

SOIL CONSERVATION AUTHORITY

REPORT ON  
**A PROPOSED LAND USE DETERMINATION**  
FOR PART OF THE  
**UPPER GOULBURN WATER SUPPLY CATCHMENT**

Prepared for consideration by:

The SOIL CONSERVATION AUTHORITY and  
The LAND CONSERVATION COUNCIL

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Report on  
A Proposed Land Use Determination for part of the  
Upper Goulburn Water Supply Catchment

## 1. INTRODUCTION

### ii) *Proclamation*

The catchment to Lake Eildon, upstream of the retaining wall situated on the Goulburn River at the township of Eildon, was proclaimed under the provisions of the *Soil Conservation and Land Utilization Act* on 18<sup>th</sup> December, 1956.

The Proclamation was published in the Government Gazette, dated the 19<sup>th</sup> January, 1957.

This report does not propose the determination of the entire catchment to Lake Eildon as delineated in the proclamation (3,807 sq. km) but a proportion of the catchment consisting of 868 sq. km, as marked on the attached plan (Section VI).

This boundary has been chosen to isolate the area within the total catchment which, with deterioration, poses the greatest threat to water quality, and to provide a suitable size to allow detailed planning and implementation of the determination, within the restraints imposed by staff and finance.

The report describes, by the use of five (5) land use categories, the best uses of all land within the proposed determination and their implementation under the *Soil Conservation and Land Utilization Act* 1958.

It is presented after detailed field work and after extensive discussion with individual landholders and representatives of the Forests Commission, the Alexandra and Mansfield Shires, State Rivers and Water Supply Commission Officers, and other Government departments. It is proposed that further landholder meetings will be held after Council has had the opportunity to comment on the proposals.

### ii) *Water Supply Systems*

Water is harvested from several river systems; 75% of the yield is from the high rainfall southern section of the catchment and the remaining 25% from the northern (Mansfield) section. The main river systems supplying the reservoir are: Delatite River, Jamieson River, Taponga River, Goulburn River, Big River, Howqua River, Fords Creek, Jerusalem Creek and Brankeet Creek.

The reservoir was constructed in 1956 to supply irrigation water for mixed farms downstream in the Goulburn Valley, to mitigate flooding, and for hydro-electric power generation.

Domestic supplies are taken from various points in the storage. Water supplies are pumped for the townships of Eildon, Jamieson and Bonnie Doon, and in the latter two cases the water is used untreated for drinking and household use. The Eildon supply is chlorinated.

Other individual domestic supplies are taken from the reservoir at Mac's Cover, Taylor Bay, Gough's Bay and for many individual household supplies on waterfront allotments. In addition, the townships of Thornton, Alexandra and Seymour draw water from the Goulburn River for domestic supplies. These supplies are treated before use.

### iii) *Water Quality*

An intensive monitoring program commenced in 1969 to determine the levels of faecal bacteria in surface waters and to study the algae, the chemical nutrients and the physico-chemical behaviour of the lake as a whole. Chemical analyses have been carried out twice yearly since 1941 and bacterial counts of the outlet water since 1964.

#### (a) Bacterial Quality

Samples are collected each month from 16 sites around the storage, including the outlet. There is a significant increase in *E. coli* and faecal streptococci counts at all sites following heavy rain at any time of the year and, in summer, the surface water contamination is confined to those sites which experience intense recreational activity. The bacterial quality of the water leaving Lake Eildon is, at all times, satisfactory.

(b) Biological Quality

During the late summer of 1969 an unsightly bloom of a white variant of the blue-green alga *Microcystis* occurred. It was assumed, in retrospect, to be due to an increase in the concentration of plant nutrients derived from rotting vegetation on the hitherto unexposed banks of the storage. The water level had fallen so low during the 1967-68 drought that there was a substantial regrowth of clovers and grasses on these banks which were subsequently inundated as the water returned to its normal level in the winter of 1968. Considerable aerial spraying activity was observed in the catchment during 1968 but, in the absence of appropriate chemical data, any conclusion as to the factors responsible for the algal bloom is merely conjecture.

