

**A REPORT ON
THREE WATER SUPPLY CATCHMENTS
IN EAST GIPPSLAND**

**A proposal for Proclamation
prepared for consideration by the
Land Conservation Council**

By

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SUMMARY

This report recommends the Proclamation of the catchments to the Tambo and Buchan Rivers and the catchment to the Boggy Creek as Water Supply Catchments under the *Land Conservation Act 1970* and the *Soil Conservation and Land Utilization Act 1958*. Proclamation is the initial stage in the process by which the Soil Conservation Authority discharges its statutory responsibility of determining appropriate land use and management in such catchments.

These streams drain more than 3 700 square km of the southerly slopes of the Great Dividing Range and supply water for domestic and industrial use to a number of townships in East Gippsland.

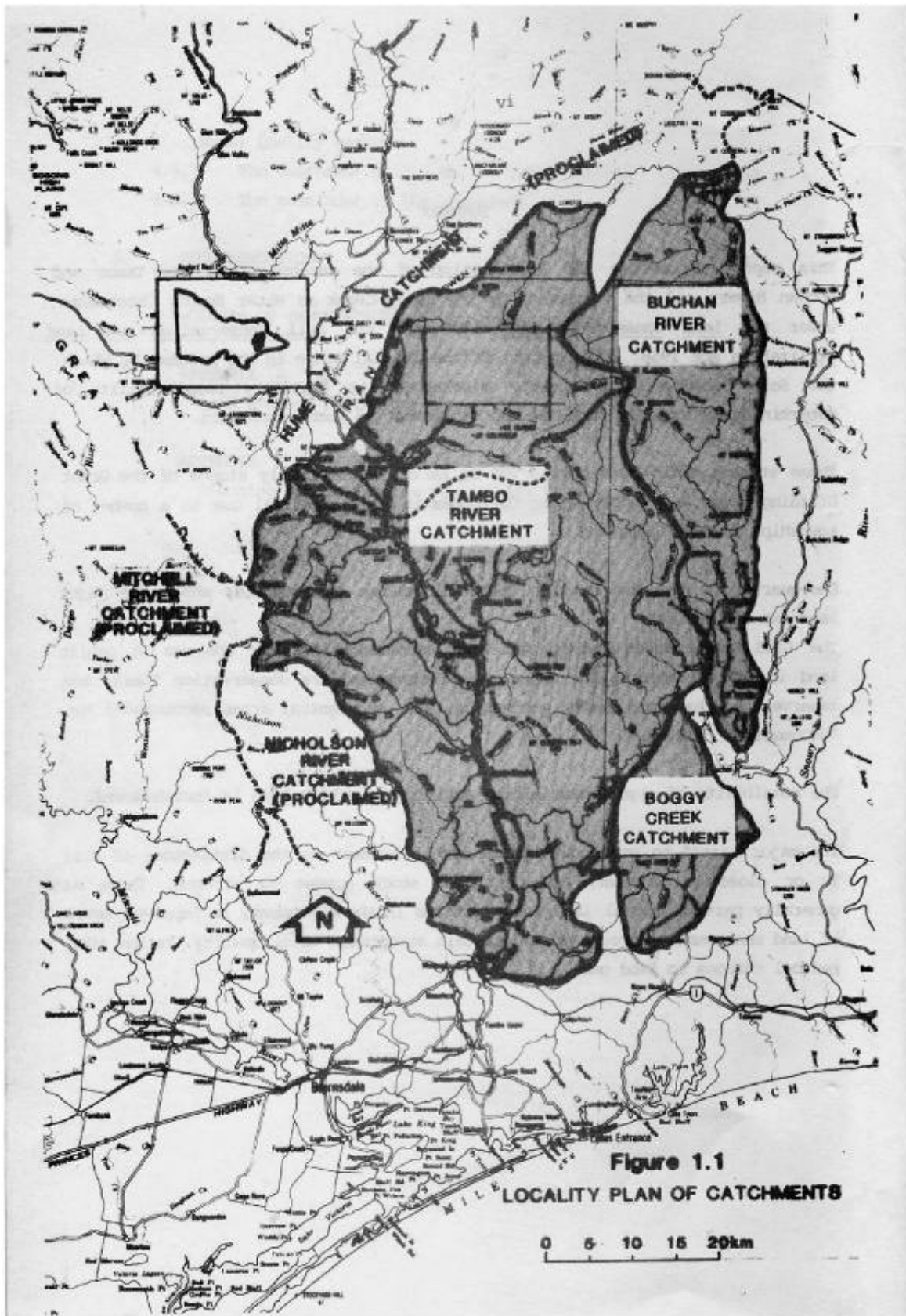
One-quarter of the land in these catchments is freehold, where the major land use is grazing.

The Land Conservation Council has made recommendations for the use of public land in the catchments. The major uses recommended are conservation (parks and reserves) and hardwood timber production, with substantial areas recommended for 'uncommitted' status.

The possibility of significant mining activity of public land is foreshadowed.

The major hazard to water quality in each catchment is the disturbance of soil in or close to streams and continued stock access to streams. These are generally part of normal land use practices in the catchment; an improved level of land management is required to maintain acceptable water quality, rather than radical changes to land use.

Figure 1.1 - Locality Plan of Catchments



INTRODUCTION

This report summaries results of preliminary investigations by the Soil Conservation Authority in the catchments of the Tambo and Buchan Rivers and the Boggy Creek in East Gippsland (Figure 1.1).

These catchments are part of land which has been the subject of studies by the Land Conservation Council, the Alpine Study Area and the Gippsland Lakes Hinterland Study Area. Final Recommendations for both areas have been published (Land Conservation Council 1979, 1983). A review of the Alpine Area is currently being undertaken with Final Recommendations due in December 1983.

It is Council's policy that

“(where).....multiple use is required of a catchment supplying water for domestic, industrial, or irrigation purposes, the catchment should be proclaimed under section 5(1) of the *Land Conservation Act 1970* and section 22(1) of the *Soil Conservation and Land Utilization Act 1958*.”

(Land Conservation Council 1979, 1983)

The three catchments which are the subject of this report supply water for domestic and industrial use to a number of small townships in East Gippsland and to private divertors along the streams. Land in these catchments is managed for a variety of uses.

The Tambo River provides water to two Waterworks Trusts with offtakes at Swifts Creek and at Bruthen. However, the catchment should be proclaimed as a single entity.

The Soil Conservation Authority has a statutory responsibility to determine suitable land use in catchment areas and, as a first step in the process, proclamation is made under the provisions of the *Land Conservation Act 1970* and the *Soil Conservation and Land Utilization Act 1958*. Progression to a Land Use Determination under the *Soil Conservation and Land Utilization Act 1958* may be made if further investigation indicates the need.

This report has been prepared to facilitate the proclamation of these catchments. It is recommended that Proclamation be made under the appropriate Acts.

2. THE BOGGY CREEK (NOWA NOWA) CATCHMENT

The Catchment and Water Resource

The catchment, of some 340 square km, lies on the southern foot slopes of the Great Dividing Range, between Mt. Victoria and the township of Nowa Nowa (Figure 2.1).

The main streams are the Boggy Creek and the Yellow Waterholes Creek. Neither stream is gauged on a regular basis, however spot checks have indicated that summer flows are, at times, unlikely to be sufficient to meet seasonal demand.

Water is diverted for domestic (Nowa Nowa township, population: 265) and industrial (three sawmills) purposes from Boggy Creek, some 6 km upstream of Nowa Nowa.

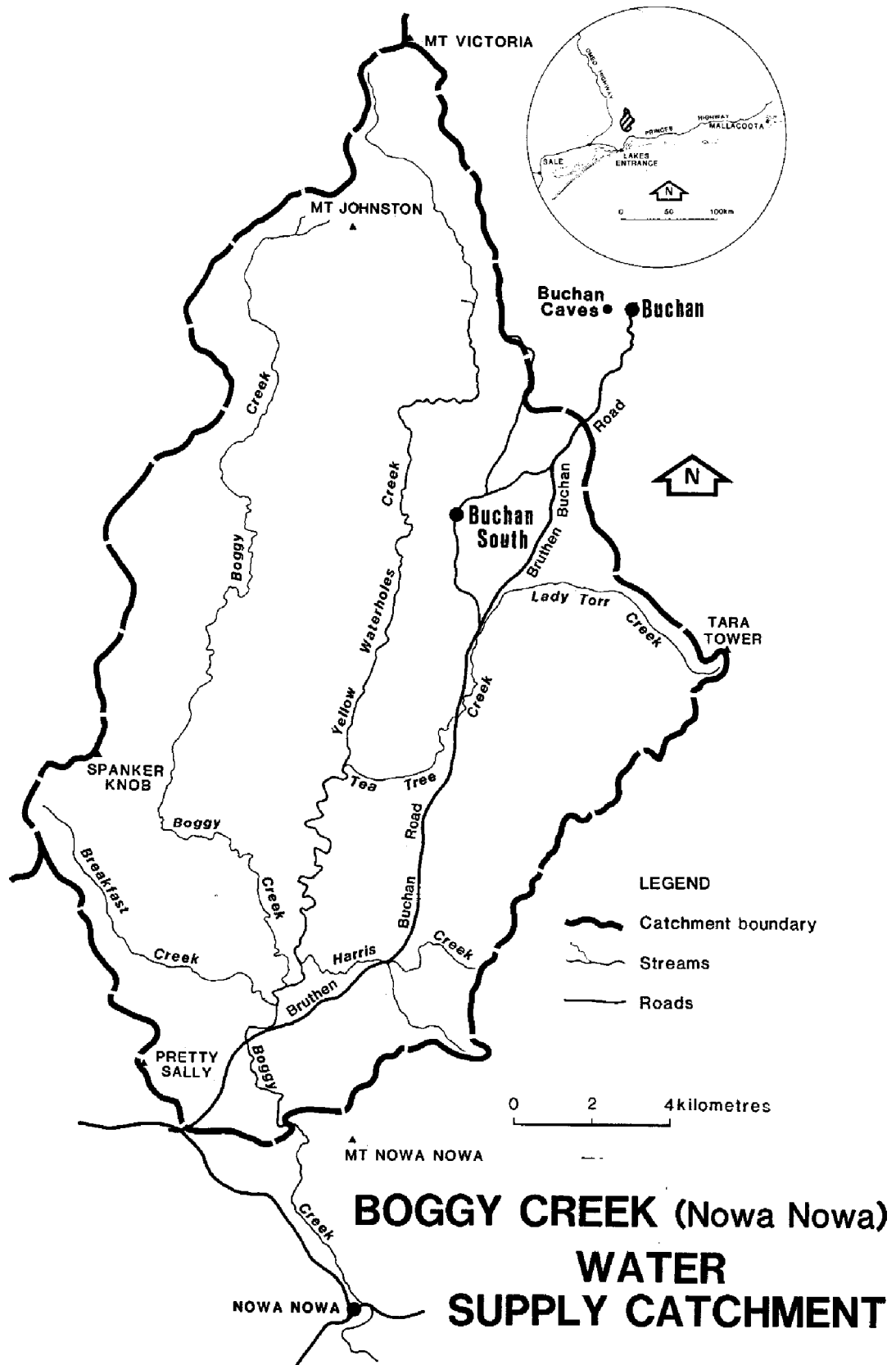
There is one licensed private diversion (industrial, 39 ML) in the catchment.

Water is pumped from a natural on-stream storage (of approximately 45 ML) to storage basins and then reticulated. There are plans to construct a low wall across the stream to increase the storage to 75 ML.

The water is tested monthly for bacterial levels. The raw river water is frequently unsuitable for domestic consumption because bacteria counts and turbidity are recognised locally as problems. The water is chlorinated on a routine basis.

Diversion, treatment and reticulation are managed by the Lakes Entrance Waterworks Trust.

Figure 2.1 - (Boggy Creek (Nowa Nowa) Water Supply Catchment



22 *Climate*

The catchment is subject to a cool temperate climate. Relevant climatic details from Nowa Nowa, which is the meteorological station closest to the catchment, are summarised in Table 2.1 (see also Figure 2.2).

