31.9	23.9	2.0	116	
24. Paroo River	US	1.8	24.1	0	20	0.8	1.3	2.0	0	60.0	25.6	111.7	336	
	SR	26.5	5.8	3.4	1.7	0.6	0.13	0	10.6	31.8	0.9	0.15	0	
	FR	0.4	0.8	0	0.2	0.6	0	0	0	0.3	1.5	0	0	
	Total	28.7	30.7	3.4	22	2.0	1.4	2.0	10.6	92.1	28.0	111.9	336	
25. Darling River	US	10.5	24.9	0	2.0	14.8	5.9	2.2	0	25.7	458.8	360.9	442.5	
	SR		0	0	0	0	0	0	0	0	27.3	18.1	12.9	
	FR	1.6	14.4	0	7.3	4.1	1.3	1.7	0	10.8	9.1	3.6	11.5	
	Total	12.1	39.3	0	9.3	18.9	7.2	3.9	0	36.5	495.2	382.6	466.9	
26. Lower Murray River	US	2	5.1	0	1	3	0.8	0.3	0	2	3	55.2	82.2	
	SR	15	50	0	10	10	30	0	0	20	15.9	40.8	5.8	
	FR	0	24.4	4	12.2	8.1	0.1	0	4.8	40.3	32.3	10.6	0	
	Total	17	79.5	4	23	21	31	0.3	4.8	62	51	106.6	88.0	
TOTALS	US	433	826	486	258	50	19	14	2 232	1 912	2 465	1 660	4 344	
	SR	301	323	58	147	67	51	0	883	1 122	758	411	1480	
	FR	153	853	383	412	49	6	2	458	687	170	27	16	
	Total	950 (c)	2 002	927	817	166	76	16	3572	3 721	3 393	2 098	5 840	

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(c) This figure includes abstractions given jointly for US and SR in the table.

Drainage Division V - South Australian Gulf

This Division comprises an arc of river basins around the perimeter of Spencer Gulf and Gulf St. Vincent. Most of South Australia's population and economic activity is found here. Adelaide, the capital of the State (River Basin 4), is a major centre for secondary and tertiary industry. Heavy industries are also located on the shores of Spencer Gulf at Port Pirie and Whyalla. Port Augusta at the head of the Gulf is an important rail centre. Port Lincoln to the south of the Eyre Peninsula is a significant fishing and wheat handling port. Wine growing areas in the Division include the Clare and Barossa Valleys and McLaren Vale.

The major topographic features of the Division are along its eastern side, comprising, in the south, the Mount Lofty Ranges which form a common boundary with the Murray-Darling Drainage Division, and the more rugged Flinders Ranges further north, bordering the Lake Eyre Drainage Division. Elsewhere the country is generally of moderate or low relief. The arid Lake Torrens region (River Basin 10) drains internally.

Climate ranges from mediterranean in character in the south-east to semi arid inland and to the north. Median annual rainfall on the slopes of the Mount Lofty Ranges (River Basins 1 to 6) is about 760 mm. Rainfall is mainly orographic and falls in winter. Streams here are short, flowing through narrow gorges to the Adelaide Plains and Gulf St. Vincent. Streamflow is variable and flow often ceases in summer, although average annual runoff in this region is much greater than elsewhere in the Division.

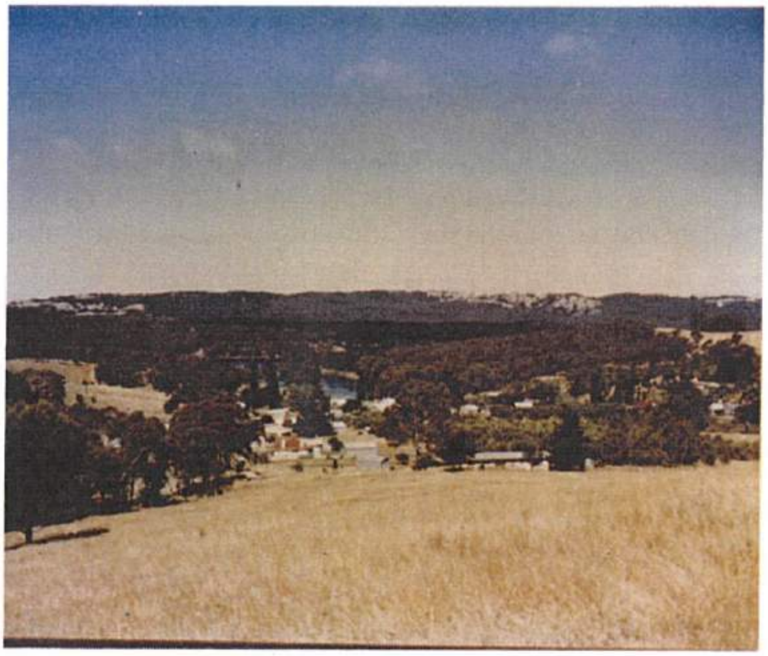


Plate 9: Millbrook Reservoir in summer. Mt. Lofty Ranges in background – River Basin 4.

Further north, median annual rainfall declines to 360 mm in the Flinders Ranges (River Basin 9) and to less than 150 mm in the north, near Lake Torrens. The north-west part of the Division borders the driest areas of Australia and rainfall is scanty and unreliable.

Due to the limitations of catchment size and rainfall, Adelaide has less locally available surface

water resources for its population than any other capital city in Australia. As a consequence, it draws a variable but increasing proportion of its water supply across the Mount Lofty Ranges from the River Murray outside the Division. Whyalla, Port Pirie and Port Augusta are also dependent on piped water from the Murray. This source however has definite limitations in terms of both water quantity and quality.

Plate 10: Pipeline from Murray Bridge to Adelaide at Monarto (Division IV): catchment boundary with Division V in background.

Groundwater resources are widely utilised and total abstractions during 1974 amounted to 49 million cubic metres. This is equivalent to 44 per cent of present annual surface water diversions. Groundwater from shallow unconsolidated sediments of alluvial and aeolian origin is important, but the most extensive development is associated with the Adelaide Plains Sedimentary Basin where groundwater is used for irrigation. Annual withdrawals from the Gawler region (River Basin 5) of this Basin are presently about 50 per cent greater than recharge, reaching 15 million cubic metres in 1974.

Aquifers receiving direct recharge from rainfall, e.g., aeolianite of the Southern Eyre Peninsula, generally provide good quality water. In areas where recharge does not occur so readily, water quality may be variable.

Table V(a)

River basin areas, gauging stations, average annual discharges and salinities

V SOUTH AUSTRALIAN GULF DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 x 10^6$)				Estimated	Average	
River basins	*Total (km^2)*	*Percent Gauged*	*Automatic*	*Total*	*Gauged Area*	*Ungauged Area*	*Fresh and Marginal Water*	*Brackish and Saline Water*	*Total Yield ($m^3 x 10^6$)*	*Annual Runoff (mm)*	*Salinity of Major River*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Fleurieu Peninsula	1 046	5	1	1	11	90	101	0	101	97	marginal
2. Myponga River	153	81	1	2	20	4	24	0	24	154	fresh
3. Onkaparinga River	961	55	11	11	92	65	157	0	157	162	fresh
4. Torrens River	1 184	38	8	8	58	51	109	0	109	92	fresh
5. Gawler River	4 455	45	7	7	74	31	105	0	105	24	fresh
6. Wakefield River	2 056	20	1	1	8	19	20	7	27	13	marginal
7. Broughton River	16 630	15	3	4	45	39	75	9	84	5.1	marginal
8. Mambray Coast (a)	3 968	3	0	1	4	46	40	10	50	12.5	marginal
9. Willochra Creek (a)	6 475	96	4	4	16	0	8	8	16	2.6	saline
10. Lake Torrens (a)	26 400	9	2	3	4	53	40	17	57	2.8	fresh
11. Spencer Gulf (a)	11 512	0	0	0	0	20	10	10	20	1.9	...
12. Eyre Peninsula (a)	3 108	11	1	1	6	8	8	6	14	4.2	brackish
13. Kangaroo Island	4 352	7	3	3	19	197	216	0	216	50	marginal
TOTALS	82 300	19	42	46	357	623	913	67	980	11.9	

(a) Discharge from gauged areas estimated due to insufficient station information.

Table V(b)

Range of discharges for selected rivers

V SOUTH AUSTRALIAN GULF DRAINAGE DIVISION River basins	*Adopted Drainage Area (km²)*	*Selected River*	*Selected Gauging Station*				*Maximum Discharge as a Percentage of Average (a)*			*Minimum Discharge as a Percentage of Average (a)*		
			Station Name	*Area above Gauge (km²)*	*Record Length (years)*	*Average Annual Discharge (m³/sec)*	*Instantaneous*	*Monthly*	*Annual*	*Instantaneous*	*Monthly*	*Annual*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Fleurieu Peninsula	1 046	Hindmarsh	Hindmarsh Weir	56	5	0.35	12 300	689	163	0	2	60
2. Myponga River	153	Myponga	Myponga Weir	115	29	0.58	14 800	945	268	0	0	22
3. Onkaparinga River	961	Onkaparinga	Clarendon Weir	445	76	2.64	25 700	1 290	325	0	0	7
4. Torrens River	1 184	Torrens	Gorge Weir	347	86	1.57	24 000	1 620	396	0	0	4
5. Gawler River	4 455	North Para	Yaldara	383	36	0.58	19 000	1 570	325	0	0	2
6. Wakefield River	2 056	Wakefield	Wakefield Weir	420	14	0.25	96 600	1 700	383	0	2	9
7. Broughton River	16 630	Hutt	Hutt Weir	280	4	0.26	26 100	1 640	240	0	0	19
8. Mambray Coast (b)	3 968	...	...	...	...	...	...	...	...	...	...	...
9. Willochra Creek (b)	6 475	...	...	...	...	...	...	...	...	...	...	...
10. Lake Torrens (b)	26 400	...	...	...	...	...	...	...	...	...	...	...
11. Spencer Gulf (b)	11 512	...	...	...	...	...	...	...	...	...	...	...
12. Eyre Peninsula (b)	3 108	...	...	...	...	...	...	...	...	...	...	...
13. Kangaroo Island	4 352	Middle	Middle River Dam	93	4	0.32	6 000	1 440	153	0	0	46

(a) In total period of gauging station record.
(b) Gauges exist but insufficient data available.

Table V(c)

Salinities of selected rivers

V SOUTH AUSTRALIAN GULF DRAINAGE DIVISION			Selected Gauging Station					Salinity (mg/l T.D.S.)			
River basins	Adopted Drainage Area (km^2)	Selected River	Station Name	Area above Gauge (km^2)	Average Annual Discharge ($m^3 x 10^6$)	Period of Sampling (years)	Number of Samples	Weighted Average of Samples	10 Percentile of Samples	50 Percentile of Samples	90 Percentile of Samples
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Fleurieu Peninsula	1 046	Hindmarsh	Hindmarsh Weir	56	11.1	3	54	520	375	645	980
2. Myponga River	153	Myponga	Myponga River	115	18.4	7	135	285	200	300	430
3. Onkaparinga River	961	Onkaparinga	Clarendon Weir	445	83.1	3	35	315	260	345	465
4. Torrens River	1 184	Torrens	Gorge Weir	347	49.5	26	58	350	290	365	450
5. Gawler River	4 455	North Para	Yaldara	383	18.3	5	144	830	515	1 980	3 280
6. Wakefield River	2 056	Wakefield	Wakefield Weir	420	7.8	3	51	990	780	2 520	3 170
7. Broughton River	16 630	Hutt	Hutt Weir	280	8.3	5	54	750	250	830	2 600
8. Mambray Coast (a)	3 968	...	...	...	...	...	...	...	...	...	...
9. Willochra Creek (a)	6 475	...	...	...	...	...	...	...	...	...	...
10. Lake Torrens (a)	26 400	...	...	...	...	...	...	...	...	...	...
11. Spencer Gulf (a)	11 512	...	...	...	...	...	...	...	...	...	...
12. Eyre Peninsula (a)	3 108	...	...	...	...	...	...	...	...	...	...
13. Kangaroo Island	4 352	Middle	Middle River Dam	93	10.0	10	15	800	650	1 150	2 110

(a) Gauges exist but insufficient data available.

Table V(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

V SOUTH AUSTRALIAN GULF DRAINAGE DIVISION	Adopted Drainage Area	Present Annual Commitments				Authorised and Planned Annual Commitments				Total Commit-ments	Possible Exploitable Yield	Estimated Total Yield of Drainage Area
River basins	(km^2)	Designed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total	Proposed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Fleurieu Peninsula	1 046	0.6	0.1	0	0.7	2.0	0.3	0	2.3	3.0	30	101
2. Myponga River	153	12.2	3.0	0.1	15.3	0	0	0	0	15.3	16	24
3. Onkaparinga River	961	43.6	5.4	0	49.0	18.1	2.2	0	20.3	69.3	70	157
4. Torrens River	1 184	27.7	3.4	0.2	31.3	13.5	1.7	0.1	15.3	46.6	58	109
5. Gawler River	4 455	19.2	5.6	0.5	25.3	0	0	0	0	25.3	50	105
6. Wakefield River	2 056	0	0	0	0	0	0	0	0	0	3	20
7. Broughton River	16 630	3.6	1.1	0.1	4.8	0	0	0	0	4.8	17	75
8. Mambray Coast	3 968	1.8	0.6	0.3	2.7	0	0	0	0	2.7	5	40
9. Willochra Creek	6 475	0	0	0	0	0	0	0	0	0	4	8
10. Lake Torrens	26 400	0.6	0.3	0.1	1.0	0	0	0	0	1.0	4	40
11. Spencer Gulf	11 512	0	0	0	0	0	0	0	0	0	1	10
12. Eyre Peninsula	3 108	2.6	1.2	0.3	4.1	0	0	0	0	4.1	5	8
13. Kangaroo Island	4 352	0.3	0.1	0	0.4	0	0	0	0	0.4	20	216
TOTALS	82 300	112	20.8	1.6	135	33.6	4.2	0.1	37.9	173	283	913

Table V(e)

Aquifer characteristics

V SOUTH AUSTRALIAN GULF DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type[(a)] (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Fleurieu Peninsula	1 046	US	200	5–30	5–40	300	100–1 000	500–5 000
		SR	...	...	...	...	...	...
		FR	800	10–80	20–70	500	20–100	500–2 000
2. Myponga River	153	US	25	2–20	5–25	340	100–1 000	500–5 000
		SR	25	2–150	5–20	96	100–1 000	500–5 000
		FR	100	2–30	20–80	386	20–100	500–5 000
3. Onkaparinga River	961	US	50	2–20	5–25	250	100–1 000	500–5 000
		SR	300	5–150	5–20	1 317	100–1 000	500–5 000
		FR	350	2–30	20–80	5 263	20–100	500–5 000
4. Torrens River	1 184	US	80	5–20	10–80	458	1 000–2 500	700–10 000
		SR	600	10–120	10–120	2 100	100–2 500	700–25 000
		FR	500	10–120	20–80	989	100–2 000	700–10 000
5. Gawler River	4 455	US	500	5–50	10–80	287	100–2 500	700–10 000
		SR	2 000	10–120	10–120	4 300	100–2 000	800–20 000
		FR	1 500	10–120	20–80	2 800	20–200	700–5 000
6. Wakefield River	2 056	US	100	5–20	10–100	291	100–2 500	1 000–5 000
		SR	200	20–50	10–100	220	100–5 000	1 000–35 000
		FR	1 000	20–80	10–200	511	20–200	1 000–5 000
7. Broughton River	16 630	US	2 000	2–10	10–30	925	100–5 000	1 000–14 000
		SR	4 000	10–30	5–40	3 200	20–2 000	2 000–20 000
		FR	9 000	2–50	10–60	1 360	20–200	1 000–15 000
8. Mambray Coast	3 968	US	1 000	5–10	5–20	160	100–5 000	1 000–20 000
		SR	3 500	5–80	10–150	350	50–1 000	1 000–20 000
		FR	500	5–50	10–60	89	20–200	5 000–20 000
9. Willochra Creek	6 475	US	500	10–30	5–20	88	50–200	1 000–4 000
		SR	1 000	10–100	10–70	950	100–1 600	1 000–10 000
		FR	3 000	10–100	10–70	346	50–200	3 000–7 000
10. Lake Torrens	26 400	US	500	5–50	5–20	145	5–20	1 000–20 000
		SR	15 000	10–80	10–150	520	10–1 000	1 000–25 000
		FR	2 000	20–100	10–80	415	1–10	7 000–14 000

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table V(e) contd.

Aquifer characteristics

V SOUTH AUSTRALIAN GULF DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Aquifer Type[a] (3)	Area of Aquifer (km^2) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m^3/day) (8)	Range of Common T.D.S. (mg/l) (9)
11. Spencer Gulf	11 512	US	1 000	10–50	10–30	268	10–100	5 000–20 000
		SR	500	5–30	10–30	215	10–100	10 000–20 000
		FR	6 000	10–80	10–100	161	2–10	7 000–25 000
12. Eyre Peninsula	3 108	US	800	5–25	15–45	1 100	500–4 000	500–2 000
		SR	1 000	5–25	15–50	423	500–2 000	500–2 000
		FR	500	5–20	10–80	169	10–100	7 000–15 000
13. Kangaroo Island	4 352	US	500	5–20	10–40	550	10–50	1 000–7 000
		SR	100	5–30	5–20	18	. . .	3 000–7 000
		FR	2 000	5–20	20–70	189	5–30	7 000–14 000
TOTALS	82 300	US	7 300	5–20	5–10	5 160	40–1 000	500–20 000
		SR	28 200	30–150	10–120	13 710	500–2 500	700–30 000
		FR	27 300	50–200	20–120	13 180	50–1 800	1 000–15 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table V(f)

Groundwater yields

V SOUTH AUSTRALIAN GULF DRAINAGE DIVISION	Aquifer Type[(a)]	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge					Total					Reliability of Estimate[(b)]
River basins				<1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	>14 000 mg/l	<1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	>14 000 mg/l	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Fleurieu Peninsula	US	0.6	0.7	0.3	0.4	0	0	0	0.4	0.5	0	0	0	
	SR	0.1	0.5	0.1	0.4	0	0	0	0.2	0.8	0.3	0	0	
	FR	2.0	2.2	0	1.0	0	1.2	0	0.2	1.5	0	1.2	0	
	Total	2.7	3.4	0.4	1.8	0	1.2	0	0.8	2.8	0.3	1.2	0	(ii)
2. Myponga River	US	0.6	0.7	0.2	0.5	0	0	0	0.3	0.6	0	0	0	
	SR	0.1	0.5	0.1	0.3	0.1	0	0	0.2	0.6	0.4	0	0	
	FR	2.0	2.1	0.1	1.5	0.5	0	0	0.3	2.0	0.8	0	0	
	Total	2.7	3.3	0.4	2.3	0.6	0	0	0.8	3.2	1.2	0	0	(i)
3. Onkaparinga River	US	0.4	0.5	0.3	0.2	0	0	0	0.4	0.3	0.2	0.1	0	
	SR	0.1	2.0	0.7	1.2	0.1	0	0	0.8	1.6	0.4	0	0	
	FR	5.0	4.5	0.5	1.8	0.2	2.0	0	1.2	2.2	0.4	2.0	0	
	Total	5.5	7.0	1.5	3.2	0.3	2.0	0	2.4	4.1	1.0	2.1	0	(i)
4. Torrens River	US	1.0	1.3	1.0	0.2	0.1	0	0	1.3	0.2	0.3	0.1	0	
	SR	2.0	10	6.0	3.0	1.0	0	0	6.2	4.0	2.0	0.1	0	
	FR	7.0	7.2	4.0	3.0	0.2	0	0	8.0	3.1	0.4	0	0	
	Total	10	18.5	11	6.2	1.3	0	0	16	7.3	2.7	0.2	0	(i)
5. Gawler River	US	1.0	0.9	0.7	0.1	0.1	0	0	0.9	0.2	0.3	0.2	0.3	
	SR	15	10	6.0	3.0	1.0	0	0	7.0	5.0	2.0	0.1	0	
	FR	3.0	3.3	1.0	2.0	0.3	0	0	2.0	2.1	0.6	0	0	
	Total	19	14.2	7.7	5.1	1.4	0	0	9.9	7.3	2.9	0.3	0.3	(i)
6. Wakefield River	US	0.3	0.4	0.1	0.1	0.1	0.1	0	0.2	0.2	0.3	0.3	0.2	
	SR	0.1	1.0	0.1	0.2	0.4	0.2	0.1	0.2	0.5	2.0	0.3	0.2	
	FR	0.1	0.2	0	0.1	0.1	0	0	0.5	0.1	0.3	0	0	
	Total	0.5	1.6	0.2	0.4	0.6	0.3	0.1	0.9	0.8	2.6	0.6	0.4	(ii)
7. Broughton River	US	0.3	0.4	0.2	0.1	0.1	0	0	0.4	0.2	0.5	0.4	0.1	
	SR	0.5	2.0	0.1	0.6	0.6	0.5	0.2	0.2	1.5	2.0	0.6	0.3	
	FR	0.5	0.6	0	0.1	0.1	0.1	0.3	0.5	0.2	0.3	0.1	0.3	
	Total	1.3	3.0	0.3	0.8	0.8	0.6	0.5	1.1	1.9	2.8	1.1	0.7	(ii)
8. Mambray Coast	US	0.2	0.3	0	0.1	0.1	0.1	0	0	0.2	0.4	0.3	0.3	
	SR	2.0	2.0	0	0.4	0.7	0.5	0.4	0	0.6	2.0	0.6	0.5	
	FR	0.1	0.2	0	0	0.1	0	0.1	0.1	0.1	0.3	0	0.1	
	Total	2.3	2.5	0	0.5	0.9	0.6	0.5	0.1	0.9	2.7	0.9	0.9	(iii)
9. Willochra Creek	US	0.5	0.3	0.1	0.1	0.1	0	0	0.1	0.2	0.4	0.1	0.1	
	SR	1.0	2.0	0	0.5	0.5	0.7	0.3	0	0.7	1.0	0.9	0.4	
	FR	0.1	0.2	0	0	0.2	0	0	0	0.1	0.6	0	0	
	Total	1.6	2.5	0.1	0.6	0.8	0.7	0.3	0.1	1.0	2.0	1.0	0.5	(iii)
10. Lake Torrens	US	0.3	0.3	0	0.1	0.1	0.1	0	0	0.2	0.7	0.8	0.5	
	SR	0.1	2.0	0	0.3	0.8	0.6	0.3	0	0.5	2.0	0.8	0.4	
	FR	0.2	0.3	0	0.1	0.1	0.1	0	0	0.2	0.4	0.1	0	
	Total	0.6	2.6	0	0.5	1.0	0.8	0.3	0	0.9	3.1	1.7	0.9	(iii)