Apart from this isolated experience there have been no algal problems in Lake Eildon. There is however a higher concentration of algae in the northern section of the storage despite a higher turbidity and low light penetration into the water column. This situation is probably a result of the flow characteristics through this section since it is reversed in the southern half of the storage where the light penetration is high, the flow-through greater and the concentration of algae low.

Sewage discharges from towns in the vicinity of the Lake and deposition of faecal matter and other garbage pose a threat to future water quality. Aerial spraying and topdressing of any magnitude should be discouraged on adjacent farmland if wind conditions are not favourable. The public should be made aware that they have a personal responsibility to maintain water quality for the benefit of themselves and others.

Although no records of suspended solids are available, observations have shown significant increases in sediment loads along the immediate shoreline in close proximity to committed residential areas, after adverse climatic conditions. There is an immediate need to limit further such development, and for the stabilisation of those areas already committed to residential development.

## **II CATCHMENT DESCRIPTION**

*i) General*

The Eildon dam is situated on the Goulburn River at the township of Eildon. From there, the catchment extends over 3,807 sq. km, with the catchment boundary extending along a line connecting Mt Torbreck, Mt Matlock, Mt Skene and Mt Howitt, then in a westerly direction to just west of Merton and then south along Skyline road to east of Eildon township.

The area proposed for determination comprises an 868 q. km portion of the total catchment, and consists of the area in close proximity to the Full Supply Level of Eildon Reservoir, which poses the main threat to water quality.

There are two major towns just outside the boundary of the area proposed for determination: Mansfield and Jamieson. There are several smaller settlements within the boundary composed mainly of holiday houses which are used only intermittently, the major ones being Taylor Bay, Gough's Bay, Bonnie Doon, Mac's Cover and Cummins Road Settlement.

Considerable development of recreational facilities and residential and semi-rural areas is being undertaken, or has been planned.

A full description of the catchment and its characteristics is contained in:-

1. The Land Conservation Council's Melbourne Study Report.
2. The Soil Conservation Authority's report by A. S. Rundle - "A Study of Land in the Catchment to Lake Eildon", to be published shortly.

*ii) Climate*

Climate conditions vary greatly, often over short distances, chiefly because of high topographic relief.

(a) Precipitation (Table I)

The pattern of precipitation is considered to result from two main influences; the topography and the general westerly origin of the rain bearing winds. All the forms of heavy precipitation results for adiabatic cooling processes brought about by the ascent of the air mass. A characteristic of the catchment is the localised uplift of air associated with individual ranges, which results in isolated intense storms. These storms occur frequently in the late summer and early autumn at a time when soil surfaces are frequently poorly vegetated and considerable sheet erosion can occur.

The average annual rainfall ranges from 690 mm at Mansfield to 760 mm at Merton and Merrijig, 840 km near Barjarg and Eildon 1120 mm at Jamieson.

Summer drought is characteristic of the Mansfield area, roughly one year in four having several months with little or no useful rainfall.

(b) Temperature (Table II)

Low temperatures in the catchment limit plant growth during winter, and lack of water in mid-summer and autumn further curtails the growing period in the lower rainfall areas, dividing the growing season sharply into late spring and autumn. For many plants, growth is very slow at temperatures 4 - 5° and below, and the onset of these conditions marks the effective end of the growing season. In the lower areas of the catchment, the first light frosts may be expected in April while at an elevation of 600 metres, the first frost may be as early as January or February. Light frosts persist until November at low levels in the catchment, but the highlands may experience frosts in December.

(c) Wind, Thunderstorms

Strong winds are predominantly from the west. Much of the weather consists of frontal and stream conditions, with a typical pattern of clear south west or, in summer, often just a storm line followed by cumulus clouds, gradually clearing with wind returning to the north west.

Win direction and strength are much influenced by local topography; the channelling effect of ridge and valley lines causes winds to blow along the valleys. Lee effects give rise to strong down draughts behind obstructions and reverse flows across valleys at low levels. The general pattern of vertical movement has a considerable effect on weather and climate in the area.

