

SOIL CONSERVATION AUTHORITY

**REPORT ON THE
LAL LAL RESERVOIR WATER SUPPLY CATCHMENT
(WEST MOORABOOL WATER BOARD)**

Prepared for consideration by the
Land Conservation Council

March 1973

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LAL LAL RESERVOIR WATER SUPPLY CATCHMENT

1. INTRODUCTION

The West Moorabool Water Board in October 1972 requested the Land Conservation Council to take steps to have this catchment proclaimed under the provision of section 22 of the Soil Conservation and Land Utilisation Act.

The matter was subsequently referred to the Authority for inspection and report.

Location of the Reservoir and Catchment: Plan 1

The Bungal Dam is sited on the West Moorabool River*, 7 miles (11 km) north of Elaine and 35 miles (55 km) north-west of Geelong. It will impound 48,000 acre feet ($60 \times 10^6 \text{m}^3$) of water behind an embankment 160 feet (50 m) in height, and the regulated output will be used to supplement the existing supplies to Geelong and Ballarat.

Boundary of the catchment, which lies mid way between Ballarat and Ballan, is formed by the Great Divide in the north, Mounts Warrenheip and Buninyong in the west and a series of smaller volcanic cones in the east. Total catchment area is 85 square miles (220 km^2). It is dissected by the Western Highway, the Ballarat - Melbourne and Ballarat - Geelong Railways and numerous Shire roads. Most of the catchment falls within the Shires of Buninyong and Bungaree, with small areas in the Shires of Ballan and Creswick.

Parishes concerned are Korweinguboora, Dean, Bungaree, Moorabool West, Warrenheip, Lal Lal, Kerrit Bareet, Buninyong, Clarendon and Bungal.

It is noted that land draining into the Ballarat Water Commission storages (Moorabool, Wilsons and Beales Reservoirs) is within the physical catchment to the Lal Lal Reservoir. The Commission has indicated to the Authority and to the Land Conservation Council that for a number of reasons it would rather not have these parts of its catchment included in a proclamation of the Lal Lal catchment.

Overflow from Beales Reservoir is generally not significant, and although overflow from the Moorabool Reservoir (into the West Moorabool River) could be large in years of very high flow, the catchment to that storage is largely owned by the Commission, and therefore well protected.

2. DESCRIPTION OF THE CATCHMENT

Climate : Temperature (°C)

Ballan, R. L. 1450 feet

	J	F	M	A	M	J	J	A	S	O	N	D
Ave Daily Max.	23.5	23.7	21.4	16.7	14.1	10.6	10.2	11.4	13.6	16.2	18.8	21.9
Ave. Daily Min.	9.2	10.4	9.6	7.1	5.2	3.5	3.0	3.5	4.2	4.5	7.0	8.7
Ave. Daily Mean	16.3	17.0	15.5	11.9	9.7	7.0	6.6	7.5	8.9	10.4	12.9	15.3

Ballarat, R. L. 1433 feet

	J	F	M	A	M	J	J	A	S	O	N	D
Ave Daily Max.	24.2	24.9	22.0	17.2	13.5	10.2	9.9	11.3	13.9	16.9	19.7	22.5
Ave. Daily Min.	10.2	11.6	10.0	7.6	5.9	4.1	3.5	4.1	5.1	6.4	7.8	9.6
Ave. Daily Mean	17.2	18.2	16.0	12.4	9.7	7.2	6.7	7.7	9.5	11.7	13.7	16.0

* The Index of Victorian Rivers and Streams (SRWSC) state that Moorabool and Moorarbool are both acceptable spelling.

Rainfall

Average annual rainfall varies from 28" to 35" within the catchment gradually increasing from south to north with elevation.

The Central Highlands Regional Resources Survey states that in the south the normal growing season extends for 9½ months from early March to mid-December. In the north it is the 10½ month period from mid-February to early January. In most years vegetative growth would be retarded by low mean daily temperatures during the winter months.

Physiography and Geography

The catchment is formed by the higher lands of the Warrenheip (basalt) plateau, at elevations between 1600' and 2000'. It includes a number of volcanic cones, and generally drains to the south with gently undulating topography formed by moderately entrenched drainage lines. Mounts Buninyong and Warrenheip are the largest cones, rising some 450 feet (140 m) above the surrounding plains.

