

SOIL CONSERVATION AUTHORITY

**REPORT ON
THE NATURE, AIMS AND IMPLEMENTATION
OF A
LAND-USE DETERMINATION IN THE
UPPER KIEWA WATER SUPPLY CATCHMENT.**

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Soil Conservation and Land Utilization Act 1958

UPPER KIEWA WATER SUPPLY CATCHMENT

PROCLAMATION

By His Excellency the Governor of the State of Victoria and its Dependencies in the Commonwealth of Australia, &c., &c., &c.

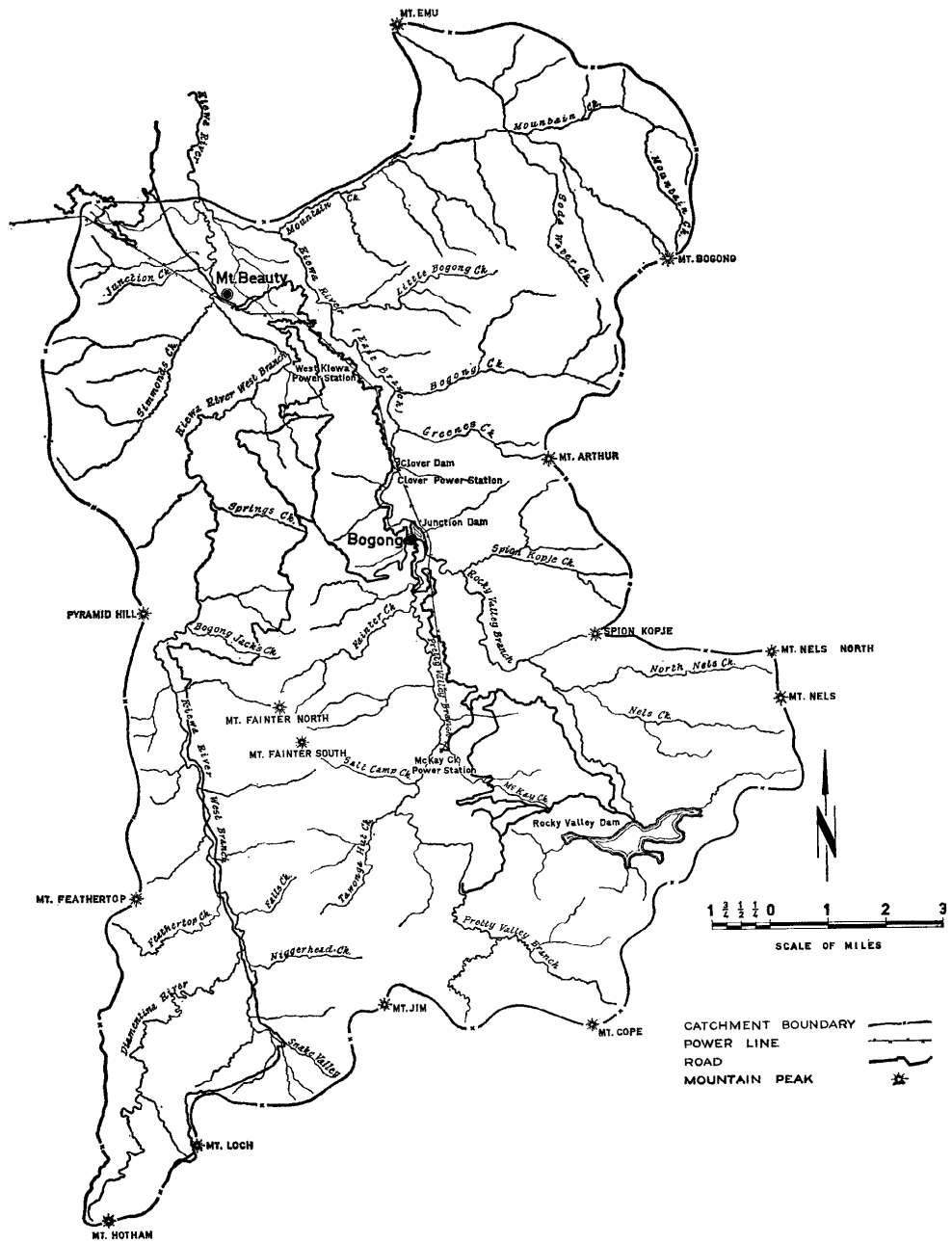
THE Governor of the State of Victoria in the Commonwealth of Australia, by and with the advice of the Executive Council of the said State and in pursuance of the provisions contained in section 22 of the *Soil Conservation and Land Utilization Act 1958* (No. 6372), do by this Proclamation define the water supply catchment to be known as the Upper Kiewa Supply Catchment.

The area to be proclaimed is the catchment of that part of the Kiewa River upstream of the confluence of the East and West Branches of the said river and includes all that land defined by the following boundary:

Commencing at the confluence of the East and West Branches of the Kiewa River and throughout following the watershed to the Kiewa River upstream from this confluence through Mount Emu to where the said watershed joins the watershed between the tributaries of the Kiewa River to the west and the Mitta Mitta River to the east as previously defined in the description of the Hume Reservoir Catchment (*Victoria Government Gazette*, 5th July, 1950, page 3754), following this common boundary through Mounts Bogong, Nelse and Loch to Mount Hotham, where the watershed between the Kiewa and Mitta Mitta Rivers separate; thence following the watershed between the tributaries of the Kiewa River to the east and the Ovens River to the west through Mount Feathertop and Pyramid Hill to the point of commencement.

