

GEOGRAPHY

CONSERVATION AND THE ENVIRONMENT

Department of Conservation, Forests and Lands

Organisation

Significant organisational changes relating to conservation and the environment were initiated by the Victorian Government in 1982. A ministerial review team was commissioned to report on the functions of four departments — the Ministry for Planning, the Ministry for Conservation, the Forests Commission, and the Department of Crown Lands and Survey.

After a year of intensive inquiry a decision was made to form two new departments from the individual existing agencies. The Department of Conservation, Forests and Lands would primarily involve administration and management of public lands and provision of services to private lands, while the role of the Ministry for Planning and Environment would primarily involve planning and regulation of land-use.

The agencies re-aligned to form the Department of Conservation, Forests and Lands comprised the Ministry for Conservation and a number of its agencies (namely the National Parks Service, Fisheries and Wildlife Division, and the Soil Conservation Authority), the Forests Commission, and the Department of Crown Lands and Survey (including its Division of Vermin and Noxious Weeds Destruction, Survey and Mapping, Crown Land Management, the National Herbarium, and the Royal Botanic Gardens).

The Environment Protection Authority, Land Conservation Council, Victoria Archaeological Survey, and a number of other units, formerly part of the Ministry for Conservation, were transferred to the new Ministry for Planning and Environment in July 1983 as part of the overall realignment of responsibilities.

Perhaps the most significant change resulting from the formation of the Department of Conservation, Forests and Lands is the integration of many formerly separate agencies and their functions into one cohesive new organisation. A primary role of this new department is to manage Victoria's public land (including national parks, State forests, wildlife reserves, and other Crown lands) for both present and possible future uses to ensure that its living resources — terrestrial, aquatic, and marine — are managed and utilised properly. It also has the important role of caring for the State's water catchments, assisting landholders to protect private land by conserving soil, fauna and flora, and general amenity.

The new department is divided structurally into eight divisions, namely the National Parks Service, State Forests and Lands Service, Fisheries and Wildlife Service, Land Protection Service, Regional Management Division, Corporate Services, Economics, and Policy Co-ordination and Strategy.

At the head of this organisation is the Minister for Conservation, Forests and Lands who is advised by the Director-General of the Department and his staff. The Minister also receives advice on matters relating to the Department's responsibility from a network of community advisory groups. Through the Minister, the Department provides a central focus of advice to the Victorian Government on a wide range of conservation and environmental matters.

From an operations point of view the hub of the organisation is the Regional Management Division which is responsible for the implementation and control of programmes in each of the Department's eighteen regions, which cover Victoria. Development of policy options and programmes and provision of technical and other services are provided by the Department's eight other head office divisions.

Each of the Department's eighteen regions has considerable autonomy to carry out the Department's work, and the major services provided by each include:

- (1) fire prevention and suppression on all public land and on adjacent private land;
- (2) management of State forests in accordance with a multiple use policy and the sustained production of timber and other forest produce;
- (3) management of a variety of Crown land reserves, river and stream frontages, and unused roads;
- (4) management of uncommitted Crown land;
- (5) assessment and inventory of land and its resources;
- (6) development and maintenance of national parks, other parks, and reserves;
- (7) identification and management of historic places;
- (8) conservation and management of fish and wildlife resources and their use for recreational purposes;
- (9) conservation and protection of natural environments including wildlife habitat, flora, areas of scientific interest, and landscapes;
- (10) control of vermin, noxious weeds, pests, and diseases;
- (11) prevention and control of soil erosion;
- (12) promotion of urban and rural tree growing;
- (13) appropriate management of proclaimed water supply catchments;
- (14) development and efficient use of farm water supplies;
- (15) liaison with rural industry advisory groups, community interest groups, trustees, and local government authorities;
- (16) liaison with and direction of the work of committees of management;
- (17) interpretation, advisory, and extension services;
- (18) enforcement of regulations;
- (19) issue of licences and leases for the private use of public land and the keeping of wildlife;
- (20) issue of recreational fishing and hunting licences;
- (21) advice on land purchase and sale of Crown land; and
- (22) sale of weedicides, maps, literature, and hire of equipment.

Legislation

The Acts of Parliament which are administered by the Minister of Conservation, Forests and Lands are as follows: *Aboriginal Lands Act 1970*, *Crown Land (Reserves) Act 1978*, *Director-General of Conservation, Forests and Lands Act 1983*, *Fences Act 1968*, sections of the *Fisheries Act 1968*, *Forests Act 1958*, *Forests (Australian Newsprint Mills Limited) Act 1980*, *Forests (Bowater-Scott Agreement) Act 1971*, *Forests (Pulpwood Agreement) Act 1959*, *Forests (Softwood Holdings Agreement) Act 1975*, *Forests (Softwood Timber Agreement) Act 1969*, *Forests (Wood Pulp Agreement) Act 1961*, *Land Act 1958*, *Land Conservation (Vehicle Control) Act 1972*, *Melbourne Cricket Ground Act 1933*, *Mt Hotham Alpine Resort Act 1972*, *National Parks Act 1975*, *Reference Areas Act 1978*, *Shrine of Remembrance Act 1978*, *Soil Conservation and Land Utilization Act 1958*, *Temperance Halls Act 1958*, *Vermin and Noxious Weeds Act 1958*, *Victorian Institute of Marine Sciences Act 1974*, *Wild Flowers and Native Plants Protection Act 1958*, *Wildlife Act 1975*, *Wire Netting Act 1958*, and *Zoological Parks and Gardens Act 1967*.

As part of the reorganisation of the Department the above legislation is being reviewed to determine statutory changes that are needed to streamline the operations of the new Department.

Statistics

The total expenditure of the Department for 1983-84 was \$157.5m, while revenue received was \$66.7m. During this period, management of Victoria's public land and its associated resources, and provision of services to private lands was carried out by a staff of 4,600 to 5,100 (seasonal variation) from 150 offices and 350 depots and workshops throughout Victoria.

Environment Protection Authority

The Environment Protection Authority, constituted under the *Environment Protection Act 1970*, is a pollution control agency responsible for protecting and improving the air, land, and water environments, and for controlling noise. The Environment Protection Review Act, passed in May 1984, gave the Authority wider powers to prevent and control pollution. Major features of this Act included the introduction of a works approvals system and the licensing of scheduled premises rather than individual discharges. The Authority was also re-constituted as a one-member rather than a

three-member Authority. Approximately 220 staff work in the Authority, which became part of the new Ministry for Planning and Environment on 1 September 1983.

REVENUE AND EXPENDITURE OF THE DEPARTMENT OF CONSERVATION, FORESTS AND LANDS, VICTORIA

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Particulars	1982-83	1983-84
REVENUE		
Department and agencies	48,989,439	66,746,807
EXPENDITURE		
Consolidated Fund —		
Central Administration Division	108,427,052	111,185,875
Survey	8,552,963	9,431,028
Royal Botanic Gardens	2,578,832	2,832,056
Port Phillip Authority	507,978	130,962
Soil Conservation Authority	7,018,321	7,454,014
Fisheries and Wildlife	11,219,071	12,949,907
Ministry for Conservation, Forests and Lands	..	182,388
Trust Fund —		
State Trust Account	4,100,471	8,950,638
Commonwealth Trust Account	6,036,963	4,368,019
Total payments	148,441,651	157,484,887

Major activities centre on assessment and management of air and water quality, wastes on land, and waste control systems. The Authority is also concerned with environmental noise issues, in particular industrial, traffic, and entertainment noise. Control mechanisms include licensing, pollution abatement notices, noise control notices, and works approvals.

Environmental planning is achieved through State environment protection policies which are developed by the Authority in draft form, issued for public review, and recommended to the Victorian Government for declaration. These policies set environmental objectives and provide the statutory framework for pollution control. At March 1985, Victoria had ten policies covering several water environments, air, and industrial noise. Four additional water policies were in various stages of completion. Declared policies cover Port Phillip Bay, Western Port Bay, the LaTrobe River catchment, Western District lakes, Lake Colac and catchment, Lake Burrumbeet and catchment, the Yarra River and its tributaries, the waters of far East Gippsland, the Victorian air environment, and noise from industrial, commercial, and trade premises in the Melbourne metropolitan area.

Further reference: Victorian Archaeological Survey, *Victorian Year Book* 1983, p.29

Land Conservation Council

Increasing concern throughout the 1960s regarding the management of Victoria's natural resources culminated in the 1969 controversy over land-use in the Little Desert. This controversy resulted in the proclamation of the *Land Conservation Act* 1970* which established the Land Conservation Council in February 1971 to replace the Land Utilization Advisory Council originally formed in 1950.

The Council consists of thirteen members and comprises an independent chairman; the chairman of the Soil Conservation Authority (who is also the deputy chairman); the heads of government agencies concerned with agriculture, water resources, and minerals and energy; four representatives from the Department of Conservation, Forests and Lands (including the permanent head); and four members appointed by the Governor in Council, of which two have experience in conservation, one in industry and commerce, and one in primary production. The two members with experience in conservation are selected from a panel of names submitted by the Conservation Council of Victoria.

The primary function of the Council is to carry out investigations and make recommendations to the Minister for Planning and Environment on the balanced use of public land in Victoria. The *Land Conservation Act* 1970 requires that the Council must take into account the present and future needs of the people of Victoria in relation to:

- (1) preservation of ecologically significant areas;

*The administration of the *Land Conservation Act* 1970 passed from the Minister for Conservation to the Minister for Planning and Environment in September 1983.

- (2) conservation of areas of natural interest, beauty, or historical interest;
- (3) creation and preservation of areas of reserved forest, areas for leisure and recreation, and reserves for the conservation of fish and wildlife;
- (4) preservation of species of native plants; and
- (5) land required by government departments and public authorities in order to carry out their functions.

For this purpose the Council has divided Victoria into seventeen study areas and has submitted final recommendations on land-use to the Victorian Government for fifteen of these areas, while the Murray Valley and Wimmera areas are currently being investigated. A map of these study areas can be found on page 39 of this *Year Book*.

The Council has also been directed by the Victorian Government to carry out special investigations of areas of public land in accordance with the provisions of section 8 of the *Land Conservation Act* 1970. The five so far conducted have been the Stradbroke area, situated in the South Gippsland District 1 area; Gelliondale, within the South Gippsland District 2 area; the Ovens Softwood Plantation Zone in north-eastern Victoria; the Hill End area within the Melbourne area; and the Alpine area. Final recommendations have been published for all these investigations. In addition, the Council has completed a review of the South-Western District 1 area; is currently reviewing the North-Eastern (Benalla-Upper Murray) area, and the East Gippsland area; and has commenced a review of that portion of the Melbourne area located west of the Hume Freeway, including Port Phillip Bay.

Over a period of fourteen years, one important effect of the Council's recommendations has been the substantial increase in the area of Victoria permanently reserved for conservation purposes and this has been achieved mainly through a system of national and State parks dedicated for conservation, recreation, and education purposes. The Council has also established other categories of land-use primarily for conservation, or low intensity recreation or education. These include reference areas, wilderness areas, marine reserves, natural features and scenic reserves, flora reserves, flora and fauna reserves, bushland reserves, coastal reserves, river, stream and lake reserves, education areas, and historic areas.

In February 1971, there were twenty-two national parks in Victoria covering some 196,000 hectares, 0.86 per cent of the State. Since that time, the Land Conservation Council has investigated most of Victoria's public land and, as a result of its recommendations, many of the existing parks have been enlarged, new parks have been created, and two wilderness areas established. The table on page 38 shows the land-use categories recommended by the Land Conservation Council and the areas of public land the Council has proposed should be set aside in each. It includes recommendations for fifteen of the seventeen areas and districts into which the State has been divided. Special investigations required by the Victorian Government and reviews have also been incorporated. The areas investigated include some eighty-six per cent of the area of the State. Of the approximately 3,800 recommendations considered by the Victorian Government, all but some sixty have been approved for implementation by the relevant government bodies.