Residual ranges of Ordovician sandstones and mudstones form part of the catchment boundary in the east and south (Mt Egerton and Mt Doran).

Low undulating ridges of granite occur in the central part of the catchment and along its south western boundary.

In the south, below the water falls on Lal Lal Creek and the West Moorarbool the streams have cut steep sided valleys, parts of which will now be flooded by the reservoir waters.

The various volcanic events which are responsible for the present topography left scattered poorly drained areas which formed swamps or lakes. Lal Lal Swamp is probably the largest example of these, being an area of sedimentary soils covering about 260 acres (105 hectares).

In summary there are five major types of parent material found in the catchment:

Sedimentary sandstones and mudstones	Ordovician
Granite/granodiorite	Devonian
Sedimentary gravels, conglomerates, sands, limestone	Tertiary
Basalt flows	Tertiary
Alluvial sediments	Recent

Soil types and land use are related to these five different categories and the Appendices describe each area in detail. The following sub-headings of catchment description are summaries of the more detailed Appendices.

Soils

Most productive and least erosion prone soils in the catchment are well structured red clay loams developed on the better drained basalts, mainly in the northern half of the catchment. The most erodible soils are the silty or sandy loams developed on the Tertiary sediments, now exposed around the Back Creek and Woolon Creek arms of the Reservoir. The potential problems of these soil types are recognised by SCA officers as similar to those of the Parwan area.

Between these two extremes are found the grey basaltic soils, sandy granitic soils, skeletal or solodic soils on Ordovician sediments and heavy alluvial clay soils.

Existing erosion

Represents no immediate hazard to the storage, although stream bank erosion can be observed in the granitic areas, and the steep faces of Tertiary material in the Back Creek and Woolon Creek show signs of past slumping. Material transported from these sites may result in minor sedimentation of the storage, but are not likely to cause colour or turbidity problems in the water. The Ordovician country south west of the reservoir could conceivably become a source of suspended sediments if it were mis-managed, but while it remains a timber reserve under native forest, roadworks constitute the only real hazard.

Existing Land Use

The two most common forms of land use are potato cropping on the red soils, and sheep and cattle grazing. Very little of the catchment, probably less than 5%, is forested. In other proclaimed catchments the proportion forested is normally 70% to 80%, so the present catchment is unique in that regard.

Timber from the forested areas is used for fencing, mining supports and firewood.

Grazing land carried sheep, beef cattle and dairies.

Crops produced on the cultivated land are principally potatoes, turnips and oats, and to a lesser extent sudax and millet.

3. DISCUSSION OF EXISTING AND POSSIBLE FUTURE RESTRAINTS

Under the existing forms of land use hazards to the water supply and the reservoir itself are not great. Indications are however that the presence of the dam itself will stimulate subdivisional activities in particular, and more intensive land use in the catchment in general. Proclamation of the catchment is considered to be a necessary first step in safeguarding the water supply interests in this situation.

Agricultural Land Use and Other Earthworks

A Land Use Determination of the freehold land in the catchment (83 square miles or 215 km²) may well be necessary eventually, since it adjoins a large population centre and will inevitably come under pressures of more intensive land use. It is considered that at present however, and for the next few years, the problem areas of the catchment lie in the vicinity of the reservoir itself.

If the catchment is proclaimed the Authority may, under the provisions of section 22(2) of its Act, specify an area within which certain changes in land use would require prior approval.

Plan 2 shows an area in the vicinity of the Reservoir which could be gazetted as a "specified area" for this purpose.

The land shown coloured green on that plan is generally the steep land between the edge of the basalt plateau and the West Moorabool Water Board's resumption line. It is predominantly freehold land, in small allotments, and undesirable developments on it should be forestalled. This could be partly achieved by specifying timber clearing, cultivation, roadworks, dam building or any other earthworks as changes in land use which require prior SCA approval.