The use of land within this catchment is subject to determination by the Soil Conservation Authority, acting under the provisions of section 23 (1) (a) of the *Soil Conservation and Land Utilization Act 1958* (No. 6372).

The area described is indicated on plan No. 1167 hereunder, the original of which is lodged at the head office of the Soil Conservation Authority, 378 Cotham Road, Kew, E.4.



Given under my Hand and the seal of the State of Victoria aforesaid, at Melbourne, this twenty-fourth day of February, in the year of our Lord One thousand nine hundred and sixty-five, and in the fourteenth year of the region of Her Majesty Queen Elizabeth II.

(L.S.)

ROHAN DELACOMBE
By His Excellency's Command
JIM BALFOUR
Minister for Conservation

GOD SAVE THE QUEEN!

By Authority: A. C. BROOKS GOVERNMENT PRINTER, MELBOURNE

2. BASIS AND EXPLANATION OF AIMS

A. Purposes of Land-Use Determination

The purposes can be stated in terms of section 22 and 23(1) of the Soil Conservation and Land Utilization Act 1958, and the Government Directive dated 29/11/1960, regarding land-use on land above the elevation of 4,000 feet.

1. **Section 22.** The Governor-in-Council may by proclamation published in the Government Gazette define water supply catchment areas for the purposes of this Part and amend or revoke any such proclamation.

("This Part" refers to Part 111 of the Act, covering Land Utilization - Division 1 - Water Supply Catchment Areas).

Section 23(1)

"The Authority after consultation with the Land Utilization Advisory Council shall determine

- (a) the most suitable use in the public interest of all land in catchment areas"
 - (b) which of such lands should be permanently used for forest purposes and which may (without deterioration of or detrimental effect to water supply catchment) be used for pasture, agriculture or any other purpose; and
 - (c) the conditions under which various forms of land-use may be permitted."
2. The Government Directive of 29th November, 1960, made the Authority responsible for the supervisory control of all grazing and earth works within alpine areas above the elevation of 4,000 feet. This control was stated specifically to link up with the statutory responsibility of the Authority in regard to determination of land-use in proclaimed catchment areas.

Land-use Determinations present the basic plan for implementation of the above mandate.

In the Upper Kiewa Water Supply Catchment, land-use determinations would cover all land above 4,000 feet as well as land below that elevation down to the junction of the East and West Kiewa Rivers to which the catchment has been proclaimed. However, the determinations envisaged for the area would cover the entire Bogong High Plains as a complete land system, and would thus cover the land on both the Upper Kiewa and Hume Catchment sides of the watershed. This total coverage would provide the basis for co-ordinating the use of the area for catchment purposes with other forms of land-use.

B. Format.

The full achievement of such purposes is a complicated process and in some instances may remain partly idealistic.

For example, while some parts of the High Plains may be suitable for periodic grazing by cattle, other should never be grazed. Practical limitations for permitting grazing in one area and excluding grazing from another nearby area may require the complete or periodic exclusion of grazing from both areas. The alternative may be a compromise in which the more vulnerable area may suffer severe and long-lasting damage. An example of such a problem are the peaks rising above the High Plains.

However, within the limits of present knowledge and experience the following stages are suggested.

(1) Formulation of a basic land-use determination.

This consists of classifying land within the catchment into those areas which may be used exclusively for water production purposes, and those areas which may be used for water production and other forms of land-use. In a water supply catchment, we may distinguish between two types of land-use conveniently termed in this report "primary" and "secondary".

- (a) Those which involve use of the land in its natural form without interference to the natural topography, and which include agriculture, grazing and forestry i.e. "primary" forms of land-use. The permanence of any of these forms of land-use depends on full knowledge of the ecology of the area, and the application of suitable techniques for the management of the land without causing deterioration of the water supply.
- (b) Those which involve modification of the natural topography, and which include engineering projects, such as reservoirs and race-lines; mines, roadworks and tourist settlements. With increasing development and pressure, these works may be necessary, although they are not always "most suitable" forms of land-use for water catchment purposes. Nevertheless, the operative consideration of the Authority's land-use determinations shall be whether the works are "in the public interest", and if so, whether it is possible to design and locate them in such a way that their presence is not detrimental to the water supply.

The only way to achieve a satisfactory balance between the need to produce reliable, plentiful and high quality water and the need to practise other forms of land-use is to establish a sound system of co-ordination between the organisations involved. This will enable advance planning including the determination of correct locations, timing and the application of suitable stabilisation measures on unavoidable earthworks.

The basic land-use determination would classify the land in terms of "primary" forms of land-use only. In applying such a basic classification, ecological considerations are used only. A plan can thus be drawn up showing the boundaries between areas to which different forms of land-use would apply. Tenure is completely disregarded in this basic determination.

(ii) Modifications Required for "Secondary" Forms of Land-Use.