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Groundwater yields

V SOUTH AUSTRALIAN GULF DRAINAGE DIVISION River basins	Aquifer Type (a)	Abstraction During 1974 ($m^3 x 10^6$)	Estimated Annual Recharge ($m^3 x 10^6$)	Estimated Possible Annual Yield ($m^3 x 10^6$) From Recharge < 1 000 mg/l	From Recharge 1 000–3 000 mg/l	From Recharge 3 000–7 000 mg/l	From Recharge 7 000–14 000 mg/l	From Recharge > 14 000 mg/l	Total < 1 000 mg/l	Total 1 000–3 000 mg/l	Total 3 000–7 000 mg/l	Total 7 000–14 000 mg/l	Total > 14 000 mg/l	Reliability of Estimate (b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
11. Spencer Gulf	US	0.2	0.4	0	0	0	0.1	0.3	0	0	0.2	0.1	0.4	
	SR	0	0.1	0	0	0	0	0.1	0	0.1	0	0	0.2	
	FR	0.2	0.3	0	0	0	0.1	0.2	0	0	0.1	0.1	0.2	
	Total	0.4	0.8	0	0	0	0.2	0.6	0	0.1	0.3	0.2	0.8	(iii)
12. Eyre Peninsula	US	0.2	0.6	0.4	0.1	0.1	0	0	1.0	0.2	0.4	0.4	0.1	
	SR	0.5	0.8	0.3	0.3	0.2	0	0	0.4	0.7	0.5	0.1	0	
	FR	0.2	0.3	0	0	0	0.1	0.2	0	0	0.3	0.1	0.2	
	Total	0.9	1.7	0.7	0.4	0.3	0.1	0.2	1.4	0.9	1.2	0.6	0.3	(ii)
13. Kangaroo Island	US	0.5	0.6	0.1	0.1	0.3	0.1	0	0.1	0.4	0.6	0.1	0	
	SR	0	0	0	0	0	0	0	0	0.1	0	0	0	
	FR	0.6	0.8	0	0	0	0.8	0	0	0	0.5	0.8	0	
	Total	1.1	1.4	0.1	0.1	0.3	0.9	0	0.1	0.5	1.1	0.9	0	(ii)
TOTALS	US	6.1	7.4	3.4	2.1	1.1	0.5	0.3	5.1	3.4	4.3	2.9	2.0	(ii)
	SR	22	33	13.4	10.2	5.4	2.5	1.4	15.2	16.7	14.6	3.5	2.0	(i)
	FR	21	22	5.6	9.6	1.8	4.4	0.8	12.8	11.6	5.0	4.4	0.8	(iii)
	Total	49	62	22.4	21.9	8.3	7.4	2.5	33.1	31.7	23.9	10.8	4.8	

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Drainage Division VI - South-West Coast

This Division comprises an arc of river basins along the south-west coast of Western Australia. The climate is temperate, similar to south-eastern Australia, with warm dry summers and cool wet winters, and the Division contains most of the State's arable lands and forest reserves. It is the most populous and developed region of Western Australia.

Most of the Division lies on the south-western corner of the Australian Shield, an extensive plateau covering 90 per cent of the State. The inland boundary of the Division, which is not well-defined, separates the region of co-ordinated seaward drainage from the unco-ordinated inland drainage of the Western Plateau (Drainage Division XII).

Plate 11: Murray River Valley near Dwellingup – River Basin 4.

From the inland divide the Division slopes gradually to the sea. In the south the slope is unbroken: in the west the Shield ends abruptly in the Darling Escarpment which is the major topographic feature of the region. At the foot of the escarpment is a 25-30 km wide sandy plain, gently undulating with alternating ridges and wet lands. Narrow sandy plains occur along the south coast.

The highest and most reliable median annual rainfall in the Division occurs just inland of the Darling Scarp (1400 mm) and reduces to 250 mm further inland. Typically, major streams have their headwaters inland on the Shield. Upper reaches are frequently dry or little more than chains of brackish or saline lakes, only connecting to form a stream, if at all, in winter. Towards the coast, runoff increases and at the escarpment there are many suitable dam sites. The main surface water diversions of the Division are from this area. The table below shows the main storages and their uses.

Most rainfall occurs during winter and decreases in quantity and reliability inland from the coast. As a result, the majority of rivers are seasonal, although a few smaller streams are perennial. Most runoff occurs during winter and flood peaks are small.

In drier parts – inland areas and river basins at the extremities of the Division (River Basins 1, 2, 15, 18 and 19) – rivers are commonly saline. In fact, throughout the Division only rivers with forested catchments in high rainfall areas yield fresh water (River Basins 4, 6, 8, 10, 11 and 13.) The

problem of salinity in these areas has been compounded by poor land use practices. This is discussed further in Section 3.5.

Principal Storages in the South-West Coast Drainage Division

Name	*River*	*Gross Capacity* ($m^3 \times 10^6$)	*River Basin*	*Purpose*
South Dandalup	South Dandalup River	280	14	Perth water supply
Wellington	Collie River	185	12	Irrigation and public water supply
Serpentine	Serpentine River	178	14	Perth water supply
Canning	Canning River	93	16	Perth water supply
Mundaring	Helena River	76	16	Public water supply to inland towns and farms
Stirling	Harvey River	57	13	Irrigation

Source: State water authority.

Plate 12: Wheat country near Pingelly – River Basin 14.

Groundwater is widely used in the Division and abstractions during 1974 of 160 million cubic metres are equivalent to nearly half the level of present surface water diversions. The Perth Sedimentary Basin is an important source of good quality groundwater and supplies artesian water for domestic use in the Perth area and some country centres such as Morawa and Bunbury. Aquifer conditions elsewhere are largely sub-artesian. Shallow unconsolidated sands in the Perth Coastal Basin (River Basin 16), are important sources of water and are being developed to augment supplies to Perth. Annual abstractions are currently about 50 million cubic metres, accounting for 75 per cent of groundwater withdrawals from unconsolidated sediments. The water is generally of good quality but in places, shallow saline groundwater with a high iron content is found. East of the Darling Scarp, moderate to small groundwater supplies of variable but mostly poor quality can be obtained from the fractured rocks of the Archaen Shield (River Basins 15, 16, 17, 18 and 19). These are an important source of supply for stock.

Table VI(a)

River basin areas, gauging stations, average annual discharges and salinities

VI SOUTH-WEST COAST DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 \times 10^6$)				Estimated Total Yield ($m^3 \times 10^6$)	Average Annual Runoff (mm)	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Esperance Coast	19 200	21	7	7	25	165	5	185	190	10	saline
2. Albany Coast	18 630	23	10	10	75	345	30	390	420	23	brackish
3. Denmark River	2 950	26	9	9	55	145	140	60	200	68	brackish
4. Kent River	2 290	72	1	1	120	90	185	25	210	92	fresh
5. Frankland River	5 940	98	1	1	205	25	120	110	230	39	brackish
6. Shannon River	3 570	62	4	4	430	270	700	0	700	196	fresh
7. Warren River	4 170	96	12	12	400	40	330	110	440	106	marginal
8. Donnelly River	1 750	66	4	4	270	140	410	0	410	234	fresh
9. Blackwood River	22 600	94	8	8	760	270	650	380	1 030	46	marginal
10. Busselton Coast	2 980	40	6	6	220	240	460	0	460	154	fresh
11. Preston River	1 210	89	9	9	180	10	190	0	190	157	fresh
12. Collie River	3 630	87	20	20	310	90	380	20	400	110	marginal
13. Harvey River	1 930	34	14	14	190	160	350	0	350	181	fresh
14. Murray River	10 150	81	22	22	530	190	500	220	720	71	marginal (a)
15. Avon River	116 000	100	12	12	300	0	0	300	300	2.6	saline
16. Swan Coast	8 150	74	28	31	460	130	410	180	590	72	brackish
17. Moore-Hill Rivers	24 400	57	5	5	290	160	75	375	450	18	brackish
18. Yarra Yarra	41 860	0.1	3	3	0 (b)	...	...	...	...	...	saline
19. Ninghan	22 680	0	0	0	0 (b)	...	...	...	...	...	saline
TOTALS	314 090	62	175	178	4 820	2 470	4 935	2 355	7 290	23	

(a) Approaching marginal/brackish.
(b) Internal drainage - ephemeral runoff.

Table VI(b)

Range of discharges for selected rivers

VI SOUTH-WEST COAST DRAINAGE DIVISION River basins	Adopted Drainage Area (km²)	Selected River	Selected Gauging Station				Maximum Discharge as a Percentage of Average (a)			Minimum Discharge as a Percentage of Average (a)		
			Station Name	Area above Gauge (km²)	Record Length (years)	Average Annual Discharge (m³/sec)	Instan-taneous	Monthly	Annual	Instan-taneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Esperance Coast	19 200	Young	Neds Corner	1 610	3	...	...	...	...	...	...	...
2. Albany Coast	18 630	Pallinup	Bull Crossing	3 600	2	...	...	...	...	...	...	...
3. Denmark River	2 950	Denmark	Mount Lindsay	603	10	1.05	2 990	844	176	0	0	31
4. Kent River	2 290	Kent	Styx Junction	1 110	14	2.70	3 660	986	196	0.10	0.14	22
5. Frankland River	5 940	Frankland	Nornalup	5 810	30	5.03	4 730	1 690	288	0.80	1.20	25
6. Shannon River	3 570	Shannon	Dog Pool	377	6	3.36	4 080	907	159	0.07	0.42	25
7. Warren River	4 170	Warren	Barker Road Crossing	3 870	5	11.1	1 550	825	169	0.01	0.02	35
8. Donnelly River	1 750	Donnelly	Stricklands Farm	805	9	5.19	2 190	590	154	0.46	1.02	30
9. Blackwood River	22 600	Blackwood	Darradup	20 500	5	19.7	1 560	980	188	0.75	1.18	30
10. Busselton Coast	2 980	Margaret	Margaret River	389	10	3,13	3 460	895	198	0	0	34
11. Preston River	1 210	Preston	Beelerup	603	16	2.95	5 160	1 040	235	0	0.21	39
12. Collie River	3 630	Collie	South Branch	668	17	0.93	6 850	1 500	273	0	0	23
13. Harvey River	1 930	Harvey	Dingo Road	148	4	1.18	1 200	320	115	8.0	12	75
14. Murray River	10 150	Murray	Hughes Bridge	6 840	31	10.4	6 900	1 790	338	1.09	3.34	29
15. Avon River	116 000	Avon	Station Number 616011 (b)	119 000	5	12.7	3 520	1 650	310	0	0	32
16. Swan Coast	8 150	Wooroloo	O'Briens Road	536	8	2.07	5 210	968	173	0	0	49
17. Moore-Hill Rivers	24 400	Moore	Quinns Ford	12 380	5	...	...	...	...	...	...	...
18. Yarra Yarra	41 860	...	...	...	...	...	...	...	...	...	...	...
19. Ninghan	22 680	...	...	...	...	...	...	...	...	...	...	...

(a) In total period of gauging station record.
(b) In basin 16 - so includes additional inflow.

Table VI(c)

Salinities of selected rivers

VI SOUTH-WEST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Selected River (3)	Selected Gauging Station: Station Name (4)	Selected Gauging Station: Area above Gauge (km²) (5)	Selected Gauging Station: Average Annual Discharge ($m^3 x 10^6$) (6)	Period of Sampling (years) (7)	Number of Samples (8)	Salinity (mg/l T.D.S.): Weighted Average of Samples (9)	Salinity (mg/l T.D.S.): 10 Percentile of Samples (10)	Salinity (mg/l T.D.S.): 50 Percentile of Samples (11)	Salinity (mg/l T.D.S.): 90 Percentile of Samples (12)
1. Esperance Coast	19 200	Young	Neds Corner	1 610	...	3	8	...	1 320	3 720	12 000
2. Albany Coast	18 630	Pallinup	Bull Crossing	3 600	...	2	11	...	9 600	18 800	30 000
3. Denmark River	2 950	Denmark	Mount Lindsay	603	33.2	10	117	295	225	490	800
4. Kent River	2 290	Kent	Styx Junction	1 110	85.3	14	225	385	270	500	930
5. Frankland River	5 940	Frankland	Nornalup	5 810	159	30	793	1 150	285	570	1 445
6. Shannon River	3 570	Shannon	Dog Pool	377	106	6	69	125	85	170	230
7. Warren River	4 170	Warren	Barker Road Crossing	3 870	350	5	64	518	260	540	1 080
8. Donnelly River	1 750	Donnelly	Stricklands Farm	805	164	9	74	155	130	180	220
9. Blackwood River	22 600	Blackwood	Darradup	20 500	621	5	506	720	530	1 115	1 730
10. Busselton Coast	2 980	Margaret	Margaret River	389	98.8	10	89	140	120	200	470
11. Preston River	1 210	Preston	Boyanup	750	84.3	20	519	200	170	345	430
12. Collie River	3 630	Collie	South Branch	668	29.4	16	743	410	345	515	785
13. Harvey River	1 930	Harvey	Dingo Road	148	37.3	4	60	...	71	100	120
14. Murray River	10 150	Murray	Hughes Bridge	6 840	327	31	1 167	895	430	1 030	2 115
15. Avon River	116 000	Avon	Northam Weir	98 000	200 (a)	12	106	...	2 010	5 190	9 038
16. Swan Coast	8 150	Wooroloo	O'Briens Road	536	65.1	8	152	730	500	1 200	3 220
17. Moore-Hill Rivers	24 400	Moore	Quinns Ford	12 380	...	5	51	4 810	1 620	7 100	13 100
18. Yarra Yarra	41 860	...	...	...	...	...	...	...	...	...	...
19. Ninghan	22 680	...	...	...	...	...	...	...	...	...	...

(a) Estimate.

Table VI(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

VI SOUTH-WEST COAST DRAINAGE DIVISION	Adopted	Present Annual Commitments				Authorised and Planned Annual Commitments				Total	Possible	Estimated
River basins (1)	Drainage Area (km^2) (2)	Designed Diversions (3)	Storage Evaporation Losses (4)	River Losses and Requirements (5)	Total (6)	Proposed Diversions (7)	Storage Evaporation Losses (8)	River Losses and Requirements (9)	Total (10)	Commitments (11)	Exploitable Yield (12)	Total Yield of Drainage Area (13)
1. Esperance Coast	19 200	0	0	0	0	0	0	0	0	0	1	5
2. Albany Coast	18 630	0.95	0.01	0	0.96	0	0	0	0	0.96	15	30
3. Denmark River	2 950	0.20	0	0	0.20	0	0	0	0	0.20	40	140
4. Kent River	2 290	0	0	0	0	0	0	0	0	0	100	185
5. Frankland River	5 940	0	0	0	0	0	0	0	0	0	10	120
6. Shannon River	3 570	0	0	0	0	0	0	0	0	0	240	700
7. Warren River	4 170	0.65	0	0	0.65	0	0	0	0	0.65	280	330
8. Donnelly River	1 750	0	0	0	0	0	0	0	0	0	200	410
9. Blackwood River	22 600	0.65	0.18	0	0.83	0	0	0	0	0.83	110	650
10. Busselton Coast	2 980	0.02	0.01	0	0.03	0	0	0	0	0.03	90	460
11. Preston River	1 210	0.60	0.03	0	0.63	0	0	0	0	0.63	70	190
12. Collie River	3 630	100	1.60	0.10	102	0	0	0	0	102	170	380
13. Harvey River	1 930	64.0	0	0	64.0	0	0	0	0	64.0	140	350
14. Murray River	10 150	84.7	2.10	1.00	87.8	9.0	0	0	9.0	96.8	200	500
15. Avon River	116 000	0.22	0.19	0	0.41	0	0	0	0	0.41	0	0
16. Swan Coast	8 150	78.7	4.15	3.15	86.0	17.0	0.25	0.25	17.5	104	160	410
17. Moore-Hill Rivers	24 400	0	0	0	0	0	0	0	0	0	15	75
18. Yarra Yarra	41 860	0	0	0	0	0	0	0	0	0	0	0
19. Ninghan	22 680	0	0	0	0	0	0	0	0	0	0	0
TOTALS	314 090	331	8.27	4.25	343	26.0	0.25	0.25	26.5	370	1 841	4 935

Table VI(e)

Aquifer characteristics

VI SOUTH-WEST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type (a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Esperance Coast	19 200	US	1 500	5–20	5–30	1 000	5–500	800–12 000
		SR	3 000	5–20	5–30			
		FR (b)	15 000	...	...	...	...	...
2. Albany Coast	18 630	US	...	...	...			500–15 000
		SR	6 000	5–20	5–30	2 000	5–50	500–10 000
		FR (b)	12 000	5–20	...			...
3. Denmark River	2 950	US	...	...	...			...
		SR	1 200	...	...	10	...	...
		FR (b)	1 700	...	...			300–9 000
4. Kent River	2 290	US	...	10–40	...			...
		SR	0			60	5–50	...
		FR (b)	2 200	10–40	...			200–6 000
5. Frankland River	5 940	US	...	10–30	...			200–15 000
		SR	0			100	5–50	
		FR (b)	5 900	10–30	...			500–15 000
6. Shannon River	3 570	US	...	...	...			600–5 000
		SR	0			30	5–50	
		FR (b)	3 500	...	...			1 000–14 000
7. Warren River	4 170	US	200	...	...			...
		SR	0			30	5–50	
		FR (b)	3 970	...	...			...
8. Donnelly River	1 750	US	200	...	...	...	...	...
		SR	450	...	...	...	...	...
		FR	1 300	...	...	< 10	...	...
9. Blackwood River	22 600	US	500	3–30	15–25	500	5–100	300–500
		SR	2 800	3–30	100–1 000			
		FR	19 800	6–30	...	2 000	5–50	500–10 000
10. Busselton Coast	2 980	US	1 000	3–15	15–25	3 000	10–500	300–600
		SR	1 880	60–150	500–1 000	100	20–4 000	300–1 500
		FR	1 100	...	...	50	5–50	...

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) Large areas of fractured rock contain very limited supplies of often very saline water.

Aquifer characteristics

VI SOUTH-WEST COAST DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type(a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
11. Preston River	1 210	US	300	3–15	15–25	500	10–500	300–600
		SR	300	50–150	500–1 000	60	20–4 000	300–600
		FR	910	. . .	. . .	0	. . .	. . .
12. Collie River	3 630	US	300	3–15	15–25	500	10–500	300–600
		SR	600	100–150	150–1 000	10	20–4 000	300–600
		FR	3 030	. . .	. . .	100	5–50	. . .
13. Harvey River	1 930	US	1 200	3–10	10–25	500	10–100	300–500
		SR	1 200	100–200	100–300	10	800–1 000	1 000–1 500
		FR	730	. . .	. . .	. . .	5–50	300–1 500
14. Murray River	10 150	US	2 050	3–20	10–25	3 000	10–100	300–1 500
		SR	2 050	20–600	500–1 000	500	20–4 000	300–1 000
		FR	8 100	6–25	. . .	200	5–50	. . .
15. Avon River	116 000	US	(b)					
		SR	0					
		FR	116 000	3–30	. . .	15 000	5–50	500–14 000
16. Swan Coast	8 150	US	1 800	3–20	15–50	16 000	10–500	250–1 000
		SR	2 150	20–500	500–1 000	4 000	20–4 000	500–2 000
		FR	6 000	3–30	. . .	1 000	. . .	. . .
17. Moore-Hill Rivers	24 400	US	5 000	3–20	15–25	300	10–100	300–10 000
		SR	15 000	50–300	500–1 000	1 700	20–4 000	500–2 000
		FR	9 400	6–30	. . .	2 000	. . .	300–14 000
18. Yarra Yarra	41 860	US	(b)					
		SR	0					
		FR	41 860	6–25	. . .	3 000	> 10	3 000–14 000
19. Ninghan	22 680	US	(b)					
		SR	0					
		FR	22 680	15–30	. . .	150	. . .	3 000–14 000
TOTALS	314 090	US	14 000	3–30	15–50	23 800	10–500	300–14 000
		SR	36 600	20–600	500–1 000	6 380	20–4 000	300–2 000
		FR	275 000	6–30	5–10	27 250 (c)	5–800	500–14 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) Included in fractured rock totals. Most water is produced from thin sands and weathered bedrock.

(c) This figure includes estimates not allocated to rock type.