Much of the remaining land in the "specified area" (uncoloured on the plan) exists as small allotments, between 5 acres (2 ha) and 20 acres (8 ha) in area. Unless consolidation of these allotments is achieved a low density residential area could develop, with each house needing a dam for its stock and domestic water. Inefficient dam design and construction would then represent a considerable hazard to the water supply, so dam building, roadworks and other earthworks would probably be made notifiable changes in land use.

Residential Uses and Subdivisions

The Shire of Buninyong on 7.4.72 commenced preparation of a Planning Scheme and has asked the Authority to submit any relevant matters for consideration. Accordingly a submission to the Shire is now being prepared and includes suggestions that within the area coloured green on Plan 2:

- (a) No permits be issued for erection of houses.
- (b) No further subdivision of existing allotments be permitted.

And further, on all other land shown on Plan 2, that no subdivision be permitted which results in the formation of a lot of less than 40 acres (16 ha).

Extractive Industries

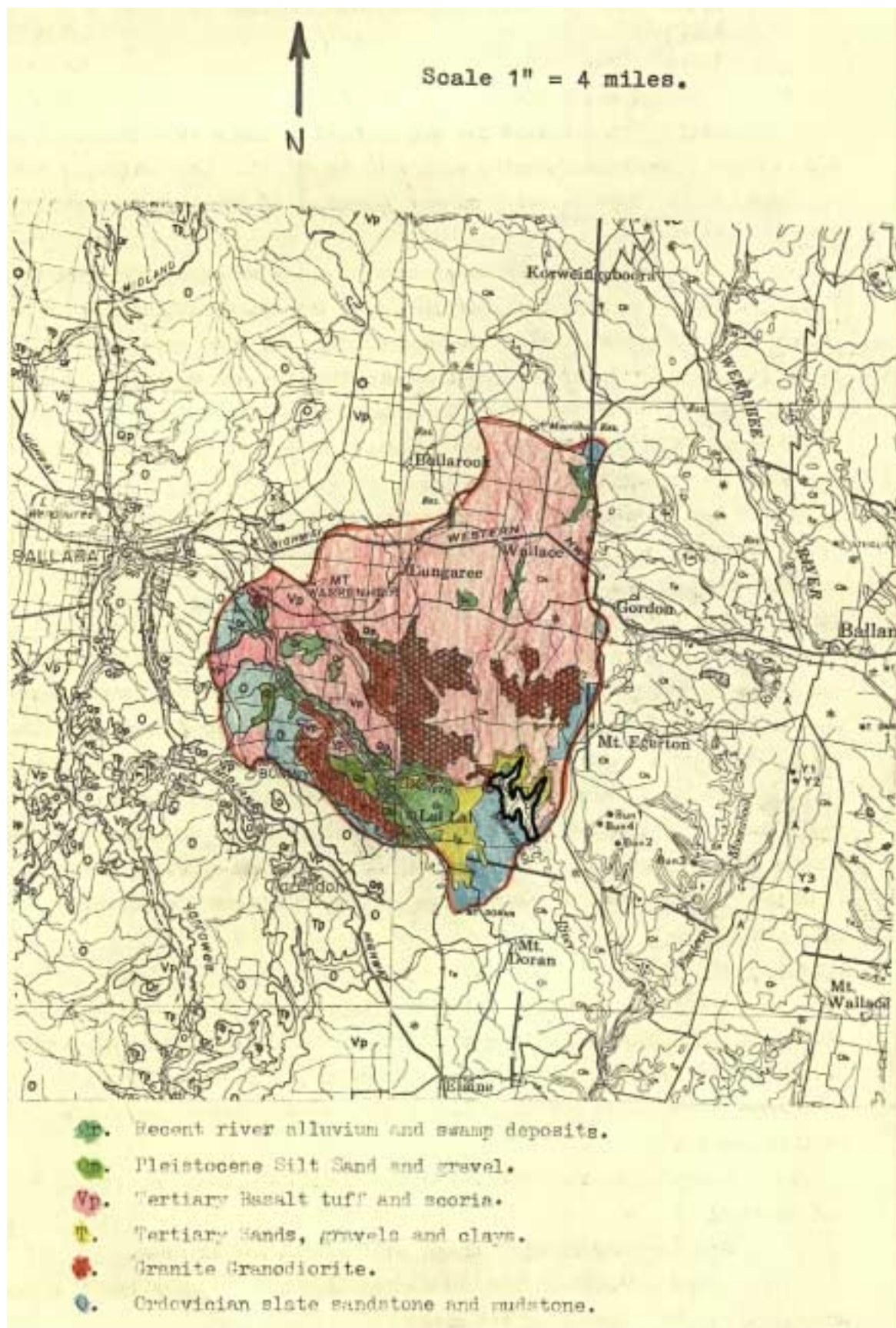
Proclamation of the catchment will ensure that all Applications for Extractive Industry Licences are seen by the Authority, which will have the opportunity to oppose them or attach conditions to them. The existing extractive industries are not considered to be hazards to the water supply.