The land-use determination as finally proposed takes into account the possibility of forms of land-use other than grazing agriculture or forestry. Within the context of the determination, a set of workable conditions or "prescriptions" must be prepared to ensure a conservation approved in the operations of each form of land-use. The outline of content of such conditions is set out in a later section of this report. The fundamental aspects which must be achieved in all instances include satisfactory location of access roads on which safe disposal of drainage and stabilisation of batters can be achieved and prompt reclamation of areas disturbed by engineering processes. In some parts of the catchment, such disturbance is undesirable under, any circumstances and in such areas the Authority's determination could require the abandonment of proposals from their organizations because of ecological considerations, or because of the high cost of stabilisation measures.

(iii) Implementation of land-use Determination

The achievement of prescriptions which are satisfying for several forms of land-use will take considerable time but it should be possible to set a deadline for the formulation of prescriptions involving particular organizations. However, the land-use determinations should be finalised during 1965, following consultation by the Soil Conservation Authority with the State Electricity Commission and the Land Utilization Advisory Council.

3. ENVIRONMENT OF THE UPPER KIEWA CATCHMENT

The formulation of a land-use determination is based on the type of environment of the area. The following description aims to present a picture of this environment, which will clarify the material of the succeeding section of this report.

The area can be sub-divided into five geomorphological units which form convenient divisions on which to base the descriptions of the principal features of the environment. The five units are

- A. The High Plains.
- B. The Scarps.
- C. The Mountains and Gorges.
- D, The Hillocks.
- E. The Terraces*

A. *The High Plains.*

The unit consists of rolling to hilly country at elevations from about 5,000' to over 6,000'. Low hillocks, rounded ridges and shallow concave valleys with relatively flat grades make up most of the area. Steeper slopes occasionally occur, mainly near the edge of the unit or as interfluves between major drainage systems. The unit is clearly defined by sharp increases in slope where it gives way to scarp and mountain land-forms.

Average annual precipitation ranges from about 60" to over 90" and a large proportion of winter precipitation is snow. The accumulation and persistence of the snow are important features of this environment.

The stronger and most persistent winds are northwesterlies. This is of some importance as these winds are powerful erosive agents and they also influence snow accumulation by drifting.

Frosts may occur throughout the year but are most common in depressions due to the drainage of cold air into them. Frost action on bare soil powders the surface and creates favourable conditions for wind erosion. Considerable soil movement is caused by frost action on bare slopes such as road batters.

Average monthly temperatures are below 42°F from April to October inclusive, indicating that no plant-growth is likely in these months and are below 50°F during March and November so that plant-growth is restricted in these months. This leaves December January and February as the only months in which temperatures are high enough for active plant-growth. It is estimated that on the average the monthly potential evapotranspiration never exceeds monthly rainfall so that soil moisture should not be a limiting factor for other than shallow rooting plants. The excess of precipitation over evaporation leaves about 50" for contribution to stream flow.

The rocks of the High Plains unit are mostly gneissic but small areas of granodiorite occur south of Rocky Valley dam, and at the head of Mt. Jim - branch of Pretty Valley Creek. A large area of granodiorite occurs in the central-mountainous part of the catchment and another is centred on the Niggerhead.

Alpine humus soils are dominant over the well drained parts of the unit. These are all very acid soils with pH's as low as 4.5 common. They have a predominantly organic profile. They are very well structured and when dry, are light and friable and readily eroded if not protected from frost and wind.

Lithosols occur mainly on exposed ridge-tops and hill-tops, particularly those exposed to the north-westerly winds. Rock-screes or rock-rivers occur in the basalt areas.

Peats derived from sphagnum-moss bogs are widespread in the valley bottoms, and where a perched water-table comes to the surface. Humified peats are fairly common and probably indicate the effect of lowering of the water table as a result of stream entrenchment during the exploitative grazing period early in the century. Fen peats, acid marsh soils, snow-patch meadow soils and gley podsols have restricted occurrence in specialised localities.

The most widespread vegetation types are tussock grassland of snow grass (*Poa australis*), and the alpine herbfield in which snow grass and snow daisy (*Celmisia longifolia*) are dominants. The former is the vegetation on the cold-air drainage depressions and the latter occurs over well drained sites, mainly at the higher altitudes.

Alpine shrub communities in which numerous species such as alpine orites (*O. longifolia*), alpine mint (*Prostanthera cuneata*), long-leaved Hovea (*H. longifolia*) and golden Oxylobium (*O. alpestri*) occur, are also widespread. Shrubs are important primary colonisers of bared soil. The present-day extensiveness of the shrub communities has been attributed to the widespread damage of the grassland and herbfield vegetation by stock and fire.

The Sphagnum moss bogs occur in permanently wet localities. These are not as extensive as they used to be because of stream entrenchment and lowering of the water-table.

Sub-alpine woodlands of snow-gum (*Eucalyptus pauciflora*) occur on well drained sites, particularly where snow is least persistent. Fire damage has reduced much of the woodlands to wet-mallee farm regrowth.

Other vegetation communities such as fen, short alpine herbfield and feldmark, though not extensive, are important as they represent the climax vegetation of highly specialised situations.

At present the High Plains unit is used as a source-area for water for hydro-electric power generation, as summer grazing for beef-cattle and for tourist activities such as winter snowsports and hiking in summer.

By far the most valuable product of the area is the water which contributes significantly to the supply for summer irrigation in the Murray Valley as well as its use for power generation.