As well as its role in preserving areas of special conservation significance, the Council has a responsibility to ensure that sufficient natural resources are available to meet the current and future needs of the community. One of the most important resources affected by the Council's recommendations is timber. Throughout rural Victoria the timber industry is an integral and often principal component of the total regional economy and many rural communities rely heavily on the timber industry for their economic viability.

In the past, areas not included in parks or set aside in various reserves have been designated as either areas for timber production or as uncommitted land. This tended to reinforce the belief that the State's commercially productive hardwood forest was entirely located within hardwood production areas and that timber production was the sole object of management. In making its recommendations for the special investigation of the Alpine area, the Council has proposed that there be a single class of land termed 'State forest', comprising land formerly designated either uncommitted or hardwood production. To ensure that values in State forest other than timber production are protected adequately, the Council has published principles for forest management, covering soil conservation and catchment protection, recreation and aesthetics, nature conservation, and historic sites. In addition to the designation of areas as State forest, the Council has also allocated large tracts in some study areas for softwood production.

The Council has also recommended smaller areas for agriculture, mining, and public utilities.

RECOMMENDED PUBLIC LAND USE, VICTORIA, 31 DECEMBER 1984

Land-use category	Area in portion of State investigated '000 hectares	Percentage (a)	
		State	Crown land
National parks (b)	1,189	5.2	13.5
State parks	308	1.3	3.5
Regional parks	66	0.3	0.8
Coastal parks (c)	42	0.2	0.5
Multi-purpose parks	59	0.3	0.7
Reference areas	77	0.3	0.9
Wilderness	153	0.7	1.7
Flora, and flora and fauna reserves	78	0.3	0.9
Wildlife	87	0.4	1.0
Natural features and scenic reserves (d)	66	0.3	0.7
Education	16	<0.1	0.2
Historic areas and reserves	40	0.2	0.5
Streamside reserves	4	<0.1	<0.1
Lake reserves	81	0.4	0.9
Marine parks	53	0.2	0.6
State forest (e)	4,450	19.5	50.6
Softwoods (f)	106	0.5	1.2
Agriculture	96	0.4	1.1
Minerals and stone (g)	7	<0.1	<0.1
Miscellaneous services and utilities (g)	49	0.2	0.6
Water production (g)	190	0.8	2.2

(a) Percentages in the table do not add to 100 per cent as two study areas are not included and substantial areas — such as road reserves, water frontages, land in townships, land held under perpetual lease, coastal reserves, etc. — have been included only in part. Area totals have been rounded to the nearest 1,000 hectares.

(b) The park categories reflect the Council's recommendations with the exceptions that Lind, Alfred, and The Lakes national parks are included.

(c) Includes Gippsland Lakes reserves.

(d) Includes caves, and geological and bushland reserves.

(e) The Council has recommended that in future uncommitted land and reserved forest, except that used for softwood production, be reserved as a single land-use category known as State forest.

(f) Estimate of net area planted or recommended to be planted. The Council has indicated a further 23,000 hectares net of uncommitted land could be used, should the Victorian Government decide further areas of forested public land are required.

(g) Substantial areas used for these and other miscellaneous purposes are not included.

Land Protection Service

The Land Protection Service of the Department of Conservation, Forests and Lands is responsible for the prevention and mitigation of soil erosion; the promotion of soil conservation; the determination of matters relevant to the use of all land, including Crown land, in such a manner as to achieve the above objectives; and the promotion of efficiency in the use and development by landholders of the water resources available to them.

Working through committees of management, the Service provides advice and financial assistance for control of erosion on the 1,600 kilometres of Victoria's coastal foreshores. Responsibility for supervisory control of earthworks and grazing on land over 1,200 metres elevation has the aim of minimising erosion in Victoria's valuable alpine snowfields and water catchment areas.

To achieve these aims, the Service carries out a variety of tasks. It gives technical advice to individual landholders, local government organisations, and other government departments on the prevention and control of wind and water erosion and soil salting. It provides a service to farmers on the siting, design, and survey of dams and pipeline water supply systems for stock and domestic purposes and outside irrigation areas, and it advises farmers on irrigation development.

In the catchments to town water supplies and major storages, the Service has responsibilities for determining land-use which will ensure the continuous production of high quality water.

Many of the above activities demand continuous research. Data on land, including geology, soil, topography, vegetation, and climatic characteristics, are being documented by the Service on a State wide basis. These data are used to assess the capability of land for various uses. Planning authorities are major users of this information.

The Service carries out studies into water movement and water yield in pastured and forested catchments, as well as laboratory studies into a variety of soil characteristics related to its structural or agronomic qualities. Field operations are also supported by agronomic research into the prevention and control of erosion.

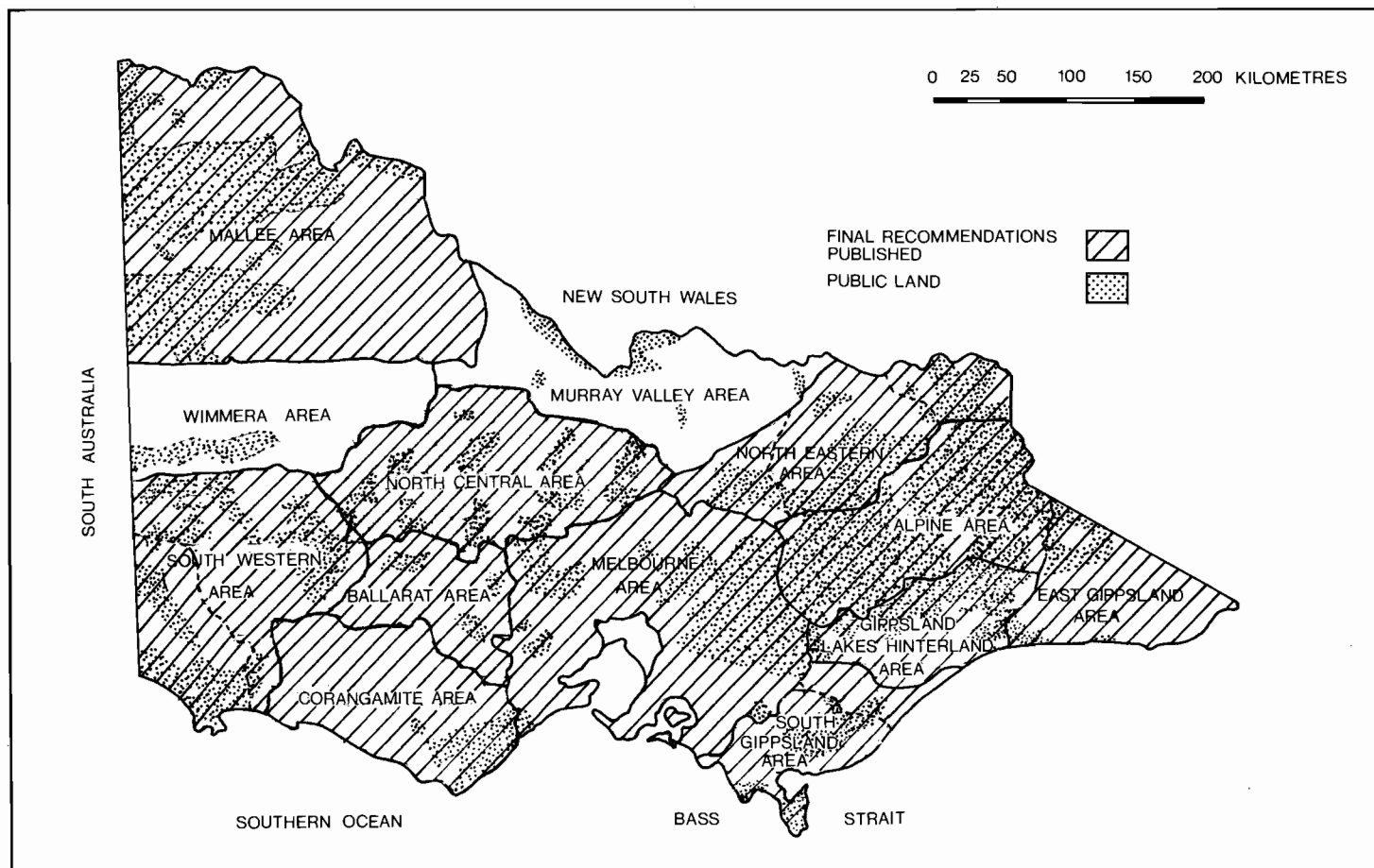


FIGURE14. Land Conservation Council study areas, Victoria.

In seeking to make the community aware of the problems associated with soil erosion and what can be done to check them, the Service encourages and conducts educational excursions for schools, universities, and colleges; appraises the economics of soil conservation and land-use practices; and organises field days, competitions, and exhibits for farmers. As a further service, in association with the Victorian Education Department, the Service prepares teacher and class project materials and guides for field excursions on soil conservation matters related to secondary school syllabuses.

The Service provides assistance to encourage landholders to participate in approved erosion control schemes and to adopt soil conservation management practices. Grants are provided towards the cost of approved works and long-term loans are provided for extensive soil and water conservation programmes.

Further references: Destruction of vermin and noxious weeds, *Victorian Year Book* 1963, pp. 491-2; Soil, land-use, and ecological surveys, 1966, pp. 465-6; Group conservation, 1969, pp. 295-6; Port Phillip Bay Environmental Study, 1975, pp. 48-50, p. 382; Westernport Bay Environmental Study, 1975, pp. 50-1; Gippsland Lakes Environmental Study, 1975, p. 51; 1981, pp. 33-4; Land Utilization Advisory Council, 1975, pp. 288-9; 1978, pp. 41-3; Dryland farming and land restoration, 1979, pp. 31-2; Dryland salting in Victoria, 1980, pp. 42-3; Port Phillip Authority, 1983, pp. 33-4

National Parks Service

Over 1.15 million hectares of land in Victoria, or about 5 per cent of the State's total area, is managed as national parks and other parks. The National Parks Service manages various types of parks and reserves under the provisions of the *National Parks Act* 1975.

National parks

In defining national parks, the Act provides: 'that certain Crown land characterised by its predominantly unspoilt landscape, and its flora, fauna or other features, should be preserved and protected permanently for the benefit of the public'.

At 1 July 1984, the area reserved as national parks under Schedule Two of the National Parks Act was 853,421 hectares, compared with 685,808 hectares at 1 July 1983.

Other parks

The Act provides: 'that certain areas of Crown land with landscape or other features of particular interest or suitability for the enjoyment, recreation, and education of the public or in matters appertaining to the countryside should be reserved permanently and made available for the benefit of the public and in particular that there should be so reserved and made available:

- (a) areas with scenic, historical, archaeological, biological, geological or other features of scientific interest that are worthy of preservation but, whether by reason of the limited size of the areas or the limited significance of the features, are not suitable for reservation as national parks;
- (b) areas that demonstrate man's effect on his environment whether through his agricultural or pastoral pursuits or otherwise;
- (c) areas in or adjacent to urban areas of natural beauty or interest or otherwise suitable for recreational use;
- (d) areas of natural beauty or interest primarily for recreational and educational use but parts of which may be used for primary industry, hunting, shooting, fishing or other uses appropriate to the area; and
- (e) areas in their natural state for scientific study or reference'.

At 1 July 1984, the area reserved as other parks under Schedule Three of the National Parks Act totalled 298,600 hectares, compared with 298,080 hectares at 1 July 1983. The National Parks Service also manages 934 hectares under arrangements with other authorities or special provisions of the National Parks Act.

Areas for which Ministerial direction to manage has been received include the Cassilis Historic Area (3,620 hectares), Victoria Falls Historic Area (100 hectares), Oriental Claims Historic Area (40 hectares), Walhalla Historic Area (2,500 hectares), and the Lake Condah Mission Site (49 hectares).