Table 2.1 *Climatic Data.*

STATION: Nowa Nowa		
Mean annual rainfall:	900 mm	
Elevation above sea level:	61 m	
	February	July
Mean daily maximum temperature	28.6 ⁰ C	14.6 ⁰ C
Mean daily minimum temperature	13.4 ⁰ C	1.4 ⁰ C

(Bureau of Meteorology, 1975)

The higher elevations of the northern portion of the catchment are likely to be moister (Figure 2.2) and cooler than conditions experienced at Nowa Nowa. The growing period may be restricted by occasional drought conditions over the summer period.

2.3 Physiography and Native Vegetation

The catchment lies between 100 and 680 metres above sea level, with Mt. Victoria, Mt. Johnston, Spanker Knob and Mt. Tara being the dominant peaks. The terrain is dominated by large tracts of both dissected highlands and foothills, with significant areas of older alluvial plains (Figure 2.3).

The landscape has developed on a variety of rock types, including siliceous and calcareous sedimentary rocks, volcanic rocks, and alluvium.

Native vegetation varies from the moist messmate forest to the drier silvertop, stringybark forest.

(Descriptions of the land systems which characterise the various terrain types are contained in Appendix A).

2.4 Land Tenure, Use and Management.

Approximately 25 per cent of the catchment is freehold land (Figure 2.4) and predominantly cleared of native vegetation. The major land use is grazing, primarily for beef production, with some residential use (the township of Buchan South). The freehold land encompasses all land types, however it is the gentler slopes which are the most intensively developed.

The public land carries native forest which is managed by the Forests Commission primarily as protection forest with small quantities of timber products being extracted.

The Forests Commission has prepared detailed prescriptions for the management of harvesting and regeneration operations; adherence to these is necessary to minimise adverse effects on water supply. Current forest operations are limited to minor post and sleeper cutting (approximately 20 ha for the 1982/83 season and a similar area projected for 1983/84). Some 50 ha of clear felling for saw log harvesting is planned for 1983/84.

A total of approximately 8150 ha was burnt by wildfire in the 1982/83 summer.

Deposits of iron ore have been mined in the past and are currently being further prospected. Quarrying of marble has also taken place in the past for building purposes.

Current water frontage licenses cover less than 1 km of land fronting the Boggy Creek, accounting for only a small portion of such frontages in the catchment. Other frontages may be either unused or subject to illegal occupation.

The catchment is within the Land Conservation Council's Gippsland Lakes Hinterland Area. Final Recommendations for the use of public land have recently been published and are summarised in Figure 2.4.

Figure 2.2 - Boggy Creek (Nowa Nowa) Water Supply Catchment

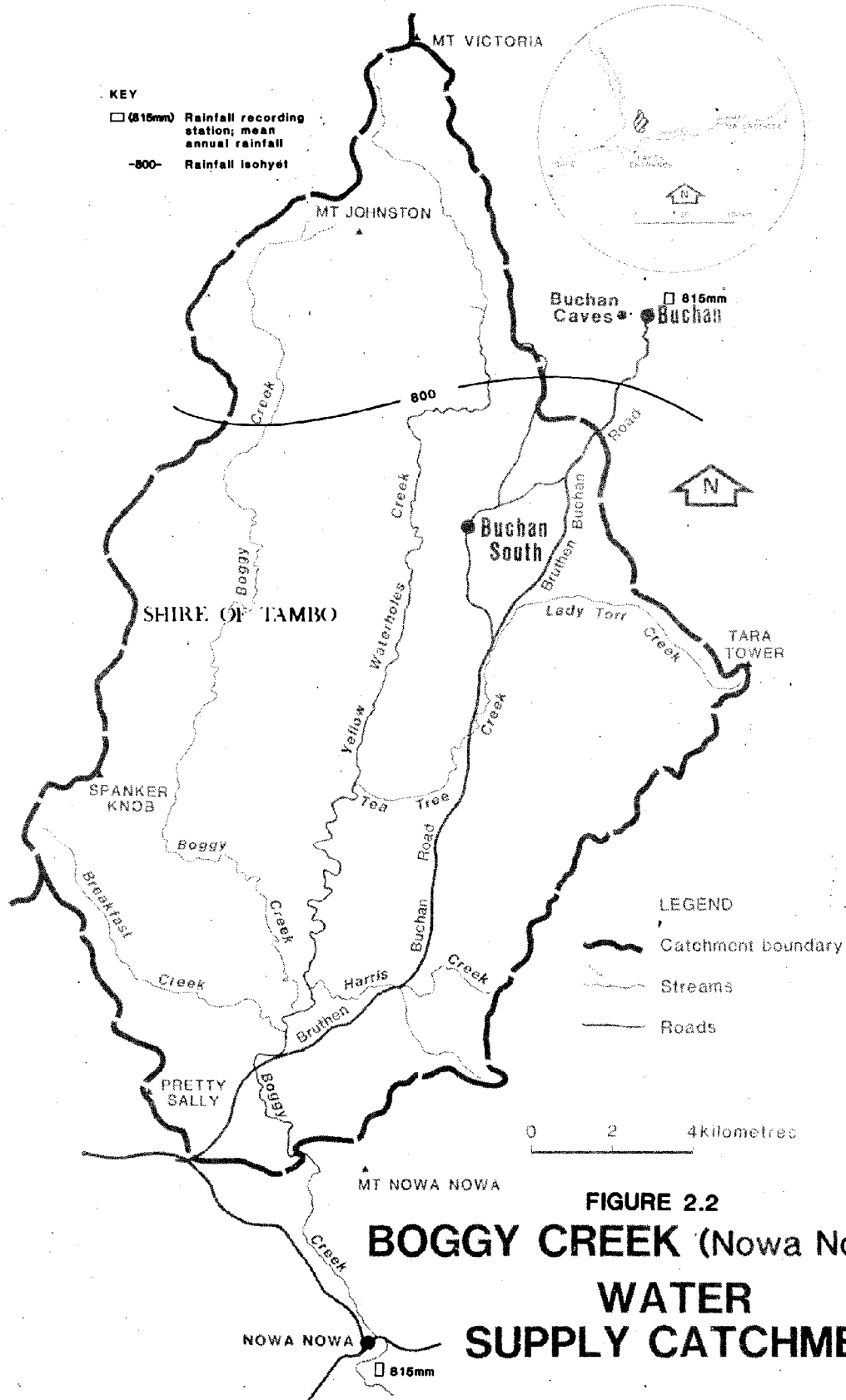
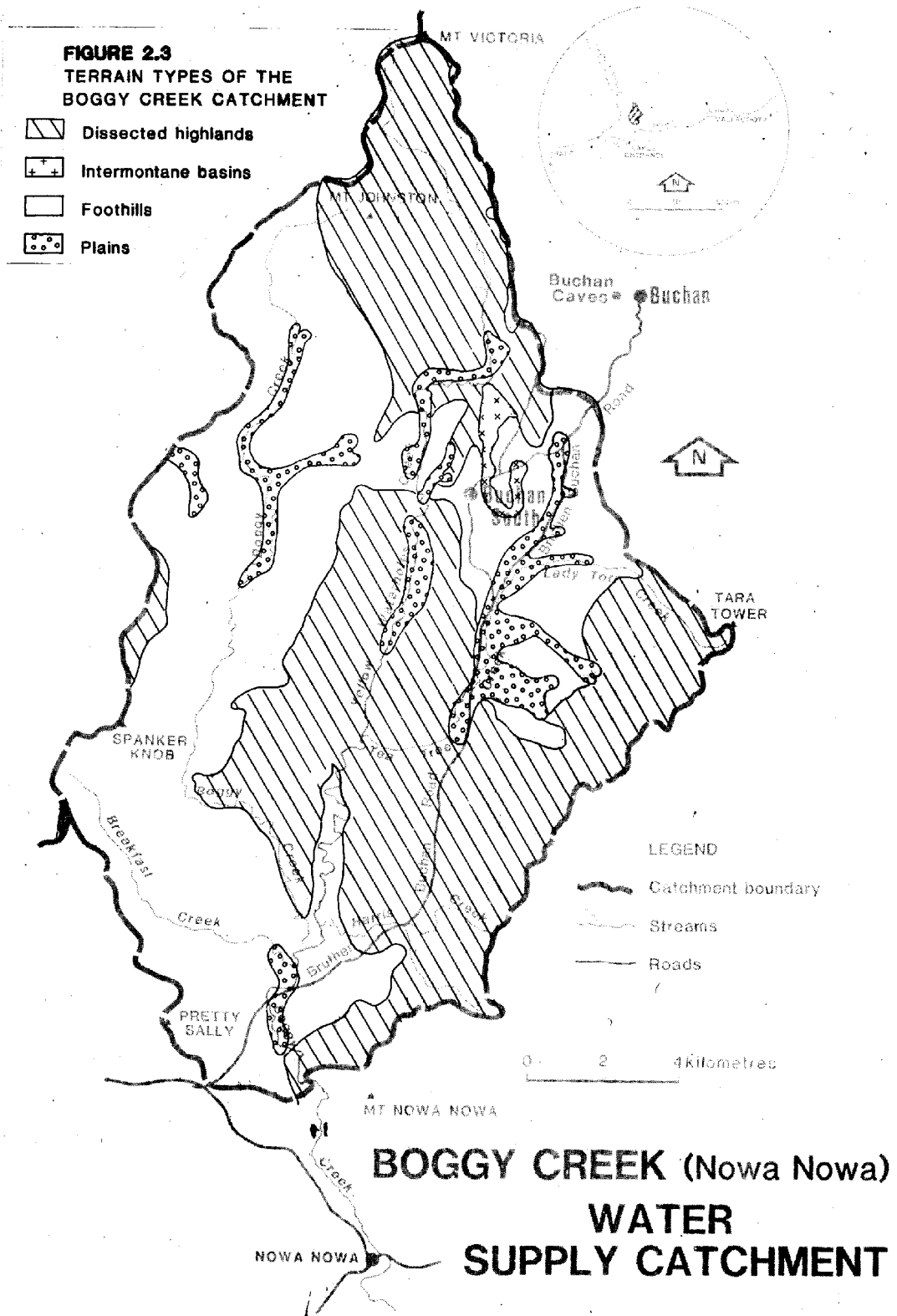


Figure 2.3 - Terrain Types of the Boggy Creek Catchment



The entire catchment is within the Shire of Tambo. Development in the shire is regulated by an Interim Development Order. Freehold land in the catchment is zoned Rural A (general farming); the relevant provisions of this zone relate to minimum subdivision allotment size and density, and the erection of buildings within 250 m of Boggy Creek requires a permit (Appendix B). State Forest is exempted from the Ordinance.

2.4 Water Quality Hazards

Erosion from disturbed sites in or close to streams is the greatest hazard to water quality. Disturbance may arise through forest operations (logging, roading), mining (open cut, roading) or agriculture. Turbidity and sedimentation problems are of most concern. Iron ore bodies in the southern part of the catchment are being prospected and, if payable, may be mined using open-cut techniques. Stock have access to substantial sections of the major streams passing through freehold areas; such access frequently results in faecal contamination and stream bank erosion. This hazard will continue while this access remains.

Aldrick, et al. (in preparation) have identified the Carrabungla, Collins, Wonnangatta, Colquhoun and Westbury land systems (see Figure A.1 and Table A.1) as being erosion prone and extensive land disturbance could be expected to be reflected in poor quality runoff water until stabilisation of the disturbed areas has been achieved.