Table VI(f)

Groundwater yields

VI SOUTH-WEST COAST DRAINAGE DIVISION River basins	Aquifer Type[(a)]	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge: < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Total: < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Reliability of Estimate[(b)]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Esperance Coast	US	1.5	40	40	...	...	...	...	50	...	...	...	...	
	SR	1.5	15	7	3	3	1	1	12	8	13	5	5	
	FR	...	5	1	1	1	1	1	1	1	1	1	1	
	Total	3.0	60	48	4	4	2	2	63	9	14	6	6	(iii)
2. Albany Coast	US	...	30	30	...	...	...	...	40	...	...	...	...	
	SR	4	48	30	10	5	2	1	60	35	25	10	10	
	FR	3	5	1	1	1	1	1	...	...	...	...	...	
	Total	7	83	61	11	6	3	2	100	35	25	10	10	(iii)
3. Denmark River	US	0			...	...	...	...		...	...	...	...	
	SR	0	50	50	...	...	...	...	55	...	...	...	...	
	FR	0			...	...	...	...		...	...	...	...	
	Total	0	50	50	...	...	...	...	55	...	...	...	...	(iii)
4. Kent River	US (c)	0	150	50	...	...	...	...	160	...	...	...	...	
	FR (c)	0.1			...	...	...	...		...	...	...	...	
	Total	0.1	150	150	...	...	...	...	160	...	...	...	...	(iii)
5. Frankland River	US (c)	0.1	100	100	...	...	...	...	110	...	...	...	...	
	FR (c)	0			...	...	...	...		...	...	...	...	
	Total	0.1	100	100	...	...	...	...	110	...	...	...	...	(iii)
6. Shannon River	US (c)	0.01	400	400	...	...	...	...	440	...	...	...	...	
	FR (c)	0			...	...	...	...		...	...	...	...	
	Total	0.01	400	400	...	...	...	...	440	...	...	...	...	(iii)
7. Warren River	US (c)	0	200	200	...	...	...	...	220	...	...	...	...	
	FR (c)	0			...	...	...	...		...	...	...	...	
	Total	0	200	200	...	...	...	...	220	...	...	...	...	(iii)
8. Donnelly River	US	0	21	20	1	0.01	0	0	30	2	...	...	...	
	SR (c)	0	30	30	0.1	0	0	0	40	1	...	...	...	
	FR (c)	0	100	100	...	...	...	...	110	...	...	...	...	
	Total	0	151	150	1.1	0.01	0	0	180	3	...	...	...	(iii)
9. Blackwood River	US	0.5	56	50	5	0.5	0	0	75	10	1	...	...	
	SR (c)	0.5	206	200	5	0.5	0	0	270	10	1	...	...	
	FR (c)	4	55	30	10	5	5	5	33	11	6	6	6	
	Total	5	317	280	20	6	5	5	378	31	8	6	6	(iii)
10. Busselton Coast	US	6	52	50	2	0.2	...	...	70	10	0.5	...	...	(ii)
	SR (c)	20	101	100	1	0.1	...	...	150	5	2	...	...	(ii)
	FR (c)	0	150	150	...	...	...	...	160	1	0	0	0	(iii)
	Total	26	303	300	3	0.3	...	...	380	16	2.5	...	...	(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(c) Weathered bedrock in forested high rainfall areas of the south-west has a high rate of recharge, but storage is small and bore hole yields are low.

Groundwater yields

VI SOUTH-WEST COAST DRAINAGE DIVISION River basins (1)	Aquifer Type (a) (2)	Abstraction During 1974 ($m^3 \times 10^6$) (3)	Estimated Annual Recharge ($m^3 \times 10^6$) (4)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge: < 1 000 mg/l (5)	From Recharge: 1 000–3 000 mg/l (6)	From Recharge: 3 000–7 000 mg/l (7)	From Recharge: 7 000–14 000 mg/l (8)	From Recharge: > 14 000 mg/l (9)	Total: < 1 000 mg/l (10)	Total: 1 000–3 000 mg/l (11)	Total: 3 000–7 000 mg/l (12)	Total: 7 000–14 000 (13)	Total: > 14 000 mg/l (14)	Reliability of Estimate (b) (15)
11. Preston River	US	1	22	20	2	...	...	...	30	5	...	...	...	(ii)
	SR (c)	10	5.5	4	1	0.5	...	...	10	5	2	...	...	(ii)
	FR (c)	0	100	100	...	...	...	...	110	0	0	0	0	(iii)
	Total	11	128	124	3	0.5	...	...	150	10	2	...	...	
12. Collie River	US	1	22	20	2	...	...	...	30	5	...	...	...	(ii)
	SR (c)	5	15	10	5	...	...	...	25	10	2	...	...	(ii)
	FR (c)	0	100	90	10	...	...	...	100	11	...	...	...	(iii)
	Total	6	137	120	17	...	...	...	155	26	2	...	...	
13. Harvey River	US	3	36	32	3	0.5	...	...	50	10	3	...	...	(ii)
	SR (c)	0.5	6	4	0.5	1	...	...	15	5	5	...	...	(ii)
	FR (c)	0	72	70	2	...	...	...	75	2	0	0	0	(iii)
	Total	3.5	114	106	5.5	1.5	...	...	140	17	8	...	...	
14. Murray River	US	3	50	45	4	1	0.01	...	80	10	5	...	...	(ii)
	SR (c)	10	11	8	2	0.5	0.1	...	30	10	5	...	...	(ii)
	FR (c)	0	210	160	40	10	...	...	170	45	11	...	...	(iii)
	Total	13	271	213	46	12	0.1	...	280	65	21	...	...	
15. Avon River	US (d)	...	...	...	...	...	...	...	...	...	...	...	...	
	FR	10	57	20	15	15	5	2	30	20	20	20	10	
	Total	10	57	20	15	15	5	2	30	20	20	20	10	(iii)
16. Swan Coast	US	50	63	60	2	0.5	...	...	100	4	5	...	...	(ii)
	SR (c)	10	71	65	5	0.5	...	...	120	10	5	...	...	(ii)
	FR (c)	1	150	100	40	10	...	...	110	45	11	...	...	(iii)
	Total	61	284	225	47	11	...	...	330	59	21	...	...	
17. Moore-Hill Rivers	US	1	105	80	20	5	...	...	150	50	20	10	...	(ii)
	SR	7	195	160	30	5	...	...	350	80	25	5	...	(ii)
	FR	3	9.5	4	3	1	1	0.5	6	5	2	2	...	(iii)
	Total	11	310	244	53	11	1	0.5	506	135	47	17	...	
18. Yarra Yarra	US (d)	...	...	...	...	...	...	...	...	...	...	...	...	
	FR	3	15	5	3	5	2	1	10	5	10	4	2	
	Total	3	15	5	3	5	2	1	10	5	10	4	2	(iii)
19. Ninghan	US (d)	...	...	...	...	...	...	...	...	...	...	...	...	
	FR	0.3	5	1	1	1	1	0.5	2	2	2	2	1	
	Total	0.3	5	1	1	1	1	0.5	2	2	2	2	1	(iii)
TOTALS	US	67	497	447	41	8	...	...	705	106	35	10	...	
	SR	69	704	618	63	16	3.1	2.0	1 080	179	85	20	15	
	FR	24	1 030	832	126	49	16	11	917	148	63	35	20	
	Total	160	3 130 (e)	2 800 (f)	230	73	19	13	3 690 (f)	433	183	65	35	(iii)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(c) Weathered bedrock in forested high rainfall areas of the south-west has a high rate of recharge, but storage is small and bore hole yields are low.

(d) Unconsolidated sediments included in fractured rock total. Most water is produced from thin sands and weathered bedrock.

(e) This figure includes estimates of recharge given jointly for aquifer types in the table.

(f) These figures include yield estimates given jointly for aquifer types in the table.

Table VI(f) contd.

Drainage Division VII - Indian Ocean

Most of the Division experiences an arid sub-tropical climate, with more temperate mediterranean conditions occuring in the south. The prevailing winds are associated with dry mid-latitude high pressure systems. Irregular tropical cyclones and monsoons bring rain to the north of the Division during summer, and low pressure systems affect the south during winter. Rainfall is low and variable in occurrence and quantity.

Plate 13: Hamersley Ranges, Wittenoom – River Basin 8.

The Division is quite rugged in parts. North of the Fortescue River, low rugged ranges rise inland from narrow coastal plains. Further south, the deeply dissected Hamersley plateau forms high ranges with entrenched drainage systems – spectacular gorges being a feature of the area. Elevations in this area reach 1250 m above sea-level, the highest in Western Australia. Further south, the relief is low with rivers draining from gently rolling plains on the Australian Shield to broad sandy plains on sedimentary basins at the coast.

Streams are intermittent and irregular. Average annual runoff is very low, the main contributions being from winter rainfall in the south, and summer rainfall in the north. Periods of no flow in many streams may extend to years, although for the major rivers, this is not normal. The summer rains may produce short periods of flooding followed by a fairly steady decline in stream-

Plate 14: View from Mt. Herbert – River Basin 8.

flow. Winter rains however, tend to produce a series of small peaks or spates. Streams are mostly fresh, although some southern streams and others draining the Australian Shield are saline. The Greenough River (River Basin 1) is brackish. Streamflow in the Murchison (River Basin 2) and the Wooramel (River Basin 3) is marginal to brackish.

The Division is the centre of extensive minerals industries based on Pilbara iron ore. Surface water resources are generally too unreliable alone for water supply to the mining townships. Groundwater resources however have been successfully developed and provide reliable water supplies for stock and domestic purposes.

The Carnarvon Sedimentary Basin contains several deep aquifers which yield brackish artesian flows suitable only for stock. The limestones of the North-West Cape contain important unconfined aquifers yielding domestic quality water. These are used for the Exmouth township supply. Other unconfined aquifers associated with rivers draining the Pilbara, supply mining townships and ports such as Cape Lambert and Port Hedland. The Gascoyne river alluvium is the main source of water for irrigation and town supply at Carnarvon, which is the centre of a small sub-tropical plantation industry producing bananas and off-season vegetables for metropolitan markets. Groundwater of variable quality occurs quite extensively in joint and bedding planes of the bedrock, where it is exploited by shallow wells and bores for stock supplies. However, at some localities such as at Marble Bar, these may be sufficiently large to be of use for town supply.

Table VII(a)

River basin areas, gauging stations, average annual discharges and salinities

VII INDIAN OCEAN DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 \times 10^6$)				Estimated Total Yield ($m^3 \times 10^6$)	Average Annual Runoff (mm)	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Greenough River	29 600	64	7	7	230	120	5	345	350	12	brackish
2. Murchison River	88 000	93	1	1	400	30	430	0	430	4.9	marginal (a)
3. Wooramel River	40 500	19	1	1	40	100	140	0	140	3.5	marginal
4. Gascoyne River	77 600	95	3	3	570	10	580	0	580	7.5	fresh
5. Lyndon-Minilya Rivers	48 300	0	0	0	0	200	200	0	200	4.1	fresh
6. Ashburton River	76 700	92	6	6	600	20	620	0	620	8.1	fresh
7. Onslow Coast	16 700	43	2	2	90	50	140	0	140	8.4	fresh
8. Fortescue River	49 570	99	9	9	187	3	190	0	190	3.8	fresh
9. Port Hedland Coast	35 100	46	6	6	320	300	620	0	620	18	fresh
10. De Grey River	56 500	19	3	3	190	700	890	0	890	16	fresh
TOTALS	518 570	65	38	38	2 627	1 533	3 815	345	4 160	8.0	

(a) Approaching marginal/brackish.

Range of discharges for selected rivers

VII INDIAN OCEAN DRAINAGE DIVISION	Adopted Drainage Area	Selected River	Selected Gauging Station				Maximum Discharge as a Percentage of Average[a]			Minimum Discharge as a Percentage of Average[a]		
River basins	(km^2)		Station Name	Area above Gauge (km^2)	Record Length (years)	Average Annual Discharge (m^3/sec)	Instantaneous	Monthly	Annual	Instantaneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Greenough River	29 600	Greenough	Karlanew Peak	12 800	3	...	...	...	...	...	...	...
2. Murchison River	88 000	Murchison	Emu Springs	82 265	6	1.70	10 500	1 290	200	0	0	2.6
3. Wooramel River	40 500	Wooramel	Meedo Pool	7 770	1	...	...	...	...	...	...	...
4. Gascoyne River	77 600	Gascoyne	Fishy Pool	70 200	8	12.8	20 500	1 330	250	0	0	3.6
5. Lyndon-Minilya Rivers	48 300	...	...	...	...	...	...	...	...	...	...	...
6. Ashburton River	76 700	Ashburton	Capricorn Range	41 400	3	7.01	4 130	2 950	260	0	0	7.7
7. Onslow Coast	16 700	Robe	Yarraloola	7 250	2	...	...	...	...	...	...	...
8. Fortescue River	49 570	Fortescue	Jimbegnyinoo Pool	48 850	3	5.28	43 200	2 630	224	0	0	16
9. Port Hedland Coast	35 100	Harding	Cooya-Pooya	1 080	6	2.07	105 000	1 830	186	0	0	28
10. De Grey River	56 500	Shaw	North Pole	6 500	5	3.81	95 900	4 060	376	0	0	0.56

(a) In total period of gauging station record.

Table VII(c)

Salinities of selected rivers

VII INDIAN OCEAN DRAINAGE DIVISION			Selected Gauging Station					Salinity (mg/l T.D.S.)			
River basins	Adopted Drainage Area (km^2)	Selected River	Station Name	Area above Gauge (km^2)	Average Annual Discharge ($m^3 x 10^6$)	Period of Sampling (years)	Number of Samples	Weighted Average of Samples	10 Percentile of Samples	50 Percentile of Samples	90 Percentile of Samples
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Greenough River	29 600	Greenough	Karlanew Peak	12 800	...	3	42	...	3 620	6 668	9 776
2. Murchison River	88 000	Murchison	Emu Springs	82 265	54	6	64	797	139	661	2 990
3. Wooramel River	40 500	Wooramel	Meedo Pool	7 770	...	...	...	...	...	...	...
4. Gascoyne River	77 600	Gascoyne	Fishy Pool	70 200	404	9	75	55	22	112	486
5. Lyndon-Minilya Rivers	48 300	...	...	...	...	...	...	...	...	...	...
6. Ashburton River	76 700	Ashburton	Capricorn Range	41 400	220	6	25	...	10	185	3 660
7. Onslow Coast	16 700	Robe	Yarraloola	7 250	...	2	33	...	177	336	482
8. Fortescue River	49 570	Fortescue	Jimbegnyinoo Pool	48 850	166	5	69	306	116	284	496
9. Port Hedland Coast	35 100	Harding	Cooya-Pooya	1 060	65	4	60	184	108	246	496
10. De Grey River	56 500	Shaw	North Pole	6 500	120	6	20	60	44	93	117

Table VII(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

VII INDIAN OCEAN DRAINAGE DIVISION	Adopted Drainage Area	Present Annual Commitments				Authorised and Planned Annual Commitments				Total Commit-ments	Possible Exploitable Yield	Estimated Total Yield of Drainage Area
River basins	(km^2)	Designed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total	Proposed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Greenough River	29 600	0	0	0	0	0	0	0	0	0	...	5
2. Murchison River	88 000	0	0	0	0	0	0	0	0	0	100 (a)	430 (a)
3. Wooramel River	40 500	0	0	0	0	0	0	0	0	0	...	140
4. Gascoyne River	77 600	0	0	0	0	0	0	0	0	0	10	580
5. Lyndon-Minilya Rivers	48 300	0	0	0	0	0	0	0	0	0	5	200
6. Ashburton River	76 700	0	0	0	0	0	0	0	0	0	120	620
7. Onslow Coast	16 700	0	0	0	0	0	0	0	0	0	25	140
8. Fortescue River	49 570	0	0	0	0	40	35	0	75	75	70	190
9. Port Hedland Coast	35 100	0	0	0	0	0	0	0	0	0	60	620
10. De Grey River	56 500	0	0	0	0	0	0	0	0	0	100	890
TOTALS	518 570	0	0	0	0	40	35	0	75	75	490	3 815

(a) Approaching marginal/brackish.

Table VII(e)

Aquifer characteristics

VII INDIAN OCEAN DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type(a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Greenough River	29 600	US	9 000	3–20	5–20	500	5–500	200–6 000
		SR	13 000	20–150	10–500	4 500	10–4 000	300–10 000
		FR	8 000	20–60	...	200	...	300–3 000
2. Murchison River	88 000	US	32 000	5–20	...	1 000	10–500	1 200–4 000
		SR	6 000	...	...	10	...	...
		FR	50 000	10–20	...	400	...	500–6 000
3. Wooramel River	40 500	US	6 000	...	...	10	10–500	...
		SR	33 000	30–600	6–30	150	20–4 000	3 000–14 800
		FR	1 000	...	...	0	...	...
4. Gascoyne River	77 600	US	15 000	5–10	3–10	1 000	50–500	150–3 000
		SR	17 500	30–600	6–30	200	20–4 000	2 000–10 000
		FR	45 000	10–20	...	200	...	500–10 000
5. Lyndon-Minilya Rivers	48 300	US	22 500	...	...	...	...	...
		SR	41 000	30–600	6–30	600	20–4 000	800–7 000
		FR	7 300	10–30	...	100	...	...
6. Ashburton River	76 700	US	10 000	10–30	...	350	10–500	500–2 000
		SR	2 800	20–30	...	10	...	2 000–10 000
		FR	64 000	10–60	...	150	10–500	...
7. Onslow Coast	16 700	US	5 500	20–40	5–30	300	50–1 000	100–20 000
		SR	7 500	80–400	5–20	10	...	900–30 000
		FR	9 200	10–30	...	10	50–250	~1 000
8. Fortescue River	49 570	US	16 200	5–30	5–20	800	10–5 000	150–6 000
		SR	370	...	...	0	...	...
		FR	33 000	10–30	...	50	...	400–1 000
9. Port Hedland Coast	35 100	US	7 000	10–30	5–60	1 150	10–1 000	400–2 000
		SR	0					
		FR	28 000	10–30	...	50	5–3 000	500–2 000
10. De Grey River	56 500	US	7 000	10–60	5–60	750	10–100	100–9 000
		SR	1 500	80–200	6–100	5	50–100	1 500–2 000
		FR	48 000	10–20	...	50	5–600	500–700
TOTALS		US	130 000	3–60	5–60	5 860	10–1 000	100–20 000
	518 570	SR	123 000	20–600	6–500	5 490	20–4 000	300–30 000
		FR	294 000	10–60	5–20	1 210	5–800	300–10 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR- fractured rocks

Table VII(f)

Groundwater yields

VII INDIAN OCEAN DRAINAGE DIVISION	Aquifer Type (a)	Abstraction During 1974 ($m^3 x 10^6$)	Estimated Annual Recharge ($m^3 x 10^6$)	Estimated Possible Annual Yield ($m^3 x 10^6$)										Reliability of Estimate (b)
				From Recharge					Total					
River basins				< 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	< 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Greenough River	US	1	46	30	10	5	1	0.1	90	70	40	5	1	(iii)
	SR	10	101	75	20	5	1	0.1	230	150	90	10	3	(ii)
	FR	0.5	5.2	1	3	1	0.1	0.1	1	4	2	0.5	0.5	(iii)
	Total	12	152	106	33	11	2.1	0.3	321	224	132	16	4.5	(iii)
2. Murchison River	US	3	114	30	60	20	2	2	35	90	40	5	5	
	SR	0	6	1	1	2	1	1	1	2	4	2	2	
	FR	0.5	31	5	20	5	0.5	0.5	6	25	10	2	2	
	Total	3.5	151	36	81	27	3.5	3.5	42	117	54	9	9	(iii)
3. Wooramel River	US	0	7	1	1	2	2	1	2	2	3	3	2	
	SR	8 (c)	20	0	0	5	10	5	0	0	6	20	10	
	FR	0	1	...	...	...	...	...	0	0	0	0	0	
	Total	8	28	1	1	7	12	6	2	2	9	23	12	(iii)
4. Gascoyne River	US	12	109	40	50	15	2	2	60	80	25	5	5	
	SR	2 (c)	3	0	1	2	...	...	0	2	4	...	...	
	FR	1	21	5	10	5	0.5	0.5	10	15	8	2	2	
	Total	15	133	45	61	22	2.5	2.5	70	97	37	7	7	(iii)
5. Lyndon-Minilya Rivers	US	1	11	2	4	3	1	1	...	...	...	...	...	
	SR	8 (c)	20	1	3	6	5	5	1	3	10	8	8	
	FR	0.2	7	1	3	2	0.5	0.5	1.2	3.5	2.5	0.6	0.6	
	Total	9.2	38	4	10	11	6.5	6.5	2.2(c)	6.5(c)	13(c)	8.6 (c)	8.6(c)	(iii)
6. Ashburton River	US	3	56	30	20	5	0.5	0.5	50	40	15	5	5	
	SR	0.05	1.0	0	0.5	0.5	...	...	0	1	1	...	...	
	FR	2	23	10	10	2	0.5	0.5	15	15	3	1	1	
	Total	5.1	80	40	31	7.5	1.0	1.0	65	56	19	6	6	(iii)

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(c) Unknown contribution from unconsolidated sediments not included.

Table VII(f) contd.

Groundwater yields

VII INDIAN OCEAN DRAINAGE DIVISION River basins	Aquifer Type (a)	Abstraction During 1974 ($m^3 x 10^6$)	Estimated Annual Recharge ($m^3 x 10^6$)	Estimated Possible Annual Yield ($m^3 x 10^6$) From Recharge					Total					Reliability of Estimate (b)
				< 1 000 mg/l	1 000– 3 000 mg/l	3 000– 7 000 mg/l	7 000– 14 000 mg/l	> 14 000 mg/l	< 1 000 mg/l	1 000– 3 000 mg/l	3 000– 7 000 mg/l	7 000– 14 000 mg/l	> 14 000 mg/l	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
7. Onslow Coast	US	2	15	10	2	2	1	0.1	15	3	3	...	...	
	SR	0	2	...	...	...	...	...	...	2	10	...	...	
	FR	0.2	5	2	3	...	...	...	3	4	...	...	...	
	Total	2.2	22	12	5	2	1	0.1	18	9	13	...	...	(iii)
8. Fortescue River	US	15 (c)	77	50	20	5	1	1	70	40	10	5	5	
	SR	0	0	0	0	0	0	0	...	...	...	...	...	
	FR	1	15	6	6	2	0.5	0.5	15	15	5	2	2	
	Total	16	92	56	26	7	1.5	1.5	85	55	15	7	7	(iii)
9. Port Hedland Coast	US	5	40	15	15	10	...	...	25	25	12	...	...	
	FR	0.5	25	10	10	5	...	...	15	15	10	...	...	
	Total	5.5	65	25	25	15	...	...	40	40	22	...	...	(iii)
10. De Grey River	US	2.5	40	15	15	10	...	...	25	25	12	...	...	
	SR	0	1	0	1	...	...	...	0	10	10	...	...	
	FR	0.5	30	15	10	5	...	...	20	15	10	...	...	
	Total	3.0	71	30	26	15	...	...	45	50	32	...	...	(iii)
TOTALS	US	45	515	223	197	77	11	8	372	375	160	28	23	
	SR	28	154	77	27	21	17	11	232	170	135	40	23	
	FR	6.4	163	55	75	27	3	3	86	112	51	8.1	8.1	
	Total	79	832	355	299	125	31	22	690	657	346	76	54	(iii)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(c) Unknown contribution from unconsolidated sediments not included.

Drainage Division VIII - Timor Sea

The climate of the Division is tropical, with hot wet summers and moderate dry winters. Monsoonal rain is fairly regular but variable in quantity from year to year. Also, tropical cyclones often bring intense rain. Median annual rainfall tapers from 1500 mm in the north to 350 mm along the southern boundary of the Division, where dry high pressure systems prevail.