The grazing of stock on the unit has caused much deterioration of the vegetation of the area and presumably to the hydrologic properties of the catchment. Even under present, controlled grazing, damage is occurring in vulnerable areas and recovery is being retarded. The major vegetation species, snow grass, is not palatable to cattle when mature, and only the seedheads and the herbs are grazed. This severely reduces the seed available for revegetating damaged areas and tends to eliminate the herbs as useful soil cover. It leads to excessive grazing pressure on the limited areas of palatable vegetation. Even though cattle do not willingly graze the mature snow grass of the High Plains, they accidentally pull it up whilst trying to get to palatable and fresh shoots. The high pressure exerted by the hooves of heavy cattle is sufficient to kill snow grass which is very susceptible to this type of damage, particularly early in its growing season. Much of the damage attributed to cattle may be caused in this way. The shrubs are also trampled and "pruned" and their lifecycle is thereby extended. Although there is still much to be learned about the management of the High Plains unit, particularly in respect to grazing, the present indications are that grazing is detrimental to the hydrology.

B. The Scarps.

The scarps are areas of very steep to precipitous slopes. Those specifically referred to are the scarps just below the High Plains unit such as those at the heads of Cairn and Bogong Creeks below Mt. Bogong, in the head of Spion Kopje Creek, in Pretty Valley Creek just below Mt. McKay, south of Mt. Fainter (south) and in the heads of Feathertop Creek. The total area involved is small and consists of a number of separate areas.

There are no climatic records for the scarps but it may be assumed that macro-climatically they are similar to the High Plains. However, their steepness imposes some important modification. Runoff is high and the soils are shallow so that effective moisture availability is low compared with the High Plains. Northern and western aspects are markedly warmer and receive more direct solar radiation than southern and eastern aspects. This affects moisture availability as well as soil temperature. Whereas snow may lie on ledges on southern aspects, northern aspects are largely snow-free.

Up-draft winds are common and result in an even more windy environment than the High Plains experience. In general the scarps provide a much more rigorous environment for plant growth.

Soils are shallow, lithosolic and not widespread. Rock faces and screes are more common. Alpine humus soils may form in stable pockets or on ledges.

The rocks are mostly gneiss, tending towards schists in the east of the area and gneissic granodiorite near Mt. McKay. The Feathertop and Diamantina scarps are on Ordovician shales.

The vegetation consists mainly of alpine herbfield in which small snow daisy (*Brachycome minalis*) and alpine Wallaby grass (*Danthonia alpicola*) are dominant. Small ferns are also common in well-watered places.

In general, there is little danger to the stability of these areas from grazing as cattle do not frequent them to any extent. They would probably not carry a fire, and, in any case, the vegetation is probably not important in maintaining stability. Stream entrenchment, which would steepen the slope, is the most likely cause of movement.

C. *The Mountains and Gorges.*

This unit which occupies about 80 per cent of the Upper Kiewa catchment consists of long, steep slopes, narrow ridges and spurs and narrow, gorge-like valleys. Elevations range from about 1200' in the north to over 6000' on the Razorback and Mt. Feathertop and some of the spurs running off Mt. Bogong.

The range of climate is considerable. Rainfall varies from about 45" in the lower country to over 80" and on the higher ridges snow is a feature of the winter weather. Average monthly temperatures at lower elevations range from about 70°F in January and February to about 45°F in July. Thus plant growth is never entirely prevented by low temperatures but is restricted for about 3 months in winter. At the highest elevations, the range of temperature is similar to that on the High Plains unit and similar restriction of plant-growth due to low temperatures may be expected. No frost data is available for this area but cold air drainage is not as severe as on the High Plains because the tall dense vegetation reduces radiation cooling of the air near the ground. Humidity figures for Bogong township and Hotham Heights indicate relative humidities of 60 to 65 per cent in summer rising to about 90 per cent in winter. The protected valleys have higher humidities than the exposed ridges.

The rocks all have high silicon/iron-magnesium ratios but vary in texture from very fine shales to the west of the West Kiewa to the coarse-textures granodiorites of the centre of the catchment and the Niggerhead area.

The soil pattern is closely related to the effective climate and thus to topography. Lithosols are common on steep slopes and the exposed ridge tops. The lower country has weakly podzolised brown loams to clay-loams (crypto-podsols) and red clay-loams (amphi-podsols). With increasing moisture availability and decreasing temperatures the extent of podzolisation lessens and accumulation of organic matter at the soil-surface increases. Deeply weathered brown loams and clay-loams showing no podzolisation (acid brown earths) occur extensively at elevations between about 2,500' and 4,000'. Above these soils, low temperatures limit chemical weathering and decomposition of organic matter, resulting in less deeply weathered soils with increasing amounts of organic matter (transitional alpine humus soils and alpine humus soils) at the highest elevations. All of these soils are acid but those at the highest elevations have the lowest pH's, as low as 4.5.

They are fairly well leached of plant nutrients and of those remaining, most are concentrated in the surface few inches.

The higher mountain soils are very permeable and well structured. Their stability to water erosion is good unless the structure is broken down and they are compacted as on roads. The lower elevation soils are less stable than the higher ones and are more easily compacted. Soils derived from coarse textured parent materials, such as grandiorites, are more readily eroded than those formed on fine textured materials, such as shales.