Figure 2.4 - Boggy Creek (Nowa Nowa) Water Supply Catchment - Land Tenure and Management

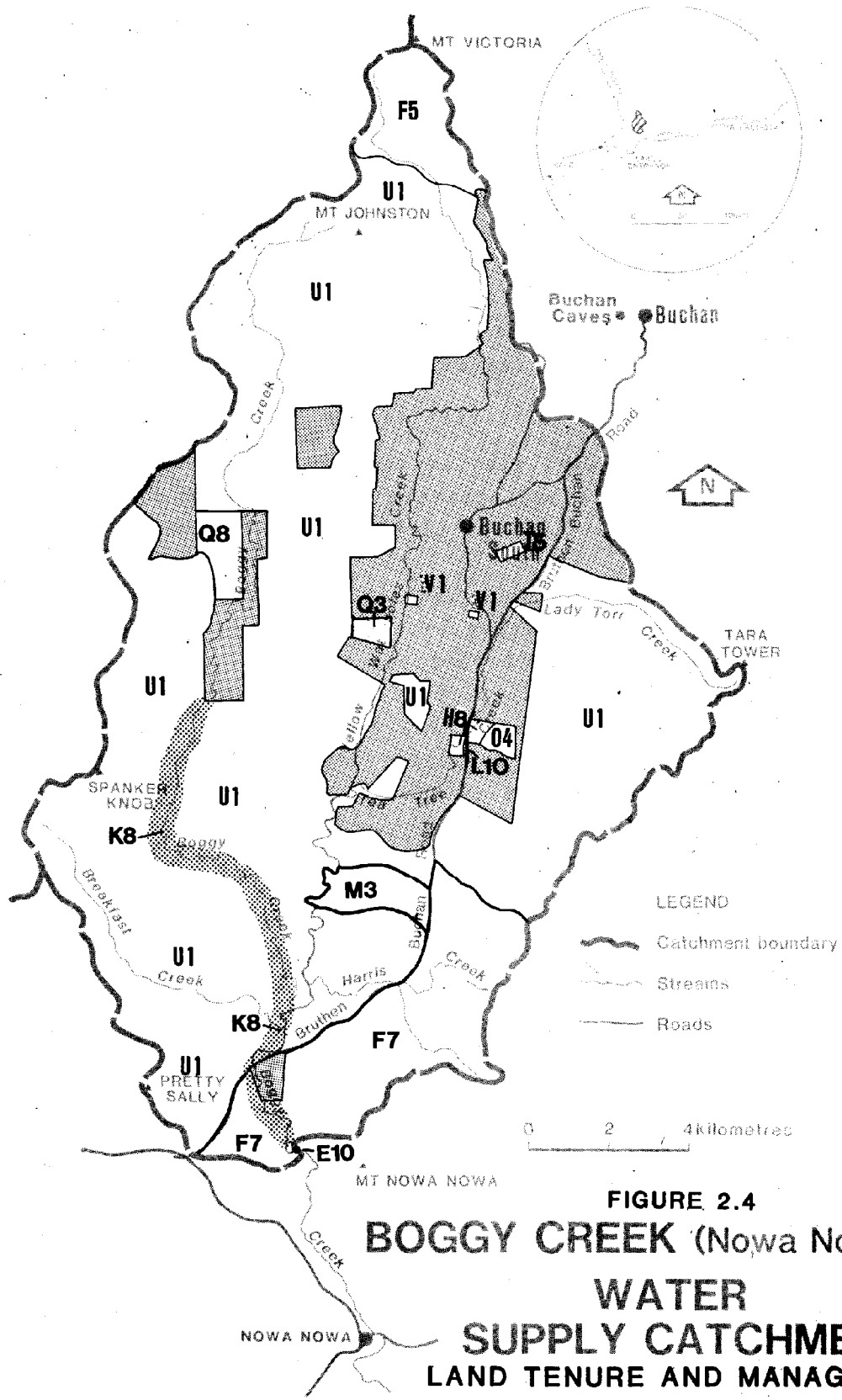


FIGURE 2.4
BOGGY CREEK (Nowa Nowa)
WATER
SUPPLY CATCHMENT
LAND TENURE AND MANAGEMENT

Key to Figure 2.4

KEY to Figure 2.4

FREEHOLD LAND



PUBLIC LAND:

	Recommended use	Nominated management authority
E10	Water production (Boggy Creek offtake)	Lakes Entrance Waterworks Trust
F5	Hardwood timber production (Nanniong - Timbarra - Tambo)	Forests Commission, Victoria
F7	Hardwood timber production (Colquhoun)	Forests Commission, Victoria
H8	Flora reserve (Kanni)	Department of Crown Lands and Survey
I5	Bushland reserve	Department of Crown Lands and Survey
R8	Natural features zone	Forests Commission, Victoria (south of Bruthen-Buchan Rd.) Department of Crown Lands and Survey (north of Bruthen-Buchan Rd.)
L10	Roadside Conservation (site of botanical significance)	Existing
M3	Education area (Cutfinger)	Department of Crown Lands and Survey
O4	Existing recreation reserve	Department of Crown Lands and Survey
Q3	Agriculture	Alienation
Q8	Agriculture	Alienation
U1	Uncommitted	Department of Crown Lands and Survey
V1	Existing use and tenure	Existing

3. THE BUCHAN RIVER (BUCHAN) CATCHMENT

3.1 The Catchment and Water Resource.

The catchment, of some 780 square km, lies on the southerly slopes of the Great Dividing Range, between Mt. Cobberas No. 1 and the township of Buchan (Figure 3.1).

The main stream is the Buchan River, with the Reedy, Mellick Munjie and Frying Pan Creeks being major tributaries.

The Buchan River has a mean annual flow of greater than 150 000 ML (Bibra and Riggs, 1971), far in excess of likely requirements. Water is diverted for domestic (Buchan township, population: 230) and industrial (sawmill) use, from the Buchan River upstream of Buchan. The estimated annual consumption is 40 ML. There are four private deviators in the catchment, two domestic (4.4 ML) and two irrigation (321 ML).

Water is pumped directly from the river to a service basin where only limited detention occurs before chlorination and reticulation. There is no on-stream storage. Chlorination is necessary due to persistently high bacteria levels. The diversion, treatment and chlorination is managed by the Buchan Waterworks Trust.

3.2 *Climate*

The majority of the catchment is subject to a cool temperate climate. Sub-alpine conditions and intermittent snow-cover prevail at higher altitudes.

Limited meteorological data are available for areas within the catchment. There are a number of rainfall recording stations throughout the catchment but no temperature recording stations. However reference is made to recordings from Omeo and Nowa Nowa which are the closest such stations.

The mean annual rainfall recorded at Buchan is 815 mm, with 903 mm recorded at Gillingall (Bureau of Meteorology, 1975). Total precipitation at higher altitudes is substantially greater (in excess of 1600 mm at Mt. Nunniong – Figure 3.2).

The pattern and extent of seasonal changes in temperature are likely to be similar to those experienced at Omeo and in the Upper Tambo River catchment (section 4.2) for the northerly portion of the catchment. Southerly areas are likely to experience a temperature regime closer to that of Nowa Nowa (see section 2.2).

The growing period is likely to be significantly restricted by low temperatures, intermittent snow cover and frost heave over the winter period and, in the lower portions of the catchment, to lesser extent by occasional summer drought.

3.3 Physiography and Native Vegetation

The catchment lies between 80 and 1800 metres above sea level, with Mt. Cobberas No. 1, Mt. Deception, Mt. Wombargo and the Nunnett Plains being the dominant topographic features. There are substantial areas at greater than 1220 m above sea level (Figure 3.2).

Two terrain types dominate the landscape – dissected highlands and plateau remnants, with minor areas of other terrain types (Figure 3.3). The landscape has developed on a variety of rock types, including volcanic, siliceous and calcareous sedimentary and metamorphosed rocks. Native vegetation varies from sub-alpine woodland and grassland, through moister ash, messmate and mountain grey gum forest, to the drier stringybark, silvertop and peppermint forests.

(Descriptions of the land systems which characterise the various terrain types of the lower portion of the catchment land are contained in Appendix A. Those which characterise the upper and mid portions of the catchment are described in the Land Conservation Council's Alpine Study Area Report, 1977. It should be noted that the latter descriptions are considered to be less accurate than the descriptions in Appendix A, which are based on extensive fieldwork).

Figure 3.1 - Buchan River (Buchan) Water Supply Catchment



Figure 3.2 - Buchan River (Buchan) Water Supply Catchment

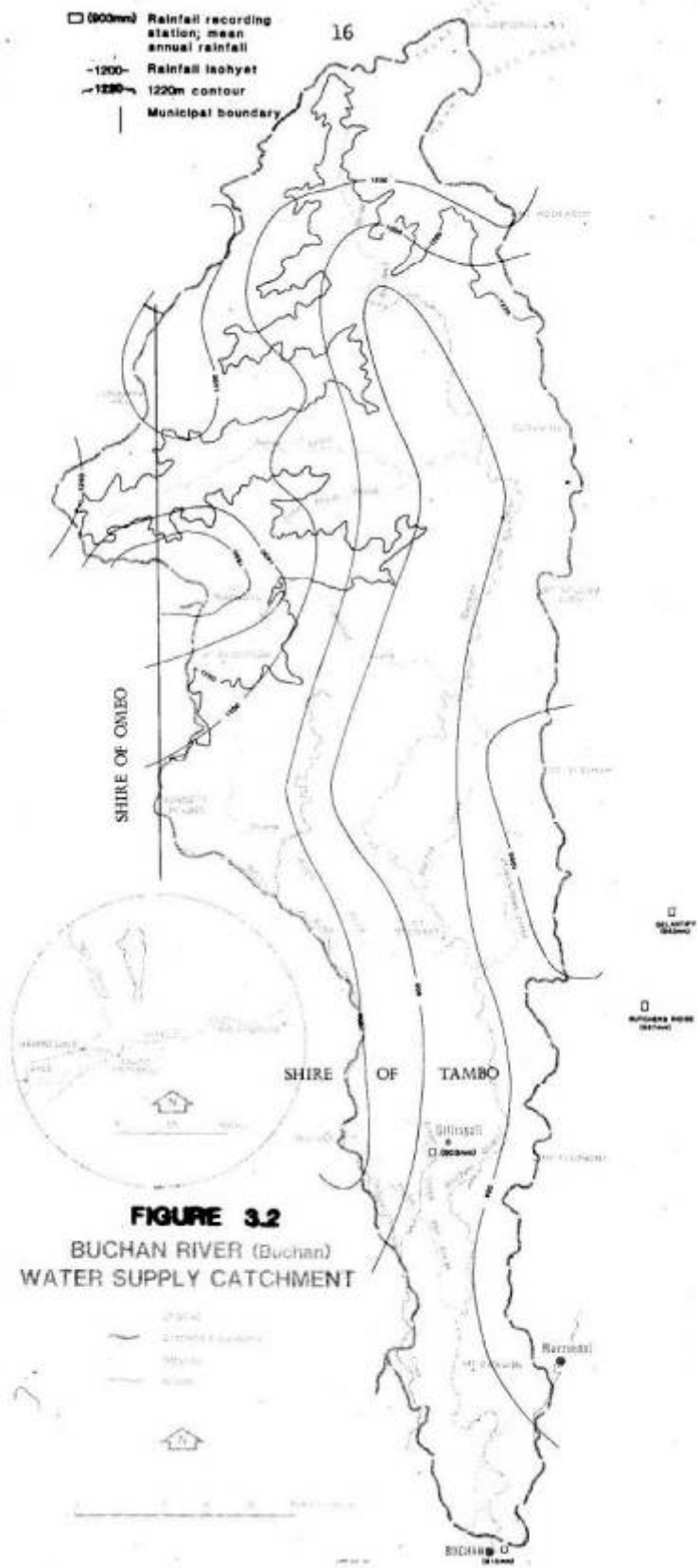


FIGURE 3.2
BUCHAN RIVER (Buchan)
WATER SUPPLY CATCHMENT

Figure 3.3 - Terrain types in the Buchan River Catchment



3.4 Land Tenure, Use and Management.

Approximately 10 per cent of the catchment is freehold land (Figure 3.4) and predominantly cleared native vegetation. Small areas of dissected highlands, foothills and plains, have been developed for pastoral purposes (mainly beef production).

Public land in the catchment is covered by Final Recommendations made by the Land Conservation Council (Alpine: 1979, Gippsland Lakes Hinterland: 1983). The Recommendations for the Alpine Area within this catchment were accepted by the government of the day and are in the process of being implemented. A review of these Recommendations is currently in progress. Final Recommendations for the Gippsland Lakes Hinterland Area have only recently been published. The current approved land use for the alpine areas and the Final Recommendations for the Gippsland Lakes Hinterland Area are summarized in Figure 3.4.

Some 330 ha of clear felling for saw log harvesting was undertaken during the 1982/83 season, with a similar amount scheduled for next season. Operations are centered in the central portion of the catchment. The Forests Commission has prepared detailed prescriptions for the harvesting and regeneration of hardwood forests; adherence to these is required to minimise adverse effects on the water supply.

Wildfires burnt some 3400 ha of forested land during the 1982/83 summer.

Mineral exploration is active in the area. Limestone is being quarried for lime and paper manufacture.