Grampians National Park

The Grampians was dedicated as a national park on 1 July 1984. With an area of 167,000 hectares, this is the State's largest national park. Grampians National Park is in central western Victoria, about 260 kilometres by road northwest of Melbourne. The park stretches 85 kilometres north-south, and is 45 kilometres across at its widest point. The Grampians are a series of parallel ranges running mostly north-south and rising abruptly above the surrounding plains. Much of the park consists of tilted sandstone layers, which create the rugged scenery for which the Grampians are famous.

It is the importance of conservation and recreation values in the Grampians which prompted the Victorian Government to declare the area a national park. It supports a very rich and diverse flora,

including 18 endemic plant species that do not occur elsewhere in Australia, an additional five species listed as rare or endangered, and many other species of interstate occurrence not found elsewhere in Victoria.

The diverse vegetation also provides habitats for many species of wildlife. The importance of the park for wildlife is illustrated by the proportion of Victoria's known species that are represented — birds (43 per cent), mammals (34 per cent), amphibians (34 per cent), reptiles (28 per cent), and freshwater fish (20 per cent). Four mammal, four reptile, and eight bird species recorded in the park are considered to be threatened, rare, or requiring careful monitoring.

Recreation is the major use of the Grampians in terms of the number of people who benefit directly. The area provides for a wide variety of recreational activities. An estimated 1.3 million visitor-days (mainly visitors from western Victoria, Melbourne, and eastern South Australia) were recorded for the Grampians in 1982-83. The number of visitors per year appears to be increasing at an average rate of 11 per cent.

The archaeological value of the area includes rock art and artefacts. The Grampians rock art sites, including some sixty sites in the national park, are the most significant record of Aboriginal art and

AREAS UNDER THE CONTROL OF THE NATIONAL PARKS SERVICE,
VICTORIA, AT 1 JULY 1984
(hectares)

National parks	Area	Other parks and reserves (a)	Area
Under Schedule Two —		Under Schedule Three —	
1. Alfred	2,300	1. Beechworth H.P.	1,130
2. Baw Baw	13,300	2. Big Desert Wilderness	113,500
3. Bogong	81,200	3. Cape Nelson S.P.	210
4. Brisbane Ranges	7,485	4. Cape Schanck C.P.	1,080
5. Bulga	80	5. Cathedral Range S.P.	3,577
6. Burrowa-Pine Mountain	17,600	6. Chiltern S.P.	4,255
7. Churchill	193	7. Coopracambra S.P.	14,500
8. Croajingalong	86,000	8. Discovery Bay C.P.	8,530
9. Fern Tree Gully	469	9. Eildon S.P.	24,000
10. Fraser	3,750	10. Gellibrand Hill P.	(b) 645
11. Glenaladale	183	11. Gippsland Lakes C.P.	16,500
12. Grampians	167,000	12. Haining Farm	66
13. Hattah-Kulkyne	48,000	13. Holey Plains S.P.	10,450
14. Kinglake	11,390	14. Lake Albacutya P.	10,700
15. The Lakes	2,390	15. Lysterfield P.	1,151
16. Lind	1,166	16. Melba Gully S.P.	48
17. Little Desert	35,300	17. Mount Samaria S.P.	7,600
18. Lower Glenelg	27,300	18. Mount Worth S.P.	1,040
19. Morwell	283	19. Murray-Kulkyne P.	1,550
20. Mount Buffalo	31,000	20. Nepean S.P.	1,151
21. Mount Eccles	400	21. Pink Lakes S.P.	50,700
22. Mount Richmond	1,707	22. Steiglitz H.P.	670
23. Organ Pipes	85	23. Wabonga Plateau S.P.	21,200
24. Otway	12,750	24. Warby Range S.P.	3,320
25. Port Campbell	1,750	25. Warrandyte S.P.	432
26. Snowy River	26,200	26. Werribee Gorge S.P.	375
27. Tarra Valley	140	27. Yea River P.	220
28. Tingaringy	18,000		
29. Wilsons Promontory	49,000	Total	298,600
30. Wonnangatta-Moroka	107,000		
31. Wyperfeld	100,000	Not under Schedule Three —	
Total	853,421	1. Churchill Island	57
		2. Glenample Homestead	8
		3. Langwarrin F.F.R.	206
		4. Long Forest F.R.	147
		5. Mornington Peninsula Reserve	75
		6. Nyerimilang P.	200
		7. Pirianda Garden	11
		8. First Settlement Site, Sorrento	1
		9. Miscellaneous reserves	229
		Total	934

(a) C.P. = Coastal Park; H.P. = Historic Park; P = Park; S.P. = State Park; F.R. = Flora Reserve; F.F.P. = Flora and Fauna Reserve.

(b) Includes 'Factors' land (379 hectares) in the course of acquisition by the Crown (possession taken under contract).

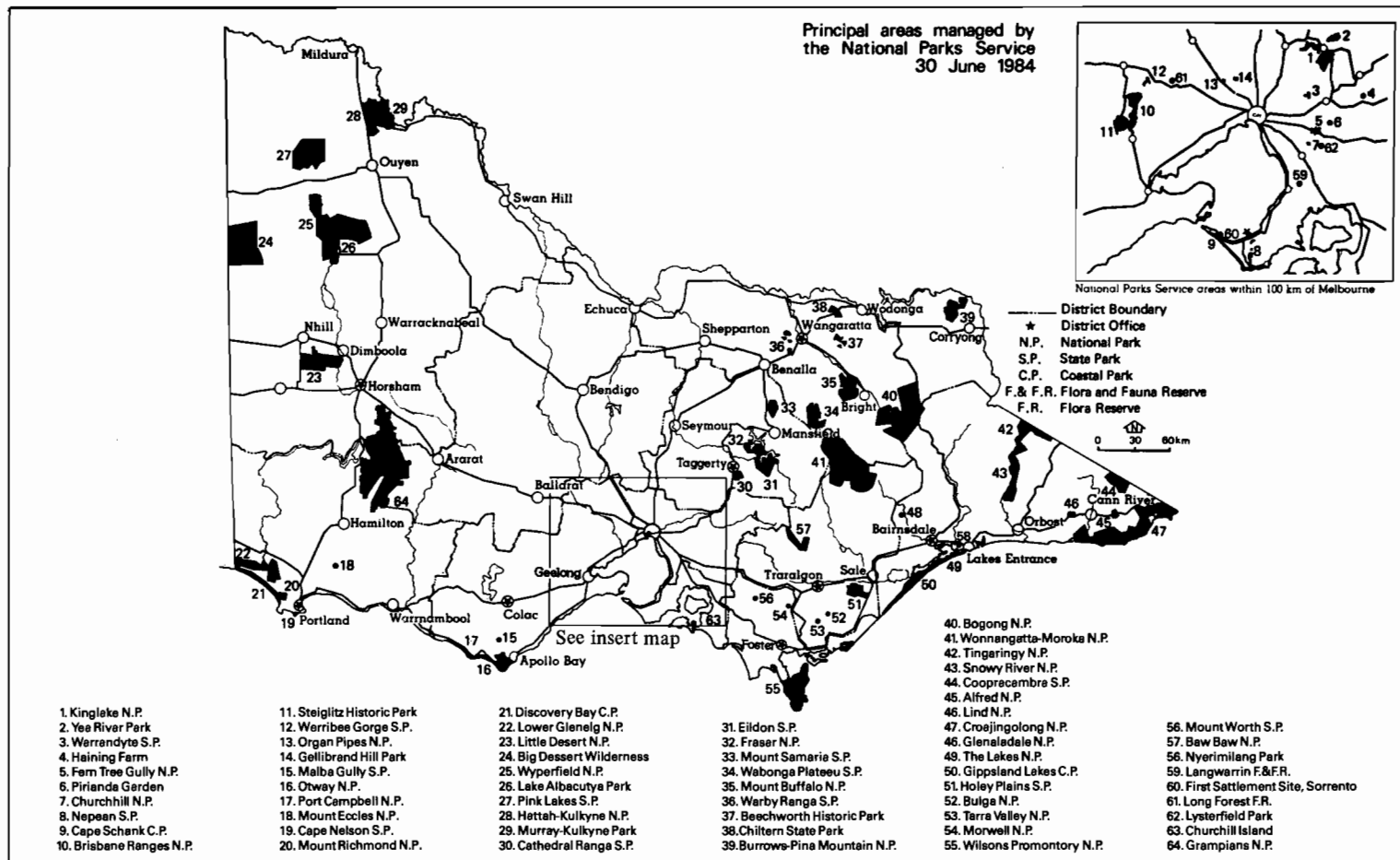


FIGURE 15. Principal areas managed by the National Parks Service, Victoria.

culture in Victoria. The history since European settlement is also of great interest. There are twenty-six historical sites and features in the park which add considerably to the attractions of the area.

Grampians National Park contains many species of introduced animals, some of which are declared vermin. Weeds, soil erosion, and wildfire all have the potential to cause problems if not controlled. A planning team of three people based at Stawell and funded by the Australian National Parks and Wildlife Service is working on a plan of management for this new national park. Interested organisations and individuals are able to make submissions to the team about the future management of the park.

Development of parks

Since 1983, many projects have been carried out in national parks under employment programmes funded by the Victorian Government.

Picnic and camping areas, visitor centres, and walking tracks have been constructed, erosion and weed control programmes pursued, and information material produced. These projects enable people to enjoy and appreciate the parks more, and help to ensure that the parks remain in (or in some cases, are restored to) a natural state.

In addition, voluntary groups have continued to make a major contribution to the care and development of parks. There are now twenty-two Friends groups, organised by the Victorian National Parks Association, and many other volunteer groups and individuals.

Restructure of administration

The structure of the new Department of Conservation, Forests and Lands was adopted by the Victorian Government in mid-1984. Decentralisation of functions is the guiding principle. Victoria has been divided into eighteen regions, each with a regional manager responsible for the day to day management of all public land in the region.

Eight divisions, one of which is the National Parks Service, have been created in the Melbourne head office. The future role of the National Parks Service will focus on planning, programming, and policy-making, rather than direct management of the parks, which is to be a regional responsibility. Technical advice to the regions and monitoring of parks will also be functions of the new Service.

The aim of this restructure is to rationalise the resources of the former authorities, and enable public land managers to meet the needs of the future more efficiently.

A special article on national parks in Victoria, supported by photographs and a map, appears on pages 1-35 of the *Victorian Year Book* 1975.

Further reference: *Victorian Year Book* 1983, pp. 34-6

ZOOLOGICAL BOARD OF VICTORIA

The Royal Melbourne Zoological Gardens

In 1857, a Society known as the Zoological Society of Victoria was formed and this led to The Royal Melbourne Zoological Gardens being the first to be established in Australia. The original site of the Zoological Gardens was known as Richmond Paddock, and was located opposite the Botanic Gardens, on the Yarra River. The collection was moved to the present site (at Royal Park) of twenty-two hectares in 1862.

In 1910, the Society, which had been incorporated with the Acclimatisation Society, was granted a Royal Charter, and became known as the Royal Zoological and Acclimatisation Society of Victoria. This Society controlled the Zoological Gardens until 1937, when the Victorian Government assumed responsibility for the administration of the Gardens through the Zoological Board of Victoria. The responsibility for ministerial jurisdiction of the Zoo was transferred from the Chief Secretary's Department to the Ministry for Conservation in June 1973, and in 1984 to the Ministry for Conservation, Forests and Lands.

A reconstruction programme for the Zoological Gardens commenced in 1965 and embraced all aspects of animal exhibition, essential services, catering, and gardens beautification. The most recent projects are an arboreal primate exhibit; a platypus exhibit where Australia's most unique mammal can be viewed inside through glass and outside in a billabong setting; the Great Flight Aviary (the longest in the world) in which birds of three distinct Australian habitats can be seen in a background of appropriate plants; and Bushland, a fauna park for native birds and mammals.