The vegetation pattern is also influenced by the climate. At the highest elevations, tussock grassland or herbfield occur with shrubs. Snow gum woodlands occur at lower elevations and below about 4,500' pure forests of alpine ash replace the snow gum. At lower elevations and on warmer aspects the alpine ash forests are replaced by forest of mixed species, mainly narrow-leaf peppermint (*E. radiata*) candlebark gum (*E. rubida*). Broad-leaf peppermint (*E. dives*) blue gum (*H. bicostata*) and Bogong gum (*E. chapmaniana*) also occur in these forests.

The ground flora of the forest communities is normally a swath of herbs and grasses with a shrub layer which may be tall and very dense. On drier slopes at lower elevations the ground flora is often sparse and in these situations forest litter becomes very important as soil protective cover.

Logging of alpine ash forests in the West Kiewa valley is the main forest utilisation in the area. Other forestry activities are mainly fire protection and spraying plague infestation of stick insects.

Some cattle grazing is carried on in the forest country but the snow gum woodlands, the grasslands and herbfields are used more intensively.

D. The Hillocks.

This unit, which represents only about 5 per cent of the area, is confined to the north of the catchment, mainly in Mountain Creek and the lower reaches of Simmonds Creek. The hillocks consist of convex hill slopes of about 25 per cent or less, usually with a maximum slope length of the order of ½ to 1 mile. Where the hill slopes flatten out towards the terraces, concave slopes of the order of 10 per cent or less occur. Elevations range from 1,200' to 2,000'. Average annual precipitation ranges from about 45" to possibly 60" in the upper reaches of Mountain Creek, with little or no snow. Average monthly temperatures in January are about 70°F and in July they are about 45°F. The temperatures indicate that plant-growth will be restricted from June to August with little significant growth occurring in July.

There are no records of frosts for this unit. However, where the forest vegetation remains frost is probably of little significance. It may affect regeneration of timber species following logging. Cleared land, particularly in low-lying areas, would be more subject to frosts. The frost-free period may be expected to be of the order of 120 to 150 days, generally from early November to late March or early April.

The rocks in this unit are mostly schists with some gneiss. Some Ordovician shales and slates occur on the north-western side of Simmonds Creek.

The dominant soils are red, weakly podsolised clay-loams (red amphi-podzols). These are relatively permeable and have good internal drainage. They retain their structure under occasional cultivation but may break down and become prone to erosion with consistent cultivation. They are readily compacted.

Some mild stripping of A horizons and deposition of the sandy textured material near the bases of slopes has produced similar soils with shallow A horizons in some situations and some poorly structured, poorly drained soils in the depositional areas.

The vegetation is forest of narrow-leaf peppermint and candlebark with broad-leaf peppermint on drier sites and blue gum in wetter situations. Swamp gum (*E. camphora*) and ti-tree (*Leptospermum scoparium*) grow on the poorly drained soils of the lower drainage lines.

Where the native vegetation has been cleared from the hillocks there has been little attempt to introduce improved pastures, and often the native scrub and tree species are regenerated in the cleared land.

E The Terraces.

Although they do not occupy much area in relation to the whole catchment, the terraces are of importance because of their agricultural potential. They are mainly on the Kiewa River at and north of Mt. Beauty township, but small terraces also occur on Simmonds and Mountain Creeks.

There are four obvious terraces in the unit. The top or fourth terrace represents the remnant of a broad-valley fill. The third terrace entrenchment removed most of this valley-fill leaving only a marginal strip along either side of the stream. The surface of the fourth terrace has been partly overlain by hill-ash sheets and alluvial fans which have produced a gently rolling lateral topography and gently rising, somewhat convex slopes up to the bordering hillocks or mountains.

The third terrace is some 20' to 40' below the top terrace with fairly sharp scarps between the two. It is fairly extensive further down the valley but is restricted in the area considered in this report.

The second terrace has been formed about 10' below the third terrace and is quite extensive between the East and the West Kiewa Rivers. The surface of this terrace is rather irregular. Further additions of alluvium along the margins of the streams have produced the first terrace. These deposits are much younger and are stratified and undifferentiated. The lowest terrace is usually not very wide, frequently no more than a few feet.

Climatically this unit is similar to the lower elevation parts of the hillock unit. Average annual precipitation is about 45", all of which is rain. About 16" falls in winter and about 7" during summer. Average temperatures in January are about 70°F and in July they are about 45°F. Because of the low drainage situation of the lower terraces, frosts may be expected to be more severe than on the higher terraces. A frost-free period of the order of 120 to 150 days may be expected extending from early November to late March or early April.

Each terrace has a different dominant soil, although soils similar to those on the three lower terraces sometimes occur on alluvial fans on the fourth or uppermost terrace. The dominant soils of the fourth terrace are mildly podzolised red clay (amphi-podzols) which tend, in places, to resemble morphologically the more strongly podzolised red podzolic soils further north in the Kiewa Valley. Some poorly drained soils, described in the hillock unit also occur on this terrace.

The third terrace has red clay loams to sandy clay loams which are fairly uniform down the profile. The soils of the second terrace are yellowish-brown sandy-loams with a dark brown surface. A shingle or gravel bed commonly occurs at about 3', thus ensuring free drainage. The permeability and erosion resistance of the soils of the two upper terraces would probably deteriorate under constant cultivation or heavy trafficking. The yellowish-brown sandy loams should be better able to retain stability under cultivation.