There are a number of grazing licenses held for public land in the catchment; grazing is usually limited to the summer months. There are two water frontage licenses held for 2 km of land fronting the Buchan River, only a small portion of such frontages in the catchment. Remaining frontages may be either unused or subject to illegal occupation.

The majority of the catchment is within the Shire of Tambo, with a small portion of the public land in the Shire of Omeo (Figure 3.2). Development in the Shire of Tambo is regulated by an Interim Development Order. Freehold land of the catchment is zoned Rural A (general farming). Relevant provisions relate to minimum subdivision allotment size and to the erection of buildings within 250 m of the Buchan River which requires a permit (Appendix B). State Forest is exempted from the Ordinance.

The Soil Conservation Authority, by direction from the Premier, has supervisory control over earthworks and grazing on land above 1220 m sea level. Substantial areas of the Cobberas – Tingaringy National Park (including the 'once-only logging' areas) and some of the Hardwood Timber Production areas (around Mt. Deception) are above the 1220 m contour.

3.5 Water Quality Hazards

River water quality is currently unsatisfactory for domestic use due to bacterial contamination and periodic turbidity.

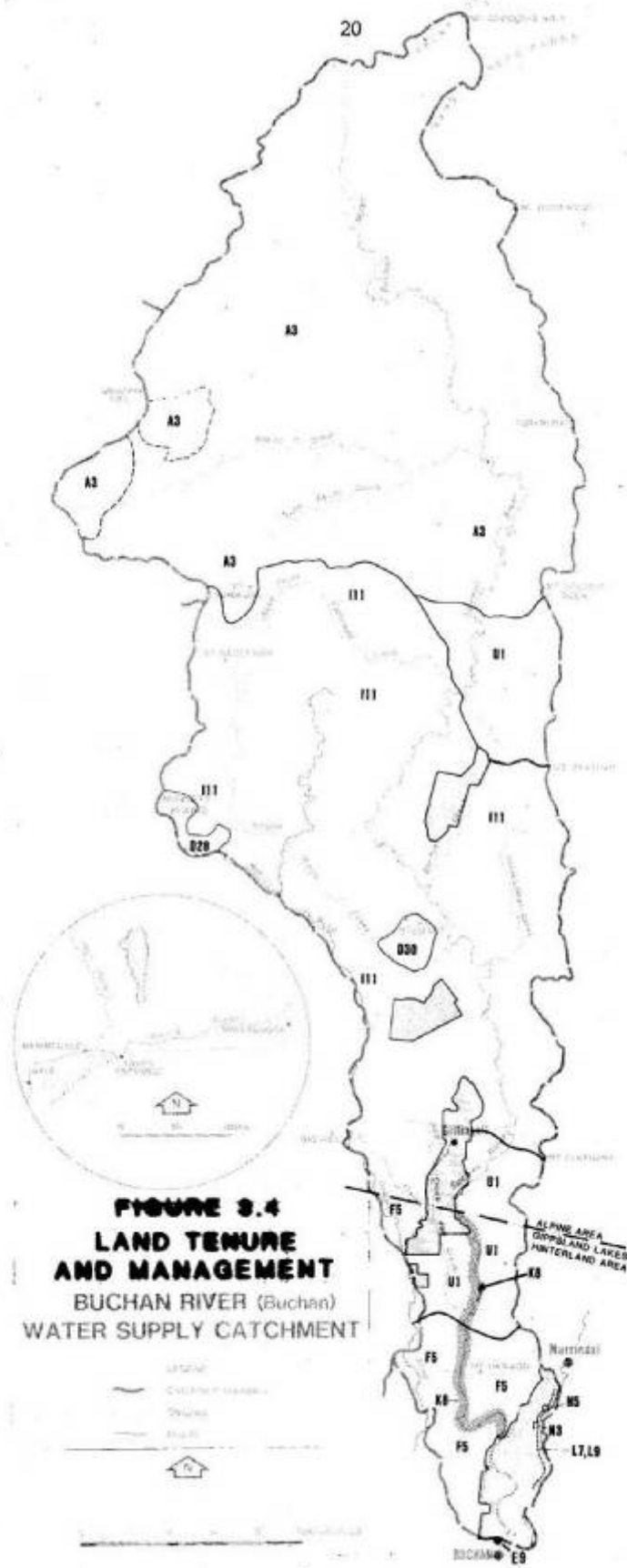
The source of the bacterial contamination has not been identified, however, stock which have free access to streams above the offtake, are thought to be the major source. The turbidity is associated with periods of heavy rainfall.

Grazing on alpine land higher in the catchment is unlikely to have a direct effect on water quality at the offtake, but long term effects on the hydrologically sensitive bogs and springs could adversely affect their regulatory function on stream flows.

Road drainage entering the streams at stream crossings is likely to be the major source of turbidity. Extension of the road network associated with forest operations and tourist activities may exacerbate the problem.

Aldrick, *et al.* (in preparation) have identified the Carrabungla and Collins land systems (see Figure A.2 and Table A.1) as being erosion prone and extensive land disturbance could be expected to be reflected in poor quality run-off water until the disturbed areas are stabilised. The alpine land systems of Jamieson and Bulltown Spur, whilst not as directly erosion prone, are difficult to stabilise once disturbed because of the harsh climate.

Figure 3.4 - Land Tenure and Management



Key to Figure 3.4

KEY to Figure 3.4

4. THE TAMBO RIVER CATCHMENT

4.1 *The Catchment and Water Resource.*

The catchment, of some 2650 square km, lies on the southerly slopes of the Great Dividing Range, between Mt. Leinster and Bruthen (Figure 4.1). The catchment can be considered in two parts, the catchment to the Swifts Creek offtake and the remainder of the catchment to the Bruthen offtake.

4.1.1 *The catchment to the Swifts Creek offtake.*

This sub-catchment, of some 690 square km, lies on the southerly face of the Bowen Mountains, between Mt. Leinster and the Swifts Creek township (Figure 4.1). The mean annual flow at Swifts Creek is far in excess of likely requirements. (The mean annual flow gauged at Bindi, 5 km upstream, is 46 000 ML, (Bibra and Riggs, 1971). However low flows during a dry summer are unlikely to meet the seasonal demand.

Water is diverted from the river immediately upstream of the townships of Swifts Creek for domestic (Swifts Creek, population: 350) and industrial (sawmill) use. The estimated annual consumption is 90 ML. Water is diverted privately under three domestic (6.6 ML) and seven irrigation (334 ML) Permits.

Water is pumped from a sump in the river to storage basins, chlorinated and reticulated. There is no on-stream storage. There are some problems with taste, algal growth and copper contamination and the water is routinely chlorinated prior to reticulation because of bacterial contamination, attributed to water fowl on the storage basins.

Diversion, treatment and reticulation is managed by the Swifts Creek Waterworks Trust.

4.1.2 *The remainder of the catchment.*

The remainder of the catchment, of some 1960 square km, lies between the townships of Swifts Creek and Bruthen (Figure 4.1).

The Tambo and the Timbarra Rivers are the main streams, with Haunted Stream, Wilkinson Creek and Swifts Creek being major tributaries. The mean annual flow of the Tambo River, gauged at Bruthen, is greater than 172 000 ML (Bibra and Riggs, 1971) which is far in excess of likely requirements.

Water is diverted for domestic (townships of Bruthen, Wiseleigh and Mossiface, combined population: 800) and industrial (sawmill) use. The estimated annual consumption is 106 ML. Private divertors in the remainder of the catchment are subject to seventeen irrigation (607 ML), one industrial (50 ML) and 26 domestic (57.2 ML) Permits.

Water is pumped from sand spears in the bed of the Tambo River to service basins and then reticulated. There is no on-stream storage. Diversion, treatment and reticulation are managed by the Lakes Entrance Waterworks Trust.

Bacterial contamination is an intermittent problem and the water has a high iron content. The water is aerated to remove iron and detention at the service basins is the only other treatment applied.

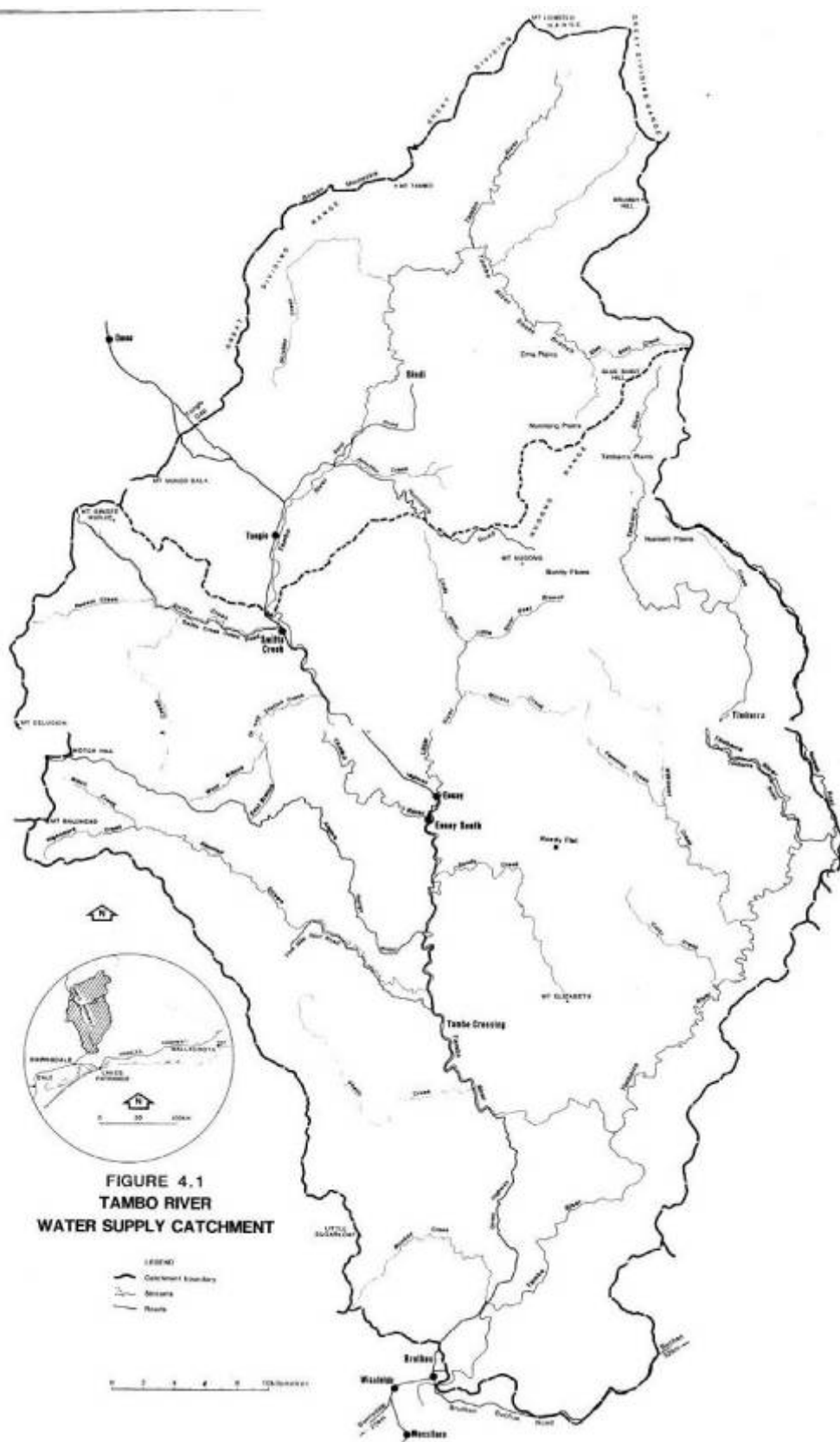
The Trust is also concerned about intermittent extreme turbidity and attributes the problem to the combination of heavy rain and unprotected riverbanks in the Swifts Creek/Ensay area.

4.2 *Climate*

Much of the catchment is subject to a cool temperate climate, with sub-alpine conditions prevailing at higher altitudes in the north.

Recorded mean annual rainfall ranges from 612 mm at Swifts Creek and 668 mm at Tongio, to in excess of 700 mm at Bruthen, Tambo Crossing and Reedy Flat (Bureau of Meteorology, 1975). Total annual precipitation is however much greater at higher altitudes being in excess of 1600 mm at Mt. Leinster and Mt. Tambo, and in excess of 1200 mm at Mt. Bindi, Mt. Nugong, Mt. Deception and Mt. Baldhead (Figure 4.2).