In 1969, the Zoological Board of Victoria established an education service with the appointment of a trainee education officer. The following year a teacher was seconded to the Zoo on a part-time basis

from the Victorian Education Department. There was such a substantial demand for lessons in the Zoo during 1970 that the next year a teaching staff of four full-time and three part-time teachers was seconded from the Education Department. The Zoological Board provided office space and appointed a full-time administrative officer to the Service. By 1977, the total teaching and administrative staff in the Zoo's Education Division had risen to eighteen, including a teacher experienced in the education of handicapped children. The Board, through the generosity of donations from industry, community service groups, and foundations, had by this time also provided eight classrooms, as well as a building specially equipped for handicapped children.

In 1977, a major step forward in the Zoo's education programme was the completion of an Education Resource Centre, achieved by reconstructing the former tea rooms. The old world charm of its exterior was retained while the interior was completely altered to permit comfortable teacher accommodation to be combined with modern resource capabilities and meeting rooms for kindred institutions.

On 6 October 1977, 120 years following the first meeting of the then Zoological Society, the Gardens received the Royal prefix, and became known as The Royal Melbourne Zoological Gardens.

In 1979, a support society known as Friends of the Zoos (FOTZ) was formed to foster a wider appreciation of wildlife and to promote better understanding and patronage of the Zoological Board's properties. By 1984 it had already raised a substantial sum towards a new bear exhibit in the Zoo and had also financed several small displays.

In 1981, a landscaped enclosure for cheetahs was completed and in the following year a new hoofed mammal area was constructed. This latter project occupied almost one-fifth of the entire Zoo area, and transformed a large number of small dusty compounds into spacious green pastures for zebra, deer, antelope, bison, tapir, and giraffe.

In 1984, the Victorian Government allocated a special grant for the building of an extensive moated bear exhibit, augmented by the FOTZ appeal for funds. Later that year, demolition of the old pits removed the last major component of the old Zoo. The year also saw the completion of a scheme for a new electrical supply and distribution system, and an extension of the staff amenities block. Another important feature of 1984 was the granting of Arms to the Board.

Planning for future projects included a major development in the catering area to substantially increase the area of enclosed public dining space integrated with a new souvenir outlet, construction of a Butterfly House, and building of a modern office block. Re-planning of the bird area was also underway.

Sir Colin MacKenzie Zoological Park (Healesville Sanctuary)

At the foothills of the Great Dividing Range, about five kilometres south of Healesville and about sixty-five kilometres north-east of Melbourne, is the Sir Colin MacKenzie Zoological Park (Healesville Sanctuary). The Park occupies 173 hectares of timbered country with tall native trees, chiefly eucalypts, and smaller shrubs. In thirty-one hectares of this area the public can move quite freely among many of the animals. The remaining 142 hectares are kept as a permanent reminder of the original appearance of the countryside. This part is called the Coranderrk Bushland. It was once part of the old Coranderrk Aboriginal Reserve, where members of the diminishing Yarra Yarra tribe were housed.

The Aborigines who lived in the area before the arrival of European settlers were led by 'King' Barak. They called the valley through which Badger Creek flows, and the mountain from which it rises, 'Coranderrk'. This name was given by them to a plant which flourished over the whole area and which always flowered there early in summer.

The Fauna Park was established in 1922 as a research station by Dr (later Sir) Colin MacKenzie, an anatomist from Melbourne. He studied the arrangement of the bones, particularly in the front legs of Australian animals, and found a way of making special splints to help children who had infantile paralysis.

When Sir Colin went to Canberra in 1928 to become the first Director of the Australian Institute of Anatomy, all the animals and cages at Healesville became part of a public reserve where visitors could go and picnic and see the animals. In 1944, the Victorian Government, realising the importance of this area as a sanctuary for scientists and tourists, appointed a small committee to manage it. In 1978, this committee was replaced by the Zoological Board of Victoria.

One of the first projects carried out by the Board was enlargement of the enclosed area for public catering. The Board then gave priority to off-limit areas and funds were directed into new staff

quarters, a modern animal food centre, and a reception block for injured and orphaned animals brought in for shelter by the public.

In 1984, the first new exhibit for several years was completed in the form of a koala exhibit featuring dense plantings of shrubs and trees from their natural environment. The same year, the Board appointed a landscape architect to study the Park's ecology and usage in order to plan the first stage of a complete rehabilitation of the Park. This followed a review conducted by the Board itself, with assistance from outside experts, of the causes of the significant decline in public patronage since the beginning of the 1970s.

It is likely that early attention will be given to new enclosures for wombats, and replacement of the old sheds being used temporarily as an animal nursery, and a veterinary treatment building.

Werribee Zoological Park

In 1975, the Zoological Board of Victoria was given powers to manage areas other than the Melbourne Zoological Gardens, and this applied in particular to the Werribee Zoological Park, a rural area of 120 hectares, which formed part of an estate purchased by the Victorian Government in 1973 to preserve the area and the historic home on the site. The development of Werribee Zoological Park, predominantly for hoofed mammals, Australian mammals, and water-birds, commenced in 1975. A conceptual master plan was prepared in 1978 with particular emphasis on visitor movement, relevance of existing buildings, the types of enclosures required, and educational opportunities.

In 1978, a Children's Zoo (Friendship Farm) was provided on part of the area under the control of the Estate Committee (later to become the Werribee Park Corporation). By 1981 the zoological park area was populated with zebra, deer, bison, camel, ostrich, rhinoceros, hippopotamus, and kangaroo.

In 1983, a stretch of high land overlooking the Werribee River was leased from the Melbourne and Metropolitan Board of Works for future public viewing and as a refuge for stock in the event of a major flood. The same year the Board introduced a mini-bus service into the zoological area to enable the public to see the animals at close hand.

A giraffe stable was built in 1984 as night quarters for a group of these animals being transferred from The Royal Melbourne Zoological Gardens.

Further references: Royal Botanic Gardens and National Herbarium, *Victorian Year Book*, 1982, pp.31-2; National Museum of Victoria, 1983, pp.36-8; 1984, pp.62-5

PHYSICAL FEATURES

Boundaries and areas

Creation of Victoria

The boundaries of the Port Phillip District of New South Wales were defined in *Imperial Act 5 & 6 Victoriae c.76* of 30 July 1842 ('An Act for the Government of New South Wales and Van Diemen's Land') as follows:

'... the Boundary of the District of Port Phillip on the North and North-east shall be a straight Line drawn from Cape Howe to the nearest Source of the River Murray, and thence the Course of that River to the Eastern Boundary of the Province of South Australia.'

Previously, by *Imperial Act 4 & 5 William IV c.95* of 15 August 1834, *Letters Patent* of about 19 February 1836, and *Imperial Act 1 & 2 Victoriae c.60* of 31 July 1838, the eastern boundary of the Province of South Australia was fixed as '... the One hundred and forty-first Degree of East Longitude ...'

By *Imperial Act 13 & 14 Victoriae c.59* of 5 August 1850 ('An Act for the better Government of Her Majesty's Australian Colonies'), the District of Port Phillip was granted the right to separate from New South Wales.

Boundaries

On 2 May 1851, the Victoria Electoral Act of 1851 was passed (*New South Wales Act 14 Victoria No. 47*) which provided for the division of the Colony of Victoria into electoral districts. A schedule to the Act set forth the boundaries of the electoral districts, being based on the boundaries of the counties then in existence. Those boundaries of the electoral districts which formed the boundaries of Victoria were described as:

'a line running in a westerly direction from Cape Howe to the source of the nearest tributary of the Murray';

'the River Murray';

'the South Australian frontier';

'the 141st meridian being the line dividing the Colony of New South Wales from South Australia';
 'the sea';
 'the sea shore';
 'the sea coast';
 'including the Lawrence and Lady Julia Percy's Islands';
 'including all the islands at Port Fairy';
 'Port Phillip Bay';
 'the shores of Port Phillip Bay';
 'the waters of Port Phillip';
 'including the small islands near the channels at the mouth of Port Phillip and those of Geelong Bay';
 'including French and Phillip Islands and the small islands in Western Port Bay'.

Writs for the election of a Legislative Council in Victoria were issued on 1 July 1851, thereby establishing the Colony of Victoria.

Murray River

The separation of Victoria from New South Wales in 1851, and the successful navigation of the Murray River by steam vessels, encouraged widespread evasion of New South Wales customs duties on articles taken across from Victoria and South Australia. The question arose as to which colony had jurisdiction over the waters of the Murray River. The position was determined by the New South Wales Constitution (*Imperial Act 18 & 19 Victoriae c.54* of 16 July 1855), which decreed that the whole watercourse of the Murray River from its source to the eastern boundary of the Colony of South Australia was thereafter to be within the Territory of New South Wales, thus fixing the left bank as the boundary between Victoria and New South Wales.

In May 1980, the High Court of Australia clarified the situation further by ruling that the northern boundary of Victoria followed the top of the southern (left) bank of the Murray River; all territory to the north being within New South Wales.

Cape Howe to the Murray River

In 1866, following the discovery of gold on the tributaries of the Snowy River near the position where the boundary was thought to be, it became evident that the remaining portion of the New South Wales-Victoria boundary should be marked on the ground. A definitive point at Cape Howe was agreed upon by the two colonies following an on-site conference between the New South Wales Surveyor General (P. F. Adams) and the Victorian Government Astronomer and Superintendent of Geodetic Survey (R. L. J. Ellery). This point was marked and named Conference Point.

Late in 1869, Alexander Black, a Victorian geodetic surveyor, was directed to determine the headwaters of the Murray River. There he identified as a certain spring near Forest Hill. Black then proceeded to clear and mark the western portion of the boundary while another Victorian geodetic surveyor, Alexander C. Allan, marked the eastern portion. The marking was completed in early 1872 and the line, which extended some 176 kilometres through extremely rugged country, passed within 5.6 metres of the provisionally established Conference Point.

The official technical description of the boundary gave as the initial azimuth $116^{\circ} 58' 09''$.42 from the spring to Station No. 1 on Forest Hill (452.6 metres away), while from a point on the coast at Cape Howe, 176,492.1 metres from the spring, the azimuth of the same line extending out to sea was given as $115^{\circ} 53' 41''$.36 to a point distant one league (5.56 kilometres) from high water line at Cape Howe.

The total length of the New South Wales boundary including the Murray River is about 2,050 kilometres.

Victoria-South Australia border

The boundary between Victoria and South Australia has had an interesting history, involving heroic work by surveyors and later much litigation between the colonies which culminated in an appeal to the Privy Council.

Prior to the creation of the Province of South Australia, New South Wales covered all of the mainland of Australia as far west as the 135° east meridian. South Australia was established in the 1830s, the boundaries being '... on the North the Twenty-sixth Degree of South Latitude, on the South the Southern Ocean, ..., and on the East the One hundred and forty-first Degree of East Longitude ...'. Thus the western boundary of New South Wales between the 26° south parallel and the coast was defined by the 141° east meridian.

By the late 1830s, it had become apparent that the south-eastern corner of South Australia would need to be located and marked on the ground, as the Hentys of Portland Bay had extended their

pastoral activities over the Glenelg River to Mount Gambier and there were disputes as to which Government (South Australia or New South Wales) had jurisdiction there.

Late in 1846, surveyors Henry Wade from New South Wales and Edward R. White from South Australia commenced the marking of the 141° east meridian. Their starting point was some 2 kilometres west of the mouth of the Glenelg River which had previously been determined to be the most likely position of the meridian. In July 1847, after completing 198 kilometres of the boundary, the party was forced to discontinue the survey due to sickness. Subsequently both colonies issued proclamations adopting the boundary as marked. Surveyor White was requested to proceed with the survey and in December 1850 reached the Murray River after suffering months of overwhelming privations which contributed to his early death.