The vegetation of the hillocks area and lower mountain slopes extends onto the fourth terrace. On the poorer drained soils, swamp gum and ti-tree are dominant. The vegetation of the third terrace has been completely cleared. It may have been similar to that of the fourth terrace. The second terrace has also been cleared but some candlebark gum trees remain, indicating that this may have been a dominant in the original vegetation.

The top terrace is used for grazing beef and dairy cattle and for orchards. The town of Mt. Beauty is on the third terrace, elsewhere this terrace is used for grazing. The second and the first terrace are used extensively for tobacco growing.

4. ORGANISATIONS AND INDIVIDUALS CONCERNED WITH CURRENT LAND-USE IN THE UPPER KIEWA CATCHMENT.

The management of the catchment will be controlled by the Land Utilization Advisory Council through the Soil Conservation Authority. The following section indicates the organisations and individuals which are concerned with different aspects of land-use in the catchment, and which will be affected in different degrees by the implications of a land-use determination.

A. State Electricity Commission.

The State Electricity Commission has a dominant interest in the water from this catchment in connection with its hydro-electric power scheme. This includes large installations such as power-generating stations, the Rocky Valley Reservoir and Bogong. It also includes extensive facilities in the township of Mount Beauty. The S.E.C. installations affect many parts of the catchment but the earthworks associated with water diversion along race lines affect mainly the High Plains and high mountain parts where water production is most efficient. Most of these race-lines are in the proclaimed Hume Catchment, and all are situated well above 4,000 feet.

The central part of the catchment where the main S.E.C. Works are installed is known as the KIEWA WORKS AREA. The tenure of Crown lands in this area, covering 25,000 acres, is vested in the S.E.C. in the form of a Crown Grant. The S.E.C. has formulated Regulations known as KIEWA WORKS PROTECTION REGULATIONS 1954 which relate to some aspects of land-use, both "primary" and "secondary". There are regulations on protection of roads, on the diversion and obstruction of streams or drains on pollution of water supply, on the protection of trees and shrubs and on fire protection. These regulations are specific and fulfil certain definite requirements particularly in relation to tourists. However, with the exception of fire protection and water pollution they bear only limited relation to many important aspects of land management which affect the water supply, particularly for hydro-electric purposes.

The interests of the State Electricity Commission are affected by both the long term aspects of land management which influence quantity and distribution of water, and by the short-term effects of individual operations which may increase the silt load of streams feeding into power stations. It is therefore important that regular silt load measurements be taken, particularly in the West Kiewa Catchment where the greatest amount of forest activity may be expected in future years.

B. Forests Commission

The Commission has a vital interest in forested areas and is responsible for fire protection, management, logging and associated activities within State Forests.

The Kiewa Works Area comes within the fire protected area of the Forests Commission. However, the S.E.C. has its own fire fighting plant for the protection of its installations. This plant is brought into action on general outbreaks. However, because of the need to apply controlled burns for regeneration within ash forest, the Forests Commission maintains overall control over all parts of the catchment.

Forestry activities and extraction in the catchment are to be managed under the terms of special prescriptions. A set of prescriptions was prepared in 1961 by the Forests Commission in consultation with the State Electricity Commission. A most important aspect which requires close scrutiny is the location of access roads. These should be planned in relation to a long term plan for logging the catchment, and must take into consideration special areas such as the town water supply catchment for Mount Beauty. Forestry in the catchment will benefit from a thorough assessment of the available timber resources, which will enable better forward planning and assessment of the economics of roading and related activities.

C. *Department of Lands and Survey*

The granting of grazing licences on all Crown lands other than Reserved Forest comes under the jurisdiction of this Department. It is one of the three Government bodies represented on the Bogong District Advisory Committee. It is also represented on the Advisory Committee concerned with the recently proclaimed Mount Hotham Alpine Reserve, part of which covers the south-western portion of the Upper Kiewa Catchment.

D *Mining*

Red Robin Gold Mine at the head of the West Kiewa River is the only active mine in the catchment at present. The mining operation alone is of little consequence in the catchment, but the treatment operations and disposal of material from the mine battery and the access road requirements are matters of concern. Timing of operations and location of new mines, access roads and sludge disposal, as well as other conditions of management, are matters which would require consultation between the Authority, the S.E.C., and the other parties concerned prior to any action being approved.

E. *Cattle Graziers*

The system of tenure in the Upper Kiewa Catchment is one of annual licensing to individual cattle-owners by the Department of Lands and Survey. However, control is exercised over the licensing system by the Soil Conservation Authority. Thirty-seven grazing licences were issued for the season 1964/65 and the Authority can recommend the cancellation of any licences if considered necessary.

For the determination of management procedures, the Authority is assisted by the District Advisory Committee consisting of three cattlemen and representatives of the State Electricity Commission, Department of Lands and the Authority.

The total number of cattle to be grazed is determined prior to every season, and also the date of entry and removal. From this total number each leaseholder then is allotted, on the advice of the District Advisory Committee, the numbers of cattle he may graze, the dates of entry to the Plains, general muster, and any other matters concerning grazing in the area.

F. *Country Roads Board.*

Under the arrangement whereby the Authority has been responsible for grazing and earthworks on land above 4,000 feet, plans for road construction above that elevation would be subject to automatic consultation between the Authority and the Board. This has covered the most essential parts of the catchment. Since the proclamation of the water supply catchment, this arrangement would be extended into the rest of the catchment.