Figure 4.1 - Tambo River Water Supply Catchment



**FIGURE 4.1
TAMBO RIVER
WATER SUPPLY CATCHMENT**

LEGEND

- Catchment boundary
- Streams
- Rivers

0 2 4 6 8 10 Kilometres

Official temperature records are limited to three nearby stations – Omeo, Bairnsdale and Nowa Nowa. The temperature regime in the northern part of the catchment is likely to be similar to that experienced at Omeo (Table 4.1) while at lower altitudes in the southern part of the catchment, a regime similar to that of Bairnsdale (Table 4.2) or that of Nowa Nowa (Table 2.1) is likely to be experienced.

Table 4.1 Climate Data.

STATION: Omeo		
Mean annual rainfall:	676 mm	
Elevation above sea level:	649 m	
	January	July
Mean daily maximum temperature	25.0 ⁰ C	10.2 ⁰ C
Mean daily minimum temperature	10.2 ⁰ C	-0.4 ⁰ C

(Bureau of Meteorology, 1975)

The growing period in these more northerly parts of the catchment is likely to be severely restricted by low temperatures, intermittent snow cover and frost heave in winter and by occasional summer drought.

Table 4.2 Climate Data.

STATION: Bairnsdale Post Office		
Mean annual rainfall:	696 mm	
Elevation above sea level:	14 m	
	February	July
Mean daily maximum temperature	25.4 ⁰ C	14.3 ⁰ C
Mean daily minimum temperature	13.2 ⁰ C	4.3 ⁰ C

(Bureau of Meteorology, 1975)

In the Swifts Creek area, which suffers from a rain shadow associated with the adjacent mountain ranges, and the southern portion of the catchment, the growing period is more likely to be restricted by summer drought than by low temperatures.

4.3 Physiography and Native Vegetation

The catchment lies between 20 and 1560 metres above sea level, the Swifts Creek offtake being located 350 metres above sea level. There are numerous peaks and some high level plains which dominate the landscape (Figure 4.2), with substantial areas at elevation greater than 1220 m above sea level.

The terrain is dominated by dissected highlands, with significant areas of intermontane basins, plateau remnants and foothills (Figure 4.3). The landscape has developed on a variety of rock types, including siliceous and calcareous sedimentary rocks; basaltic and acid volcanic rocks and associated metamorphosed sediments; and recent alluvium.

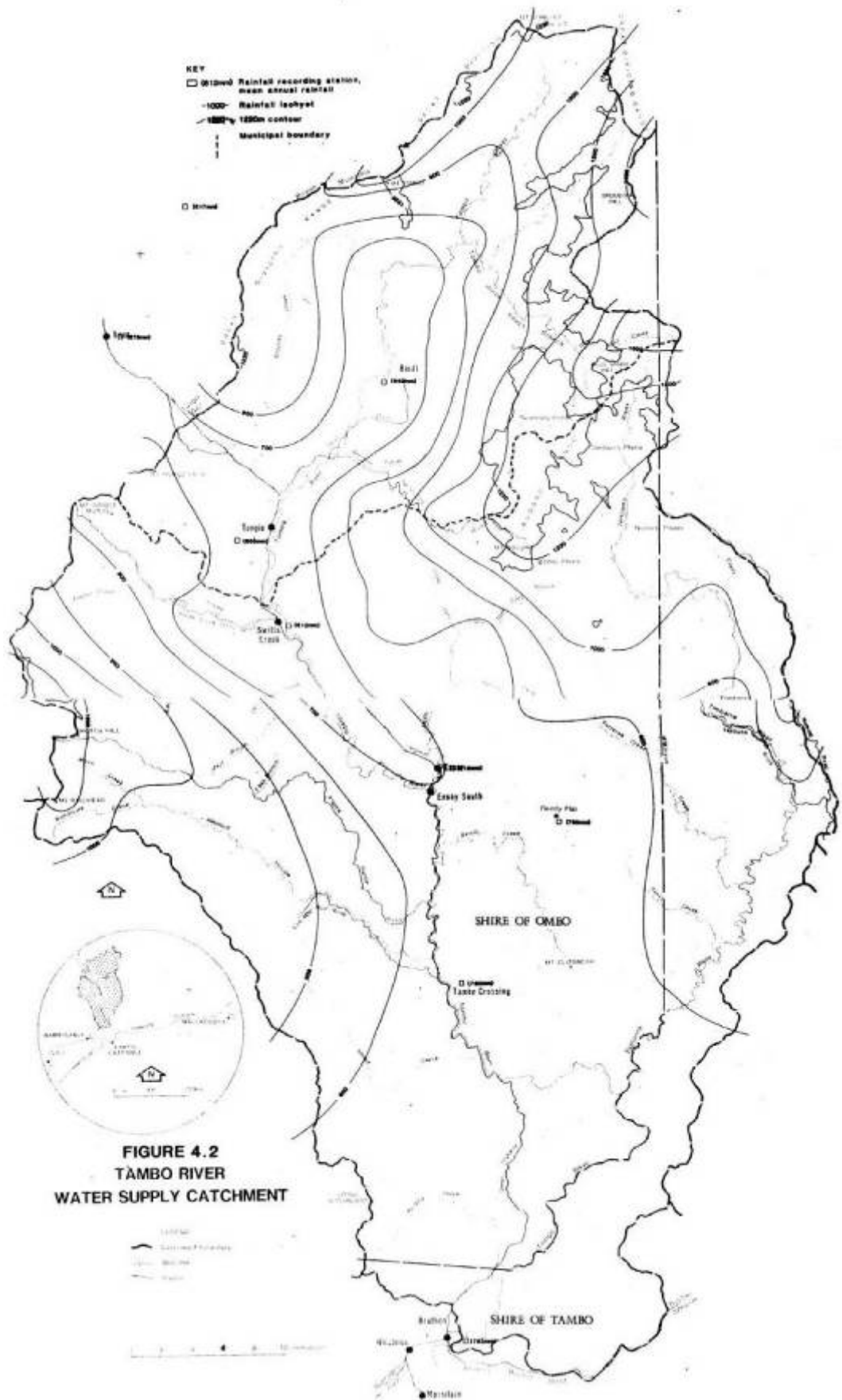
Native vegetation varies from sub-alpine woodland and grassland, through moist ash, messmate and mountain grey gum forest, to drier silvertop, stringybark and yertchuk forest types.

(Descriptions of the land systems which characterise the landscape are contained in Appendix A).

4.4 Land Tenure, Use Management.

Approximately 40 per cent of the catchment is freehold land (Figure 4.4) and predominantly cleared of native vegetation. Relatively large areas of dissected highlands, foothills and intermontane basins have been developed for pastoral purposes (mainly sheep and cattle production with limited cultivation for fodder crops and pasture renovation. There is also limited residential development (Swifts Creek and Ensay townships).

Figure 4.2 - Tambo River Water Supply Catchment



The public land of the catchment is covered by Final Recommendations made by the Land Conservation Council. The Recommendations for the Alpine Study Area affecting the catchment were accepted by the government of the day and are in the process of being implemented. A review of the alpine area is currently in progress. The Final Recommendations for the Gippsland Lakes Hinterland Area have only recently been published. The current approved land use for the Alpine Area and the Final Recommendations for the Gippsland Lakes Hinterland Area are summarised in Figure 4.4.

Current forest operations involve some 480 ha of clear felling for saw log harvesting, distributed throughout the central regions of the catchment, and some 150 ha of selective logging for posts and sleepers in the southern portion of the catchment. Planned operations for the coming season include 540 ha of clear felling for saw log harvesting and 200 ha of selective logging. The Forests Commission has prepared detailed prescriptions for hardwood harvesting and regeneration operations; adherence to these is required to minimise adverse effects on water supply.

Wildfires burnt some 22 500 ha of forested land in the catchment during the 1982/83 summer.

There are several grazing licenses held for various areas of public land in the catchment. There are also five water frontage licenses held for some 16 km land fronting the Tambo River above the Swifts Creek offtake, and 37 licenses for 30 km of land fronting the Tambo River below the offtake, the Timbarra and Little Rivers, and Riley, Swifts and Sandy Creeks. These are only a small portion of such frontages in the catchment; other frontages may be either unused or illegally occupied.

A number of ore bodies in the catchment are being prospected and evaluated, particularly deposits of copper and allied metals in the upper reaches of the Tambo River sub-catchment. This find has encouraged further exploration over much wider areas of the catchment.

The catchment spans two municipalities – the Shire of Omeo and the Shire of Tambo.

Development in the Shire of Omeo is regulated by an Interim Development Order: all development requires a permit (Appendix B). Development in the Shire of Tambo is also regulated by an Interim Development Order. Freehold catchment land in the Shire is zoned Rural A (general farming). Relevant provisions relate to minimum allotment size and density (Appendix B) and to the erection of buildings within 250 m of Wilkinson Creek and the Tambo and Timbarra Rivers which requires a permit. State Forest is exempted from the Ordinance.

The Soil Conservation Authority, by direction from the Premier, has supervisory control over grazing and earthworks on land greater than 1220 m above sea level. The majority of this land is within the recommended Hardwood Timber Production areas (Figure 4.4).

4.5 Water Quality Hazards.

4.5.1 The catchment to the Swifts Creek offtake.

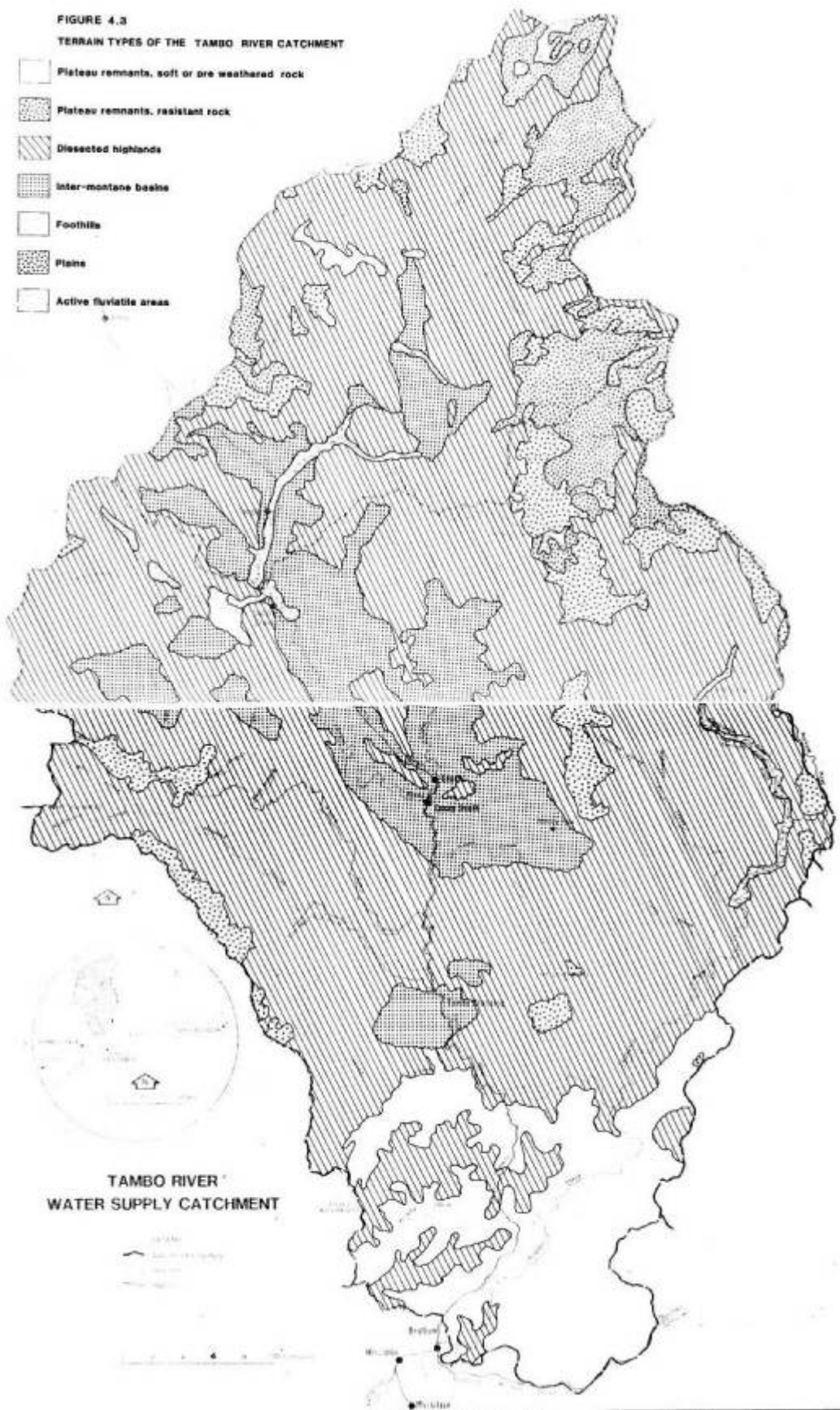
The main water quality problem is bacterial contamination, attributed to water fowl on the storage basins. There appears to be little which can be done to prevent this contamination.