Doubts about the accuracy of the determination of the 141° east meridian (upon which Wade's and White's surveys were based) were expressed in the 1840s and grew in the 1850s, but no action was taken until the late 1860s. Although there was no conclusive evidence, the Governments of South Australia and New South Wales were agreed that it was desirable to verify the longitude of the line marked by Wade and White, before proceeding with the marking of the boundary between those two colonies north of the Murray River.

There was reason to believe that a more accurate location of the 141° east meridian could be established. Since the determinations of the position of the 141° east meridian near the coast between 1839 and 1845 there had been increases in scientific knowledge, larger and more accurate instruments were available, and the electric telegraph had been developed. Furthermore, as the result of the appointment of government astronomers in Sydney and Melbourne, there were more accurate values for the longitudes of these cities. In May 1868, a temporary observatory was established at Chowilla and as a result of precise observations, and with the aid of the newly developed electric telegraph, George Smalley, New South Wales Government Astronomer, and Charles Todd, South Australian Superintendent of Telegraphs, determined the 141° east meridian to be approximately 3.6 kilometres east of the boundary marked by White.

After many years of vain efforts asking Victoria to relinquish the land between the marked boundary and the more accurately determined 141° east meridian, the South Australian Government in 1911 appealed to the High Court of Australia. When this appeal failed, it appealed to the Privy Council which ruled in favour of Victoria in 1914. Thus ended the dispute; the boundary as marked, approximating to a longitude of 140° 58' east, was confirmed as the State boundary.

There remains the question of the location of the border in the far north-western corner of Victoria, along the Murray River downstream from the 141° meridian (as determined by Smalley and Todd) to Wade and White's line. The length of this section of the river is about 10 kilometres with Victoria to the south and South Australia to the north of the river.

Recent legal opinion suggests that ordinary common law principles would apply; consequently, the boundary is presumably the centre thread of the Murray River as at 1842 (as modified by slow and imperceptible natural changes in its course since then).

Offshore boundaries

The *Imperial Act 13 & 14 Victoriae* c.59 of 5 August 1850 which separated the Colony of Victoria from New South Wales described only the land boundaries of the new colony; no southern boundary was defined. However, the northern boundary of Van Diemen's Land (Tasmania) was defined in 1825 as the latitude 39° 12' south and this has generally been accepted as the southern limit of Victoria's jurisdiction. It lies about 7 kilometres south of Wilsons Promontory. The lateral offshore boundaries between Victoria and the adjoining mainland States have not been defined.

In 1973, the Commonwealth Government passed the *Seas and Submerged Lands Act 1973* (No. 161), and it received Royal Assent on 4 December 1973. The Act declares that the sovereignty in respect of the territorial sea of Australia, and in respect of the air space over it and in respect of its bed and subsoil, is vested in and exercisable by the Crown in right of the Commonwealth. The Act gives the Governor-General power to proclaim the breadth of the territorial sea, and the power to proclaim the baseline from which the breadth of the territorial sea is to be measured. The Act declares that the sovereignty in respect of the internal waters of Australia (that is to say, any waters of the sea on the landward side of the baseline of the territorial sea) not within the limits of a State, and in respect of the airspace over those waters and in respect of the seabed and subsoil beneath those waters, is vested in and exercisable by the Crown in right of the Commonwealth.

Baselines from which the territorial sea is to be measured are delimited according to procedures

spelt out by the Convention on the Territorial Sea and the Contiguous Zone which was signed at Geneva on 29 April 1958, and under which Australia has obligations under international law.

The six Australian States challenged the validity of the Seas and Submerged Lands Act in the High Court of Australia, but in the decision handed down on 17 December 1975, the High Court dismissed all actions, thereby confirming that, broadly speaking, the sovereignty of the Crown in right of the States extends only to the low-water line. This applies both to the mainland and to islands off the coast which belong to the State, which in the case of Victoria would probably mean all islands between 140° 58' and 149° 58' east longitude (approximately) to the north of 39° 12' south latitude.

Depth

Although no depth limitation for Victoria was given in the Imperial Statutes defining the boundaries of Victoria, it has always been accepted that the Crown has sovereignty to the centre of the earth. The Land Act of 1891 imposed a depth limit in new Crown grants and, since 8 August 1892, 99 per cent of Crown grants issued have been limited to the surface and down to a depth of 15.24 metres below the surface. Since 3 July 1973, the depth limitation for new Crown grants has been 15 metres. A well or spring to obtain water from the ground is not necessarily subject to the depth limitation imposed in the Crown grant.

The exceptions to the 15 metres depth limitation on freehold tenure are:

- (1) in areas close to coal mines, gravel deposits, etc., where the depth limits were fixed in 1909 at 7.62 metres, sometimes 6.10 metres, or 9.14 metres – e.g. Wonthaggi, Kirrak, Korumburra, Woolamai, and Tarwin. Crown grants issued since 3 July 1973 in Wonthaggi and Kirrak are to be the same as elsewhere, namely 15 metres;
- (2) on sites for buildings with deep foundations, e.g. 30 metres, 60 metres;
- (3) some land at Morwell and Churchill–305 metres; and
- (4) lands vested in the Commonwealth. The depth limitation is usually 76 metres (occasionally 15 metres) but by sections 8 and 10 of the *Lands Acquisition Act* 1955-1973, the Commonwealth can compulsorily acquire Crown lands to unlimited depth, thus implying that the State of Victoria extends to the centre of the earth.

Height

Although no height limitation for Victorian territory was given in the Imperial Statutes defining the boundaries of Victoria, it has generally been accepted that the Crown has complete and exclusive sovereignty over the air space above its territories.

The Convention on Civil Aviation of 1944 (the Chicago Convention), to which Australia was a party, recognises that every contracting State has complete and exclusive jurisdiction over the air space above its territory. Territory is defined for the purposes of the Convention as being the land areas and territorial waters adjacent thereto under the sovereignty of the contracting State.

The Commonwealth Parliament has the constitutional power to legislate to give effect to the Chicago Convention and in relation to air navigation with respect to trade and commerce with other countries and among the Australian States.

The Victorian Parliament has power to make laws relating to the control and use of the air space above its territory which are not inconsistent with laws made by the Commonwealth Parliament on the matter.

In pursuance of its constitutional powers the Commonwealth Parliament has passed legislation regulating air navigation within the air space over the whole of Australia. The Victorian Parliament has passed the Air Navigation Act of 1958 which provides that the Air Navigation Regulations made under the Commonwealth Air Navigation Act, to the extent that they do not apply to the air space over Victoria of their own force, apply to air navigation within that air space as Victorian law.

Geographic position and area

The most southerly point of Wilsons Promontory, in latitude 39° 08' S., longitude 146° 22½' E., is the southernmost point of the mainland of Victoria and similarly of the mainland of Australia; the northernmost point is where the western boundary of the State meets the Murray River, latitude 33° 59' S., longitude 140° 58' E; the point furthest east is Cape Howe, situated in latitude 37° 31' S., longitude 149° 58' E. The westerly boundary lies upon the meridian 140° 58' E., and extends from latitude 33° 59' S. to latitude 38° 04' S.—a distance of 451 kilometres.

Victoria covers an area of about 227,600 square kilometres. It is therefore slightly smaller than Great Britain which (if inland water is included) contains 229,900 square kilometres.

The following table shows the area of Victoria in relation to that of Australia, the other States, and mainland Territories:

AREA OF STATES AND TERRITORIES

State or Territory	Area in square kilometres	Percentage of total area
Western Australia	2,525,500	32.88
Queensland	1,727,200	22.48
Northern Territory	1,346,200	17.52
South Australia	984,000	12.81
New South Wales	801,600	10.44
Victoria	227,600	2.96
Tasmania	67,800	0.88
Australian Capital Territory	2,400	0.03
Australia	7,682,300	100.00

Mountain areas

A wedge of mountainous country extends across Victoria; it tapers from the high peaks of the north-east and far east of the State to the western limits of the highlands at the lower Dundas Tableland near the South Australian border. This belt of high country, which includes the Great Dividing Range, separates the Northern, Wimmera, and Mallee Plains from the plains and uplands of the coastal areas and forms the watershed dividing the northern flowing tributaries of the Murray River from the southern flowing streams. Further information on the Great Dividing Range in Victoria can be found in Chapter 1 of the 1980 edition of the *Victorian Year Book*.

Considerable geological variation occurs in the highlands with granitic intrusives, volcanic complexes, sedimentary and metamorphic rocks, and tectonic structures all in evidence. Broad plateaux, high plains, and extensive ridge and valley terrains are the chief topographic characteristics with only occasional high peaks and deep gorges occurring. A broad low pass to the north of Melbourne (the Kilmore Gap) provides an easy route across the highlands and this is utilised by the major road and rail links to the north. The Kilmore Gap provides a convenient reference point at which to divide the highlands into eastern and western sections.

Eastern section

The highlands of eastern Victoria consist of strongly dissected and steeply sloping forested country with narrow ridges and deep V-shaped valleys. The area which includes the highest peaks is contiguous with the Kosciusko massif in New South Wales, but the Victorian mountains lack the clear evidence of past glacial activity that can be found in limited areas of Kosciusko. Frost weathering has been intensive at higher elevations and some spectacular accumulations of weathered rock occur as block streams or rock rivers such as Mt Wombargo near the headwaters of the Murray River.

The high country is not typically alpine in character: sharpened peaks and precipitous bluffs are rare, although the Cobberas, The Bluff, and the Mt Buffalo gorge all have impressive cliffs. One distinctive feature of the generally dissected mountain landscape is the High Plains country. Flat to gently undulating topography at elevations of 1,300 metres and above occurs, for example, as the Nunniong, Bogong, and Dargo High Plains, and the High Plains of the Snowy Range. These plains are remnants or residuals of formerly more extensive upland surfaces and include many different rock types—the basalts of the Bogong and Dargo High Plains being two of the best known.

Although snow capped for the winter season with a snow line at about 1,000 metres, even the highest peaks—Mt Bogong (1,986 metres) and Mt Feathertop (1,922 metres)—become free of snow in summer.

Western section

The highlands here are of much lower relief than the eastern section and in places lack the clearly defined watershed of the eastern ranges. A notable feature is the concentration of volcanic activity (Newer Volcanics) extending from just north of Melbourne to the Ballarat district in the west. Over 200 eruption points have been identified with many of the lava flows now forming ridges which bury the pre-volcanic stream channels and give rise to deep leads, some of which are gold bearing. Diversion and modification of river courses by lava flows has led to the formation of waterfalls, for example, on the Coliban River at Trentham Falls where the river runs across lava and cascades over twenty metres onto bedrock.

The most rugged section of highland in western Victoria is the Grampians, a series of resistant sandstone ridges etched out by differential weathering and removal of softer siltstones and shales. The

highest peak, Mt William (1,167 metres), has a spectacular easterly facing escarpment and a broad plateau-like summit surface. The Grampians form a major water catchment for the Wimmera and Glenelg systems.

The following table lists some of Victoria's highest mountains:

HEIGHT OF SELECTED MOUNTAINS, VICTORIA
(metres)

Mountain	Height	Mountain	Height
Bogong	1,986	Niggerhead	1,843
Feathertop	1,922	McKay	1,843
Nelse North	1,883	Cobberas No 1	1,838
Fainter South	1,877	Cope	1,837
Loch	1,874	Spion Kopje	1,836
Hotham	1,861	Buller	1,804

Coastline

The Victorian coastline comprises many types of environments. Broad sandy beaches and impressive cliffed headlands along the ocean coast contrast with mangrove-fringed mudflats and marshland of the sheltered embayments and estuaries. There are approximately 1,200 kilometres of ocean coast between Cape Howe and the South Australian border; in addition three large embayments—Port Phillip Bay (260 kilometres), Western Port Bay (140 kilometres), and Corner Inlet (80 kilometres)—partially enclose protected waters where most of the ports and harbours are situated.