Relief is dominated by the northern margin of the Australian Shield and consists of dissected tablelands and ridges extending from the Kimberleys to Arnhem Land. The Kimberleys are rocky and rugged with steep-sided ranges and gorges. They are flanked to the south-west by the broad alluvial valley of the Fitzroy River and the sand plains of the Canning Basin.

Plate 15: Dimond Gorge, Kimberleys – River Basin 2.

Most streamflow occurs in summer with little or no flow during winter. Although streamflow is irregular, all major rivers do flow every year. Flooding can be severe and by world standards, peak floods are very high.

In general, streams rising in the drier southern regions of the Division, in particular the main Kimberley rivers (including the Fitzroy, Lennard, King Edward, Ord and Keep) are more seasonally variable than the shorter northern streams from Darwin east to Arnhem Land (River Basins 17 to 26). These latter streams are more exposed to moderating coastal conditions and for most of their length lie in regions of higher average annual runoff.

The waters of all the major rivers are fresh and salinities of other streams are generally low. However, seawater may penetrate up to 100 km inland in places due to low stream gradients, low dry season flows and high tidal ranges.

The total annual yield of water in this Division is high and the Ord and Fitzroy rivers have considerable potential for development. The Ord has been dammed to form Lake Argyle with a storage capacity of 5680 million cubic metres. This is the second largest water storage in Australia, but with its flood storage reserve included, its capacity increases six-fold to make it easily the largest. The full irrigation potential of these rivers has yet to be realized. Grain and fodder crops have been produced: sugar cane, kenaf and other crops are being investigated.

A major problem associated with water conservation in the region is the very high evaporation rates. This together with high flow variability, further increases the size of storage required to safely

maintain water supplies during dry periods.

Plate 16: Leopold Ranges, Kimberleys – River Basin 2.

Good quality groundwater suitable for domestic and stock supplies has been obtained from the fractured rocks in the north of the Division and in the Kimberleys. Both the yields and water quality tend to deteriorate towards the south owing to the lower rainfall. Larger supplies are obtainable from the alluvial sediments associated with the main drainages and the Fitzroy trough, but these are seldom used as surface water is generally available. The Victoria River and Daly sedimentary basins produce good quality groundwater from high yielding bores. These are used for stock purposes at present. Bores in the Darwin-Pine Creek Geosyncline are high yielding and provide a standby service for Darwin.

Table VIII(a)

River basin areas, gauging stations, average annual discharges and salinities

VIII TIMOR SEA DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 \times 10^6$)				Estimated Total Yield	Average Annual Runoff	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water	($m^3 \times 10^6$)	(mm)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Cape Leveque Coast	17 500	0	0	0	0	330	330	0	330	19	fresh
2. Fitzroy River	88 980	55	9	9	5 000	1 000	6 000	0	6 000	67	fresh
3. Lennard River	14 160	8	3	3	200	1 300	1 500	0	1 500	106	fresh
4. Isdell River	19 400	30	2	2	1 440	2 360	3 800	0	3 800	196	fresh
5. Prince Regent River	14 630	0	0	0	0	4 200	4 200	0	4 200	287	fresh
6. King Edward River	17 150	23	5	5	960	3 140	4 100	0	4 100	239	fresh
7. Drysdale River	26 120	53	1	1	2 800	2 200	5 000	0	5 000	191	fresh
8. Pentecost River	29 040	17	2	2	900	3 400	4 300	0	4 300	148	fresh
9. Ord River	55 130	87	15	17	4 500	600	5 100	0	5 100	93	fresh
10. Keep River	12 300	29	15	24	130	330	460	0	460	37	fresh
11. Victoria River	77 700	72	34	70	4 020	1 590	5 610	0	5 610	72	fresh
12. Fitzmaurice River	10 600	0 (a)	3	5	0	900	900	0	900	85	fresh
13. Moyle River	7 510	0 (a)	0	5	0	640	640	0	640	85	fresh
14. Daly River	51 800	90	39	61	3 740	440	4 180	0	4 180	81	fresh
15. Finniss River	9 060	30	29	47	780	1 840	2 620	0	2 620	288	fresh
16. Bathurst & Melville Is.	8 280	2 (a)	3	9	0	1 700	1 700	0	1 700	205	fresh
17. Adelaide River	7 640	63	42	69	1 090	640	1 730	0	1 730	226	fresh
18. Mary River	7 770	74	11	14	1 470	530	2 000	0	2 000	257	fresh
19. Wildman River	4 770	4	7	7	30	740	770	0	770	160	fresh
20. South Alligator River	11 600	11	13	19	370	2 900	3 270	0	3 270	282	fresh
21. East Alligator River	14 500	18 (a)	10	20	0	5 100	5 100	0	5 100	350	fresh
22. Goomadeer River	5 700	0 (a)	1	2	0	2 000	2 000	0	2 000	350	fresh
23. Liverpool River	8 280	13	5	6	380	2 470	2 850	0	2 850	344	fresh
24. Blyth River	9 320	0 (a)	2	2	0	2 000	2 000	0	2 000	215	fresh
25. Goyder River	10 600	0 (a)	2	5	0	2 400	2 400	0	2 400	230	fresh
26. Buckingham River	7 510	3	13	18	50	1 650	1 700	0	1 700	226	fresh
TOTALS	547 050	46	266	422	27 860	46 400	74 260	0	74 260	136	

(a) Short period of record only.

Table VIII(b)

Range of discharges for selected rivers

VIII TIMOR SEA DRAINAGE DIVISION River basins	Adopted Drainage Area (km²)	Selected River	Selected Gauging Station				Maximum Discharge as a Percentage of Average (a)			Minimum Discharge as a Percentage of Average (a)		
			Station Name	Area above Gauge (km²)	Record Length (years)	Average Annual Discharge (m³/sec)	Instantaneous	Monthly	Annual	Instantaneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Cape Leveque Coast	17 500	...	...	...	...	...	...	...	...	...	...	...
2. Fitzroy River	88 980	Fitzroy	Fitzroy Crossing	45 720	12	98.3	12 400	2 700	399	0	0	3.18
3. Lennard River	14 160	Fletcher	Dromedary Yard	129	3	0.34	32 900	876	126	0	0	61
4. Isdell River	19 400	Isdell	Dales Yard	1 810	6	...	...	...	...	...	...	...
5. Prince Regent River	14 630	...	...	...	...	...	...	...	...	...	...	...
6. King Edward River	17 150	Camp Creek	Amax Pool	79	4	0.56	15 100	1 250	232	0	0	24
7. Drysdale River	26 120	Drysdale	115 km.	13 900	1	...	...	...	...	...	...	...
8. Pentecost River	29 040	Durack	Nettopus Pool	4 150	6	...	...	...	...	...	...	...
9. Ord River	55 130	Ord	Coolibah Pocket	46 100	15	137	19 900	2 640	259	0	0	4.99
10. Keep River	12 300	Keep	Legune Road Crossing	3 500	8	5.96	11 100	3 360	281	0	0	25.4
11. Victoria River	77 700	Victoria	Coolibah H/S	53 300	20	122	8 550	2 280	262	0	0	27.8
12. Fitzmaurice River	10 600	...	...	...	...	...	...	...	...	...	...	...
13. Moyle River	7 510	...	...	...	...	...	...	...	...	...	...	...
14. Daly River	51 800	Daly	Gourley	46 300	12	199	1 530	1 130	223	6.35	6.45	30.4
15. Finniss River	9 060	Finniss	Gitchams	1 010	12	9.28	9 980	1 860	224	0.09	0.53	29.3
16. Bathurst & Melville Is.	8 280	Takamprimili Creek	Dam Site	166	5 (b)	...	...	...	...	...	...	...
17. Adelaide River	7 640	Adelaide	Marrakai	1 610	15	12.9	2 620	1 320	220	0	0	19.4
18. Mary River	7 770	Mary	Mount Bundey	5 700	14	46.6	4 380	1 530	187	0	0	16.8
19. Wildman River	4 770	Swim Creek	Wildman Road	168	15	0.85	6 720	1 100	187	0	0	25.8
20. South Alligator River	11 600	Sth. Alligator	El Sherana	1 300	14	11.6	8 540	1 880	149	0	0	46.4
21. East Alligator River	14 500	Magella Creek	Bower Bird W/H	314	1	...	...	...	...	...	...	...
22. Goomadeer River	5 700	...	...	...	...	...	...	...	...	...	...	...
23. Liverpool River	8 280	Liverpool	Cuthbertson Falls	1 090	7	11.9	6 710	865	142	0.08	0.16	74.8
24. Blyth River	9 320	...	...	...	...	...	...	...	...	...	...	...
25. Goyder River	10 600	...	...	...	...	...	...	...	...	...	...	...
26. Buckingham River	7 510	Giddy	Yirrkala Road	111	5	0.69	7 880	805	150	2.90	4.93	60.6

(a) In total period of gauging record.
(b) Only one complete year of record.

Table VIII(c)

Salinities of selected rivers

VIII TIMOR SEA DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Selected River (3)	Selected Gauging Station: Station Name (4)	Selected Gauging Station: Area above Gauge (km^2) (5)	Selected Gauging Station: Average Annual Discharge ($m^3 \times 10^6$) (6)	Period of Sampling (years) (7)	Number of Samples (8)	Salinity (mg/l T.D.S.): Weighted Average of Samples (9)	Salinity (mg/l T.D.S.): 10 Percentile of Samples (10)	Salinity (mg/l T.D.S.): 50 Percentile of Samples (11)	Salinity (mg/l T.D.S.): 90 Percentile of Samples (12)
1. Cape Leveque Coast	17 500	...	...	...	...	...	...	...	...	...	...
2. Fitzroy River	88 980	Fitzroy	Fitzroy Crossing	45 720	3 100	12	21	...	60	110	194
3. Lennard River	14 160	Fletcher	Dromedary Yard	129	10.7	6	16	66	38	74	110
4. Isdell River	19 400	Isdell	Dales Yard	1 810	...	6	16	...	40	106	160
5. Prince Regent River	14 630	...	...	...	...	...	...	...	...	...	...
6. King Edward River	17 150	Camp Creek	Amax Pool	79	17.7	3	35	80	37	66	104
7. Drysdale River	26 120	Drysdale	115 km.	13 900	...	1	1	...	...	70	...
8. Pentecost River	29 040	Durack	Nettopus Pool	4 150	...	5	12	...	20	38	110
9. Ord River	55 130	Ord	Coolibah Pocket	46 100	4 320	11	183	267	110	184	386
10. Keep River	12 300	Keep	Legune Road Crossing	3 500	188	...	...	...	...	69	...
11. Victoria River	77 700	Victoria	Bridge Site	42 100	2 160	...	...	...	...	90	...
12. Fitzmaurice River	10 600	...	...	...	...	...	...	...	...	...	...
13. Moyle River	7 510	...	...	...	...	...	...	...	...	...	...
14. Daly River	51 800	Daly	Gourley	46 300	3 740	...	...	...	...	280	...
15. Finniss River	9 060	Darwin	Dam Site	207	...	...	...	...	...	170	..
16. Bathurst & Melville Is.	8 280	Tarakumby Ck.	Snake Bay	17.6	...	...	...	...	...	7	...
17. Adelaide River	7 640	Adelaide	Marrakai Crossing	1 610	407	...	...	...	...	120	...
18. Mary River	7 770	Mary	El Sherana	567	80.0	...	...	...	...	20	...
19. Wildman River	4 770	Wildman	Plain	1 460	...	...	...	...	...	450	...
20. South Alligator River	11 600	Sth. Alligator	Road Bridge	...	...	...	...	...	...	64	...
21. East Alligator River	14 500	East Alligator	Second Gorge	3 470	...	...	...	...	...	12	...
22. Goomadeer River	5 700	Goomadeer	D/S Gorge	782	...	...	...	...	...	33	...
23. Liverpool River	8 280	Liverpool	Gorge	1 090	376	...	...	...	...	17	...
24. Blyth River	9 320	Blyth	Mululu	4 660	...	...	...	...	...	260	...
25. Goyder River	10 600	Goyder	Road Crossing	5 440	...	...	...	...	...	140	...
26. Buckingham River	7 510	Giddy	Yirrkala Road	111	21.9	...	...	...	...	33	...

Table VIII(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

VIII TIMOR SEA DRAINAGE DIVISION	Adopted Drainage Area	Present Annual Commitments				Authorised and Planned Annual Commitments				Total Commit-ments	Possible Exploitable Yield	Estimated Total Yield of Drainage Area
River basins	(km^2)	Designed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total	Proposed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Cape Leveque Coast	17 500	0	0	0	0	0	0	0	0	0	0	330
2. Fitzroy River	88 980	10.0	6.0	2.0	18.0	0	0	0	0	18.0	1 500	6 000
3. Lennard River	14 160	0	0	0	0	0	0	0	0	0	160	1 500
4. Isdell River	19 400	0	0	0	0	0	0	0	0	0	1 300	3 800
5. Prince Regent River	14 630	0	0	0	0	0	0	0	0	0	900	4 200
6. King Edward River	17 150	0	0	0	0	0	0	0	0	0	800	4 100
7. Drysdale River	26 120	0	0	0	0	0	0	0	0	0	1 200	5 000
8. Pentecost River	29 040	0	0	0	0	0	0	0	0	0	1 300	4 300
9. Ord River	55 130	1 900	1100	0	3 000	0	0	0	0	3 000	2 000 (a)	5 100
10. Keep River	12 300	0	0	0	0	0	0	0	0	0	43	460
11. Victoria River	77 700	2.2	0	0	2.2	0	0	0	0	2.2	1 200	5 610
12. Fitzmaurice River	10 600	0	0	0	0	0	0	0	0	0	400	900
13. Moyle River	7 510	0	0	0	0	0	0	0	0	0	120	640
14. Daly River	51 800	21.2	0	0	21.2	0	0	0	0	21.2	1 800	4 180
15. Finniss River	9 060	13.7	22.3	0	36.0	36.0	0	0	36.0	72.0	350	2 620
16. Bathurst & Melville Is.	8 280	0	0	0	0	0	0	0	0	0	9	1 700
17. Adelaide River	7 640	3.8	...	...	3.8	8.4	0.8	...	9.2	13.0	41	1 730
18. Mary River	7 770	0	0	0	0	0	0	0	0	0	310	2 000
19. Wildman River	4 770	0	0	0	0	0	0	0	0	0	0	770
20. South Alligator River	11 600	0	0	0	0	0	0	0	0	0	390	3 270
21. East Alligator River	14 500	0	0	0	0	0	0	0	0	0	500	5 100
22. Goomadeer River	5 700	0	0	0	0	0	0	0	0	0	200	2 000
23. Liverpool River	8 280	0	0	0	0	0	0	0	0	0	400	2 850
24. Blyth River	9 320	0	0	0	0	0	0	0	0	0	400	2 000
25. Goyder River	10 600	0	0	0	0	0	0	0	0	0	800	2 400
26. Buckingham River	7 510	2	...	...	2	...	...	...	...	2	300	1 700
TOTALS	547 050	1 953	1 128	2.0	3 083	44.4	0.8	0	45.2	3 128	16 423	74 260

(a) Refers to 'usable' resources only – storage and transmission losses have already been deducted.

Table VIII(e)

Aquifer characteristics

VIII TIMOR SEA DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type[(a)] (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Cape Leveque Coast	17 500	US	16 000	1–30	. . .	20	. . .	300–14 000
		SR	17 500	30–450	. . .	40	20–4 000	300–3 000
		FR	0					
2. Fitzroy River	88 980	US	10 000	6–20	. . .	100	. . .	. . .
		SR	48 400	20–200	100–500	350	20–700	300–2 000
		FR	40 500	3–20	. . .	150	20–200	250–600
3. Lennard River	14 160	US	1 000	. . .	. . .	. . .	. . .	. . .
		SR	9 400	20–200	100–500	100	20–1 000	400–600
		FR	4 700	3–20	. . .	10	20–200	400–500
4. Isdell River	19 400	US	1 500	. . .	. . .	. . .	. . .	. . .
		SR	0					
		FR	19 000	3–20	. . .	30	20–200	250–600
5. Prince Regent River	14 630	US	0					
		SR	0					
		FR	14 630	. . .	. . .	0	. . .	. . .
6. King Edward River	17 150	US	500	. . .	. . .	0	. . .	. . .
		SR	0					
		FR	17 000	. . .	. . .	0	. . .	. . .
7. Drysdale River	26 120	US	1 500	. . .	. . .	0	. . .	. . .
		SR	0					
		FR	26 000	. . .	. . .	0	. . .	. . .
8. Pentecost River	29 040	US	400	. . .	. . .	5	. . .	200–500
		SR	0					
		FR	29 000	3–20	. . .	5	. . .	250–600
9. Ord River	55 130	US	2 500	3–20	. . .	100	20–2 000	200–500
		SR	20 000	20–150	. . .	90	40–900	100–1 000
		FR	33 900	10–80	5–60	170	40–700	200–600
10. Keep River	12 300	US	5 500	15–20	5–10	5	40–400	5 000–14 000
		SR	9 900	15–30	5–30	100	40–260	400–7 000
		FR	10	40–80	5–30	1	40–700	250–500

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentery rocks
FR - fractured rocks

Table VIII(e) contd.

Aquifer characteristics

VIII TIMOR SEA DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type(a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
11. Victoria River	77 700	US	100	20–30	5–10	10	130–260	500–1 000
		SR	61 000	10–120	5–100	400	40–260	500–1 500
		FR	16 000	15–50	5–60	200	40–400	200–1 000
12. Fitzmaurice River	10 600	US	0					
		SR	10 000	5–40	5–100	10	40–260	100–500
		FR	0					
13. Moyle River	7 510	US	0					
		SR	7 000	10–30	5–100	10	170–860	50–200
		FR	0					
14. Daly River	51 800	US	0					
		SR	36 000	15–70	20–40	300	40–2 000	300–2 500
		FR	8 000	10–60	5–30	50	40–260	300–3 000
15. Finniss River	9 060	US	0					
		SR	8 000	10–60	5–30	300	40–4 000	150–1 000
		FR	300	10–50	5–60	50	40–350	500–1 500
16. Bathurst & Melville Is.	8 280	US	4 000	1–5	5–20	40	40–80	20–80
		SR	4 000	15–25	5–50	40	80–400	20–80
		FR	0					
17. Adelaide River	7 640	US	0					
		SR	7 000	20–50	5–50	150	40–260	150–1 000
		FR	50	10–50	5–60	0	...	500–1 500
18. Mary River	7 770	US	0					
		SR	6 000	20–80	5–100	30	90–500	200–300
		FR	500	...	...	0	...	...
19. Wildman River	4 770	US	1 000	10–30	5–30	1	40–260	100–200
		SR	4 000	10–50	5–50	1	90–500	200–300
		FR	0					
20. South Alligator River	11 600	US	0					
		SR	10 000	10–110	5–50	20	40–260	30–1 000
		FR	200	30–50	10–30	3	40–260	30–1 000

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table VIII(e) contd.