Road drainage entering the streams at stream crossings is the most likely source of potential sediment turbidity problems. Extension of the road network associated with access, mining, forest operations and tourist activities would result in deterioration of water quality, particularly if the design and maintenance of road drains are inadequate.

There are no extensive areas of active sheet or gully erosion in the catchment. Many drainage lines on freehold land have eroded in the past, however these have generally stabilised and are not of immediate concern.

Continued access to streams by stock in the lower reaches of the catchment may result in minor but continuing stream bank erosion and faecal contamination of the stream. Grazing on alpine land higher in the catchment is unlikely to have a direct effect on water quality at the offtake, but long term effects on the hydrologically sensitive bogs and springs could adversely affect their regulatory function on stream flow.

Figure 4.3 - Terrain types of the Tambo River Catchment



4.5.2 The remainder of the catchment.

In view of the size of the catchment, significant attention of the effect of local deterioration of water quality is likely to occur before water reaches the present offtake. Consequently, land uses close to the offtake are likely to have the greatest effect on water quality and are therefore of the greatest concern. However sound land management practices should be encouraged throughout the catchment.

There have been problems with turbid water, presumed to be the result of stream bank erosion (see section 4.1.2) entering the supply system during periods of high river flow. Inadequate disposal of road drainage water and continued free stock access to streams represent the most significant potential sources of water quality deterioration at the offtake (turbidity and bacterial contamination).

Possible effects of grazing on alpine land are as described above (section 4.5.1).

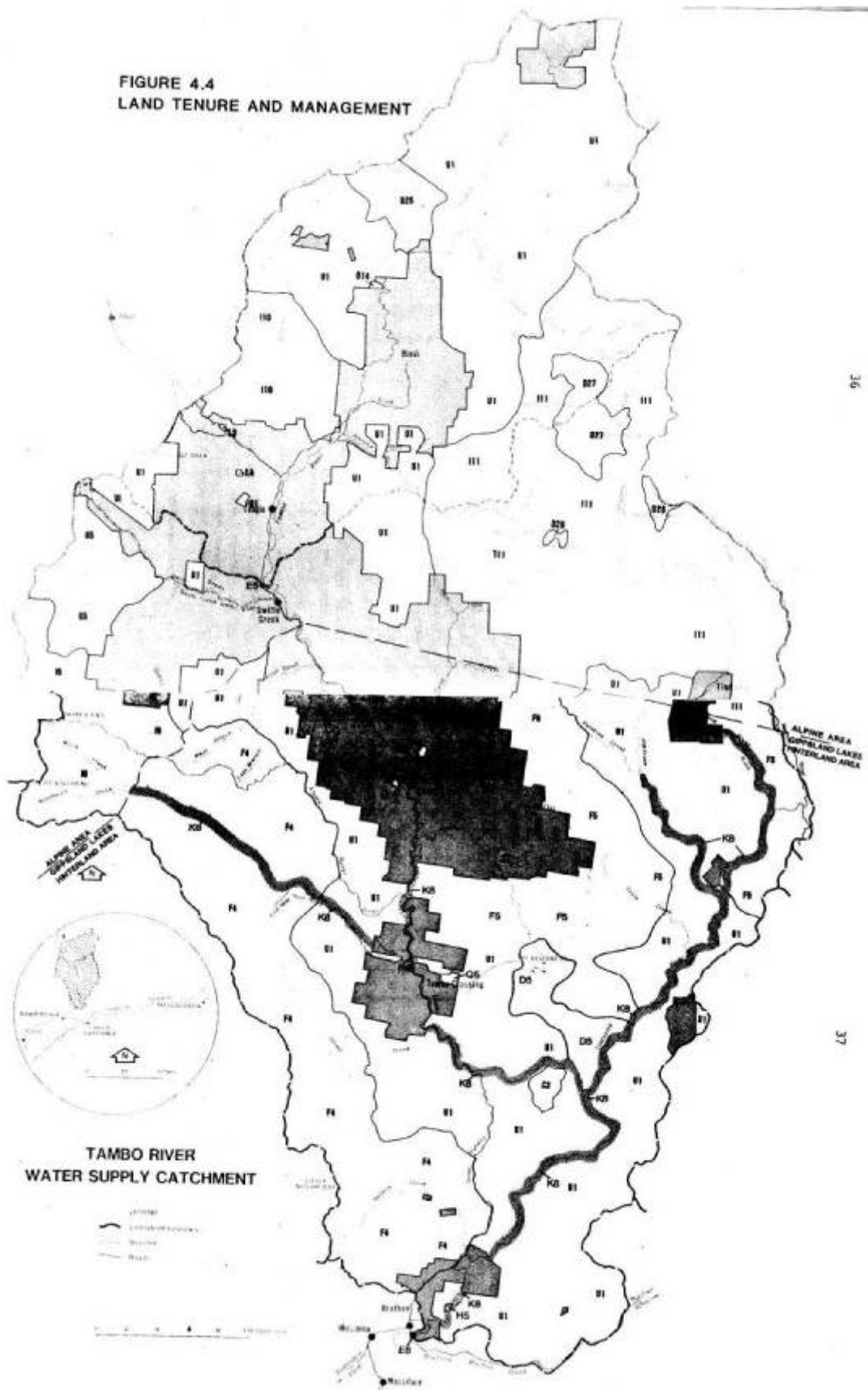
The old King Cassilis mining area is close to the Swifts and Power Creeks and a number of the sludge dams remain. These presumably contain a high concentration of toxic substances and as they are beginning to erode, the possibility of these substances being carried into the water supply is grounds for considerable concern. Consideration should be given to the stabilisation of these old dams in the interests of water supply.

There has been concern expressed over the possible impact on water quality of the mining of ore bodies which are now being prospected. It is likely that the mining techniques used, if mining proceeds, will be modified to minimise the risk of contamination of the water supply.

Part of the mineral exploration program in the northern part of the catchment has been the monitoring of water quality to determine natural base metal concentrations in the catchment water. Initial results indicate a high natural level of base level concentrations of base metals in the catchment waters during low stream flows, reflecting the outcropping of mineralized rocks in the stream bed.

Aldrick, et al. (in preparation) have identified the Blomford, Carrabungla, Collins, Wonnangatta, Dargo and Colquhoun land systems (see Figure A.3 and Table A.1) as being erosion prone and extensive land disturbance in these areas can be expected to be reflected in poor quality run-off water until the disturbed areas stabilise. The alpine land systems of Wellington, Jamieson, Bulltown Spur, Bennison, Nunniong, Hotham and Moroka, whilst not as directly erosion prone, are difficult to stabilise once disturbed because of the harsh climate.

Figure 4.4 - Land Tenure and Management



Key to Figure 4.4

KEY to Figure 4.4

FRESHOLD LAND



PUBLIC LAND:

Recommended use

Nominated management authority

Alpine Area (Final Recommendations)

D26	Natural features and scenic reserve (Mount Tambo)	Department of Crown Lands and Survey
D27	Natural features and scenic reserve (Nunniong)	Forests Commission, Victoria
D28	Natural features and scenic reserve (Nunnett Plain)	Forests Commission, Victoria
D29	Natural features and scenic reserve (Bentley Plain)	Forests Commission, Victoria
E5	Water production (Tambo River offtake)	Swifts Creek Waterworks Trust
G5	Historic area (Cassilis)	National Parks Service
I6	Hardwood timber production (Baldhead - Phipps)	Forests Commission, Victoria
I10	Hardwood timber production (Splitters Range)	Forests Commission, Victoria
I11	Hardwood timber production (Nunniong - Timbarra)	Forests Commission, Victoria
L3	Bushland reserve	Department of Crown Lands and Survey
L4	Bushland reserve	Department of Crown Lands and Survey
Q14	Agriculture	Alienation
U1	Uncommitted	Department of Crown Lands and Survey

Gippsland Lakes Hinterland Area (Final Recommendations)

C3	Reference area (Tambo River)	Department of Crown Lands and Survey
D5	Natural features and scenic reserve (Mt. Elizabeth)	Forests Commission, Victoria
E8	Water production (Tambo River offtake)	Bruthen Waterworks Trust
F4	Hardwood timber production (Nicholson - Mt. Alfred)	Forests Commission, Victoria
F5	Hardwood timber production (Nunniong - Timbarra - Tambo)	Forests Commission, Victoria
H5	Flora reserve (The Glen)	Department of Crown Lands and Survey
K8	Natural features zone	Forests Commission, Victoria (within F4, F5) Department of Crown Lands and Survey (within U1)
O4	Existing recreation reserve	Department of Crown Lands and Survey
Q5	Agriculture	Alienation
R18	Mineral and stone production	Department of Crown Lands and Survey
T1	Township land	Department of Crown Lands and Survey
U1	Uncommitted	Department of Crown Lands and Survey
V1	Other reserves and public land	Existing

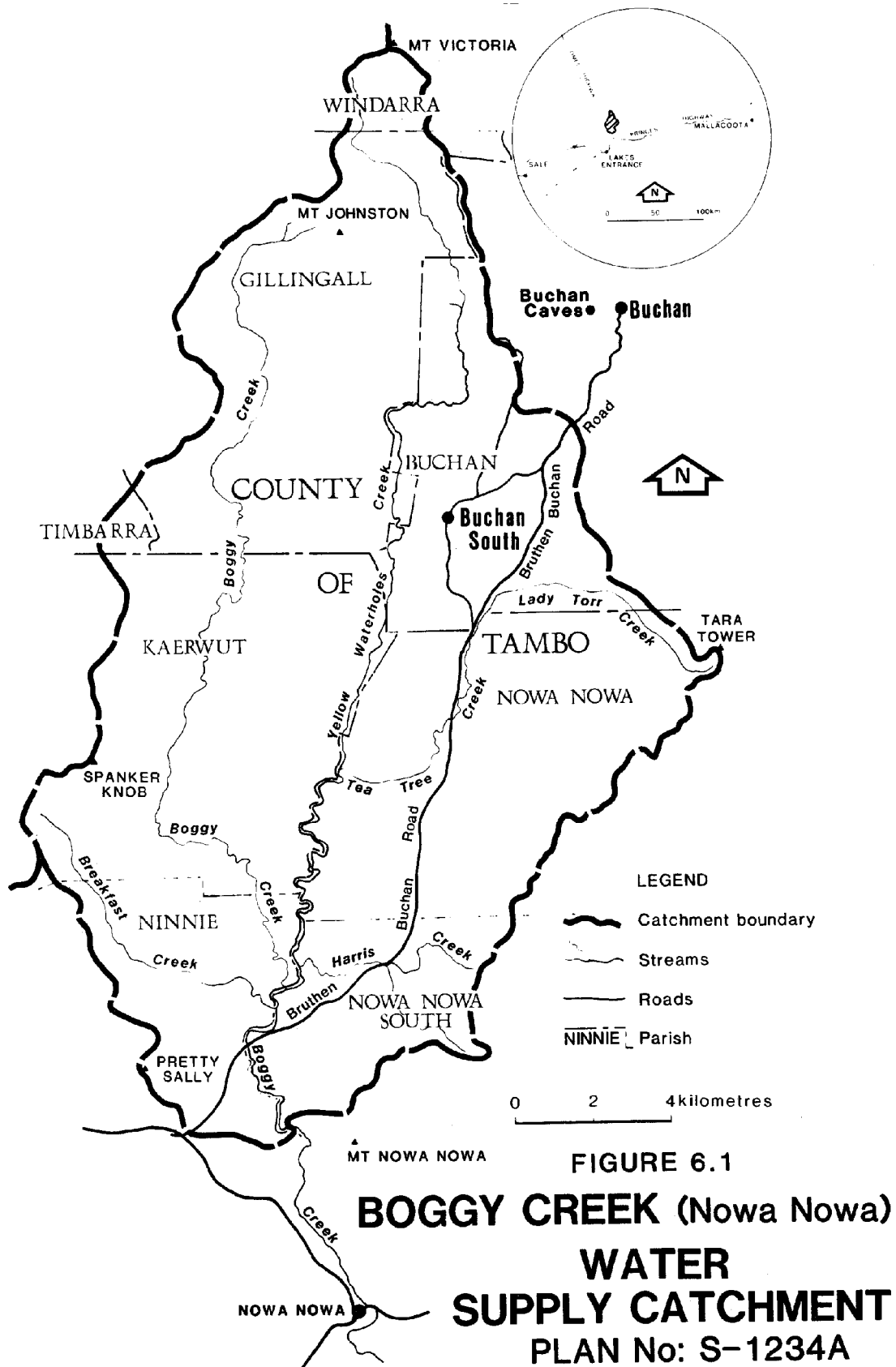
RECOMMENDATIONS

As a result of these investigations, it is recommended that:

the Land Conservation Council recommend to the Governor-in-Council that the following catchments be proclaimed under section 5(1)(b) of the *Land Conservation Act* 1970 and section 22(1) of the *Soil Conservation and Land Utilization Act* 1958:

- a) the Boggy Creek (Nowa Nowa) Catchment, as shown on Plan No. S-1234A (Figure 6.1);
- b) the Buchan River (Buchan) Catchment, as shown on Plan No. S-1235A (Figure 6.2); and
- c) the Tambo River Catchment, as shown on Plan No. S-1236A (Figure 6.3).