Much of the ocean coast is exposed to high wave energy from strong and regular ocean swells and storm wave activity generated in the Southern Ocean. In western Victoria, swells arrive predominantly from the west and south-west, while the coastline of eastern Victoria (particularly east of Wilsons Promontory) is subject to swell from the south-east across the Tasman Sea. The shape of the long, gently curving Ninety Mile Beach from Corner Inlet to Lakes Entrance is determined by wave action from this swell.

Three general coastal types may be recognised: cliffed coasts, sandy coasts, and salt marsh and swamp coasts. The most extensive cliffed section is west of Port Phillip Bay from Torquay to Warrnambool, including a zone where the Otway Ranges lie adjacent to the coastline. The sandstone rocks of the Otways generally dip seaward and form steep cliffs, commonly with a level rock bench called a shore platform lying between high and low tide marks. Intricate weathering and erosion forms develop, etching out details of rock structures in the cliffs and platforms. Along this sector, sandy beaches are rare, being confined to small embayments or river mouths and often containing a high component of gravel.

West of Cape Otway to Warrnambool and particularly from the Gellibrand River to Peterborough is a spectacular cliffed coastline cut into soft horizontally bedded limestones and marls. Wave action has eroded along joints and weaknesses in the rock to produce near-vertical cliffs up to 60 metres high and forming blowholes, arches, and isolated rock stacks. Many of these features may be observed in the Port Campbell National Park.

High cliffed sectors are formed in volcanic rocks near Portland where Cape Duquesne and Cape Bridgewater illustrate many of the features associated with volcanic explosions and lava flows. As well, the coast at Cape Schanck and the ocean coast of Phillip Island are cliffed into layers of early Tertiary lava flows. Along the Gippsland coast sandstones form high cliffs at Cape Paterson and Cape Liptrap, while the plunging cliffs of Wilsons Promontory are of granite. Shore platforms occur in both the sandstone and the volcanic rocks but no such feature is found along the granite sectors.

Sandy beaches backed by extensive dune topography extend around Discovery Bay in far western Victoria. In many places these dunes are actively eroding and sand is spilling and blowing inland to cover coastal vegetation. Similar erosion is also present along the Ninety Mile Beach and on the sandy beaches and dunes further east between Lakes Entrance and Cape Howe. Some of this erosion is being controlled by soil conservation measures.

Estuary and lagoon systems occur at river mouths or where embayments have been partially or wholly enclosed by sand. Rivers such as the Snowy, the Barwon, and the Glenelg have lagoons occupying their lower reaches and the river mouth may be constricted by the growth of sandy spits. These may be breached and modified by flood discharge. During the floods of early 1971 the Snowy

River shifted its outlet over one kilometre to the west by breaking through the dune-capped barrier that deflects the entrance eastward of Marlo.

The Gippsland Lakes are an extensive lagoon system enclosed behind broad sandy barrier systems. In the sheltered lake waters deposits of silt and mud have accumulated among the reed swamps at the mouths of rivers to form long silt jetties or deltas. The largest of these, the Mitchell delta, and its companion at the mouth of the Tambo River are no longer extending, but are subject to erosion by wave action.

In the shallow and sheltered waters of Western Port Bay and Corner Inlet, mangrove swamps and salt marshes form a broad coastal fringe. Creeks and channels cross the soft, sticky mud-flats exposed in front of the mangrove fringe and form intricate patterns of tidal drainage. Smaller areas of mud and mangrove occur in the estuaries of the Barwon River and the Tarwin River; in the latter, the rapid spread of an introduced, salt-tolerant plant (*Spartina anglica*) is of particular interest.

Physical divisions

The chief physical divisions of Victoria are shown in Figure 16 on page 53. Each of these divisions has certain physical features (elevation, geological structure, climate, and soils) which distinguish it from the others. The following is a list of these divisions:

1. Murray Basin Plains:
 - (a) The Mallee
 - (b) The Riverine Plains
 - (c) The Wimmera
2. Central Highlands:
 - A. The Eastern Highlands
 - B. The Western Highlands:
 - (a) The Midlands
 - (b) The Grampians
 - (c) The Dundas Tablelands
3. Western District Plains:
 - (a) The Volcanic Plains
 - (b) The Coastal Plains
4. Gippsland Plains:
 - (a) The East Gippsland Plains
 - (b) The West Gippsland Plains
5. Southern Uplands:
 - (a) The Otway Ranges
 - (b) The Barrabool Hills
 - (c) The Mornington Peninsula
 - (d) The South Gippsland Highlands
 - (e) Wilsons Promontory

Murray Basin Plains

These plains include the areas commonly known as the Mallee, the Wimmera, and the Northern or Riverine Plains. The plains are effectively subdivided by a topographic feature known as the Leaghur Fault which runs sub-parallel with the Loddon River immediately west of Kerang.

From the Murray River to the Central Highlands, eastwards of the Leaghur Fault, is the remarkably flat landscape of the Riverine Plains, which are coalescing alluvial plains of the Murray, Ovens, Broken, Goulburn, Campaspe, and Loddon Rivers, formed by fluvial sedimentation. Also crossing the Riverine Plains is an extensive system of dry abandoned stream courses known as prior streams.

West of the Leaghur Fault the landscape and soil are very different. Here the Mallee country starts, with its surface cover predominantly of fine sands. Parallel north north-west to south south-east orientated Pliocene beach ridges or dunes which ripple the landscape are the basic landscape element of the Mallee, formed on the margin of a retreating sea. Hollows between these ridges are partly filled by Pleistocene fluviolacustrine clays; the ridges are partly obscured by younger east to west orientated longitudinal dunes, parabolic dunes, and sand plains. Of significance are areas of groundwater discharge such as the gypsum playas and salinas, as exemplified by Lake Tyrrell.

The Mallee is the marine plain of the former Murray Basin, with a veneer of wind-blown sands overlying fossiliferous marine Tertiary sands and silts, which reach eastwards to the Gredgwin Ridge on the Avoca-Loddon divide near Kerang. Westward of the Loddon River the streams fail to reach the Murray River and terminate in brackish or saline shallow lakes commonly bordered by lunettes. This is because of the low flow volumes and high rates of evaporation and infiltration.

The Wimmera is essentially the low alluvial fans, alluvial plains, and abandoned river channels lying between the Western Highlands and the Mallee.

Central Highlands

Extending east to west across Victoria is a mountainous and hilly backbone known as the Central Highlands. In eastern Victoria, it is rugged and mountainous, and with plateau-like features commonly capping elevated mountain areas. Known as the Eastern Highlands, these mountains in eastern Victoria attain elevations of above 1,800 metres at the highest points such as Mt Bogong and

Mt Hotham, and elevations of 1,200 metres are common. The major rivers of Victoria with high flow-rates, with the exception of the Glenelg River, all rise in the Eastern Highlands, and characteristically show steep-sided, deep, and narrow valleys. Residuals of Lower Tertiary basalts occur in the Eastern Highlands, filling old valleys as at the Dargo High Plains and the Bogong High Plains.

The topography of the Eastern Highlands has been strongly influenced by the variety of rock types and structures present. Thus a flat-topped and step-like landscape is found in the hard, almost flat-lying Upper Devonian sandstones and rhyolites between Briagolong and Mansfield; plateaux are preserved in granite at Mt Buffalo and the Baw Baws; and lower elevations with dendritic drainage are generally seen in areas of folded Lower Palaeozoic sandstones and mudstones.

The Western Highlands, in contrast to the Eastern, are much lower in elevation and are generally subdued hills rather than mountains. Rugged areas are mostly found near fault scarps. The general elevation is about 600 metres at Ballarat, but usually considerably less. Resistant masses of igneous rocks such as Mt Macedon and Mt Cole rise well above the general level, but fall well short of the main peaks in the Eastern Highlands. Extensive flat and only slightly dissected areas of Upper Tertiary to Quaternary basalt cover parts of the Western Highlands, conspicuously in the Ballarat area where they have yielded rich soils, and above the basalt flows rise prominent eruption points such as Mt Warrenheip and Mt Buninyong.

The Grampians, sharp-crested strike ridges of hard sandstone reaching 1,200 metres in height, are prominent mountains rising far above the general level of the highlands which decrease in height westwards. The westerly extremity of the Western Highlands is the Dundas Tablelands, a tilted block extending to Dergholm, formed in contorted Lower Palaeozoic rocks capped with laterite and dissected by the Glenelg River system.

Valleys in the Western Highlands are generally broad rather than deep, except where rejuvenating movements have occurred along fault scarps leading to the formation of gorges in some cases.

The Central Highlands owe their elevation—and relief caused by resultant erosion—to varied upwarping movements and faulting during Tertiary time.

Western District Plains

The Western District Plains stretch westwards from Melbourne to Camperdown, Hamilton, and Portland. They subdivide naturally into volcanic plains and coastal plains.

Volcanic Plains

With an area of 15,000 square kilometres, the Volcanic Plains are one of the largest volcanic plains in the world. They begin at an east-west line through Colac and Warrnambool and reach northwards to the foot of the Grampians.

The Volcanic Plains are almost horizontal, with only a slight southward inclination, and are composed of Pliocene to Holocene basalt flows and some basaltic ash. The Camperdown area and several other areas show extensive minor irregularities known locally as 'Stony Rises', formed by lava collapse during solidification; these lava flows are so young that they are unmodified by erosion and soil formation. Volcanic cones, frequently of scoria, rise sharply from the plains as at Mt Elephant (394.4 metres) and Tower Hill (98.4 metres), and to some cones can be traced extensive areas of basalt. Much of the scoriaceous basalt of the 'Stony Rises' between Colac and Camperdown can be linked with Mt Porndon (289.2 metres). Lakes in some cones occupy craters formed by explosive vulcanism.

The plains are crossed by some streams such as the Hopkins River with narrow incised valleys, but much drainage is internal, with precipitation finding its way to shallow lakes and underground.

Coastal Plains

Coastal plains, interrupted by the Otway Ranges, extend from Torquay to Warrnambool and northwards to Colac. They are flat or undulating, and are essentially the uplifted surface of Tertiary sedimentary rocks, including limestones, partly dissected by streams and commonly veneered with Quaternary dune limestone and sands. The limestones beneath the plains are cavernous, and are high yielding aquifers for groundwater. A broad coastal plain, bounded by a fault scarp to the north-east, lies to the west and north-west of Portland.