Summer thunderstorms are common. Most of them are thermal, that is they are associated with convection induced by solar heating of the land the mass, typically with north-westerly winds so that the cloud base is very high. There appear to be definite storm tracks and some areas are struck more frequently by lightning than others; these tracks are associated with thermal source areas or strong orographic uplift.

iii) ***Geology and Soils*** (Figure 1)

(a) Silurian Sediments

Mudstones, shales and fine sandstones form a band of strongly folded strata running from north-west of Bonnie Doon to the Big River arm in the South-east, the strike being north-west.

Soils range from moderately fertile grey to yellow solodic soils in the flatter areas, to shallow grey clay loams toward the hilltops. Bedrock is close to the surface and may be evident on the surface towards the crest of ridges.

(b) Lower Devonian Sediments

Sandstones and shales of slightly younger age than Silurian sediments; usually moderately folded, covering almost the entire remainder of the area proposed for determination.

Soils range from shallow podsolised yellow loams in steeper areas to solodic soils being more fertile towards the north (Mansfield).

(c) Ordovician Sediments

A small area of Ordovician sediments protrudes in the Bonnie Doon section. Soils are shallow grey loams with heavy yellow subsoil; slopes are steep.

iii) ***Geomorphology***

The main features of the portion of the catchment proposed for determination are:

- a) Steep hill zone;
- b) Mountain Forest Zone;
- c) Mansfield Grazing Zone

The Steep Hill Zone is confined mainly to the west of the reservoir in the Maintongoon area, and east of Bonnie Doon extending to the Papas. This Zone consists of steep, long slopes with the whole landscape moderately folded at times, and is found at elevations of between 400 m and 600 m above sea level.

The Mountain Forest Zone is found at elevations up to 800 m above sea level and is restricted to the south-west corner of the determination area, there being a grade in altitude from the south to the north, the most southerly being steep sub-alpine slopes through small areas of steeply folded hills to the broken lower ridges and foothills, with moderately steep slopes to the water's edge.

Most of the remainder of the determination area consists of undulating (some steep) grazing land bounded by the Mansfield plain. The whole areas has been mildly folded, causing long, gentle slopes with occasional steep ridges.

*iv) Land Systems*

There are six (6) distinctive land systems included within the boundaries of the determination. Three (3) of these form the major portion of it and three encompass a more minor section. These units have been documented comprehensively in "A Study of the Land in the Catchment to Lake Eildon" by A. S. Rundle. A summary of these units is presented in Table III and an associated map of system boundaries in Figure 2.

The summary has been altered from the original where necessary, to describe the area under consideration more specifically.

The most significant water producing land systems lie outside the area proposed for determination, these being the Howqua, Taponga and Buller systems. These provide consistent and regular flows throughout the year and supply the major river systems of the Goulburn, Howqua, Jamieson and Delatite. All of these systems (excluding the Delatite) lie mainly within forest areas under the control of the Forests Commission of Victoria. While some problems do exist in these areas, they are not regarded as a major threat to water quality.

The Maintongoon system form the steeper slopes on the western side of the reservoir and is mainly timbered and is unused, or used for low intensity grazing. Erosion hazard is high in this area, and there is a high potential for sedimentation of the water supply through sheet erosion.

*v) Land Tenure*

Land within the area proposed for determination is composed of the following land ownerships:-

Freehold	422 sq km	48.6%
Crown Land	83 sq km	9.5%
Reserved Forest	202 sq km	23.3%
National Park	31 sq km	3.6%
Water (surface area)	130 sq km	15.0%
	868 sq km	100%

Change in the use and management of public land in the area is likely in the future. The Land Conservation Council has recommended that 3 700 ha of public land on the western shores of Lake Eildon be reserved as a Regional Park, managed by the National Parks Service; and that a substantial proportion (some 25 000 ha) of the remainder of the public land in the proposed Land Use Determination area be reserved as State Park, managed by the National Parks Service.

### **III LAND USE**

*i) Agriculture*

The entire area of freehold land which is devoted to agriculture has historically been used for large scale grazing of sheep, initially for wool production and, in more recent times, this has changed to cross breeding for fat lamb production.

Since 1970, there has been a trend towards the production of beef cattle and this has now become the most significant agricultural product, although many properties still run sheep in conjunction with beef enterprises.