G. *River Murray Commission*

The River Murray Waters Agreement was incorporated in the 1915 *River Murray Waters Act* in the Commonwealth Parliament, and in the New South Wales, Victorian and South Australian Parliaments. It provided originally for the construction or works, the allocations of the water between the three States concerned, and the appointment of the River Murray Commission to give effect to the Agreement. In 1949, two of several new amendments covered the protection of the Upper Murray Catchment against erosion and the provision for better conservation and regulation of Murray waters. The water from the Kiewa Catchment drains to the Murray River above Albury but below the Hume Reservoir, but it is still part of "Murray Waters" as defined in the River Murray Waters Agreement, which includes the flow in the River Murray and its tributaries above Albury.

The Soil Conservation Authority submits an annual report to the Commission regarding the condition of the Hume Catchment and the Bogong High Plains. Insofar as the Bogong High Plains are part of both the Hume and the Upper Kiewa Catchments, the Commission therefore has an interest in the conservation and management of this area.

H. Sawmillers

At present only one major sawmiller is concerned with utilisation within the catchment. The activities connected with extraction of timber - roading, snigging, log landings, etc are being conducted under prescriptions drawn up by the Forests Commission in consultation with the State Electricity Commission. The Authority's determinations of land-use in forested land usually involve a delineation of boundaries between areas where utilization may be practised on an intensive scale consistent with silvicultural requirements, and areas where surface conditions, slopes, and proximity to streams require restriction of utilization because of the erosion hazard created.

In the Upper Kiewa Catchment, as in similar adjoining areas, the area between 3,500 and 4,500 feet is the land most sought after for logging purposes. This is the zone where alpine ash occurs in largely pure stands as distinct from the snow-gum community above 4,500 feet and the mixed species forest below 3,500 feet. Fortunately for the timber interests, the alpine ash areas are generally those with the most favourable soil conditions and lowest erosion hazard. They would therefore be delineated as being suited to utilization within the catchment. Other areas in the lower parts of the catchment are not so well favoured with rainfall and soils and may require more restriction.

The determination to be prepared for forestry would cover a full set of requirements for different areas. Before any area would be logged, it would be considered on its merits by the Authority in consultation with both the State Electricity and Forests Commissions. The determination would thus be used more as a regulatory measure than a restrictive one wherever possible.

I. Tourist Bodies

The main tourist area at present is Falls Creek Ski Village and the adjoining areas developed for skiing. A similar type of settlement could develop on Mt. Hotham, but this will be outside the Kiewa River Catchment. These settlements are thus confined to the High Plains or highest parts of the Mountains, and present certain definite problems in construction and maintenance, location of access roads, and disposal of effluent and refuse.

Planning of tourist settlements and facilities involve several bodies, which are represented, in the case of Falls Creek, on the Kiewa Works Area Ski Resorts Management Committee. This comprises two representatives of the State Electricity Commission, two nominees of licensees of land in the Falls Creek area, and one nominee from each of the following - Soil Conservation Authority, Upper Murray Regional Committee of the Central Planning Authority, and Bright Shire Council. Other departments concerned with the operation of the resorts include the Tourist Development Authority and the Alpine Resorts Development Advisory Committee.

Land-use determinations in the catchment would aim at co-ordinating the aims of catchment conservation with the location, planning, orderly development of such resorts, so that the need for erosion control following constructional works is reduced to a minimum, and stabilisation measurements are easily achieved. This can be achieved only by considering plans for new developments prior to their finalisation, so that all aspects of the environment can be taken into account.

J. Residential Administration

Mount Beauty Township is now administered by Bright Shire Council. While this Council would be kept informed of land-use determinations covering the area, there is unlikely to be any significant effect on the land-use of the Mount Beauty area which mostly covers gently sloping or flat country.

K. Private Landholders

A few properties would be included in the proclaimed area as proposed at present down to the junction of the East and West Kiewa Rivers. However, the proclamation would have no effect on present methods of land-use as these properties are on flat or gently sloping land and present land-use is satisfactory.

5. PROPOSED LAND-USE CATEGORIES

A. *Basis of Formulation.*

The following comments give an outline of the approach to be taken towards classifying land in the Upper Kiewa Catchment for the purposes of the land-use determination. This involves ecological aspects of the environment related to the forms of land-use suited to catchment requirements.

The basic statement of any land-use category must have an ecological basis. Thus the knowledge of the environment can lead to categories such as "Land which shall be used and managed solely for water catchment purposes, where protective vegetation must be maintained for optimum catchment efficiency", applied to a sensitive ecological unit of the catchment

OR

"Land which shall be used and managed mainly for water catchment purposes, where agriculture may be practised", applied to an area which may be cultivated and used more intensively.

The dominant form of "land-use" is water supply management, followed by one or more "primary" forms of land-use relating directly to the main components of the environment - climate, soils and topography.

The "secondary" forms of land-use are considered next. As these are subject to varying needs and developments, they are sometimes not predictable and must be covered by a broad practical statement relating to the need for consultation with and subsequent approval of the Soil Conservation Authority prior to a change in land-use being carried out.

In all categories water catchment efficiency should remain paramount, but special emphasis is given to "water catchment" in the first categories because of the sensitivity of the environments to which these categories would apply, i.e. the High Plains, Peaks and Mountain Units.