Aquifer characteristics

VIII TIMOR SEA DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type(a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
21. East Alligator River	14 500	US	0					
		SR	10 000	10–40	5–50	70	40–350	20–100
		FR	1 000	30–50	10–30	10	40–900	200–1 500
22. Goomadeer River	5 700	US	0					
		SR	4 000	10–40	5–50	0	40–350	20–100
		FR	500	30–50	10–30	0	40–900	200–1 500
23. Liverpool River	8 280	US	500	5–50	30–40	3	90–200	50–100
		SR	7 000	10–40	5–40	10	170–400	50–250
		FR	0					
24. Blyth River	9 320	US	0					
		SR	9 000	3–15	5–40	2	170–400	50–200
		FR	0					
25. Goyder River	10 600	US	0					
		SR	10 000	10–25	5–40	4	40–90	40–100
		FR	0					
26. Buckingham River	7 510	US	0					
		SR	7 000	2–40	10–20	40	40–900	40–150
		FR	0					
TOTALS	547 050	US	44 500	1–50	5–40	280	20–2 000	100–14 000
		SR	305 200	2–450	5–500	2 070	20–4 500	30–15 000
		FR	211 300	3–80	5–60	680	20–900	200–1 500

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Groundwater yields

VIII TIMOR SEA DRAINAGE DIVISION River basins	Aquifer Type[(a)]	Abstraction During 1974 ($m^3 x 10^6$)	Estimated Annual Recharge ($m^3 x 10^6$)	Estimated Possible Annual Yield ($m^3 x 10^6$) — From Recharge					Total					Reliability of Estimate[(b)]
				< 1 000 mg/l	1 000– 3 000 mg/l	3 000– 7 000 mg/l	7 000– 14 000 mg/l	> 14 000 mg/l	< 1 000 mg/l	1 000– 3 000 mg/l	3 000– 7 000 mg/l	7 000– 14 000 mg/l	> 14 000 mg/l	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Cape Leveque Coast	US	0	200	200	...	...	...	...	500	500	...	...	...	
	SR	5												
	Total	5	200	200	...	...	...	...	500	500	...	...	...	(iii)
2. Fitzroy River	US	1	100	100	...	...	...	...	105	...	...	...	...	
	SR	5	400	300	100	...	...	...	2 000	2 000	...	...	...	
	FR	0.5	100	100	...	0	0	0	150	...	...	...	...	
	Total	6.5	600	500	100	...	...	...	2 260	2 000	...	...	...	(iii)
3. Lennard River	US	0	20	20	...	...	...	...	22	...	...	...	...	
	SR	0.4	150	100	50	...	...	...	400	400	...	...	...	
	FR	0.1	50	50	...	0	0	0	110	...	0	0	0	
	Total	0.5	220	170	50	...	...	...	532	400	...	...	...	(iii)
4. Isdell River	US	0	5	5	...	0	0	0	5.5	...	0	0	0	
	FR	0.1	100	100	...	0	0	0	120	...	0	0	0	
	Total	0.1	105	105	...	0	0	0	126	...	0	0	0	(iii)
5. Prince Regent River	FR	0	100	100	...	0	0	0	120	...	0	0	0	
	Total	0	100	100	...	0	0	0	120	...	0	0	0	(iii)
6. King Edward River	US	0	5	5	...	0	0	0	5.5	...	0	0	0	
	FR	0	100	100	...	0	0	0	120	...	0	0	0	
	Total	0	105	105	...	0	0	0	126	...	0	0	0	(iii)
7. Drysdale River	US	0	5	5	...	0	0	0	5.5	...	0	0	0	
	FR	0	100	100	...	0	0	0	130	...	0	0	0	
	Total	0	105	105	...	0	0	0	136	...	0	0	0	(iii)
8. Pentecost River	US	0	5	5	...	0	0	0	5.5	...	0	0	0	
	FR	0	100	100	...	0	0	0	130	...	0	0	0	
	Total	0	105	105	...	0	0	0	136	...	0	0	0	(iii)
9. Ord River	US	0.5	5			5					5.5			
	SR	0.2	400			400					500			
	FR	0.5	250			250					280			
	Total	1.2	655			655					786			(iii)
10. Keep River	US	0	80			80					80			
	SR	2	350			350					400			
	FR	0	1			1					1			
	Total	2	431			431					481			(iii)

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

VIII TIMOR SEA DRAINAGE DIVISION River basins (1)	Aquifer Type[(a)] (2)	Abstraction During 1974 ($m^3 \times 10^6$) (3)	Estimated Annual Recharge ($m^3 \times 10^6$) (4)	Estimated Possible Annual Yield ($m^3 \times 10^6$) From Recharge < 1 000 mg/l (5)	1 000–3 000 mg/l (6)	3 000–7 000 mg/l (7)	7 000–14 000 mg/l (8)	> 14 000 mg/l (9)	Total < 1 000 mg/l (10)	1 000–3 000 mg/l (11)	3 000–7 000 mg/l (12)	7 000–14 000 mg/l (13)	> 14 000 mg/l (14)	Reliability of Estimate[(b)] (15)
11. Victoria River	US	0.05	30			30					30			
	SR	2	3 000			3 000					3 000			
	FR	1	800			800					800			
	Total	3.1	3 830			3 830					3 830			(iii)
12. Fitzmaurice River	SR	0.05	700			700					700			
	Total	0.05	700			700					700			(iii)
13. Moyle River	SR	0.05	700			700					700			
	Total	0.05	700			700					700			(iii)
14. Daly River	SR	3	3 000	2 000		1 000			2 000		1 000			
	FR	0.3	800	800		0			800		0			
	Total	3.3	3 800	2 800		1 000			2 800		1 000			(iii)
15. Finniss River	SR	2	1 000			1 000					1 000			
	FR	0.3	40			40					40			
	Total	2.3	1 040			1 040					1 040			(iii)
16. Bathurst & Melville Is.	US	0.4	800			800					800			
	SR	0.4	800			800					800			
	Total	0.8	1 600			1 600					1 600			(iii)
17. Adelaide River	SR	1	900			900					900			
	FR	0	6			6					6			
	Total	1	906			906					906			(iii)
18. Mary River	SR	0.2	800			800					800			
	FR	0	200			200					200			
	Total	0.2	1 000			1 000					1 000			(iii)
19. Wildman River	US	0	100			100					100			
	SR	0	500			500					500			
	Total	0	600			600					600			(iii)
20. South Alligator River	SR	0.05	1 300			1 300					1 300			
	FR	0	30			30					30			
	Total	0.05	1 330			1 330					1 330			(iii) (contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table VIII(f) contd.

Table VIII(f) contd.

Groundwater yields

VIII TIMOR SEA DRAINAGE DIVISION River basins	Aquifer Type (a)	Abstraction During 1974 ($m^3 x 10^6$)	Estimated Annual Recharge ($m^3 x 10^6$)	Estimated Possible Yield ($m^3 x 10^6$) From Recharge < 1 000 mg/l	From Recharge 1 000–3 000 mg/l	From Recharge 3 000–7 000 mg/l	From Recharge 7 000–14 000 mg/l	From Recharge > 14 000 mg/l	Total < 1 000 mg/l	Total 1 000–3 000 mg/l	Total 3 000–7 000 mg/l	Total 7 000–14 000 mg/l	Total > 14 000 mg/l	Reliability of Estimate (b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
21. East Alligator River	SR	0.4	1 000			1 000					1 000			
	FR	0.05	100			100					100			(iii)
	Total	0.5	1 100			1 100					1 100			
22. Goomadeer River	SR	0	400			400					400			
	FR	0	50			50					50			(iii)
	Total	0	450			450					450			
23. Liverpool River	US	0.01	60			60					60			
	SR	0.05	900			900					900			(iii)
	Total	0.06	960			960					960			
24. Blyth River	SR	0.01	1 200			1 200					1 200			(iii)
	Total	0.01	1 200			1 200					1 200			
25. Goyder River	SR	0.02	1 300			1 300					1 300			(iii)
	Total	0.02	1 300			1 300					1 300			
26. Buckingham River	SR	8	900			900					900			(iii)
	Total	8	900			900					900			
TOTALS	US	2.0	1 210			1 210					1 220			
	SR	30	19 700			19 700					24 600			
	FR	2.9	2 930			2 930					3 190			
	Total	35	24 000 (c)			24 000 (c)					29 500 (c)			(iii)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(c) This figure includes estimates given jointly for US and SR in the table.

Drainage Division IX - Gulf of Carpentaria

The climate of the Division is essentially monsoonal, with heavy summer rains and dry winters. Northern parts of the Division on Arnhem Land and Cape York Peninsula have high median annual rainfalls – over 1500 mm. Conditions further south are more arid with rainfall reducing to 300 mm.

The topography of the region is dominated by the Barkly Tableland and the Gregory Range which rise from a broad coastal plain extending about 180 km inland. Rivers have cut deep incisions in the uplands to depths up to 150 m, and in the coastal belt they have formed extensive deltas and tidal salt flats. The coastal plain is flat, typically with grades of less than 1 in 50000.

The majority of rivers flow only during the summer monsoon season. However, some streams with substantial baseflows are perennial. The Nicholson and Gregory Rivers (River Basin 12) are fed by large springs from limestone aquifers in the Barkly Tableland, and some of the rivers of northern Cape York Peninsula are fed from unconfined aquifers. Salt water penetrates long distances inland due to low dry season flows and the flat grades of the coastal plains. The major surface water diversions in the Division are the Moondarra Dam (80 million cubic metres capacity) and the Julius Dam (127 million cubic metres), both on the Leichhardt River (River Basin 13) serving the mining town of Mt. Isa.

Very little is known of the groundwater resources of the Gulf of Carpentaria Division. Three sedimentary basins, the Carpentaria and Eromanga Basins and Arnhem McArthur Province, underlie the Division and yield groundwater suitable for domestic and stock purposes. The yield and quality can be quite variable with water from limestone aquifers being very hard. Unconsolidated beds on the western side of Cape York yield good quality water for domestic and industrial use at Weipa. Similar supplies have been obtained in some areas between the Edward and Gilbert Rivers.

Plate 17: Typical north-west Queensland country – River Basin 12.

Table IX(a)

River basin areas, gauging stations, average annual discharges and salinities

IX GULF OF CARPENTARIA DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 x 10^6$)				Estimated Total Yield ($m^3 x 10^6$)	Average Annual Runoff (mm)	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Koolatong River	7 770	0 (a)	3	5	0	1 700	1 700	0	1 700	220	fresh
2. Walker River	9 060	0 (a)	5	15	0	900	900	0	900	100	fresh
3. Roper River	81 300	8 (a)	13	28	310	3 530	3 840	0	3 840	47	marginal
4. Towns River	4 920	0 (a)	0	1	0	200	200	0	200	41	fresh
5. Limmen Bight River	16 600	0 (a)	1	2	0	660	660	0	660	40	fresh
6. Rosie River	5 440	0	0	0	0	220	220	0	220	41	fresh
7. McArthur River	18 400	0 (a)	9	15	0	740	740	0	740	40	fresh
8. Robinson River	11 400	0 (a)	3	6	0	570	570	0	570	50	fresh
9. Calvert River	10 600	0 (a)	2	2	0	420	420	0	420	40	fresh
10. Settlement Creek	15 515	0	0	0	0	820	530	290	820	53	...
11. Mornington Island	1 035	0	0	0	0	170	170	0	170	164	...
12. Nicholson River	53 195	24	11	15	260	1 670	1 780	150	1 930	36	fresh
13. Leichhardt River	33 020	20	12	12	210	490	630	70	700	21	fresh
14. Morning Inlet	4 040	0	0	0	0	110	10	100	110	27	...
15. Flinders River	108 775	4	26	27	80	1 750	1 750	80	1 830	17	fresh
16. Norman River	48 950	72	4	4	1 200	760	1 790	170	1 960	40	fresh
17. Gilbert River	46 880	0 (a)	21	28	0	4 880	4 540	340	4 880	104	fresh
18. Staaten River	25 460	0 (a)	2	2	0	1 990	1 780	210	1 990	78	...
19. Mitchell River	71 790	7	23	30	230	12 460	11 490	1 200	12 690	177	fresh
20. Coleman River	13 080	0 (a)	3	3	0	3 010	2 040	970	3 010	230	...
21. Holroyd River	10 425	0 (a)	3	3	0	2 400	2 050	350	2 400	230	...
22. Archer River	13 595	1	4	4	70	4 230	3 400	900	4 300	316	fresh
23. Watson River	4 715	0 (a)	1	1	0	1 950	1 300	650	1 950	414	...
24. Embley River	4 715	8	2	2	200	2 050	950	1 300	2 250	478	fresh
25. Wenlock River	7 575	44	3	3	730	1 540	1 900	370	2 270	300	fresh
26. Ducie River	6 655	0 (a)	3	3	0	3 590	2 070	1 520	3 590	540	fresh
27. Jardine River	3 265	0 (a)	1	1	0	1 950	1 570	380	1 950	597	fresh
28. Torres Strait Islands	285	0	0	0	0	180	180	0	180	632	...
TOTALS	638 460	10	155	212	3 290	54 940	49 180	9 050	58 230	91	

(a) Short period of record only.

Range of discharges for selected rivers

IX GULF OF CARPENTARIA DRAINAGE DIVISION River basins	Adopted Drainage Area (km²)	Selected River	Selected Gauging Station: Station Name	Area above Gauge (km²)	Record Length (years)	Average Annual Discharge (m³/sec)	Maximum Discharge as a Percentage of Average (a): Instantaneous	Monthly	Annual	Minimum Discharge as a Percentage of Average (a): Instantaneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Koolatong River	7 770	...	...	...	...	...	...	...	...	...	...	...
2. Walker River	9 060	...	...	...	...	...	...	...	...	...	...	...
3. Roper River	81 300	Roper	Mataranka	6 630	11	9.92	8 510	1 680	210	7.66	7.74	24.9
4. Towns River	4 920	...	...	...	...	...	...	...	...	...	...	...
5. Limmen Bight River	16 600	...	...	...	...	...	...	...	...	...	...	...
6. Rosie River	5 440	...	...	...	...	...	...	...	...	...	...	...
7. McArthur River	18 400	...	...	...	...	...	...	...	...	...	...	...
8. Robinson River	11 400	...	...	...	...	...	...	...	...	...	...	...
9. Calvert River	10 600	...	...	...	...	...	...	...	...	...	...	...
10. Settlement Creek	15 515	...	...	...	...	...	...	...	...	...	...	...
11. Mornington Island	1 035	...	...	...	...	...	...	...	...	...	...	...
12. Nicholson River	53 195	Gregory	Gregory Downs	12 846	11	9.7	14 600	850	152	13	21	41
13. Leichhardt River	33 020	...	...	...	...	...	...	...	...	...	...	...
14. Morning Inlet	4 040	...	...	...	...	...	...	...	...	...	...	...
15. Flinders River	108 775	...	...	...	...	...	...	...	...	...	...	...
16. Norman River	48 950	...	...	...	...	...	...	...	...	...	...	...
17. Gilbert River	46 880	...	...	...	...	...	...	...	...	...	...	...
18. Staaten River	25 460	...	...	...	...	...	...	...	...	...	...	...
19. Mitchell River	71 790	Walsh	Dimbulah	1 036	14	7.7	29 100	1 850	226	0	0	11
20. Coleman River	13 080	...	...	...	...	...	...	...	...	...	...	...
21. Holroyd River	10 425	...	...	...	...	...	...	...	...	...	...	...
22. Archer River	13 595	Coen	Coen	166	15	2.7	23 300	890	189	0	0	7
23. Watson River	4 715	...	...	...	...	...	...	...	...	...	...	...
24. Embley River	4 715	...	...	...	...	...	...	...	...	...	...	...
25. Wenlock River	7 575	Wenlock	Moreton Telegraph	3 328	12	35.4	2 360	1 130	188	0	0	10
26. Ducie River	6 655	...	...	...	...	...	...	...	...	...	...	...
27. Jardine River	3 265	...	...	...	...	...	...	...	...	...	...	...
28. Torres Strait Islands	285	...	...	...	...	...	...	...	...	...	...	...

(a) In total period of gauging station record.

Table IX(c)

Salinities of selected rivers

IX GULF OF CARPENTARIA DRAINAGE DIVISION River basins	Adopted Drainage Area (km²)	Selected River	Selected Gauging Station: Station Name	Selected Gauging Station: Area above Gauge (km²)	Selected Gauging Station: Average Annual Discharge ($m^3 x 10^6$)	Period of Sampling (years)	Number of Samples	Salinity (mg/l T.D.S.): Weighted Average of Samples	Salinity (mg/l T.D.S.): 10 Percentile of Samples	Salinity (mg/l T.D.S.): 50 Percentile of Samples	Salinity (mg/l T.D.S.): 90 Percentile of Samples
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Koolatong River	7 770	Wonga	GS901003	186	...	...	...	...	...	30	...
2. Walker River	9 060	Walker	GS902007	...	...	...	...	...	...	65	...
3. Roper River	81 300	Roper	Red Rock	47 400	...	...	...	...	...	515	...
4. Towns River	4 920	...	...	...	...	...	...	...	...	...	...
5. Limmen Bight River	16 600	...	...	...	...	...	...	...	...	...	...
6. Rosie River	5 440	...	...	...	...	...	...	...	...	...	...
7. McArthur River	18 400	McArthur	...	...	...	...	...	...	...	23	...
8. Robinson River	11 400	Robinson	...	...	...	...	...	...	...	136	...
9. Calvert River	10 600	Calvert	...	...	...	...	...	...	...	100	...
10. Settlement Creek	15 515	...	...	...	...	...	...	...	...	...	...
11. Mornington Island	1 035	...	...	...	...	...	...	...	...	...	...
12. Nicholson River	53 195	Gregory	Riversleigh No. 2	11 605	...	6	33	169	154	294	350
13. Leichhardt River	33 020	Gunpowder Ck.	Gunpowder	2 395	...	6	25	130	30	71	459
14. Morning Inlet	4 040	...	...	...	...	...	...	...	...	...	...
15. Flinders River	108 775	Cloncurry	Cloncurry	5 905	...	6	12	102	67	120	206
16. Norman River	48 950	Walker Creek	Maggievilla	3 087	...	8	7	57	53	96	364
17. Gilbert River	46 880	Elizabeth Creek	Mount Surprise	590	...	3	6	132	80	324	419
18. Staaten River	25 460	...	...	...	...	...	...	...	...	...	...
19. Mitchell River	71 790	Walsh	Flatrock	2 780	...	4	29	26	23	28	83
20. Coleman River	13 080	...	...	...	...	...	...	...	...	...	...
21. Holroyd River	10 425	...	Strathgordon	1 528	...	1	2	23	21	25	28
22. Archer River	13 595	Archer	Telegraph Crossing	3 136	2 304	3	5	74	67	90	94
23. Watson River	4 715	...	...	...	...	...	...	...	...	...	...
24. Embley River	4 715	Embley	Kurracoo Creek	363	...	4	13	31	19	60	11 592
25. Wenlock River	7 575	Wenlock	Moreton Telegraph	3 328	1 126	4	10	31	25	41	51
26. Ducie River	6 655	Bertie Creek	Swordgrass Swamp	129	...	4	6	31	21	25	34
27. Jardine River	3 265	Jardine	Telegraph Line	2 505	...	4	6	27	25	26	28
28. Torres Strait Islands	285	...	...	...	...	...	...	...	...	...	...

Table IX(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

IX GULF OF CARPENTARIA DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km^2) (2)	Present Annual Commitments: Designed Diversions (3)	Present Annual Commitments: Storage Evaporation Losses (4)	Present Annual Commitments: River Losses and Requirements (5)	Present Annual Commitments: Total (6)	Authorised and Planned Annual Commitments: Proposed Diversions (7)	Authorised and Planned Annual Commitments: Storage Evaporation Losses (8)	Authorised and Planned Annual Commitments: River Losses and Requirements (9)	Authorised and Planned Annual Commitments: Total (10)	Total Commitments (11)	Possible Exploitable Yield (12)	Estimated Total Yield of Drainage Area (13)
1. Koolatong River	7 770	0	0	0	0	0	0	0	0	0	300	1 700
2. Walker River	9 060	5	...	...	5	...	...	...	...	5	400	900
3. Roper River	81 300	7	...	...	7	...	...	...	...	7	700	3 840
4. Towns River	4 920	0	0	0	0	0	0	0	0	0	0	200
5. Limmen Bight River	16 600	0	0	0	0	0	0	0	0	0	130	660
6. Rosie River	5 440	0	0	0	0	0	0	0	0	0	20	220
7. McArthur River	18 400	1	...	...	1	17	8	0	25	26	120	740
8. Robinson River	11 400	0	0	0	0	0	0	0	0	0	80	570
9. Calvert River	10 600	0	0	0	0	0	0	0	0	0	40	420
10. Settlement Creek	15 515	0	0	0	0	0	0	0	0	0	66	530
11. Mornington Island	1 035	0	0	0	0	0	0	0	0	0	10	170
12. Nicholson River	53 195	0	0	2	2	0	0	1	1	3	40	1 780
13. Leichhardt River	33 020	19	23	10	52	36	24	0	60	112	112	630
14. Morning Inlet	4 040	0	0	0	0	0	0	0	0	0	10	10
15. Flinders River	108 775	2	...	0	2	0	0	0	0	2	100	1 750
16. Norman River	48 950	0	0	1	1	0	0	0	0	1	140	1 790
17. Gilbert River	46 880	0	0	1	1	0	0	0	0	1	340	4 540
18. Staaten River	25 460	0	0	0	0	0	0	0	0	0	320	1 780
19. Mitchell River	71 790	1	...	2	3	0	0	0	0	3	1 580	11 490
20. Coleman River	13 080	0	0	0	0	0	0	0	0	0	470	2 040
21. Holroyd River	10 425	0	0	0	0	0	0	0	0	0	460	2 050
22. Archer River	13 595	0	0	0	0	0	0	0	0	0	850	3 400
23. Watson River	4 715	0	0	0	0	0	0	0	0	0	510	1 300
24. Embley River	4 715	0	0	0	0	0	0	0	0	0	600	950
25. Wenlock River	7 575	0	0	0	0	0	0	0	0	0	370	1 900
26. Ducie River	6 655	0	0	0	0	0	0	0	0	0	1 420	2 070
27. Jardine River	3 265	0	0	1	1	0	0	0	0	1	900	1 570
28. Torres Strait Islands	285	0	0	1	1	0	0	0	0	1	6	180
TOTALS	638 460	35	23	18	76	53	32	1	86	162	10 094	49 180

Table IX(e)

Aquifer characteristics

IX GULF OF CARPENTARIA DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type (a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Koolatong River	7 770	US	0					
		SR	7 000	1–15	10–20	9	40–260	50–150
		FR	0					
2. Walker River	9 060	US	3 000	3–20	5–15	40	200–700	50–500
		SR	3 000	10–30	10–20	70	40–200	150–7 000
		FR	0					
3. Roper River	81 300	US	0					
		SR	40 000	10–60	5–30	150	40–2 000	250–2 500
		FR	10 000	50–80	10–30	50	40–100	50–1 500
4. Towns River	4 920	US	0					
		SR	4 000	20–100	5–50	0	40–350	300–1 500
		FR	0					
5. Limmen Bight River	16 600	US	0					
		SR	12 000	20–100	5–50	15	40–350	300–1 500
		FR	0					
6. Rosie River	5 440	US	0					
		SR	5 000	20–100	5–50	0	40–350	300–1 500
		FR	0					
7. McArthur River	18 400	US	0					
		SR	15 000	20–100	5–50	20	40–1 700	300–1 500
		FR	0					
8. Robinson River	11 400	US	0					
		SR	10 000	20–100	5–50	0	40–350	300–1 500
		FR	0					
9. Calvert River	10 600	US	0					
		SR	10 000	20–100	5–50	1	40–350	300–1 500
		FR	0					
10. Settlement Creek	15 515	US	8 500	. . .	2	0	. . .	. . .
		SR	3 000	20–100	5–100	1	40–350	300–1 500
		FR	2 700	. . .	40	0	. . .	. . .

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table IX(e) contd.

Aquifer characteristics

IX GULF OF CARPENTARIA DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type (a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
11. Mornington Island	1 035	US	950	...	2	0	...	...
		SR	1 036	...	...	...	...	...
		FR	0					
12. Nicholson River	53 195	US	13 100	10–30	2	20	100–3 000	...
		SR	21 200	20–150	5–100	40	40–350	300–1 500
		FR	9 500	50–150	40	60	100–200	...
13. Leichhardt River	33 020	US	13 000	10–30	2	30	100–200	500–1 000
		SR	150	...	40	...	...	...
		FR	17 000	10–75	40	50	50–150	...
14. Morning Inlet	4 040	US	500	...	2	0	...	...
		SR	4 040	...	...	...	...	...
		FR	0					
15. Flinders River	108 775	US	11 836	4.5–12	3–12	60	65–430	400–1 100
		SR	102 527	100–350	50–150	700	50–5 500	300–3 000
		FR	3 688	9–40	10–30	130	15–150	350–2 000
16. Norman River	48 950	US	466	4.5–18	2–9	6	11–90	500–900
		SR	48 480	100–300	50–150	80	200–5 500	1 000–3 000
		FR	130	20–45	2–7	10	20–150	500–2 200
17. Gilbert River	46 880	US	1 140	6–50	4–6	40	5–55	500–3 000
		SR	433	40–50	10–15	...	...	...
		FR	907	40–50	45–50	...	...	...
18. Staaten River	25 460	US	2 218	5–65	10–15	...	...	1 000–3 000
		SR	206	40–50	10–15	...	...	...
		FR	0					
19. Mitchell River	71 790	US	4 333	2.5–9	2.5–5.5	4	65–220	500–1 000
		SR	14 314	100–300	50–150	50	200–5 500	1 000–3 000
		FR	...	...	...	...	...	...
20. Coleman River	13 080	US	5 900	5–8	1–3	6	60–70	200–400
		SR	10 050	100–300	50–150	20	200–5 500	1 000–3 000
		FR	...	...	...	...	...	...