Soils are of moderate fertility and in recent years with the development of better techniques of pasture improvement, a large proportion of the determination area has been sown to exotic pasture species. Apart from the remaining areas of forested freehold land, there are only small pockets of land which still have not had superphosphate applied at some time. Although considerable improvement has been carried out on flatter land, most of the steeper country associated with land forms described earlier has had a good history of superphosphate application but little improvement with introduced pasture species.

Problems of management along conservation lines arise where a property contains a large proportion of steep hill country. These hills contribute significant silt loads through sheet erosion and act as steep catchments to many drainage systems. Any undue increase in stocking rates due to poor economic conditions or adverse seasons can have a dramatic effect on the acceleration of erosion, both on the hill slopes themselves and on lower lands. Ultimately, water quality in Lake Eildon will be affected.

With the recent successful development of aerial seeding techniques, a dense vegetative cover on these sensitive steep hill areas can be more readily maintained.

Economic conditions for all agricultural producers are depressed, but this has been felt most severely by beef producers. As the most significant enterprise in the area proposed for determination is the funds for conservation or other farm improvement works. This lack of finance is the main limiting factor on the advancement of catchment protection through SCA/landholder co-operation.

#### **ii) *Rural Subdivision***

Increasing number of people are seeking small acreages close to Lake Eildon to use as a base for holidaying and making use of the lake for water sports. This has caused a dramatic increase in the number of larger agricultural holdings being divided into allotments of four (4) hectares and above, for sale to these people. Considerable increase in the intensity of land use associated with this form of development can cause catchment deterioration under some circumstances.

Such subdivision must be directed towards land which has the physical capability to support intensive land use, and improvements in the design and siting of developments on each allotment must be achieved.

#### **iii) *Residential Subdivision***

Several areas of intensive residential subdivision occur on the shore of Lake Eildon. These include Bonnie Doon, Taylor Bay, Gough's Bay and several smaller un-named areas. All of these areas pose a severe threat to long term water quality in Lake Eildon, due to the high sediments loads from roading and large bared soil surface areas associated with housing development, and the intensity of effluent disposal systems on residential allotments.

Although residential areas pose a serious threat, the Soil Conservation Authority can have only a minimal effect on the reduction of this threat through contact with individual landholders. Because of the small block size, flexibility and alternatives for development are very restricted and it is believed that the Soil Conservation Authority will have more effect in concentrating its efforts on larger blocks where the potential for large scale earthworks exists.

Attention will, however, be paid to erosion problem areas that already exist with these intensive developments. Emphasis must be placed on Authority involvement in planning decisions associated with such areas, to reduce further problems. It is proposed that existing allotments with an area of less than 0.4 ha will be exempted from the Authority's determination.

#### **iv) *Forestry***

A large proportion of the area proposed for determination is at present forested. Most of this land is contained within Reserved Forest with smaller areas of unused Crown Land and forested freehold land. Timber extraction is undertaken only on a limited basis and most of the hardwood forests concerned have been logged previously and are now regenerating. The Mt Enterprise area has a peppermint/stringybark forest association and is of limited value for timber production.

There is only large area planted to *Pinus radiata* and controlled by the Forests Commission of Victoria, which borders the southern side of the Delatite arm of the reservoir. This area is at present at the thinning stage; prescriptions for management are to be drawn up with the Forests Commission.

The Land Conservation Council has recommended that the softwood production areas in the Enterprise Range continue to be so used, and that several adjoining areas be designated as Forested Area. Much of the remaining forest in the proposed Land Use Determination area is within the State and Regional Parks recommended by the Land Conservation Council. It is expected that these uses should be compatible with the long-term maintenance of water quality.

Small areas of conversion from hardwood forest to pine forest on freehold land exist and there is a potential for this to be expanded in some areas. The Authority considers that prescriptions for these operations should closely follow the prescriptions applicable to Forests Commission operations.

Generally, the determination should have only a minor effect on present forest operations. More control will need to be implemented on private forest operations in close proximity to Full Supply Level of the reservoir.

v) **Roadworks**

Roading is a major source of sedimentation, in particular where roads are located on steep slopes and with excessive road grades. Major roads within the catchment are either sealed or of fairly high standard. There are only four major roads remaining unsealed within the proposed determination area.