Gippsland Plains

As a planar surface, the Gippsland Plains begin near Yallourn and Port Albert, and spread eastwards to the Bairnsdale area, between the ocean and the Eastern Highlands. Further east, through Orbost to

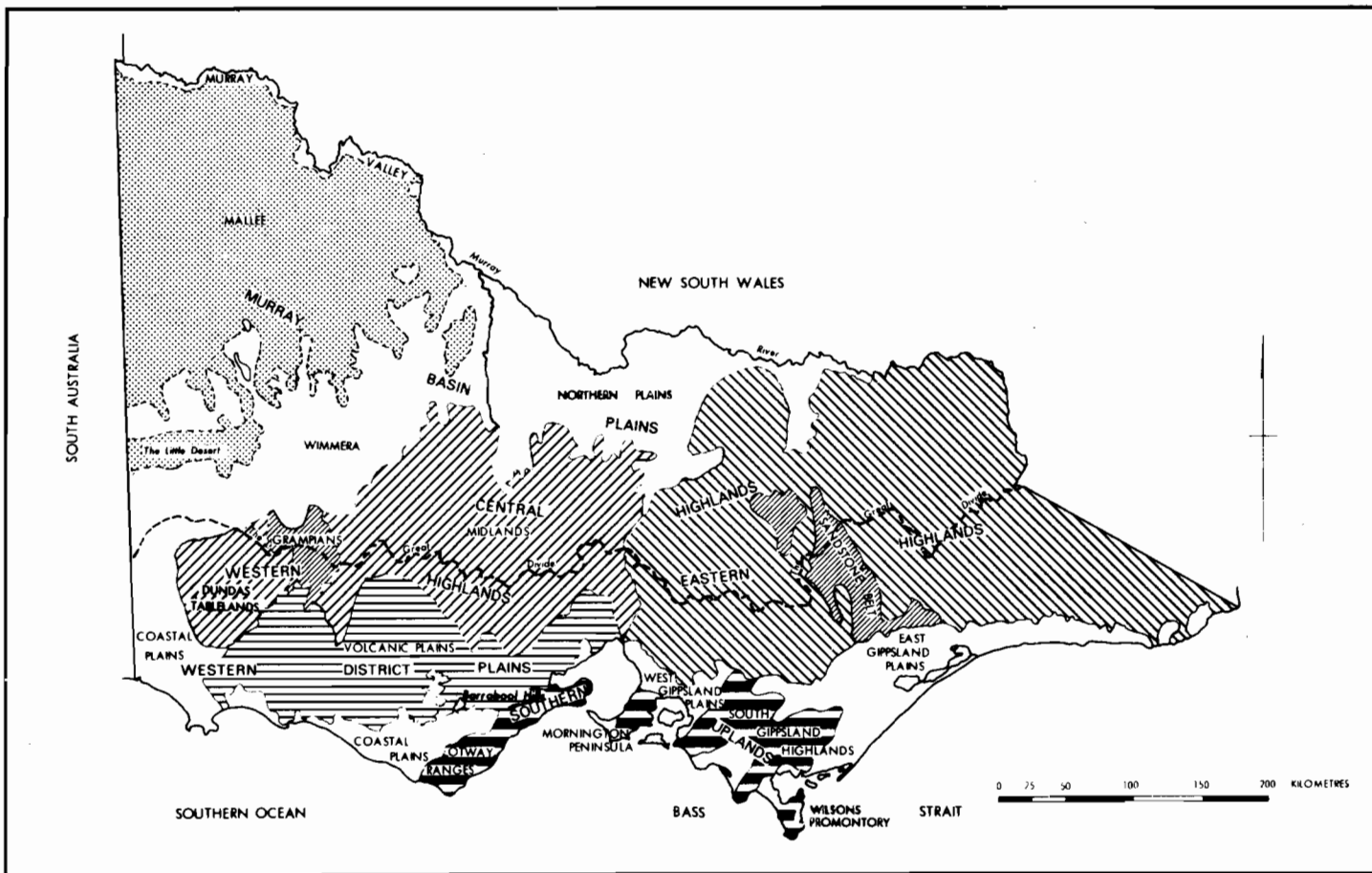


FIGURE 16: Physiographic divisions of Victoria.

Cann River, they form coastal downs—a dissected coastal plain—rather than a plain.

West of Yallourn, the Gippsland Plains continue, but they are displaced by late Tertiary block faulting to give the Moe Swamp and the Western Port Sunkland down faulted blocks, and uplifted areas such as the Drouin block and the Haunted Hills which are now maturely dissected. Faulting is responsible for related plains bordering the South Gippsland coast in the Wonthaggi area and landward from Cape Liptrap.

The present plains are the upper surface of a Tertiary and Quaternary basin, in which thick sequences of marine and freshwater sediments have accumulated, including the major brown coal seams of the La Trobe Valley. The plains are generally covered with piedmont-type sands, sandy clays, and gravels, which originated from the Eastern Highlands during the final late Tertiary movements which elevated them to their present height, and into these gravels the streams have cut broad alluvium filled valleys with flights of terraces that can be traced back into the Highlands.

A former coastline can be recognised behind the present coastline in the Bairnsdale-Lakes Entrance area. The conspicuous Ninety Mile Beach is a barrier bar which has cut off some of the Gippsland Lakes from the sea, and both spits and islands inland from the beach betray a complex history of barrier formation and erosion related to changed sea levels. Present day coastal dunes are prominent along sections of the Ninety Mile Beach, and earlier dunes and beach ridges are found on the barriers; still older dunes are found north of Woodside and east of Stratford.

Southern Uplands

South-west of the Gippsland Plains is a steep mountainous region, the Southern Uplands, formed by upwarping and faulting, and separated from the Eastern Highlands by the westerly extension of the Gippsland Plains appropriately named by J. W. Gregory as the 'Great Valley of Victoria'. These mountains, together with the Barrabool Hills near Geelong and the Otway Ranges, are formed of freshwater Lower Cretaceous sandstones and mudstones, and all display a characteristic rounded topography, due in part to very extensive landslipping and structural weakness in these rocks.

Areas of weathered basalt from the Lower Tertiary are found on the Uplands in plateau-like form at Thorpdale and Mirboo North in South Gippsland, and many smaller remnants are found elsewhere in these ranges; the basalts yield rich soils.

The Otway Ranges similarly originated by upwarping and faulting during Tertiary time.

A further element in the Southern Uplands is the Mornington Peninsula, which is a raised fault block of Palaeozoic granites and sedimentary rocks separating the downwarped Western Port Sunklands and the Port Phillip Sunklands.

Land surface of Victoria

The present topography of Victoria is the result of interaction between the rock types present (themselves events in the geological history), changes in elevation and deformation recorded in that history, processes such as weathering and erosion—including climatic effects—and the stage of development reached by these processes. Hard resistant rocks, for example, will after prolonged erosion tend to stand out in relief, whereas softer more weathered rocks will be topographically more depressed. Over extensive periods of geological time without major sea-level changes, erosion will tend to wear down a land mass to a surface of low relief—known as an erosion surface—not far above sea-level. In the highlands of Victoria remnants of several such erosion surfaces can be recognised as plateau-like features raised to elevations of hundreds of metres by uplift.

Jurassic erosion surface

In the Eastern Highlands, plateau remnants are widespread as, for example, the Cobberas, the Mt Hotham area, Mt Buffalo, the Snowy Plains, Mt Wellington, and the Baw Baw Plateau. They are all in hard rocks such as granite, rhyolite, and massive sandstone. These plateau remnants, and ridge tops at similar levels, are relics of the most ancient landscape or erosion surface preserved in Victoria. They are the surviving parts of sub-planar surface which was close to sea-level in Jurassic time, before uplift and warping late in the Jurassic commenced its destruction, and began to form troughs or sedimentary basins in which the sediments represented in the Otways and the South Gippsland Highlands were deposited during Cretaceous time. These upwarps had already begun to define the Central Highlands.

Later evolution

Uplift and downwarping continued intermittently during Tertiary time, with the development of sedimentary basins such as the Murray Basin in north-west Victoria and the Gippsland and Otway Basins in southern Victoria. In the basins was deposited detritus carried down by streams from the

rising Highlands, and in swamp conditions great thicknesses of brown coal were laid down in the Gippsland Basin. Deep valleys were cut into the Central Highlands, which were then lower than their present height; in some of these valleys gold bearing gravels were deposited. Parts of the landscape and some of the valleys were filled with Lower to Mid-Tertiary basalts.

Erosion proceeded to advanced stages during parts of the Tertiary Period, as attested by remains of younger erosion surfaces, preserved at lower levels than the Jurassic surface on the hill summits immediately east of the centre of Melbourne and around the Dandenong Ranges to Gembrook, on the Kinglake Plateau, and elsewhere in the Central Highlands.

By Miocene time, downwarping movements were at their maximum. Embayments of the sea covered much of Gippsland, the Port Phillip Basin, an extensive area of western Victoria south of Lismore and the Grampians (the Otway Basin), and north of the Grampians the Murray Basin spread as far as Broken Hill, New South Wales. The record of this transgression is left in limestones and other sedimentary deposits. Retreat of the sea towards its present position during the Pliocene was accompanied by further uplift of the Central Highlands, leading to further erosion, valley deepening, and the accumulation of extensive sheets of sands, clays, and gravels both on the lowland plains and as piedmont gravels on the spurs leading down to the lowlands.

The Upper Tertiary and Quaternary saw vast volcanic activity in central and western Victoria. From Melbourne to Hamilton basalts and tuffs were outpoured and ejected. Flows followed pre-existing valleys in the Western Highlands, burying gravels as deep leads in the Ballarat district.

Final downwarpings, assisted by the melting of glacial ice at the end of the Pleistocene, led to the drowning which has given Port Phillip Bay and Western Port Bay their present configurations, and concomitant upwarps in the Central Highlands elevated them to their present level.

Changing climate has played a role in this physiographic evolution. Thus the Mid-Tertiary, with the rich flora evident in the brown coals, appears to have been a time of higher rainfall than at present, which resulted in larger streams with more erosive power. Changing Quaternary climates are also recognised in the changing regimes evident in the former lakes and prior streams of the Riverine Plains.

Further reference: *Geology of Victoria, Victorian Year Book 1976, pp. 77-80*

Hydrology

Water resources

The average annual rainfall over Victoria is about 660 mm. As the area of the State is 227,600 square kilometres, the total precipitation is, therefore, about 148 million megalitres. Only 21 million megalitres appear in the average annual flow of the State's river systems. It is not yet known how much of the remainder soaks underground to recharge groundwater resources, but total storage of groundwater with less than 1,000 parts per million salinity is very large. Groundwater resources are being assessed by a long-term programme of investigation being carried out by the Victorian Department of Minerals and Energy.

Victoria's surface water resources are unevenly distributed in both space and time. Their distribution in space can be conveniently described by considering the State as being divided into four segments, by an east-west line along the Great Dividing Range and a north-south line through Melbourne. The north-west segment contains 40 per cent of the State's area, and the other three segments 20 per cent each. Surface water resources, represented by average annual river flow, are heavily concentrated in the eastern segments, each accounting for approximately 40 per cent of the total. The western segments account for only 20 per cent of total flow, with only 3 per cent in the north-west segment.

Quality of stream flow also deteriorates from east to west. Waters of the eastern rivers mostly contain less than 100 parts per million of total dissolved solids. In the western rivers the figure is generally above 500 parts per million, except near their sources, and increases downstream to figures in excess of 1,500 parts per million.

River flows in Victoria exhibit a marked seasonal pattern, and marked variability in annual flow from one year to another and from place to place, affecting the usability of the transitory local surface supplies of fresh water.

Over the State as a whole, about 60 per cent of the average annual flow is accounted for between July and October. In western streams this percentage approaches 75 per cent. Everywhere, flows typically recede in the summer and autumn, at the time of year when water requirements for most uses are at a peak.

*Rivers**Topography*

The topography of Victoria is dominated by the Great Dividing Range, which extends from a triangular mountainous region in the east, through the narrower and lower central highlands, and terminates at the Grampians in the west. This divide separates the State and its rivers into two distinct regions: those rivers flowing northwards towards the Murray River and those flowing southwards towards the sea. The only other significant high country within Victoria is formed by the Otways in the south-west and the Strzelecki Ranges in South Gippsland.

Geography

Of all the major Victorian rivers, the Snowy River is the only stream not wholly situated within the State, the headwaters of this river being in the Snowy Mountains of New South Wales. The Murray River, although an important water supply source for Victoria, is legally wholly in New South Wales as the State boundary coincides with the southern bank of this stream. (See page 46.)

Of the major northern rivers, all except three flow into the Murray River. The three exceptions—the Avoca, Richardson, and Wimmera Rivers—finish their course at inland lakes in the Wimmera-Mallee region, with the Avoca River, on rare occasions, overflowing its lakes system to reach the Murray River.