Figure 6.1 - Boggy Creek (Nowa Nowa) Water Supply Catchment - Plan No. S-1234A



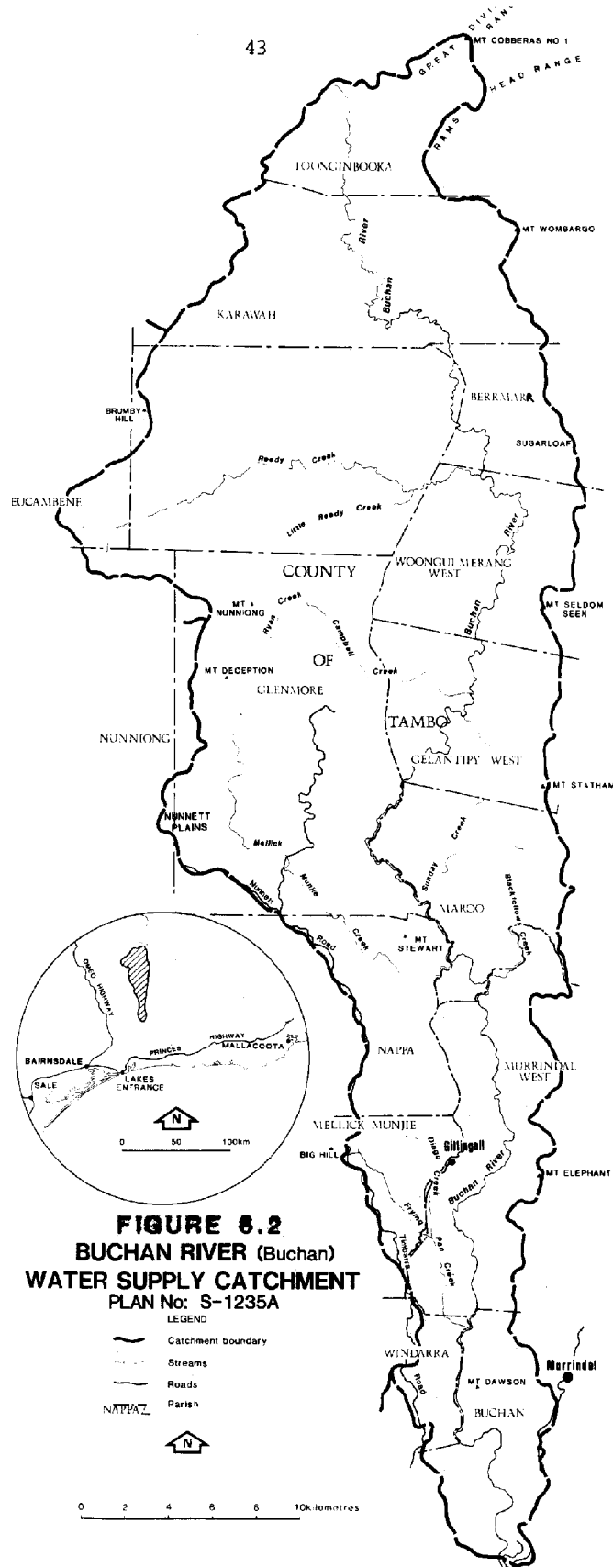


FIGURE 6.2
BUCHAN RIVER (Buchan)
WATER SUPPLY CATCHMENT
PLAN No: S-1235A

LEGEND
 — Catchment boundary
 — Streams
 - - - Roads
 — Parish
 NATPAZ
 N

0 2 4 6 8 10 kilometres

Figure 6.3 - Tambo River Water Supply Catchment - Plan No. S1236A



FIGURE 6.3
TAMBO RIVER
WATER SUPPLY CATCHMENT
PLAN No S-1236A

SOURCES OF INFORMATION

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Discussions with officers of the Buchan, the Lakes Entrance and the Swifts Creek Waterworks Trusts.
Discussions with officers of the Forests Commission, Victoria, and the Department of Crown Lands and Survey.

APPENDIX A - LAND SYSTEMS OF THE CATCHMENTS.

The following maps and tables describe the land of the catchments in terms of land systems (areas of land in which recognisable patterns of topography, soils and vegetation occur).

The tables are based on data presented by Aldrick, et al. (in preparation) in an early draft. Subsequent revisions of the data may have resulted in reclassification of some small areas of land in these catchments. However any changes are of a minor nature and do not materially affect this report.

Figure A.1 - Boggy Creek (Nowa Nowa) Water Supply Catchment - Land Systems

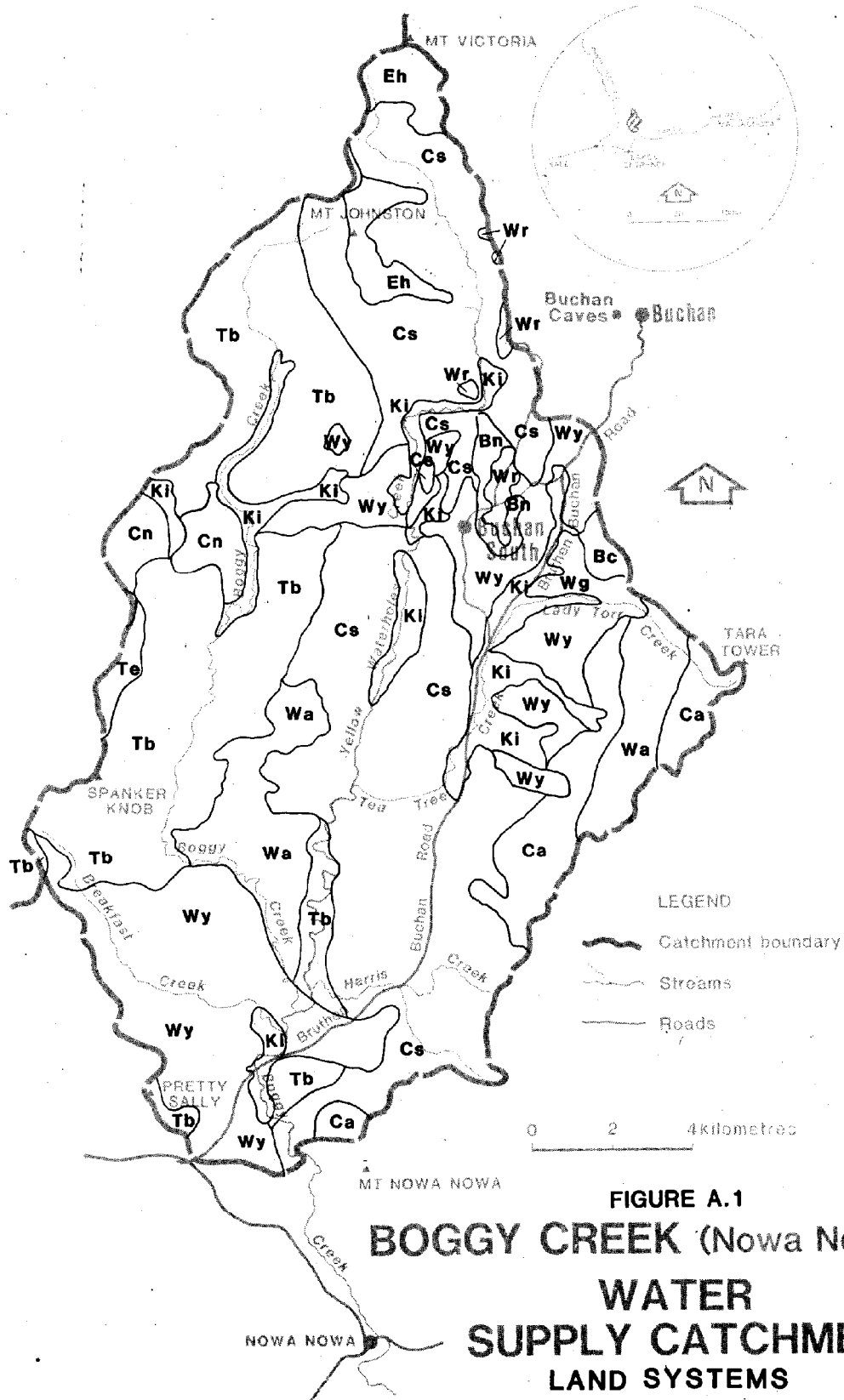


FIGURE A.1
**BOGGY CREEK (Nowa Nowa)
 WATER
 SUPPLY CATCHMENT
 LAND SYSTEMS**

Figure A.2 - Buchan River (Buchan) Water Supply Catchment - Land Systems

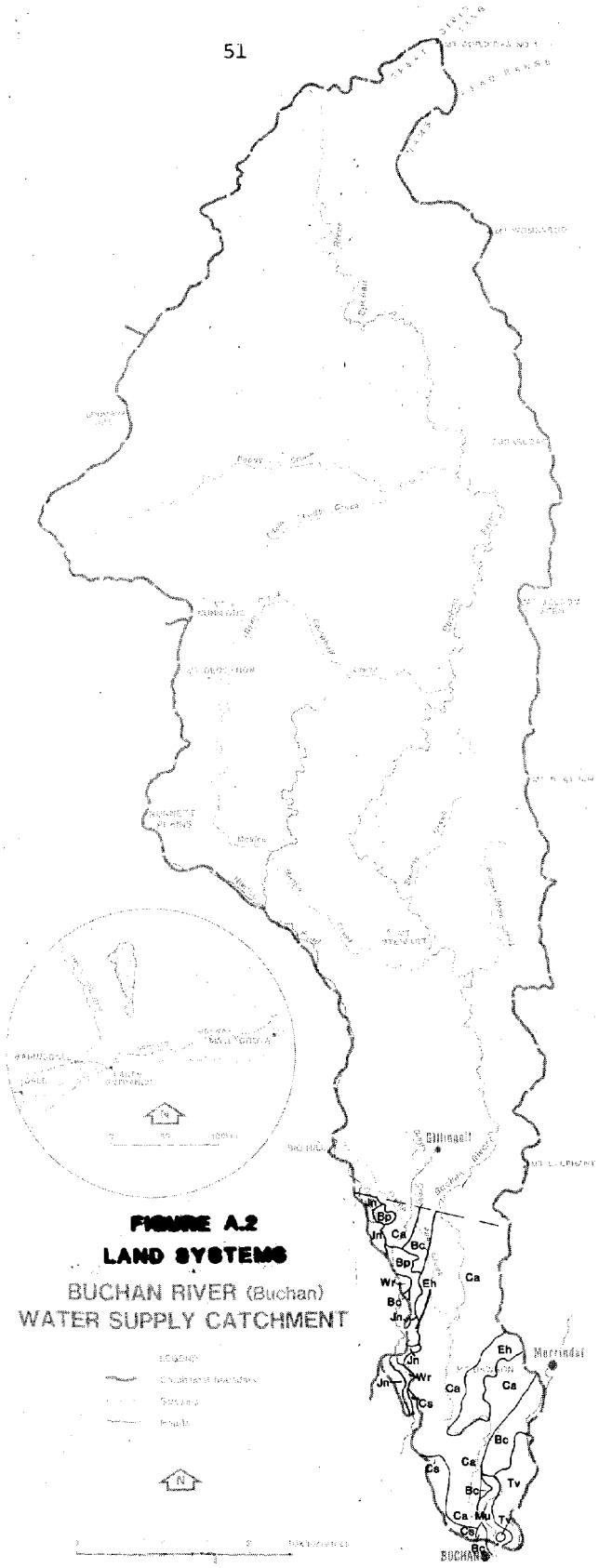


TABLE A.1 Land Systems of the Catchments.