(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table IX(e) contd.

Aquifer characteristics

IX GULF OF CARPENTARIA DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type(a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
21. Holroyd River	10 425	US	1 200	5–8	1–3	...	60–70	200–450
		SR	8 375	100–300	50–150	10	200–5 500	1 000–3 000
		FR	850	...	...	...	...	...
22. Archer River	13 595	US	392	1.5–14	2.4–6.1	8	22–220	200–450
		SR	11 494	100–300	50–150	8	200–5 500	1 000–3 000
		FR	1 712	...	...	...	...	...
23. Watson River	4 715	US	208	15–25	5–15	...	...	...
		SR	207	40–50	10–15	...	...	...
		FR	0					
24. Embley River	4 715	US	260	6–15	6–10	30	1 200–1 400	300–800
		SR	4 700	100–300	50–150	15	200–5 500	1 000–3 000
		FR	0					
25. Wenlock River	7 575	US	...	...	...	...	...	...
		SR	6 451	100–300	50–150	5	200–5 500	1 000–3 000
		FR	...	...	...	...	...	...
26. Ducie River	6 655	US	160	15–25	5–15	...	...	...
		SR	238	40–50	10–15	...	...	...
		FR	0					
27. Jardine River	3 265	US	46	15–25	5–15	...	...	...
		SR	184	40–50	10–15	...	...	...
		FR	0					
28. Torres Strait Islands	285	US	65	1–4	1.5–4	10	10–90	200–1 500
		SR	14	2–40	1.5–3	20	20–150	250–900
		FR	0					
TOTALS	638 460	US	67 300	1–65	1–15	250	5–3 000	50–3 000
		SR	343 000	1–350	5–150	1 210	40–5 500	50–7 000
		FR	46 500	2–150	1–50	300	15–200	50–2 200

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Groundwater yields

IX GULF OF CARPENTARIA DRAINAGE DIVISION River basins (1)	Aquifer Type[(a)] (2)	Abstraction During 1974 ($m^3 \times 10^6$) (3)	Estimated Annual Recharge ($m^3 \times 10^6$) (4)	Estimated Possible Annual Yield ($m^3 \times 10^6$) — From Recharge: < 1 000 mg/l (5)	From Recharge: 1 000–3 000 mg/l (6)	From Recharge: 3 000–7 000 mg/l (7)	From Recharge: 7 000–14 000 mg/l (8)	From Recharge: > 14 000 mg/l (9)	Total: < 1 000 mg/l (10)	Total: 1 000–3 000 mg/l (11)	Total: 3 000–7 000 mg/l (12)	Total: 7 000–14 000 mg/l (13)	Total: > 14 000 mg/l (14)	Reliability of Estimate[(b)] (15)
1. Koolatong River	SR	0.05	900			900					900			(iii)
	Total	0.05	900			900					900			
2. Walker River	US	0.2	300			300					300			
	SR	0.4	300			300					300			(iii)
	Total	0.6	600			600					600			
3. Roper River	SR	0.8	4 000			4 000					4 000			
	FR	0.2	1 000			1 000					1 000			(iii)
	Total	1.0	5 000			5 000					5 000			
4. Towns River	SR	0	300			300					300			(iii)
	Total	0	300			300					300			
5. Limmen Bight River	SR	0.07	1 000			1 000					1 000			(iii)
	Total	0.07	1 000			1 000					1 000			
6. Rosie River	SR	0	400			400					400			(iii)
	Total	0	400			400					400			
7. McArthur River	SR	0.1	900			900					900			(iii)
	Total	0.1	900			900					900			
8. Robinson River	SR	0	600			600					600			(iii)
	Total	0	600			600					600			
9. Calvert River	SR	0.005	600			600					600			(iii)
	Total	0.005	600			600					600			
10. Settlement Creek	US	0	510	510	0	0	0	0	517	0	0	0	0	(iii)
	FR	0	4	4	0	0	0	0	4.1	0	0	0	0	(iii)
	Total	0	514	514	0	0	0	0	521	0	0	0	0	
11. Mornington Island	US	. . .	72	72	0	0	0	0	73.9	0	0	0	0	(iii)
	SR	0	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	
	Total	. . .	72	72	. . .	. . .	. . .	. . .	73.9	. . .	. . .	. . .	. . .	
12. Nicholson River	US	0.4	786	786	0	0	0	0	812	0	0	0	0	(iii)
	SR	0.6	110	100	10	0	0	0	102.7	10.3	0	0	0	(iii)
	FR	0.6	20	20	0	0	0	0	20.0	0	0	0	0	(iii)
	Total	1.6	916	906	10	0	0	0	935	10.3	0	0	0	
13. Leichhardt River	US	0.6	650	650	0	0	0	0	676	0	0	0	0	(iii)
	SR	. . .	1.5	1.5	0	0	0	0	1.5	0	0	0	0	(iii)
	FR	0.5	34	34	0	0	0	0	34.7	0	0	0	0	
	Total	1.1	686	686	0	0	0	0	712	0	0	0	0	(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table IX(f)

Table IX(f) contd.

Groundwater yields

IX GULF OF CARPENTARIA DRAINAGE DIVISION River basins (1)	Aquifer Type[(a)] (2)	Abstraction During 1974 ($m^3 \times 10^6$) (3)	Estimated Annual Recharge ($m^3 \times 10^6$) (4)	Estimated Possible Annual Yield ($m^3 \times 10^6$) From Recharge < 1 000 mg/l (5)	From Recharge 1 000–3 000 mg/l (6)	From Recharge 3 000–7 000 mg/l (7)	From Recharge 7 000–14 000 mg/l (8)	From Recharge > 14 000 mg/l (9)	Total < 1 000 mg/l (10)	Total 1 000–3 000 mg/l (11)	Total 3 000–7 000 mg/l (12)	Total 7 000–14 000 mg/l (13)	Total > 14 000 mg/l (14)	Reliability of Estimate[(b)] (15)
14. Morning Inlet	US	35	35	35	0	0	0	0	36	0	0	0	0	(iii)
	FR	...	...	...	...	...	...	...	...	...	...	...	...	
	Total	35	35	35	0	0	0	0	36	0	0	0	0	
15. Flinders River	US	1.5	232.2	220.6	11.6	0	0	0	234.4	12.2	0	0	0	(ii)
	SR	32.9	51.4	9.7	41.2	0.4	0.04	0	10.9	46.1	0.4	0.05	0	(iii)
	FR	0.47	131	100	31	0	0	0	100.6	31.2	0	0	0	(iii)
	Total	34.9	415	330	84	0.4	0.04	0	345.9	89.5	0.4	0.05	0	(iii)
16. Norman River	US	0.14	28.3	28.3	0	0	0	0	30.5	0	0	0	0	(iii)
	SR	13.7	31.8	0	31.8	0	0	0	0	33.2	0	0	0	(iii)
	FR	.003	3.3	2.1	1.2	0	0	0	2.15	1.2	0	0	0	(iii)
	Total	13.8	63.4	30.4	33.0	0	0	0	32.7	34.4	0	0	0	
17. Gilbert River	US	0.02	130	0	130	0	0	0	0	136	0	0	0	(ii)
	SR	...	3.5	0	3.5	0	0	0	0	3.9	0	0	0	(iii)
	FR	...	3.6	0	3.6	0	0	0	0	4.6	0	0	0	(iii)
	Total	0.02	137	0	137	0	0	0	0	145	0	0	0	
18. Staaten River	US	...	252.5	0	252.5	0	0	0	0	274.5	0	0	0	(iii)
	SR	...	1.6	0	1.6	0	0	0	0	3.7	0	0	0	(iii)
	Total	...	254.1	0	254.1	0	0	0	0	278.2	0	0	0	
19. Mitchell River	US	0.1	80.3	80.3	0	0	0	0	93.5	0	0	0	0	(iii)
	SR	12.9	29.9	0	29.9	0	0	0	0	31.2	0	0	0	(iii)
	FR	...	...	...	...	...	...	...	...	...	...	...	...	
	Total	13.0	110.2	80.3	29.9	0	0	0	93.5	31.2	0	0	0	
20. Coleman River	US	0.2	546	546	0	0	0	0	555	0	0	0	0	(iii)
	SR	2.8	6.4	0	6.4	0	0	0	0	6.7	0	0	0	(iii)
	FR	...	...	...	...	...	...	...	...	...	...	...	...	
	Total	3.0	552	546	6.4	0	0	0	555	6.7	0	0	0	
21. Holroyd River	US	...	108	108	0	0	0	0	110	0	0	0	0	(iii)
	SR	2.4	5.2	0	5.2	0	0	0	0	5.4	0	0	0	(iii)
	FR	...	...	...	...	...	...	...	...	...	...	...	...	
	Total	2.4	113	108	5.2	0	0	0	110	5.4	0	0	0	
22. Archer River	US	0.2	71.6	71.6	0	0	0	0	72.8	0	0	0	0	(iii)
	SR	3.2	6.5	0	6.5	0	0	0	0	6.8	0	0	0	(iii)
	FR	...	...	...	...	...	...	...	...	...	...	...	...	
	Total	3.4	78.1	71.6	6.5	0	0	0	72.8	6.8	0	0	0	
23. Watson River	US	...	20	20	0	0	0	0	22.1	0	0	0	0	(iii)
	SR	...	1.3	0	1.3	0	0	0	0	1.5	0	0	0	(iii)
	Total	...	21	20	1.3	0	0	0	22.1	1.5	0	0	0	
24. Embley River	US	15	62	62	0	0	0	0	62.1	0	0	0	0	(ii)
	SR	1.3	3.5	0	3.5	0	0	0	0	3.6	0	0	0	(ii)
	Total	16	65	62	3.5	0	0	0	62.1	3.6	0	0	0	(contd.)

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) Reliability of estimate: (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Groundwater yields

IX GULF OF CARPENTARIA DRAINAGE DIVISION River basins	Aquifer Type(a)	Abstraction During 1974 (m³ x 10⁶)	Estimated Annual Recharge (m³ x 10⁶)	Estimated Possible Annual Yield (m³ x 10⁶) — From Recharge: < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	< 14 000 mg/l	Total: < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	< 14 000 mg/l	Reliability of Estimate(b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
25. Wenlock River	US	...	...	...	...	...	...	...	...	...	...	...	...	
	SR	1.8	3.8	0	3.8	0	0	0	0	3.9	0	0	0	
	FR	...	...	...	...	...	...	...	...	...	...	...	...	
	Total	1.8	3.8	0	3.8	0	0	0	0	3.9	0	0	0	
26. Ducie River	US	...	29.7	29.7	0	0	0	0	29.9	0	0	0	0	(iii)
	SR	...	2.9	0	2.9	0	0	0	0	3.1	0	0	0	(iii)
	Total	...	32.6	29.7	2.9	0	0	0	29.9	3.1	0	0	0	
27. Jardine River	US	...	8.5	8.5	0	0	0	0	8.8	0	0	0	0	(iii)
	SR	...	2.3	0	2.3	0	0	0	0	2.5	0	0	0	(iii)
	Total	...	10.8	8.5	2.3	0	0	0	8.8	2.5	0	0	0	
28. Torres Strait Islands	US	0.013	1.0	0.8	0.2	0	0	0	1.0	0.2	0	0	0	(iii)
	FR	0.06	0.9	0.9	0	0	0	0	0.9	0	0	0	0	(iii)
	Total	0.07	1.9	1.7	0.2	0	0	0	1.9	0.2	0	0	0	
TOTALS	US	53.4	3 923				3 923				4 058			
	SR	73.0	9 262				9 262				9 277			
	FR	1.8	1 197				1 197				1 199			
	Total	128.2	14 382				14 382				14 534			

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) Reliability of estimate: (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Table IX(f) contd.

Drainage Division X - Lake Eyre

The Division is second in size only to Drainage Division XII, the Western Plateau. It is arid throughout and drains internally towards Lake Eyre, a large salt lake, usually dry, about 10 m below sea level.

The Division is mostly flat, often less than 150 m above sea level, although near its boundaries, there are regions with some relief. In the west these comprise the Musgrave and McDonnel Ranges, in the south, the northern part of the Flinders Ranges and in the north-east, inland slopes of the Great Divide. The region is heavily alluviated and lakes, which are mostly dry, consist of extensive clay and salt pans. About one-third of the Division is a complex of low linear sand dunes up to 30 m high and 10 to 100 km in length, and these direct and restrict drainage. Another feature of the Division is the Simpson Desert, a sandy desert without any significant channels for streamflow.

Vegetation ranges from low desert scrub and grasses, through low shrublands and tussock grassland in the MacDonnell and Musgrave Ranges, to low woodlands in the east. After rains, luxuriant, but short-lived growth appears, even in the heart of the desert.

Median annual rainfall varies from less than 100 mm a year in the region to the north-east of Lake Eyre to over 400 mm in the upper reaches of the Georgina and Diamantina Rivers and Cooper Creek. Here some rainfall is received in summer months from the southern edges of the monsoons, and heavy falls may occur. Throughout the Division, average annual potential evaporation is greater than 2500 mm, so water rarely persists on the land surface.

Plate 18: Cooper Creek in flood, Channel Country, January 1974 – River Basin 2.

Rivers only flow in times of heavy rains. Streams in the Todd and Hay River Basins rise in the MacDonnell Ranges and disappear between sand ridges in the Simpson Desert. In the north-eastern part of the Division, mainly in western Queensland, Cooper Creek and the Diamantina, Georgina and Mulligan Rivers carry very variable summer runoff. After heavy rains, large areas may be inundated due to the flat terrain and the interlacing nature of the channel network. Mostly, however, rivers are either dry or form ribbon-like water holes and natural reservoirs as much as 30 km or more in length. Rains in recent seasons have been particularly heavy, and the Channel Country rivers (River Basins 1, 2 and 3) have flooded, reaching Lake Eyre and filling it to an extent not

previously recorded. The photograph above shows Cooper Creek in flood during January 1974.

Plate 19: Arid country – River Basin 4.

Some surface water is diverted from more or less reliable waterholes in the Todd River and Cooper Creek for stock and domestic purposes, but the main water resource is groundwater from the Great Artesian Basin, which underlies the greater part of the Division. Groundwater from this source is used for stock, domestic and town water supplies. The quality of groundwater from many aquifers is generally good but deteriorates towards the southern and western margins of the basin. Its quantity and good quality have made possible much of what pastoral activity there is in the Division. In the Northern Territory the most significant aquifers are in the sediments of the Georgina and Amadeus basins. Supplies from river alluvium are locally important. Until 1964 Alice Springs depended on groundwater from the alluvium of the Todd River, but now the town's requirements come from deeper aquifers of the Mereenie Sandstone at the north-eastern edge of the Amadeus Basin. Overall, 77 million cubic metres was abstracted from sedimentary aquifers during 1974, accounting for 96 per cent of all groundwater consumption. Yields from the Great Artesian Basin can be sustained with prudent management but poor and infrequent recharge of other aquifers is a major constraint on long term groundwater development in central Australia.

Table X(a)

River basin areas, gauging stations, average annual discharges and salinities

X LAKE EYRE DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 x 10^6$)				Estimated Total Yield ($m^3 x 10^6$)	Average Annual Runoff (mm)	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Georgina River	242 000	0 (a)	10	15	0	730	730	0	730	3	fresh
2. Diamantina River	158 000	96	2	4	1 110	20	1 130	0	1 130	7	fresh
3. Cooper Creek	296 000	97	9	13	470 (b)	20	490	0	490	2	fresh
4. Lake Frome	205 000	0.6	2	2	14	406	340	80	420	2	marginal
5. Finke River	115 000	0.2	9	17	2	248	250	0	250	2	fresh
6. Todd River	71 000	0.6	16	20	2	128	130	0	130	2	fresh
7. Hay River	83 000	0 (a)	8	9	0	110	110	0	110	1	fresh
TOTALS	1 170 000	38	56	80	1 598	1 662	3 180	80	3 260	3	

(a) Short period of record only.
(b) The actual recorded mean for five years is 335 $m^3 \times 10^6$. This figure has been adjusted using rainfall data to give a long term average.

Table X(b)

Range of discharges for selected rivers

X LAKE EYRE DRAINAGE DIVISION River basins	Adopted Drainage Area (km²)	Selected River	Selected Gauging Station				Maximum Discharge as a Percentage of Average (a)			Minimum Discharge as a Percentage of Average (a)		
			Station Name	Area above Gauge (km²)	Record Length (years)	Average Annual Discharge (m^3/sec)	Instan-taneous	Monthly	Annual	Instan-taneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Georgina River	242 000	...	...	...	...	...	...	...	...	...	...	...
2. Diamantina River	158 000	Diamantina	Birdsville	115 200	19	25.3	5 760	2 290	491	0	0	2
3. Cooper Creek	296 000	Cooper Creek	Currareva	150 215	7	82.4	2 630	1 040	223	0	0	0
4. Lake Frome (b)	205 000	...	...	...	...	...	...	...	...	...	...	...
5. Finke River	115 000	...	...	...	...	...	...	...	...	...	...	...
6. Todd River	71 000	Todd	Alice Springs	443	18	0.23	189 000	3 020	293	0	0	0
7. Hay River	83 000	...	...	...	...	...	...	...	...	...	...	...

(a) In total period of gauging station record.
(b) Gauges exist but insufficient data available.

Table X(c)

Salinities of selected rivers

X LAKE EYRE DRAINAGE DIVISION River basins	Adopted Drainage Area (km^2)	Selected River	Selected Gauging Station: Station Name	Selected Gauging Station: Area above Gauge (km^2)	Selected Gauging Station: Average Annual Discharge ($m^3 x 10^6$)	Period of Sampling (years)	Number of Samples	Salinity (mg/l T.D.S.): Weighted Average of Samples	Salinity (mg/l T.D.S.): 10 Percentile of Samples	Salinity (mg/l T.D.S.): 50 Percentile of Samples	Salinity (mg/l T.D.S.): 90 Percentile of Samples
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Georgina River	242 000	Burke	Boulia	15 540	...	4	7	124	112	128	251
2. Diamantina River	158 000	Diamantina	Birdsville	115 205	807	3	7	77	72	104	191
3. Cooper Creek	296 000	Thomson	Stonehenge	88 060	1 798	4	8	40	35	93	205
4. Lake Frome	205 000	...	...	...	...	...	...	...	...	...	...
5. Finke River	115 000	Hugh	Birthday Gap	287	...	...	...	...	...	130	...
6. Todd River	71 000	Todd	Wills Terr.	443	7.32	...	...	...	...	129	...
7. Hay River	83 000	...	...	...	...	...	...	...	...	...	...

Table X(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

X LAKE EYRE DRAINAGE DIVISION River basins *(1)*	*Adopted Drainage Area (km^2)* *(2)*	*Present Annual Commitments* Designed Diversions *(3)*	Storage Evaporation Losses *(4)*	River Losses and Requirements *(5)*	Total *(6)*	*Authorised and Planned Annual Commitments* Proposed Diversions *(7)*	Storage Evaporation Losses *(8)*	River Losses and Requirements *(9)*	Total *(10)*	*Total Commit-ments* *(11)*	*Possible Exploitable Yield* *(12)*	*Estimated Total Yield of Drainage Area* *(13)*
1. Georgina River	242 000	0	0	1	1	0	0	0	0	1	4	730
2. Diamantina River	158 000	0	0	1	1	0	0	0	0	1	90	1 130
3. Cooper Creek	296 000	1	...	5	6	0	0	0	0	6	20	490
4. Lake Frome	205 000	0	0	0	0	0	0	0	0	0	15	340
5. Finke River	115 000	0	0	0	0	0	0	0	0	0	0	250
6. Todd River	71 000	1	...	...	1	0	0	0	0	1	0	130
7. Hay River	83 000	0	0	0	0	0	0	0	0	0	0	110
TOTALS	1 170 000	2	0	7	9	0	0	0	0	9	129	3 180

Table X(e)

Aquifer characteristics

X LAKE EYRE DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type (a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Georgina River	242 000	US (b)	14 500	5–30	2–20	40	40–200	250–10 000
		SR (b)	226 900	20–140	20–300	770	40–2 000	500–14 000
		FR	30 850	10–75	5–40	80	0.5–200	150–14 000
2. Diamantina River	158 000	US	5 000 (c)	5–40	5–15	23	10–20	1 000–4 000
		SR	158 000	180–1 500	60–250	526	20–40 000	300–4 000
		FR	0					
3. Cooper Creek	296 000	US	47 900	5–25	4–20	153	10–130	300–5 000
		SR	278 500	80–1 500	100–250	2 466	50–10 000	400–3 000
		FR	0					
4. Lake Frome	205 000	US	23 500	10–120	0.3–15	1 240	20–350	1 000–15 000
		SR	145 500	45–1 000	0.3–150	453	30–2 000	100–14 000
		FR	50 000	. . .	. . .	657	10–100	1 000–3 000
5. Finke River	115 000	US	3 000	10–30	5–20	370	10–100	500–10 000
		SR	85 000	10–1 500	30–300	338	10–800	500–10 000
		FR	11 000	10–30	5–100	136	10–100	500–5 000
6. Todd River	71 000	US	1 500	5–30	5–20	200	40–400	500–3 000
		SR	47 500	30–1 500	30–300	202	10–5 000	500–14 000
		FR	8 000	10–30	5–20	60	40–200	500–14 000
7. Hay River	83 000	US (d)	1 000	10–30	10–20	20	40–400	500–14 000
		SR (d)	40 000	30–500	10–300	25	40–400	500–14 000
		FR (d)	10 000	10–30	5–20	40	40–400	500–14 000
TOTALS	1 170 000	US	96 400	5–120	2–20	2 050	10–400	250–15 000
		SR	981 400	10–1 500	0.3–300	4 780	10–40 000	300–14 000
		FR	109 900	10–75	0.3–250	970	0.5–400	150–14 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) Figures in Columns (5) and (6) exclude the Eromanga Basin.