Offensive Trades

Buninyong Shire has not adopted the Offensive Trades Regulations as provided for in Part 4, Division 1, sections 94 to 105 of the Health Act.

They do have a by-law which prohibits the keeping of swine within certain parts of the Shire, but this does not cover any of the land shown on Plan 2. The Shire will be requested to either (a) Adopt the Offensive Trades Regulations for that part of the Shire within the catchment, or (b) Extend the area covered by by-law number 25 to that part of the Shire within the catchment.

Geological Map of the Lal Lal Catchment



Other Industries

The dairy products factory at Wallace and the fence post treatment plant at Bungaree are two examples of waste producing industries within in the Catchment. These and any other waste producing industries will eventually have to be licensed under the provisions of the Environment Protection Act.

4. RECOMMENDATION

It is recommended that Council take action necessary to have the Lal Lal Reservoir Water Supply Catchment proclaimed.

A. C. Chappell
Senior Catchment Investigation Officer

(9.3.1973)

V APPENDIX: DETAILED CATCHMENT DESCRIPTION

1. ORDOVICIAN SEDIMENTARY AREAS

11% of the total catchment area.

Geology: Ordovician interbedded slates, sandstones and mudstones, with quartz reefs and occasional granitic dykes.

Topography: Hilly to steep, with well defined drainage pattern, occurring as residual hills rising above the basaltic Warrenheip plateau. Slopes range from 7% to 20%.

Soils: A horizon grey-brown silty loam 0-8" Soils are shallow and stony in low rainfall (28")
B horizon yellow-brown silty clay 8" - 48" area, deeper and with less stone in higher rainfall areas.
C horizon fractured sedimentary rocks. Topsoils poorly structured with low fertility and clays in
Subsoil are usually dispersive.

Native
Vegetation: Mixed species forest, made up predominantly of messmate (*E. obliqua*) in the low rainfall areas (e.g. Mt Doran) but including Peppermint (*E. radiata*) and box species in the Wombat Forest near Korweinguboora.

Existing
Land Use: State Forest: Mt Doran forest used only for mining timbers and firewood
Wombat forest also produces mill logs and fencing timber.
Freehold: Grazing land with improved pastures based on Ryegrass and subterranean clover.
Ballarat Water Commission have *P. radiata* plantations which extend onto this type of land.

Erosion
Hazard: Sheet erosion and salting after clearing of timbered land, especially on steep slopes. Road surface and table drain erosion, producing runoff water with high colour turbidity. Cultivation can rapidly destroy topsoil structure and lead to surface sealing.

Potential
Lane Use: Native forest or pine plantations on the steep land. Elsewhere grazing with pasture improvement, possibly occasional summer fodder crops on flat lands.

2. **GRANITIC AREAS**

16% of the total catchment area

Geology: Parent material is neither a true granite nor true granodiorite, but has been termed a biotite adamellite. It has intruded the Ordovician sediments.

Topography: Broad based hills rising 50' to 100' above the Warrenheip (basalt) plateau. Undulating to hilly with slopes generally between 6% and 15%.

Soils:

A horizon - grey sandy loam.	Well drained where depth to B horizon is greater than 6 - 8". Structure very much dependent on organic matter content and Surface sealing occurs after excessive cultivation. Low fertility.
B horizon - heavy grey clay	A/B interface is bleached, and buckshot (ironstone) gravel is commonly found there

Native Vegetation: Open woodland of Box species and Peppermint, with Red Gums near streams.