Of the major southern rivers, the La Trobe, Thomson, Macalister, Avon, Mitchell, and Tambo Rivers all flow into the Gippsland Lakes system, which is linked with the sea by an artificial cut constructed in 1888 for navigation purposes. The Woody-Yallock River in the west flows to the inland Lake Corangamite, while the remaining southern rivers find their way directly into the sea.

Water availability

The eastern rivers of Victoria, both northerly and southerly flowing and those rising in the Otway Ranges, have their sources in high rainfall country and provide abundant water resources, while those in the western portion of Victoria, with the exception of the Glenelg River, have limited useful yield and many are frequently dry in summer. In fact, the vast majority of Victoria's available water resources originate in the eastern half of the State.

Physical properties

The actual physical properties of Victorian rivers differ markedly from the east to the west. Rivers in the far east to north-eastern regions of Victoria flow for most of their journey through mountainous terrain in deep gorges, and then into flood plains, before reaching either the Murray River or the sea. Heavy shingle has been scoured from the bed and banks of these fast flowing mountainous streams and finally deposited downstream in the plain area. The water of these streams is clear and free from excessive suspended mud and silt.

Rivers in central and western Victoria, on the other hand, have comparatively short mountainous sections, and for the majority of their length wander sluggishly through undulating to flat country. Velocities of flow are far less than for their mountainous counterparts, and material carried by these streams consists of fine silt and clay which causes the muddy turbid waters, typical of these central and western rivers.

For those rivers that flow to the sea, there is a tendency at the river mouth to form sand spits and dunes, with the consequent obstruction of the mouth. Some of the smaller streams become blocked entirely and breach only in times of flood.

Salinity

Rivers in the Eastern Highlands, flowing mainly through heavily timbered mountain tracts, generally have very good quality water suitable for all purposes. In the lower Central Highlands, salinities vary from stream to stream but generally flows are fresh in the winter and spring and slightly saline in the summer and autumn. In the south-west regions of Victoria, catchments consist mainly of grasslands, with scrub regions in the north-west, and streams here are slightly to moderately saline for most of the year.

Flooding

Rainfall throughout Victoria is erratic during the year and hence the majority of the State's rivers are prone to flooding at any time, with rivers in Gippsland often subject to summer flooding. Flooding problems on a number of major streams have been markedly reduced by the construction of dams which, although designed for the supply of water and not for flood mitigation, provide substantial temporary storage above the full water supply level.

MAIN STREAM FLOWS, VICTORIA

Stream	Length (kilometres)	Drainage area (square kilometres)	Annual stream flows in million cubic metres				Site of gauging station
			Mean	Max.	Min.	No. of years gauged	
NORTHERN RIVERS							
Murray	1,926 (from source to Victorian border)	6,527 (upstream of Jingellic)	2,507	6,148	675	90	Jingellic, N.S.W.
Mitta Mitta	286	5,058	1,411	4,256	250	49	Tallangatta
Kiewa	185	1,145	567	2,071	166	94	Kiewa
Ovens	228	5,827	1,312	4,897	221	64	Wangaratta
Broken	193	1,924	227	1,091	19	94	Goorambat
Goulburn	566	10,772	2,211	7,369	145	98	Murchison
Campaspe	246	3,212	236	820	1	78	Elmore
Loddon	381	4,178	235	740	9	85	Laanecoorie Reservoir
Avoca	270	2,624	76	395	3	80	Coonoor
Wimmera	291	4,066	128	589	—	77	Horsham
SOUTHERN RIVERS							
Snowy	162 (in Victoria)	13,421	1,838	4,002	381	43	Jarrahmond
Tambo	200	943	58	121	21	15	Swifts Creek
Mitchell	251	3,903	959	2,834	193	42	Glenaladale
Thomson	209	1,088	400	680	175	50	Cowwarr
Macalister	202	1,891	502	1,533	45	61	Lake Glenmaggie
La Trobe	251	4,144	937	3,240	271	65	Rosedale
Bunyip	63	661	153	304	69	47	Bunyip
Yarra	246	2,328	783	1,494	176	62	Warrandyte
Maribyrnong	183	1,303	107	327	4	49	Keilor
Werribee	124	1,155	92	314	7	63	Melton Reservoir
Moorabool	153	1,114	76	221	1	34	Batesford
Barwon	188	1,269 (excluding Leigh and Moorabool Rivers)	141	328	7	14	Inverleigh
Hopkins	282	1,347	32	127	1	48	Wickliffe
Glenelg	457	1,570	127	540	3	60	Balmoral

Lakes

Lakes may be classified into two major groups: those without natural outlets which are called closed lakes, and those with a natural overflow channel which may be termed open lakes. For closed lakes to form, annual evaporation plus infiltration must exceed the rainfall in the catchment; this is the case over most of Victoria.

Closed lakes occur mainly in the flat western part of the State. They fluctuate in level much more than open lakes and frequently become dry if the aridity is too high. For example, Lake Tyrrell in the north-west is usually dry throughout the summer and can consequently be used for salt harvesting.

The level of water in an open lake is more stable because as the lake rises the outflow increases, thus governing the upper lake level and partially regulating streams emanating from it. This regulation enhances the economic value of the water resources of open lakes, but Victoria does not possess any natural large lake-regulated streams. However, there are small streams of this type in the Western District, such as Darlots Creek, partly regulated by Lake Condah, and Fiery Creek by Lake Bolac.

Salinity is often a factor which limits the use of lake water; even freshwater lakes are not used extensively in Victoria due to the cost of pumping. The average salinity of closed lakes covers a wide range depending upon the geological conditions of the catchments and the water level.

Lake Corangamite is Victoria's largest lake. It can be regarded as a closed lake, although during the wet period in the late 1950s it rose to within 1.2 metres of overflowing. The total salt content of the lake is about 16.32 million tonnes, giving it a salinity somewhat higher than seawater under average water level conditions.

The Gippsland Lakes are a group of shallow coastal lakes in Eastern Victoria, separated from the sea by broad sandy barriers bearing dune topography, and the Ninety Mile Beach. A gap through the coastal dune barrier near Lakes Entrance, which was completed in 1888, provides an artificial entrance to the lakes from the sea. However, seawater entering this gap has increased the salinity of some lakes, which in turn has destroyed some of the bordering reed swamp and led to erosion. The Gippsland Lakes have been of value for commercial fishing and private angling and also attract many tourists.

A number of Victorian lakes and swamps have been converted to reservoirs. Waranga Reservoir is an example of this, as are Lake Fyans, Batyo Catyo, and Lake Whitton in the Wimmera. A good example of lake utilisation is the Torrumbarry irrigation system on the riverine Murray Plains near Kerang in north-west Victoria.

Groundwater resources

Groundwater resources move slowly through pores and cracks in soil and rock and respond sluggishly to seasonal and annual fluctuations in recharge. For this reason, groundwater can be regarded as a generally more reliable source of water through drought periods. However, mapping of resources in terms of depth, yield, and quality is much more complex than the mapping of visible surface resources.

The present position, very broadly stated, is that there are groundwater resources of reasonable quality and yield for domestic and irrigation purposes over about 4,000,000 hectares or about one-sixth of Victoria's area, mainly in the far west and south-west and in alluvial valleys in the north and south-east.

On the other hand, there is about half the State's area, in the central and western sectors, where groundwater is generally not available at qualities better than 3,000 parts per million of total dissolved solids.

Groundwater has played a very important part in providing supplies of water for domestic and stock use in pastoral settlement. It is also used for some isolated town supplies, and is being increasingly used for irrigation, the area irrigated from groundwater now being about 12,000 hectares.

For the future, there are prospects of generally increased use for irrigation, and for the augmentation of town water supplies on the south-west coast, in the Barwon Valley, and in Gippsland. However, these prospects can only be clarified by continuing investigation.

Additional information can be found in the publications entitled *Groundwater Investigation Program Reports, 1971-1982* which are issued by the Victorian Department of Minerals and Energy.

Further reference: Natural Resources Conservation League, *Victorian Year Book*, 1965, p.47

Survey and mapping

The Division of Survey and Mapping of the Department of Property and Services is responsible for the maintenance and intensification of the National Geodetic Survey within Victoria; the preparation of topographic maps in standard map areas; the survey of Crown lands under the provisions of the *Land Act 1958*; the co-ordination of surveys throughout the State under the provisions of the *Survey Co-ordination Act 1958*; surveys for other departments and authorities; and the documentation of these surveys.

The National Geodetic Survey provides a framework of co-ordinated ground points for the control of mapping and other surveys. The current co-ordinate values for these points were determined in 1966, and notwithstanding a re-evaluation on the basis of the intensified network together with positions based on satellite observations, the 1966 co-ordinate values remain as the control datum for all surveys. Within Victoria there exists a network of levels based on the Australian Height Datum. This network is constantly being maintained and extended, and level values are available from the Central Plan Office of the Department.

An official map of Victoria showing highways, roads, railways, watercourses, towns, and mountains, together with other natural and physical features has been published in four sheets at a scale of 1:500,000. A less detailed map of Victoria is also available in one sheet at a scale of 1:1,000,000. Topographic maps at a scale of 1:250,000 providing a complete map coverage of the whole State have been published by the Division of National Mapping of the Commonwealth Department of National Development and Energy and the Royal Australian Survey Corps. A joint Commonwealth-State project to produce topographic maps at a scale of 1:100,000 has been completed. Other departments and authorities also contribute to State mapping by producing various large-scale maps for specific purposes.

A series of 26 maps at a scale of 1:25,000 showing streets, rivers, creeks, and municipal boundaries is available for Melbourne and environs. A long-term programme for production of general purpose standard topographic maps, at a scale of 1:25,000, is being carried out with 440 maps out of a total of 1,300 already printed. This series will cover most of the settled areas of the State. Also, production has commenced on a fully integrated topographic-cadastral map and plan system at a scale of 1:25,000 for rural and 1:2,500 for urban areas.

The publication *Official Map and Plan Systems, Victoria* sets out the standard format size and numbering systems which have been adopted for the production of maps and plans at the standard scales of 1:20,000, 1:16,000, 1:5,000, 1:2,500, 1:1,000, 1:500, and 1:250. The systems are based on the Australian Map Grid (AMG) which fulfils the basic principles necessary for the complete integration of surveys. The Division publishes annually a brochure entitled *Maplist* indicating the coverage of standard mapping throughout the State. The Division has also produced a whole range of maps for inclusion in the *Atlas of Victoria* which was published in September 1982.

The Division carries out cadastral surveys of Crown lands for the purpose of defining boundaries and for determining dimensions and areas of reservations and of allotments for the subsequent issue of Crown grants. This information forms the basis for the compilation of county, parish, and township plans, which are published at various scales and show details of the original subdivision of Crown lands. These plans form a register of all land alienated by the Crown, a register of all land reserved for various specific purposes, and a register of all the remaining Crown land within the State of Victoria.

The Division provides an aerial photography service for its own and other users' requirements. The Aerial Photography Library currently comprises approximately 400,000 photographs dating from 1931, and provides a comprehensive coverage of the State.

The Map Sales Centre at 35 Spring Street, Melbourne, is the main outlet for maps and plans, and provides facilities for the inspection and ordering of aerial photography and enlargements. The Centre is also the sole Victorian agent for Landsat imagery and holds microfiche copies for inspection.

Further references: Hydrography, Coastline, *Victorian Year Book* 1966, pp. 33-6; Coastal physiography, 1967, pp. 32-6; Plant ecology of the coast, 1968, pp. 31-7; Marine animal ecology, 1969, pp. 36-40; Marine algae of the Victorian coast, 1970, pp. 39-43; Erosion and sedimentation on the coastline, 1971, pp. 44-6; Conservation on the Victorian coast, 1972, pp. 37-43; Illustrated flora of Victoria, 1979, p. 36; Victorian Institute of Marine Sciences, 1980, pp. 49-50; Recent land legislation, 1981, pp. 55-6; Settlement of Victoria, 1981, pp. 24-6

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