- a) Howes Creek - Mansfield Road;
- b) Skyline Road;
- c) Monkey Gully Road;
- d) Jamieson - Eildon Road

These roads are of reasonable standard although in the interests of water quality, upgrading and possibly sealing of these roads could be warranted to cope with the large volume of traffic which they carry.

As well as the road surface, of particular concern are roadside drains and batters. All roads in the catchment suffer to some degree from slumping or scouring batters. The stabilisation of these batters does not receive adequate attention by either local government or the Country Roads Board, in construction or maintenance of roads. In the interests of reducing sedimentation, a major effort on roadside erosion will be necessary.

In addition to the above public roads, there are a considerable number of other roads constructed and maintained by the State Electricity Commission and the Forests Commission. Problem areas exist with some sections of this roading and it is felt that a programme of restoration is required for these areas, by authorities responsible for them.

vi) **Recreation**

The presence of a large expanse of inland water relatively close to the main population centre of Melbourne, has stimulated a strong demand for the recreational facility provided by the lake. The number of people engaged in recreational activity on and around the lake has increased markedly over the past 5 - 6 years. This is instanced by a 300% increase in the number of people visiting Fraser National Park, between 1969 and 1975.

The activities of the people themselves has caused little environmental damage, although there are isolated spots affected by four wheel drive vehicles and trail bikes. Rather, it is the facilities required for camping which are of concern - e.g. caravan parks, camping areas, toilet blocks and launching ramps.

The recommendations of the Land Conservation Council provide for recreation to be one of the primary uses of virtually all of the public land abutting Lake Eildon (other than the softwood production area). The existing Fraser National Park has been incorporated into a larger Fraser Regional Park which, as for all Regional Parks, includes provisions for intensive recreation.

Emphasis must be placed on directing such developments to areas of land suitable for sustaining the intense human pressure and anticipated increased erosion hazard that accompanies it.

#### **IV. CONCLUSION**

The section of the Eildon catchment to be determined is the largest such area that has been made the subject of a Land Use Determination by the Soil Conservation Authority. It supports a wide range of activities, not all of which are directly involved with primary production. The pattern of land use has changed considerably in recent times and it is not the intention of this Determination to capriciously restrict or inhibit all or any of these uses. However, it has become evident that some guidance and direction is necessary in order that the value of the area as a water supply catchment is protected.



Thus the principal aim of the proposed Determination is to ensure that any use to which the land is put is compatible with the ability of that land to sustain the proposed use without detriment to either the land or water resource.

MAX KITCHELL  
Conservation Officer

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Conservation Officer Catchments

## V PROPOSED LAND USE DETERMINATION

CATEGORY NUMBER	LAND CATEGORY	PROVISIONS OF CATEGORY
1	Land to be used for the protection of streams, watercourses and Lake Eildon. <ul style="list-style-type: none"> <li>- within 200 metres of full supply level of Lake Eildon, or a lesser distance where defined.</li> <li>- within 40 metres of the banks of streams shown by heavy line on Plan No. S125B.</li> <li>- within 20 metres of other streams and watercourses within the Determined area.</li> </ul>	Disturbance of soils and vegetation should be minimal on land in this category. Consultation with the SCA is required before the commencement of clearing or cultivation operations, earthworks associated with construction of buildings or stream crossings, or other earthworks.  All sewage and sullage waters shall be treated in accordance with the requirements of the <i>Environment Protection Act, 1970</i> , the <i>Health Act, 1958</i> , and the local municipality.
2	Land to be retained as forest.	Grazing of land in this category should be limited to that required to reduce fire hazard, and where necessary the SCA will apply stocking rate conditions.
3	Steep land of a high erosion hazard best suited for protection forest but which may be used for grazing.	Forested land in this category should remain uncleared. The Authority may specify conditions relating to grazing management or other conservation measures.
4	Land suitable for grazing, parts of which may also be cultivated for cropping purposes.	The Authority will, where necessary, specify conditions relating to conservation measures or cultivation. Prior consultation with the SCA is required before land is used for commercial horticulture.
5	Land at present subdivided for residential development.	The Authority may advise on the use and management of this land to prevent or correct erosion and to protect water supply interests.