(c) Characteristics of the Queensland portion are unknown.

(d) There are no bores in the South Australian part of this river basin.

Groundwater yields

X LAKE EYRE DRAINAGE DIVISION River basins	Aquifer Type (a)	Abstraction During 1974 ($m^3 \times 10^6$)	Estimated Annual Recharge ($m^3 \times 10^6$)	Estimated Possible Annual Yield ($m^3 \times 10^6$) From Recharge < 1000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Total < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Reliability of Estimate (b)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Georgina River	US	0.1	80	80	0	0	0	0	140	0	0	0	0	(iii)
	SR	8.5	390	145	175	70	0	0	590	180	115	0	0	(iii)
	FR	0.6	40	40	0	0	0	0	65	0	0	0	0	
	Total	9.2	510	265	175	70	0	0	795	180	115	0	0	
2. Diamantina River	US		...	...	...	...	...	...	...	...	...	...	...	
	SR	16.5	22.6	13.3	6.8	2.2	0.3	0	70	20	3	0.5	0	(ii)
	Total	16.5	22.6	13.3	6.8	2.2	0.3	0	70	20	3	0.5	0	
3. Cooper Creek	US	0.2	76	45	23	8	0	0	48	27	12	0	0	
	SR	43	46	27.3	13.9	4.5	0.5	0	42	91	17	0	0	
	Total	43	122	72	37	13	0.5	0	90	118	29	0	0	(iii)
4. Lake Frome	US	0.2	1.3	0	0.7	0.005	0.003	0.6	0	110	20	0	113.8	
	SR	1.6	0	0	0	0	0	0	10	86	52	0.6	0	
	FR	0.3	2.0	0	1.9	0.07	0.01	0	0	13	7.2	0	0	
	Total	2.1	3.3	0	2.6	0.08	0.01	0.6	10	209	79	0.6	113.8	(iii)
5. Finke River	US	0.7	5			5			0	32	32	0	0	
	SR	2	50			50			50	160	110	0	0	
	FR	0.2	2			2					4			
	Total	3	57			57					388			(iii)
6. Todd River	US	0.5	5			5			0	9.5	9.5	0	0	
	SR	5.1	50			50			160	80	0	0	0	
	FR	0.2	25			25					40			
	Total	5.8	80			80					299			(iii)
7. Hay River	US	0.1	5			5					15			
	SR	0.2	50			50					240			
	FR	0.2	25			25					40			
	Total	0.5	80			80					295			(iii)
TOTAL	US	1.8	172			172					569			
	SR	77	609			609					2078			
	FR	1.5	94			94					169			
	Total	80	875			875					2816			

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation
(ii) derived from limited investigation
(iii) derived without investigation information

Drainage Division XI - Bulloo-Bancannia

The Division is flat and arid. It drains internally towards the Bulloo River in the north and Lake Bancannia in the south, both of which rarely contain water. The Grey Range in Queensland marks the topographic divide between the Murray-Darling and the Lake Eyre Divisions, so that the Bulloo-Bancannia Division lies within the former. Rainfall is erratic and can fall anytime during the year. Median annual rainfall ranges from 200 to 300 mm across the Division and varies markedly from year to year. Potential evaporation rates are high, exceeding 2000 mm per annum.

Streams are ephemeral, flowing for only short periods after rains. When heavy flood rains occur, large sheets of water lie on the ground and may take weeks to evaporate or percolate underground.

The only town of any size is the small railhead of Quilpie. The only significant industry is pastoral – beef cattle and sheep. More intensive development in the Division probably awaits the the discovery of economic mineral reserves.

The major source of groundwater is the Great Artesian Basin. The Division is underlain by a series of aquifer systems, the deeper ones in the Bulloo River Basin producing good quality groundwater of less than 1000 mg/1 T.D.S. At present the pressure and discharge of artesian bores in the region have virtually stabilised. Upper aquifers in the Lake Bancannia River Basin are more saline and less suitable for stock.

Plate 20: Dry stream bed – River Basin 2.

Table XI(a)

River basin areas, gauging stations, average annual discharges and salinities

XI BULLOO-BANCANNIA DRAINAGE DIVISION	Adopted Drainage Area		Number of Stations		Average Annual Discharge ($m^3 x 10^6$)				Estimated Total Yield ($m^3 x 10^6$)	Average Annual Runoff (mm)	Salinity of Major River
River basins	Total (km^2)	Percent Gauged	Automatic	Total	Gauged Area	Ungauged Area	Fresh and Marginal Water	Brackish and Saline Water			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Bulloo River	78 220	20	2	3	460	0	460	0	460	5.9	fresh
2. Lake Bancannia	22 350	0.1	1	1	0	80	80	0	80	3.6	fresh
TOTALS	100 570	16	3	4	460	80	540	0	540	5.4	

Table XI(b)

Range of discharges for selected rivers

XI BULLOO-BANCANNIA DRAINAGE DIVISION	Adopted Drainage Area (km^2)	Selected River	Selected Gauging Station				Maximum Discharge as a Percentage of Average [(a)]			Minimum Discharge as a Percentage of Average [(a)]		
River basins			Station Name	Area above Gauge (km^2)	Record Length (years)	Average Annual Discharge (m^3/sec)	Instantaneous	Monthly	Annual	Instantaneous	Monthly	Annual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Bulloo River	78 220	Bulloo	Quilpie	15 385	5	8.5	7 360	1 650	225	0	0	50
2. Lake Bancannia	22 350	...	...	...	...	...	...	...	...	...	...	...

(a) In total period of gauging station record.

Table XI(c)

Salinities of selected rivers

XI BULLOO-BANCANNIA DRAINAGE DIVISION River basins	Adopted Drainage Area (km^2)	Selected River	Selected Gauging Station			Period of Sampling (years)	Number of Samples	Salinity (mg/l T.D.S.)			
			Station	Area above Gauge (km^2)	Average Annual Discharge ($m^3 \times 10^6$)			Weighted Average of Samples	10 Percentile of Samples	50 Percentile of Samples	90 Percentile of Samples
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Bulloo River	78 220	Bulloo	Cowra	26 755	...	4	5	58	45	54	65
2. Lake Bancannia	22 350	...	...	...	...	...	...	...	...	...	...

Table XI(d)

Present, authorised and planned annual commitments of fresh and marginal surface water ($m^3 \times 10^6$)

XI BULLOO-BANCANNIA DRAINAGE DIVISION River basins	Adopted Drainage Area (km^2)	Present Annual Commitments				Authorised and Planned Annual Commitments				Total Commit-ments	Possible Exploitable Yield	Estimated Total Yield of Drainage Area
		Designed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total	Proposed Diversions	Storage Evaporation Losses	River Losses and Requirements	Total			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Bulloo River	78 220	0	0	3	3	0	0	0	0	3	...	460
2. Lake Bancannia	22 350	0	0	0	0	0	0	0	0	0	...	80
TOTALS	100 570	0	0	3	3	0	0	0	0	3	...	540

Table XI(e)

Aquifer characteristics

XI BULLOO-BANCANNIA DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type(a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Bulloo River	78 220	US	21 900	5–120	0.3–5	74	5–60	350–14 000
		SR	73 500	50–500	0.3–160	290	30–400	500–7 000
		FR	100	45–90	. . .	5	80–140	1 000–3 000
2. Lake Bancannia	22 350	US	10 200	30–100	0.3–6	80	30–100	2 000–14 000
		SR	16 600	15–250	0.3–10	88	30–300	2 000–7 000
		FR	3 600	9–75	0.3–6	39	20–100	2 000–7 000
TOTALS	100 570	US	32 100	5–120	0.3–6	150	5–100	350–14 000
		SR	90 100	15–500	0.3–160	380	30–400	500–7 000
		FR	3 700	9–90	0.3–6	40	20–140	1 000–7 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

Table XI(f)

Groundwater yields

XI BULLOO-BANCANNIA DRAINAGE DIVISION River basins	Aquifer Type [(a)]	Abstraction During 1974 ($m^3 x 10^6$)	Estimated Annual Recharge ($m^3 x 10^6$)	Estimated Possible Annual Yield ($m^3 x 10^6$) From Recharge < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Total < 1 000 mg/l	1 000–3 000 mg/l	3 000–7 000 mg/l	7 000–14 000 mg/l	> 14 000 mg/l	Reliability of Estimate [(b)]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Bulloo River	US	0.4	15.5	9	4.8	1	0	0.7	10	13.1	1.2	7.8	189.7	(iii)
	SR	14.0	10.8	6.5	3.2	1	0.1	0	42.6	17.6	1.8	0.23	0	(ii)
	Total	14.4	25.3	16	8	2	0.1	0.7	53	30.7	3.0	8.0	189.7	(iii)
2. Lake Bancannia	US	0.4	0.7	0	0.2	0	0.2	0.3	0	28	0	28	99	
	SR	0.4	0	0	0	0	0	0	1.1	31	9.3	0	0	
	FR	0.2	2.2	0	2.1	0.03	0.02	0.05	0	3.7	0.08	0.07	0.6	
	Total	1.0	2.9	0	2.3	0.03	0.2	0.4	1.1	63	9.4	28	100	(iii)
TOTALS	US	0.8	16.5	9	5.0	1	0.2	1.0	10	41	1.2	36	289	
	SR	14.4	10.8	6.5	3.2	1	0.1	0	43.7	49	11.1	0.23	0	
	FR	0.2	2.2	0	2.1	0.03	0.02	0.05	0	3.7	0.08	0.07	0.6	
	Total	15.4	29.5	16	10.3	2	0.3	1.1	54	94	12.4	36	290	

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

Drainage Division XII - Western Plateau

This Division is by far the largest of the Drainage Divisions, comprising 32 per cent of the area of Australia. There is minor pastoral activity on its northern and western fringes, but the main economic activity is mining. This is quite extensive and includes the goldfields of Kalgoorlie, copper mines at Tennant Creek and the nickel mines of Kambalda. As surface water resources of the Division are negligible, water supplies for the Kalgoorlie region are piped from the Mundaring Weir in the South-West Coast Division. For other settlements groundwater is the main source of supply.

Plate 21: East Murchison country – River Basin 4.

Most of the Division is about 450 to 600 m above sea level, but the general continuity is interrupted by several smaller and higher plateaus, ridges and ranges. Many small isolated eminences are scattered over the Plateau, the better known being Ayers Rock, Mount Olga and Mount Connor. These are among the most spectacular natural features of Australia and are popular tourist attractions. Low-lying areas of the Tanami, Gibson, Great Victoria and Sandy Desert as well as the Nullarbor Plain, separate the distinctively higher sections of the Plateau.

Median annual rainfall varies from about 100 to 350 mm across the Division and potential evaporation greatly exceeds rainfall. The north-west and north-east sections are affected by the tropical monsoons, and although rainfall is erratic it generally occurs during the summer months. In the south rainfall may occur in any month. The region is sparsely vegetated with desert grasses, shrubs, and stunted scrubby growth. Shrub cover is sometimes found in flats between extensive dunes. The ephemeral vegetation flashes through its flowering, fruiting and seeding stages after each rainfall and great areas are covered with flowers after local thunderstorms.

The whole Division is essentially an area of unco-ordinated drainage. Streams where they do exist are seldom of any length, disappearing in flat lands or shallow lakes. Many of these lakes are long, narrow and salt encrusted. Water courses only flow after infrequent heavy rains. The absence of surface water is not just due to lack of rainfall. In many places the ground is sandy and porous so that rainfall that does not evaporate is readily lost to infiltration.

No surface water data are available for the Western Plateau Drainage Division. Although automatic gauging stations have been recently installed on Newcastle Creek (River Basin 8) no

flow estimates are as yet available.

Two major areas within this region, the Desert Basin of Western Australia and the Nullarbor Plain, consist of marginal depressions underlain by groundwater basins, both possessing a seaward slope. The Desert Basin has an abundance of blown sands and a porous underlying aquifer. The Sandy Desert region of this basin contains the greater proportion of good quality groundwater reserves in the Division. However possible yields from recharge are low compared to yields available from storage as recharge is mostly by infiltration of infrequent rain.

The other main reservoir of groundwater is in the sedimentary rocks of the Nullarbor Plain. It is highly saline and unsuitable for consumptive use. Much of the surface water of the Nullarbor is conveyed to the groundwater table through solution channels in limestone formations, occasionally giving rise to pockets of fresh water.

Aquifer characteristics

XII WESTERN PLATEAU DRAINAGE DIVISION River basins (1)	Adopted Drainage Area (km²) (2)	Aquifer Type (a) (3)	Area of Aquifer (km²) (4)	Range of Common Depth to Aquifer (m) (5)	Range of Common Thickness of Aquifer (m) (6)	Estimated Number of Bores (1974) (7)	Range of Common Bore Yields (m³/day) (8)	Range of Common T.D.S. (mg/l) (9)
1. Gairdner	200 000	US	2 000	5–20	5–40	3 500	10–30	1 000–10 000
		SR	100 000	10–200	20–50	1 010	10–50	1 000–20 000
		FR	40 000	5–40	10–100	1 128	20–30	7 000–20 000
2. Nullarbor	187 000	US	6 000	...	...	...	...	...
		SR	186 000	10–180	5–120	124	1–20	500–25 000
		FR	1 000	...	...	...	...	...
3. Warburton	356 000	US	5 000 (b)	5–30	5–40	55	10–30	900–20 000
		SR	223 000	10–180	5–120	107	0.1–1 000	500–25 000
		FR	78 000	5–30	10–100	103	5–10	7 000–25 000
4. Salt Lake	505 000	US	...	6–30	5–10	3 600	20–10 000	400–10 000
		SR	143 000	...	...	0	...	...
		FR	362 000	...	...	400	...	1 000–14 000
5. Sandy Desert	397 000	US	200 000	5–25	...	120	5–200	1 000–7 000
		SR	298 000	20–200	100–500	100	5–4 000	600–2 000
		FR	98 000	80–130	...	30	100–250	400–2 500
6. Mackay	396 000	US	20 000 (b)	5–40	5–10	80	40–1 000	100–14 000
		SR	174 000	10–150	5–500	90	40–500	500–6 000
		FR	157 000	10–150	5–20	120	40–200	100–5 000
7. Burt	41 000	US	10 000	10–20	5–10	80	40–300	500–14 000
		SR	15 000	10–40	5–200	50	40–1 000	500–5 000
		FR	10 000	10–30	5–20	50	40–200	500–5 000
8. Wiso	247 000	US	5 000	10–20	5–10	50	40–600	500–5 000
		SR	170 000	10–80	5–50	140	40–400	500–5 000
		FR	10 000	10–20	5–10	80	40–200	500–5 000
9. Barkly	126 000	US	5 000	10–30	10–40	5	40–400	300–14 000
		SR	90 000	40–100	10–100	400	100–400	500–6 000
		FR	4 000	10–20	5–10	10	40–100	1 000–15 000
TOTALS	2 455 000	US	253 000	5–40	5–40	7 490	10–10 000	100–20 000
		SR	1 399 000	10–200	5–500	2 020	0.1–4 000	500–25 000
		FR	760 000	5–150	5–100	1 920	20–250	100–25 000

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) Does not include area of aquifer in Western Australia.

Groundwater yields

XII WESTERN PLATEAU DRAINAGE DIVISION River basins (1)	Aquifer Type(a) (2)	Abstraction During 1974 ($m^3 \times 10^6$) (3)	Estimated Annual Recharge ($m^3 \times 10^6$) (4)	Estimated Possible Annual Yield ($m^3 \times 10^6$) From Recharge < 1 000 mg/l (5)	From Recharge 1 000–3 000 mg/l (6)	From Recharge 3 000–7 000 mg/l (7)	From Recharge 7 000–14 000 mg/l (8)	From Recharge > 14 000 mg/l (9)	Total < 1 000 mg/l (10)	Total 1 000–3 000 mg/l (11)	Total 3 000–7 000 mg/l (12)	Total 7 000–14 000 mg/l (13)	Total > 14 000 mg/l (14)	Reliability of Estimate(b) (15)
1. Gairdner	US	0.30	6	4	1	1	0	0	15	1.3	1.3	0	0	
	SR	0	0	0	0	0	0	0	8	30	0	0	30	
	FR	0.01	0.5	0	0.25	0.25	0	0	0	0.3	0.3	0	0	
	Total	0.31	6.5	4	1.3	1.3	0	0	23	32	1.6	0	30	(iii)
2. Nullarbor	US	0	0.01	0.01	...	...	...	...	0.01	...	...	...	...	
	SR	0.01	50	0.01	...	...	...	50	3	60	1	10	5 200	
	FR	0.01	0.5	0	0.25	0.25	...	...	...	...	...	...	...	
	Total	0.02	51	0.02	0.25	0.25	...	50	3	60	1	10	5 200	(iii)
3. Warburton	US	0.21												
	SR	0	34			34					350			
	FR	0.03												
	Total	0.24	34			34					350			(iii)
4. Salt Lake	US(c)	10	205	100	50	30	15	10	120	70	50	25	...	
	SR	0	20	...	...	...	...	...	...	...	...	...	...	
	FR	0.5	29	10	10	5	2	2	...	...	...	...	...	
	Total	11	254	110	60	35	17	12	120	70	50	25	...	(iii)
5. Sandy Desert	US	...	500	250	250	...	...	...	5 000	5 000	...	...	...	
	SR	5				...	...	...	5 000	5 000	...	...	...	
	FR	0	10	...	...	...	...	...	...	...	...	...	...	
	Total	5	510	250	250	...	...	...	10 000	10 000	...	...	...	(iii)
6. Mackay	US	0.3	40		40			0		105			0	
	SR	0.2	40		40		0	0		500		0	0	
	FR	0.2	25		25		0	0		106		0	0	
	Total	0.7	105		105			0		711			0	(iii)
7. Burt	US	0.4	10		10			0		40			0	
	SR	0.3	15		15		0	0		200		0	0	
	FR	0.2	10		10		0	0		60		0	0	
	Total	0.9	35		35			0		300			0	(iii)
8. Wiso	US	0.1	5		5		0	0		20		0	0	
	SR	1	100		100		0	0		500		0	0	
	FR	0.4	20		20		0	0		40		0	0	
	Total	1.5	125		125		0	0		560		0	0	(iii)
9. Barkly	US	0.05	1		1			0		1			0	
	SR	2	150		150		0	0		600		0	0	
	FR	0.05	10	0	10		0	0	0	20		0	0	
	Total	2.1	161		161			0		621			0	(iii)
TOTALS	US	11	267			267					10 500			
	SR	8.5	909			909					17 500			
	FR	1.4	105			105					227			
	Total	21	1 281			1 281					28 200			

(a) Aquifer type: US - unconsolidated sediments
SR - sedimentary rocks
FR - fractured rocks

(b) (i) derived from reasonable investigation information
(ii) derived from limited investigation information
(iii) derived without investigation information

(c) The most important aquifers are calcretes.

6. COMPARISON OF AUSTRALIAN AND WORLD WATER RESOURCES

The following diagrams and tables show the salient features of Australia's surface water resources compared to those of other countries.

Agriculture is an important sector of the Australian economy but its contribution fluctuates annually as seasonal conditions and export prices change. In the recent good year of 1973/74 it accounted for 9 per cent of total domestic output. Irrigation is important, and the intensive agriculture it supports contributes to decentralisation of Australia's highly urban society. Only 1.8 per cent of Australia's area is actually cultivated, and 9.1 per cent of this is irrigated. As Table 7 shows, this gives Australia among the largest cultivated and irrigated areas per head of population.

Table 7: Areas Under Cultivation and Irrigation in Selected countries

	Total Area (ha x 10^6)	*Area Cultivated (ha x 10^6)*	*Area Irrigated (ha x 10^6)*	*Cultivated Area (ha/head)*	*Irrigated Area (ha/head)*
USSR	2 240	225.5	9.90	0.95	0.042
Canada	998	25.3	0.63	1.22	0.030
China (Mainland)	956	109.4	74.00	0.15	0.101
U.S.A.	936	176.0	16.93	0.87	0.084
Brazil	851	70.0	0.14	0.79	0.002
Australia	768	14.0	1.27	1.16	0.105
India	328	137.9	37.64	0.26	0.071
Argentine	278	27.2	1.15	1.15	0.049
Mexico	196	15.0	3.30	0.32	0.070
United Arab Republic	100	2.9	2.9	0.09	0.090
Venezuela	91	5.2	0.36	0.54	0.037
Burma	67	8.7	0.75	0.33	0.028
Malagasy Republic	60	1.0	0.90	0.15	0.135
France	55	20.0	2.50	0.40	0.050
Thailand	51	7.3	1.90	0.22	0.057
Italy	30	27.5	3.15	0.52	0.060
New Zealand	27	0.8	0.08	0.29	0.029

Source: K.K. Framji & I.K. Mahajan, *Irrigation and Drainage in the World*, 1969, pp cxv - cxviii

Figure 7 shows that in comparison to the major rivers of the world, Australian rivers have low average annual discharges. In fact the total average annual discharge of all Australian streams (343 x 10^9 m^3/annum) is considerably less than the average flow of many large rivers such as the Mississippi and the Ganges.

Figure 8 shows mean and extreme relative monthly discharges (at selected stations) of Australian and world rivers. Rivers north of the tropic of Capricorn exhibit large seasonal variations in their flows due to the occurence of heavy cyclonic and monsoonal rainfall over extensive areas.