Existing Land Use: All in freehold ownership, most is cleared for cattle and sheep grazing, with shade trees remaining. Pastures based on native grasses, low grazing pressure. Small pine plantation on the ridge between Buninyong and Lal Lal Townships. Kaolin deposits are mined at two sites.

Erosion Hazard: No high under existing land uses although rilling will occur with overgrazing. Roadside erosion is common.

Potential Land Use: Predominantly grazing, although low water holding capacity limits summer growth. Areas of deeper soils suitable for cropping in rotation with improved pastures to maintain organic matter content.

3. *TERTIARY SEDIMENT AREAS*

4% of the total catchment area

Geology: Pliocene sands, clay sands and gravels, also small areas of earlier Tertiary sands, gravels, conglomerates and limestone.

Topography: Generally flat to undulating except where exposed in the steep sides of the Moorabool River. Drainage lines poorly defined.

Soils: A horizon - grey silty or sandy loam. Depth variable, common 10" to 12". Porosity if fair but structure is weak, and broken by cultivation. Low fertility.

B horizon - yellow silty clay

Native

Vegetation: Occasional trees, mainly native grasses. Greater density of trees on steep sections in the vicinity of the Moorabool River.

Existing

Land Use: Low on flat areas, high on the slopes adjoining the West Moorabool River, as evidenced by areas which have been used to supply sands and gravels for construction of the dam. Sandy loams in particular scour at points where surface flows are concentrated.

Potential

Land Use: Grazing, light grazing on steeper land.

4. *Basaltic Areas*

58% of the total catchment area.

Geology: Six Tertiary basalt flows, various extrusions, with associated tuff and scoria.

Topography: Flat to gently undulating, with steeper slopes surrounding points of extrusion or eruption.

Soils:	<i>Grey soils</i> A horizon grey clay or sandy clay loam, some surface rock. Fair structure, will withstand limited cultivation. Drainage poor, subject to Winter waterlogging. Fertility poor. B horizon A/B interface uneven, often has buckshot gravel. Yellow and grey mottled montmorillonitic clay.	<i>Red soil</i> A horizon red-brown clay loam with scoria rock throughout profile. Clayey content increases with depth. Structure, drainage and fertility all good. B horizon A/B interface not obvious.
	Red soils developed near volcanic cones, grey soils are most distant from the cones, and Transitional soils are found between the two.	

Native
Vegetation: Open woodland of Box, Peppermint and Blackwood. Wallaby grass, rushes in wet situations.

Existing Land Use:	Predominantly grazing, limited cultivation.	Predominantly cropping in rotation with a pasture phase. Common crops are potatoes, rape, turnips, sudax, often irrigated. Other enterprises are dairying and fat lamb production.
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Erosion Hazard:	Minor stream bank erosion, and erosion where surface drains have been cut in wet areas.	Minor stream bank erosion.
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Potential Land Use:	Pasture and limited cropping. Pasture response to fertiliser is limited by cold and waterlogged conditions in autumn and winter. Surface stone may limit cultivation in some Areas.	Intensive agriculture with supplementary irrigation.
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5. *Alluvial Areas*

11% of the total catchment area.

Geology: Recent alluvial deposits associated with streams, lakes or swamps.

Topography: Flat.

Soils:	<i>Stream deposits</i>	<i>Swamp/Lake deposits</i>
	A horizon sandy clay loam. Poor structure, Prone to waterlogging in winter and surface crusting in summer. Drainage and fertility poor.	A horizon grey clay loam. Topsoil structure good, but drainage is poor and soil is difficult to work for agricultural uses
	B horizon heavy yellow grey clay. A/B interface not well defined.	B horizon dark grey clay, A/B interface not well defined.

Native Vegetation: Rushes in swampy areas, elsewhere tussock grass, Danthonia and Stipa sp. Occasional Red Gum.

Existing Land Use: Predominantly grazing, occasional summer fodder crops.

Erosion Hazard: Low. Minor erosion possible if surface drains cut in swampy areas.

Potential Land Use: Moisture retention into summer makes these areas useful for pasture, production, and the lighter soil areas are suitable for summer fodder crops if cultivation is minimal.