### PROVISIONS APPLY TO CATEGORIES 1, 2, 3 AND 4

Forest operations are to be carried out in accordance with prescriptions made or approved by the SCA, and conditions to that effect will be developed accordingly.

### GENERAL PROVISIONS APPLYING TO ALL CATEGORIES

Proposals for subdivision of land, gravel removal, extractive industries, mining operations and recreational developments, likely to result in disturbance to soils or vegetation require prior assessment by the Soil Conservation Authority.

Where necessary, conditions will be applied to ensure that any disturbance to soils or vegetation does not cause erosion or otherwise present a risk to water supply interests.

**Table I - Mean Monthly and Annual Rainfall Records (mm)**

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year's Total
Alexandra	41	39	52	53	65	72	71	74	66	70	56	48	707
Merton	37	43	55	56	69	77	85	82	73	71	56	50	742
Mansfield	42	40	54	53	64	67	70	74	66	71	57	50	705
Jamieson	55	57	70	82	115	146	140	142	109	109	80	71	1155

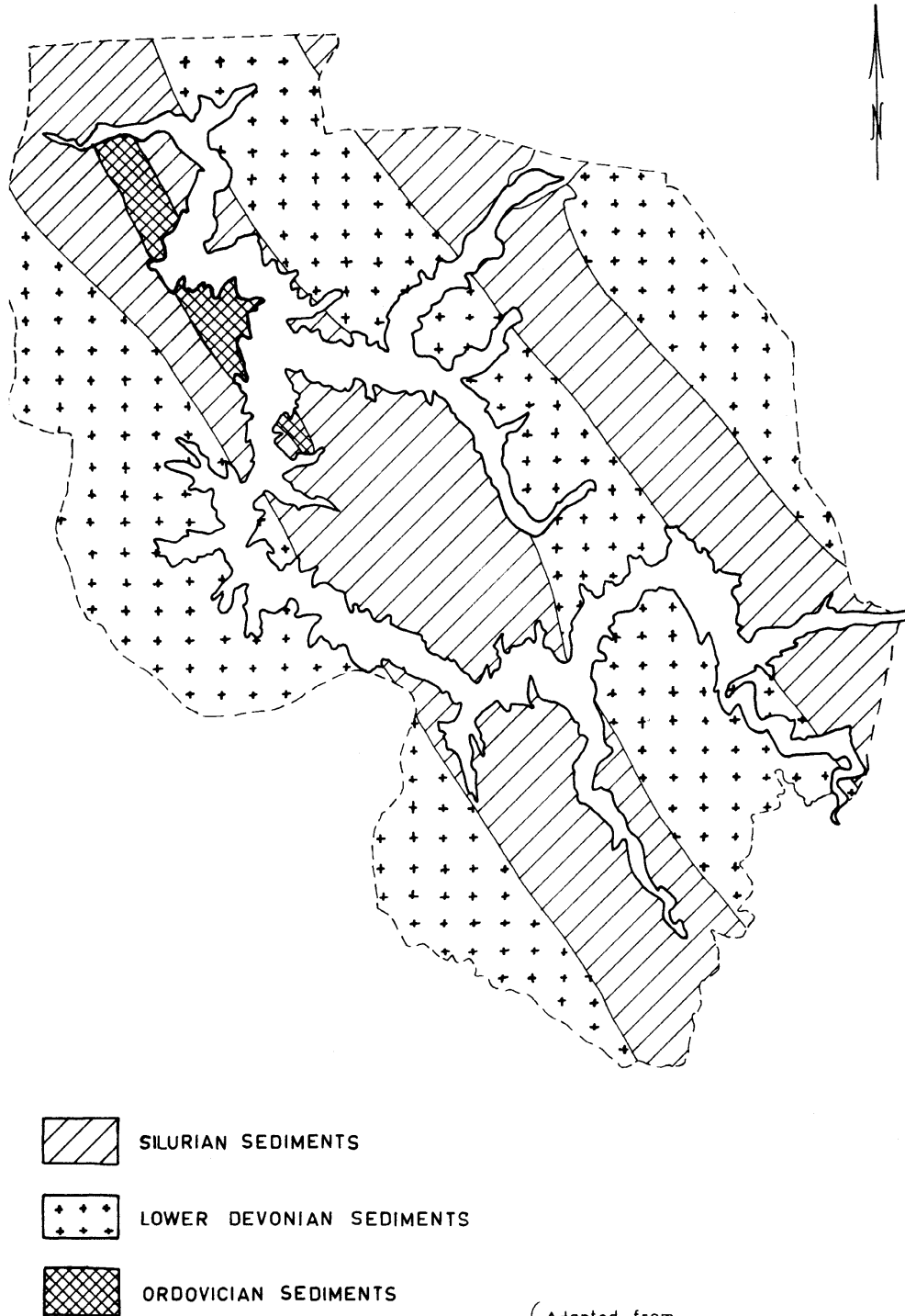
**Table II - Average and Extreme Temperatures (Monthly) (°C)**