LAND TYPE	DISTINGUISHING CHARACTERISTICS	LAND SYSTEM		GEOLOGY	SOILS	NATIVE VEGETATION TYPES
Plateau remnants on soft or pre-weathered rock	Dense humid forest	Wn	Wellington	Various, often acid volcanic, plutonic & metamorphic rock	Red earths; brown earths; lithosols; humic gley soils	Alpine ash, peppermint, candlebark Open Forest II, III; alpine ash, mountain grey gum, peppermint, messmate, manna gum Open Forest III, IV
	Less dense humid	Jn Bp	Jamieson Bulltown Spur	Various – mainly Ordovician sediments Various	Red earths; brown earths; alluvial soils; lithosols Red earths; lithosols	Snowgum, peppermint, candlebark, Open Forest II, ash Open Forest III, messmate, brown stringybark, peppermint, candlebark Open forest II, III Peppermint, mountain ash, snow gum, peppermint, or mountain grey gum, messmate, silvertop, red stringybark, long-leaved box Woodland I, II, Open Forest II, III
Plateau remnants on resistant rock	Lower sub-alpine areas	Bs	Bennison	Palaeozoic sediments and associated metamorphic rocks	Red earths; brown earths, alpine humus soils	Snowgum Woodland I, II; alpine ash Open Forest III, IV; candlebark, peppermint Open Forest II
	Alpine to sub-alpine areas	Ng	Nunniong	Tertiary basalts	Lithosols; brown earths; alpine humus soil	Snowgum Woodland I; alpine Grassland
Dissected highlands	Mountains in alpine and sub-alpine areas	Hm	Hotham	Various	Lithosols; alpine humus soils	Snowgum Woodland I, alpine Grassland and Heathland
	Mountains with humid forests	Bd	Baldhead	Palaeozoic granitics, gneissic metamorphics	Brown earths; red earths; lithosols	Peppermint Open Forest II, III; mountain grey gum, messmate, manna gum Open forest III
		Be Eh	Birregun Elizabeth	Palaeozoic metamorphics Palaeozoic sediments Palaeozoic acid volcanics	Lithosols; brown earths Red earths; brown earths	Mountain grey gum, peppermint, messmate candlebark Open Forest II, III; ash Open Forest III, peppermint Open Forest I, II Messmate or silvertop Open Forest II, III; alpine ash, candlebark Open Forest III
Dissected highlands (continued)	Hills with humid forests	Tj	Tanjil	Palaeozoic plutonics; gneissic metamorphics	Brown earths; red earths; yellow earths	Ash, peppermint Open Forest III; silvertop, messmate, mountain grey gum Open Forest II
		Le	Latrobe	Palaeozoic sediments	Red and yellow podzolics; lithosols	Silvertop messmate Open Forest II, messmate, manna gum Open Forest III

LAND TYPE	DISTINGUISHING CHARACTERISTICS	LAND SYSTEM		GEOLOGY	SOILS	NATIVE VEGETATION TYPES
	Mountains with drier forests	Bf	Blomford	Palaeozoic granitics, gneissic metamorphics	Lithosols; brown earths	Red stringybark or silvertop Open Forest I, II; peppermint, messmate Open Forest II
		Ca	Carrabungla	Palaeozoic acid volcanics	Lithosols; brown earths	Mixed Open Forest II of peppermint, silvertop, yertchuk, long-leaved box, red box and others.
		Cd	Clifford	Various	Lithosols	Snowgum Woodland I, II; peppermint, candlebark or red stringybark, long-leaved box Open forest I, Open Woodland I, II.
		Te	Talbotville	Palaeozoic sediments	Lithosols; red and brown earths	Mixed Woodland I to Open forest II of apple box, peppermint, long-leaved box, yellow box
		M	McAdam	Palaeozoic calcareous sediments	Red and brown earths; lithosols	Snowgum, manna gum grassy woodlands I
	Hills with drier forests	Cs	Collins	Palaeozoic acid volcanics and	Lithosols; brown and yellow earths; yellow podzolics	Mixed Open Forest II, III of yertchuk, red stringybark, red box, mixed Open Forest II, III of mountain grey gum, white and yellow stringybark, red box, red stringybark
		Tv	Taravale	Palaeozoic calcareous sediments	Structured red earths	Yellow box Open Forest II, Woodland II
		Ta	Timbarra	Palaeozoic granitics, gneissic metamorphics	Red earths; yellow podzolic, solodic soils; alluvial soils	Mixed Open Forest I, II, III of white box, long-leaved box, blue gum, white stringybark
		Wa	Wonnangatta	Palaeozoic sediments	Lithosols; brown earths; red podzolics; alluvial soils	Mixed Open Forest II, III of silvertop, red stringybark, peppermint, messmate, mountain grey gum
Intermontane basins	Lower elevation areas with drier forests	Bn	Bindi	Palaeozoic calcareous sediments	Euchrozems, solodic soils	Snowgum, manna gum grassy Woodland II; long-leaved box, red box Open Forest II

LAND TYPE	DISTINGUISHING CHARACTERISTICS	LAND SYSTEM		GEOLOGY	SOILS	NATIVE VEGETATION TYPES
		Do	Dargo	Palaeozoic pre-weathered granitics, gneissic metamorphics	Red, yellow and brown podzolics; weisenbodens	Mixed Open Forest II of white box, but-but, peppermint, white stringybark, long-leaved box, blue gum, candlebark, red stringybark; manna gum grassy Open Forest II
Foothills	Areas of base volcanic rock	Wr	Wheeler	Cainozoic basalt	Prairie soils	Red box, but-but Open Forest II
	Various parent lithologies	An	Anderson	Mesozoic fan deposits	Yellow podzolic soils; solodics; yellow earths	White stringybark, silvertop, red box Open Forest II, III; lilly pilly Closed Forest II
		Bc	Buchan	Palaeozoic calcareous sediments	Structured red earths	Yellow box Open forest II, Woodland II
		C	Colquhoun	Cainozoic fan deposits, plateau remnants, small spurs	Siliceous sands; yellow podzolics; podzols	Mixed Open Forests II of silvertop, white stringybark, mountain grey gum, red box, swamp gum, manna gum, but-but
		n	Deadhorse	Palaeozoic plutonics	Earthy sands; yellow podzolics	White stringybark or red stringybark or silvertop Open Forest II, but-but or swamp gum or peppermint Open Forest II
		D	Tambo	Palaeozoic sediments	Yellow podzolic soils; brown earths; red podzolic soils	White stringybark, mountain grey gum Open Forest III; red stringybark, red box Open Forest II; lilly pilly Closed Forest II
e	Westbury	Cainozoic sediments	Yellow podzolic soils; yellow solodic soils	White stringybark, silvertop, Forest red gum, brown stringybark Open Forest III, red ironbark, blue gum, swamp gum Open Forest II, III		
Plains	Duplex soils	Ki	Kinni	Cainozoic sediments	Yellow podzolic soils; soloths	Silver-leaf stringybark Woodland I; manna gum, narrow-leaf peppermint, but-but Open Forest II
		Mu	Murrindal	Cainozoic alluvium and colluvium	Soloths; yellow podzolic soils; alluvial soils; chernozems	Manna gum, red box Open Forest II
Active fluvial areas	Well drained, soils	M1	Maffra 1	Cainozoic clays, silts, sands	Minimal prairie soils; red earths; alluvial soils	Forest red gum, red box Open Forest II
		Wt	Walnut	Cainozoic alluvium, colluvium	Alluvial soils; earthy sands; solodic soils	Yellow box or manna gum Open Forest II; Closed Sedgeland

LAND TYPE	DISTINGUISHING CHARACTERISTICS	LAND SYSTEM		GEOLOGY	SOILS	NATIVE VEGETATION TYPES
	Poorly drained, non-arable areas	Ma	Moroka	Palaeozoic sediments, Recent alluvium, colluvium	Yellow earths; humic gley soils; acid peat soils	Black sallee, snowgum shrubby Woodland I, II; Open Heathland

APPENDIX B - PLANNING SCHEME INTERIM DEVELOPMENT ORDERS.

The following are relevant extracts from the Interim Development Orders for the Shire of Omeo and the Shire of Tambo.

a) Shire of Omeo Planning Scheme Interim Development Order

“Clause 3. (1)

Subject to this Order, a person shall not use, develop or subdivide any land within the Shire of Omeo, except in accordance with the consent of the responsible authority.”

b) Shire of Tambo Planning Scheme Interim Development Order

“Part II – GENERAL

4. USE AND DEVELOPMENT OF LAND

4.1 Use and Development of Land in Zones. Subject to this Order, land in a zone specified in Table of Uses to any Clause:

- (a) may be used for a purpose specified in column 2 of the table;
- (b) may be used or developed for a purpose specified in column 3 of the table if the conditions indicated or set forth opposite are complied with, but shall not be used or developed for such purpose unless those conditions are complied with;
- (c) may, with consent, be used or developed for a purpose specified in column 4 of the table; and
- (d) shall not be used for a purpose specified in column 5 of the table.”

“Part III – ZONE PROVISIONS

6. RURAL ‘A’ ZONE

6.1 Purpose of the Zone. The purpose of the Rural “A” Zone is:-

- (a) to promote the use of the land for essentially farming activities
- (b) to limit unnecessary fragmentation of farming lands;
- (c) to permit limited expansion of the saw milling industry and other related industries;
- (d) to preserve the physical environment and retain the rural amenity of land within the zone;
- (e) to regulate use, development and subdivision which may limit the range of practicable future use of land within the zone.

6.2 Subdivision

(a) Land within the Rural “A” Zone shall not be subdivided except with the consent of the Responsible Authority and provided that:-

- (i) in any parcel of land being subdivided each separate allotment to be created shall have an area of not less than 2.0 hectares and the overall density of allotments shall not exceed one allotment for every 30.0 hectares of land within the parcel exclusive of any reservations and road areas:

“Part IV – SPECIAL CONTROLS

9. CONTROL OF DEVELOPMENT ALONG STREAMS

9.1 The area of land within 250 metres of the following waterways are specified as being areas of natural beauty and interest within the meaning of Clause 8A of the Third Schedule to the Town and Country Planning Act:

Boggy Creek	Nicholson River
Buchan River	Snowy River
Lake Tyers	Suggan Buggan River
Little River	Tambo River
Livingston River	Timbarra River
Murrindal River	Wilkinson River”

TABLE B.1 Table of uses to clause 6.

COLUMN 1	COLUMN 2	COLUMN 3		COLUMN 4	COLUMN 5
Zone	Purposes for which land may be used or developed.	Purposes for which land may be used or developed subject to conditions.		Purposes for which land may, with consent be used or developed.	Purposes for which land shall not be used or developed.
Rural A	Farming Forestry Home occupation Minor road Passive recreation	Purpose	Conditions	Any purpose other than those referred to in Columns 2,3, or 5.	Bank Bulk Store (other than the bulk storage of agricultural produce) Bus Depot Flat Hotel Machinery Showroom Motel Motor Showroom Place of assembly Residential Building Restaurant (other than ancillary to a Service Station) Shop Trade Storage Building Warehouse
		Advertising sign House	Subject to Clause 6.7 On an allotment of not less than 30 ha or on an allotment created pursuant to Clause 6.2.		