B. *Land-Use Categories Formulated for the Upper Kiewa Catchment.*

1. "Land which will be used and managed solely for water catchment purposes under the direction of the Soil Conservation Authority".

Comments Land-use within this category is to be directed solely at water production. This implies that the land must be protected from any form of disturbance, though there may be instances where a particular type of management will improve the water holding capacity of an area such as a bog. Two areas can be considered to belong in this category -

- (a) the peaks above the High Plains, where excessive slopes, shallow soils, extreme exposure and related conditions make the environment too sensitive to allow any other form of land-use;
 - (b) the drainage lines on the High Plains, including sphagnum bogs or peat areas, which retain their water holding capacity in an undisturbed condition only. There are, however, many instances of degraded bogs which could be improved by artificially raising the permanent water table.
2. "Land which shall be used and managed primarily for water catchment purposes where this and other forms of land-use shall be under the direction of the Soil Conservation Authority".

Comments This category covers all land on the High Plains other than peaks and drainage lines, down to the change to sub-alpine woodland. The difference from category No. 1 is in the recognition that the land covered here has a less vulnerable nature than the peaks or drainage lines, that therefore other forms of land-use may be considered in the public interest and if a change is

approved, it can be carried out under specific and well controlled conditions. The areas included are the tussock grasslands alpine herbfields, and shrub communities.

3. "Land which shall be used and managed mainly for water catchment purposes, where
 - (a) forestry may be carried out for the purpose of maintaining a sound protective forest;
 - (b) grazing may be permitted under strictly controlled conditions formulated by the Soil Conservation Authority;
 - (c) other forms of land-use. including residential, recreational, commercial or mining developments shall be subject to conditional approval by the Soil Conservation Authority".

Comments This category would apply to the sub-alpine woodland areas down to the transition to forests of alpine ash.

These first three categories will therefore cover the land on the High Plains and the mountain areas of high elevation, which are the areas with the greatest water catchment potential

4. "Land which shall be used and managed for water catchment purposes, where forestry operations may be carried out under conditions specifically prepared for the water supply catchment, and where these and other forms of land-use shall be subject to conditional approval by the Soil Conservation Authority".

Comments This category would apply to the lower mountains, gorges and hillocks as described earlier in this report. Thus it would cover the productive Alpine Ashforests which in the West Kiewa River valley are now being logged extensively. It would also cover mixed species forest.

5. "Land which may be used and managed for agriculture or grazing purposes, subject to conditions imposed for conservation purposes in special circumstances by the Soil Conservation Authority".

Comments The application of this category is almost self-explanatory. It covers the lower slopes and flats at the foot of the mountains along Simmonds Creek, the Mount Beauty area and Mountain Creek. Because of the stable nature of agriculture in these areas, there is likely to be little, if any, effects on landholders' present practices.

6. "Land which may be used for residential, recreational or commercial purposes, subject to conditions imposed under relevant Acts, such conditions to be imposed by the Responsible Authority, in consultation with the Soil Conservation Authority for particular conservation requirements".

Comments This category would apply to township areas in the lower parts of the catchment, as distinct from the specification of such settlements in category 3 which covers the high parts of the catchment. In this instance, the townships of Bogong and Mount Beauty would be covered.

6. RESIDENTIAL AND TOURIST ACTIVITIES.

The following points indicate the range of land-use conditions to be defined in relation to each form of land-use. Formulation of such conditions will usually be done jointly by the Authority, State Electricity Commission, Forests Commission, or principal organizations concerned with the particular form of landuse. The points mentioned below are meant as an indication and don't represent a complete picture, nor are they necessarily in order of importance.

(a)	Grazing	Dates of Entry Criteria for timing of entry Numbers of cattle Localisation of Runs Supervision Licences, sale of properties Management of vulnerable area - e.g. bogs and fens Exclusion of motor vehicles from grassland Presence of bulls and horses Lighting of fires Provision of stock watering points
(b)	Forestry	Logging and extraction methods in relation to silvicultural requirements and on very steep slopes Timing of activities Wet weather prohibition Access Road - culverts, crossings, road surfaces, batters. Maintenance Snigging One chain minimum buffer strip for perennial streams Assessments Fire Control Regeneration methods Timber allocations
©	Mining	Location of new mines Location of Batteries Extent of Sluicing Operations Prevention of stream pollution Sludge disposal Bonds for conservation Living quarters Working Plans Lease control
(d)	Earthworks (i) Type of Earthworks	Roads Tracks Racelines Barrow Pits Gravel stripping Spillways Diversion Works
	(ii) Conservation Requirements covering construction and maintenance	Stabilisation of works especially batters Maintenance of works especially batters Location Gradients Directions Avoidance of deep peaty and boggy soils Time available for stabilisation, sowing down Disposal sections - design and maintenance Fire Control Protection of re-vegetated earthworks from grazing

(e)	Residential, Tourist Establishments and Ski Runs	Design for subdivision Drainage disposal, Drainage patters, Layout Gradient of roads Stabilisation of batters, earthworks Protection of stabilised batters and earthworks from traffic on ski tows or runs when no snow Location of settlements and installations Bonds for conservation Crown Land alienation Permissive occupancies and leases
(f)	Research	Hydrology <ul style="list-style-type: none"> Stream flow Erosion Silt load Vegetation Land management <ul style="list-style-type: none"> e.g. grazing Forestry