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
<b>ALEXANDRA</b>													Extreme
Mean daily Max. Temp.	29.5	29.7	26.2	20.7	15.3	11.7	11.3	13.8	16.2	21.0	23.1	25.5	44.4
Mean daily Min Temp.	10.7	11.8	9.5	5.9	4.6	2.0	2.0	3.1	4.0	6.0	7.7	9.6	-6.1
<b>LAKE EILDON</b>													
Mean daily Max. Temp.	28.6	27.9	24.2	20.4	15.1	12.2	11.7	12.8	15.9	19.2	22.5	26.5	
Mean daily Min. Temp.	13.5	14.4	10.0	8.3	5.2	3.7	3.3	4.2	5.4	7.2	8.3	10.7	

**Table III - Summary of Land Systems**  
(See also accompanying plan)

UNIT	% OF TOTAL AREA	TOPOGRAPHY	CLIMATE	GEOLOGY	PRESENT LAND USE	EROSION HAZARD
EILDON	48.1	Broken lower ridges and foothills. Moderate to steep slopes.	Rainfall 640 - 760 mm with a dry, late summer. Mean temp. Jan 26°C July 7°C	Strongly folded Silurian age slates and quartzite, strike being north-west.	Mainly cleared and used for sheep and cattle grazing. Some uncleared private and Crown Land.	High because of steep slopes and dry climate. Moderate to severe gully erosion in cleared land.
MAINTONGOON	29.1	Valley and ridge topography of lower stream dissected areas. Slopes steep and long.	Rainfall 760 - 1000 mm annually with maximum in winter. Mean temp. Jan 22°C July 7°C	Tightly folded slates of Lower Devonian age with small areas of Silurian sediment.	Largely unused, or forest grazing. Some fencing timber produced. Steep neighbouring area.	Moderate to high because of steep slopes. Forest floor in poor conditions. Sheet erosion common after fires.
MANSFIELD	9.7	Mansfield Plain and associated river valleys	Annual rainfall 140 - 760 mm with dry summer. Mean temp. Jan 26°C July 7°C	Flat or gently dipping Devonian sediments with deep clays.	Grazing of sheep and cattle, mainly on improved pastures.	Low except for gullied creeks due to poor hydrological conditions on surrounding hills.
JAMIESON	7.8	Stream dissection pattern. High ridges with long steep slopes.	Annual rainfall 1000 - 1270 mm. Winter incidence. Mean temp. Jan 18°C July 7°C	Devonian and Silurian age sediments, with strike north-west.	Used as reserved forest. Has been logged now regenerating.	Moderate under present management. Becomes high when cleared, or bared by fires.
HOWQUA	3.5	Headwaters of stream dissection pattern. Ridges and peaks in the upper valleys.	Annual rainfall 1150 - 1400 mm, winter predominance with a little snow. Mean temp. Jan 18°C July 6.5°C	As for Jamieson land system.	Has been logged in past, all reserved forest. Regeneration of timber	Lower under forested conditions due to high growth rate.
TAPONGA	1.8	Insignificant Area.				

Figure 1 - Geology



( Adapted from  
LAND CONSERVATION COUNCIL  
MELBOURNE STUDY REPORT )

**Figure 2 - Land Systems**  
(see Table 3)