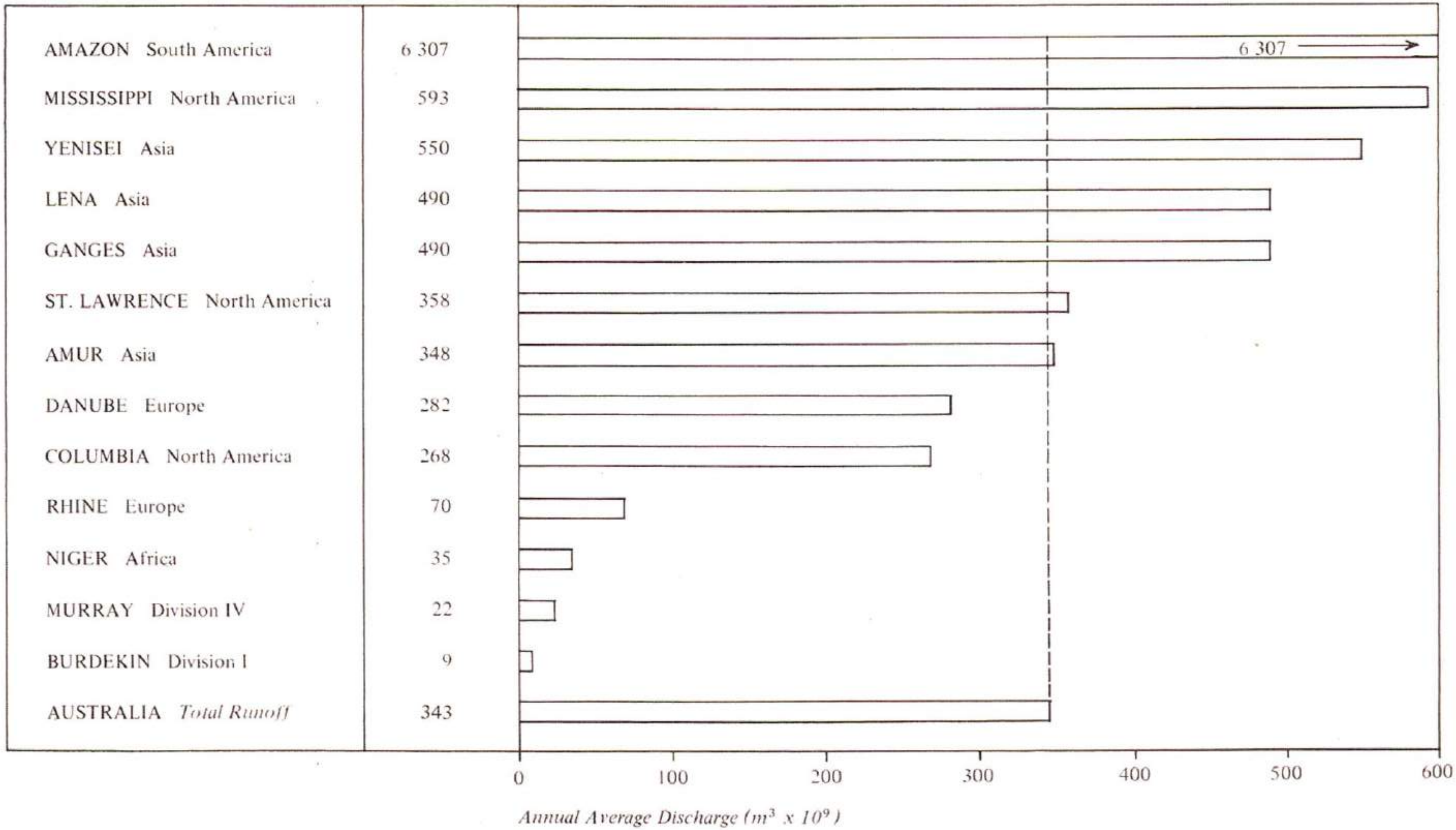


Figure 7: Streamflow and Runoff in Australia compared with Flow in some of the World's Largest Rivers

Source: International data: K. K. Framji & I. K. Mahajan, *Irrigation and Drainage in the World* 1969, pp civ-cx.
Australian data: Australian and State water authorities.

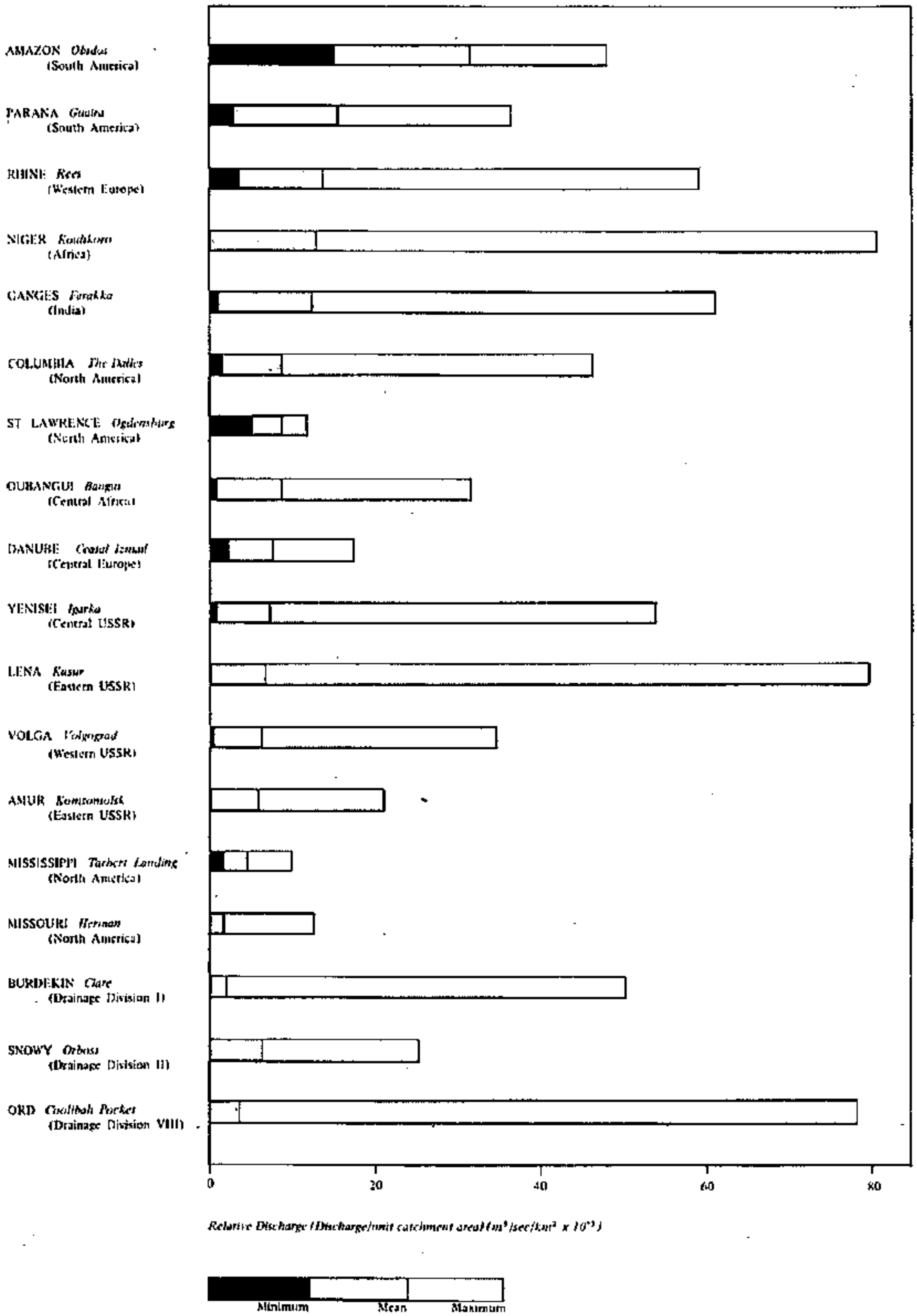


Figure 8: Mean and Extreme Relative Monthly Discharges per Unit of Catchment Area of Rivers at Selected Stations

Source: International data: UNESCO, *Discharge of Selected Rivers of the World.* Vol. III, Part I & II, The Unesco Press, Paris, 1974.
Australian data: Australian and State water authorities.

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APPENDIX

Principal Organisations Responsible for Surface and Groundwater Resources in Australia

Australia's surface and groundwater resources are measured by both Australian and State Government authorities. Most of the measurement programs are undertaken by State authorities.

Measurement, assessment and management of surface and groundwater supplies within the States are the responsibilities of State Government authorities. In a number of States a single authority is responsible for most of both surface and groundwater in the State with other authorities having specific duties for particular functions.

In the Northern Territory and the Australian Capital Territory, Australian Government authorities have similar responsibilities for surface and groundwater. The Bureau of Mineral Resources of the Department of National Resources also undertakes groundwater investigations. Specially-created Australian-State bodies such as the River Murray Commission and the Snowy Mountains Hydro-electric Authority also have assessment and management roles in particular areas.

This section is aimed at assisting readers seeking more detailed information. Public authorities in Australia with activities in the field of water resources are listed below together with a note on their respective responsibilities. Generally, enquiries should be directed to either the Secretary (Departments and Commissions) or the Director (Bureaus) of the authority concerned.

AUSTRALIA

(i) *Bureau of Meteorology: Department of Science, 2 Drummond Street, Carlton, Victoria, 3053.* The Bureau carries out meteorological observations (in particular, rainfall and climatological observations) and forecasting throughout Australia and maintains a network of flood warning stations in flood-prone areas.

(ii) *Bureau of Mineral Resources, Geology and Geophysics: Department of National Resources, Anzac Park East Building, Constitution Avenue, Parkes, Canberra, A.C.T., 2600.* The Bureau carries out groundwater investigations as part of its functions of geological and geophysical surveying.

(iii) *Department of Construction: 17 Yarra Street, Hawthorn, Victoria, 3122.* This Department is responsible for stream gauging work in the Australian Capital Territory and the development and management of town water supplies in the Northern Territory.

(iv) *Water Resources Branch/Mines Branch: Department of the Northern Territory, Darwin, Northern Territory, 5794.* The Water Resources Branch is responsible for the overall assessment, development and control of surface and groundwater resources in the Northern Territory. The Mines Branch assists with geological advice.

(v) *Division of National Mapping, Department of National Resources: P.O. Box 667, Canberra City, A.C.T., 2601.* The Division's function is geological, geophysical and geodetic surveying and the production of topographic maps. It carries out water resources mapping for the Australian Water Resources Council.

(vi) *Australian Water Resources Council, Department of National Resources: P.O. Box 5, Canberra City, A.C.T., 2601.*

NEW SOUTH WALES

(i) *Water Conservation and Irrigation Commission: Ibis House, 201 Miller Street, North Sydney, N.S.W., 2060.* The Commission is responsible for rural water supplies throughout the State and for the measurement, investigation and control of development of surface water and groundwater resources.

(ii) *Metropolitan Water, Sewerage and Drainage Board: Corner Pitt and Bathurst Streets, Sydney, N.S.W., 2000.* The Board is responsible for urban water supplies, sewerage and drainage in the greater Sydney and Wollongong areas. It maintains a number of gauging stations in river basins near Sydney.

(iii) *Department of Public Works: State Office Block, Phillip Street, Sydney, N.S.W., 2000.* The Department administers the provision of country town water supplies and sewerage and undertakes flood mitigration investigations and associated works in many tidal rivers.

(iv) *University of New South Wales: Anzac Parade, Kensington, N.S.W., 2033.* The University maintains a number of small experimental catchments, principally in the Sydney-Wollongong area.

(v) *Department of Mines - Geological Survey of New South Wales: ADC Building, 189 Kent Street, Sydney, N.S.W., 2000.* The Department formerly undertook some investigations and measurement of ground water resources. Its activities connected with water resources now consist of geological mapping and chemical analyses of water samples.

VICTORIA

(i) *State Rivers and Water Supply Commission: 590 Orrong Road, Armadale, Victoria, 3143.* The Commission is the main organisation responsible for the assessment, development and utilisation of surface water resources in Victoria, and itself administers a number of rural and urban water supply systems outside the Melbourne metropolitan area.

(ii) *State Electricity Commission of Victoria: 15 William Street, Melbourne, Victoria, 3000.* The Commission's main function is to supply electric power to Victoria. As part of this function it maintains a small number of gauging stations on the upper reaches of various rivers with headwaters in the Central Highlands of Victoria.

(iii) *Melbourne and Metropolitan Board of Works: 625 Little Collins Street, Melbourne, Victoria, 3000.* The Board is responsible for water supplies in the Melbourne metropolitan area and the assessment of water resources and water quality aspects of present and potential sources of supply. It maintains gauging and water quality stations on the Yarra, Upper Thomson and Aberfeldy Rivers, and two tributaries of the Goulburn River. The Board also maintains 17 small forest hydrology research catchments.

(iv) *Latrobe Valley Water and Sewerage Board: 7 Seymour Street, Traralgon, Victoria, 3844.* The Board is responsible for water supplies to towns in the Latrobe Valley. It maintains a number of stream gauging stations, most of which are located on the Latrobe River and its tributaries.

(v) *Soil Conservation Authority of Victoria: 378 Cotham Road, Kew, Victoria, 3101.* The Authority gauges approximately twenty small catchments ranging in area from about 1 to 500 ha. These catchments are used for research purposes.

(vi) *Department of Mines - Geological Survey of Victoria: 107 Russell Street, Melbourne, Victoria, 3000.* The Department is responsible for the location, investigation, development and utilisation of groundwater throughout the State.

QUEENSLAND

(i) *Irrigation and Water Supply Commission: George and Margaret Streets, Brisbane, Queensland, 4000.* The Commission has major responsibility for the overall allocation of the State's water resources. It has the duties of measurement, assessment, development and management of the State's surface and underground water supplies, and in the case of the latter, receives assistance from the investigation programs of the Department of Mines.

(ii) *Department of Mines - Geological Survey of Queensland: 2 Edward Street, Brisbane, Queensland, 4000.* The Department undertakes field investigations and measurements of the groundwater resources of Queensland in association with the Irrigation Commission.

(iii) *Brisbane City Council: City Hall, King George Square, Brisbane, Queensland, 4000.* The Council is responsible for water supplies to the Brisbane metropolitan area.

(v) *Department of Local Government: Old Treasury Building, Queen Street, Brisbane, Queensland, 4000.* The Department oversees local authority water supply undertakings, and arranges investigations of water supplies for local authorities. The Water Quality Council of Queensland is established within this Department.

TASMANIA

(i) *Rivers and Water Supply Commission: Marine Board Building, 1 Franklin Wharf, Hobart, Tasmania, 7000.* The Commission exercises general control over the utilisation of Tasmania's water resources and is one of two authorities responsible for carrying out stream gaugings in the State.

(ii) *Hydro-Electric Commission: 16 Elizabeth Street, Hobart, Tasmania, 7000.* The Commission's principal functions are to generate and supply electricity to Tasmanian consumers. As part of this function, the Commission maintains and operates an extensive stream gauging network and is responsible for the operation of most major dams and reservoirs in the State.

(iii) *Department of Mines - Geological Survey of Tasmania: Davey Street, Hobart, Tasmania, 7000.* The Department is responsible for investigation and measurement of groundwater resources in Tasmania.

SOUTH AUSTRALIA

(i) *Engineering and Water Supply Department: State Administration Centre, Victoria Square, Adelaide, South Australia, 5000.* The Department is responsible for all stream gauging work and for the investigation, development and management of water resources in South Australia.

(ii) *Department of Mines: 169 Rundle Street, South Australia, 5000.* The Department is responsible for investigation and measurement of groundwater resources in South Australia.

WESTERN AUSTRALIA

(i) *Public Works Department: 2 Havelock Street, West Perth, Western Australia, 6005.* The Department is responsible for the development of both surface and groundwater resources in the greater part of the State. It carries out virtually all stream gauging in the State, and some groundwater investigation.

(ii) *Metropolitan Water Supply, Sewerage and Drainage Board: 2 Havelock Street, West Perth, Western Australia, 6005.* The Board is responsible for water supplies to the Perth metropolitan area. It carries out underground water investigations, but relies on the Public Works Department for stream gauging.

(iii) *Department of Mines - Geological Survey of Western Australia: 66 Adelaide Terrace, Perth, Western Australia, 6000.* The Department is responsible for the investigation and assessment of the State's groundwater resources. It also advises on groundwater problems.

OTHER AUTHORITIES

(i) *Snowy Mountains Hydro-Electric Authority: Cooma North, N.S.W., 2629.* The Authority's principal functions are the construction, maintenance and operation of works for the collection, storage and diversion of water and the generation of hydro-electric power. The Authority established an intensive stream gauging network in the Snowy Mountains area, but most gaugings have now been discontinued.

(ii) *River Murray Commission: P.O. Box 409, Canberra City, A.C.T., 2601.* The Commission's function is to ensure the equitable use of the waters of the River Murray and its tributaries above Albury, for irrigation, water supply and navigation. The Victorian, New South Wales and South Australian Governments carry out gaugings on behalf of the Commission at stations established under the Commission's direction.

(iii) *Commonwealth Scientific and Industrial Research Organisation: (Head Office), Limestone Avenue, Campbell, A.C.T., 2601.* The CSIRO maintains gauging stations on 17 experimental catchments for research purposes and through its Division of Land Use Research, carries out research in many areas of hydrology and water resources. In addition the Division of Forestry Research maintains twelve gauging stations on the tributaries of the Murrumbidge River.

AUSTRALIAN WATER RESOURCES COUNCIL

c/o DEPARTMENT OF NATIONAL RESOURCES
Postal Address: P.O. Box 5, Canberra, A.C.T. 2600
Telephone: 474611 *Telex:* 62101

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Circular

REVIEW OF AUSTRALIA'S WATER RESOURCES 1975

This publication presents the results of the second national assessment of water resources undertaken by the Australian Water Resources Council. The results of the previous assessment were published in 1965 as Review of Australia's Water Resources (Streamflow and Underground Resources) 1963. The latest review represents the increase in knowledge obtained as a result of the national water resources assessment program undertaken jointly by the Commonwealth and State governments since 1964.

Copies of the publication are being distributed to the libraries of major water organisations and institutions, both within Australia and overseas. In addition, copies will be sent to members of AWRC technical committees and to major local government libraries. This represents a distribution of approximately 900 copies in Australia and 200 overseas. Copies will be available for sale at $12.95 from all Australian Government Publishing Service bookshops in early March 1977 or from:

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(Alan Hatfield)
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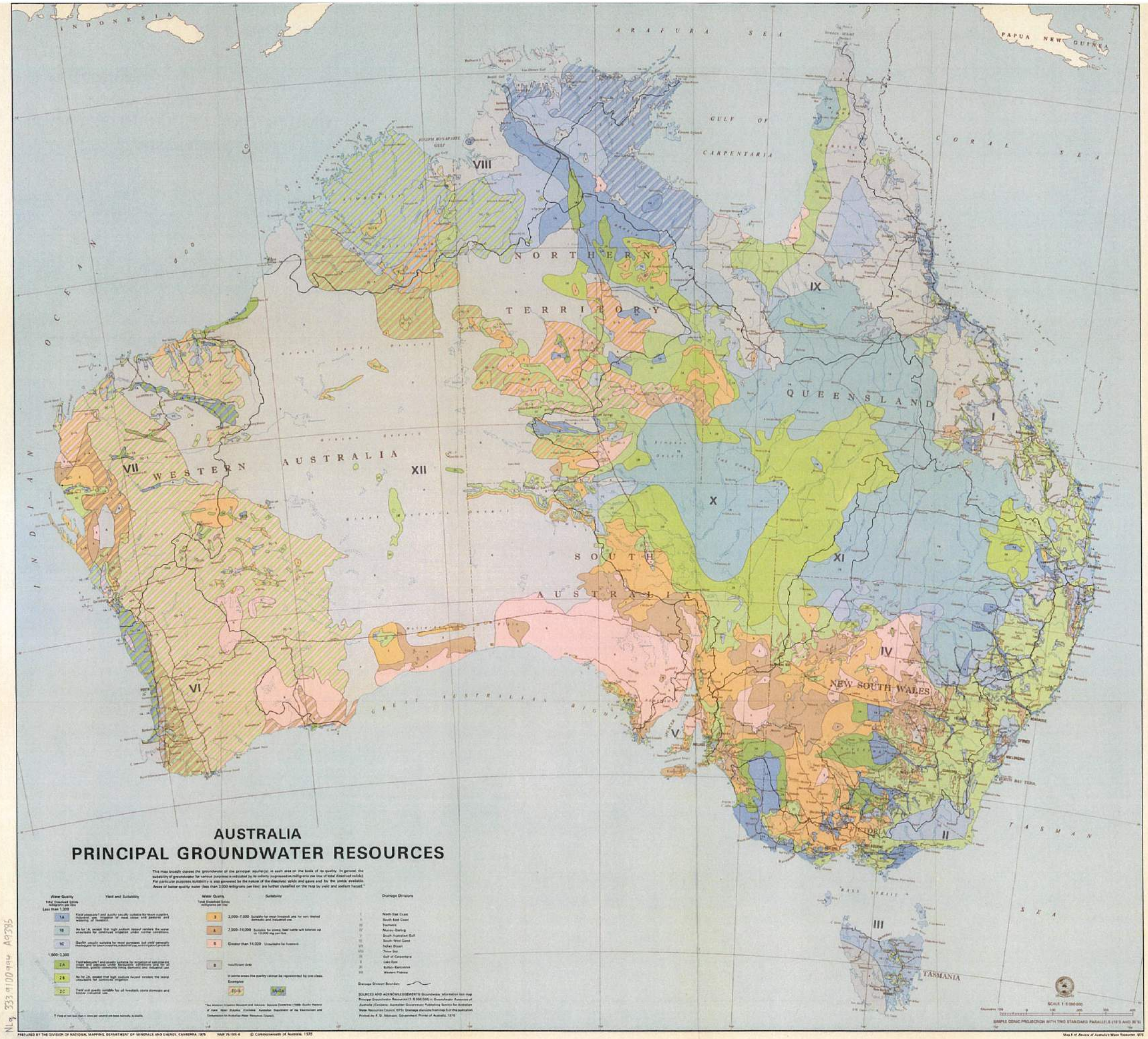
AUSTRALIA
PRINCIPAL GROUNDWATER RESOURCES
INDONESIA
ARAFURA SEA
PAPUA NEW GUINEA
GULF OF CARPENTARIA
CORAL SEA
INDIAN OCEAN
NORTHERN TERRITORY
QUEENSLAND
WESTERN AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
VICTORIA
TASMANIA
TASMAN SEA
GREAT AUSTRALIAN BIGHT
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
Water Quality
Yield and Suitability
Less than 1,000
1A
1B
1C
1,000–3,000
2A
2B
2C
Suitability
3
3,000–7,000
4
7,000–14,000
5
Greater than 14,000
Drainage Divisions
Drainage Division Boundary
Examples
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AUSTRALIA
DRAINAGE DIVISIONS AND BASINS