GENERAL INFORMATION ABOUT THE AREA

Location.

While the location and outline of the surveyed area can be found from the locality plan (Fig. 1) and the "Index to Soil Maps", additional information about locality references is given below.

There are no large towns within the area. The largest township is Boort (894[**]) latitude 36°6'S, longitude 143°42'E and 152 miles by road from Melbourne. Pyramid (649**), also known as Pyramid Hill, is a smaller township on the Bendigo-Swan Hill railway. Dingee and Mitiamo are hamlets while other localities are identified by railway stations, post offices and country schools. Kerang (4,164**), 7 miles beyond the area, is the main business centre serving the northern part of the district.

The parishes covered by the soil maps, either wholly or in part, are Calivil, Dingee, Hayanmi, Janiember East, Janiember West, Jarklan, Mitiamo, Pompapeil, Talambe, and Yallook in the County of Bendigo; Boort, Kinypanial, Marmal, Mysia, Terrappee and Wychitella in the County of Gladstone; Gunbower West, Loddon, Macorna, Mincha, Mincha West, Mologa, Patho, Terrick Terrick West, Tragowel and Yarrowalla in the County of Gunbower; Boort, Gredgwin, Koorangie, Leaghur, Meering and Meering West in the County of Tatchera.

The soil maps accord with the standard mapping areas of the Military Map Series. However, for convenience, parts of more than one standard mapping area have been placed on a few of the printed soil maps. The Military Map grid lines are shown on the " Index to Maps " and this can be used to identify the military sheet references for any of the soil maps.

The four Irrigation Areas of Boort, Calivil, Dingee and Tragowel Plains, the East Loddon Waterworks Area and the West Loddon Waterworks District are all administrative divisions set up by the State Rivers and Water Supply Commission for the control and distribution of water in particular, defined locations. They comprise part of the Goulburn-Murray Irrigation District. Other Irrigation Areas in this District which have been soil-surveyed previously are Shepparton (Skene and Freedman 1944), North Shepparton, South Shepparton, Rodney, and Tongala-Stanhope (Skene and Poutsma 1962), Deakin (Skene 1963), and Rochester together with the Campaspe Irrigation District (Skene and Harford 1964).

The total area covered by published soil surveys in the Goulburn-Murray Irrigation District and the Campaspe Irrigation District is 1,610,500 acres. This includes some adjoining land outside the statutory Irrigation Districts.

Water Supply, Agriculture and Government Centres.

The first organized attempts at irrigation in Victoria were made when the amended *Water Conservation Act* 1883 came into operation.[††] This was the beginning of an era when water for irrigation was distributed by Irrigation Trusts. Among the first to be constituted were the Leaghur and Meering Trusts in 1885 in the Loddon Valley to the north of Boort. The formation of Trusts received an impetus with the passage of the *Irrigation Act* 1886 which, amongst other things, authorised the construction of national works by the State and enabled Trusts to finance irrigation schemes with money advanced by the Government.

The Loddon Valley received early consideration when construction of the Laanecoorie Weir on the Loddon River was commenced in 1889, as well as works to divert water from the Murray to the Loddon River by way of Kow Swamp.

By 1899, there were nearly 90 Irrigation and Waterworks Trusts operating in Victoria, but many were in financial difficulties. An Act passed in 1899 writing off three-quarters of their existing liabilities gave only temporary relief, and in 1905 the whole structure of control of water for irrigation was altered with the passage of the *Water Act* 1905. This abolished the Irrigation Trusts (except the First Mildura Irrigation Trust) , constituted the present State Rivers and Water Supply Commission, and placed the control of all rural water supplies under the Commission.

Today water is supplied to the Mid-Loddon Valley from the Goulburn System, supplemented by water from the Loddon System. Water from Lake Eildon, a constructed storage of 2,750,000 ac ft. capacity on the Upper Goulburn, is released downstream 150 miles to the Goulburn Weir near Nagambie. From here, water is diverted to Waranga Reservoir, a storage of 333,400 ac ft. capacity. The Waranga Western Main Channel supplies water from Waranga Reservoir to the districts covered by the soil survey.

Storages on the Upper Loddon River are Cairn Curran, Tullaroop and Laanecoorie with a total capacity of 186,900 ac ft. Water is released down the Loddon River and serves the area by means of several diversion weirs.

[**] Population 1966 Census

[††] Information in this section is taken from “Irrigation and Water Supply Development in Victoria”, compiled by H. L. Boorman, and in the 1968-69 Annual Report, both fo the State Rivers and Water Supply Commission

Water usage for irrigation is rather low in the Dingee, Calivil, Tragowel Plains and Boort Irrigation Areas. In 1968-69, the total water delivered to farms in these Irrigation Areas under water rights and sales was 164,549 ac ft. As the area actually irrigated is given as 171,686 ac. (Table 6) , the average water usage per acre irrigated was only 11.5 ac in.

The reason for the low water usage lies in the dominance of pastures requiring only spring and autumn irrigations. This is shown by the statistics for the different forms of irrigated culture given in Table 6. Summer irrigated pastures comprise only about one quarter of the area of irrigated native and annual pastures. The area of lucerne and summer fodder crops is relatively small, while crops with high water requirements such as fruit trees and vegetables are hardly grown at all.

Table 6 – Area of Lands Under Irrigated Culture in the Mid-Loddon Valley Area 1968-69

Land Use.	Tragowel Plains I.A. ac.	Boort I.A. ac.	Calivil I.A. ac.	Dingee I.A. ac.	East Loddon W.S.D. ac.	West Loddon W.S.D. ac.	Total ac.
Area of Irrigation Area	218,490	100,837	51,740	8,890			
Area Irrigated	96,943	42,038	27,605	5,100	1,535	6,095	179,316
Pastures							
Annual	60,287	23,956	14,165	1,293	765	1,255	101,721
Perennial	11,216	5,828	8,090	3,491	228	143	28,996
Native	9,267	80	1,180	52	4		10,583
Lucerne	1,708	3,989	1,394	47	394	988	8,520
Cereals	1,998	2,920	691	58	97	759	6,523
Summer fodder crops	3,022	1,719	730	21		88	5,580
Orchards		10				2	12
Market gardens		20					25
Fallow and Miscellaneous	9,445	3,511	1,355	138	47	2,860	17,356

Most of the irrigated lands are used for dairying and fat lamb production.

About 448,800 ac within the surveyed area is not irrigated. Approximately 11,000 ac of this is State Forest Reserve, comprising about 6 000 ac of Murray pine-box forest on the Terricks Hills and 5,000 ac of red gum-box forest between Lake Meering and Lake Leaghur. The remainder represents land which, in the main, is devoted to dry-farming agriculture. Mixed wheat- and sheep-farming, or the grazing of sheep for meat and wool production are the principal activities on most of this land.

The State Rivers and Water Supply Commission administers the Dingee, Calivil and Tragowel Plains Irrigation Areas and the East Loddon Waterworks Area from its Pyramid Centre, and the Boort Irrigation Area and West Loddon Waterworks District from its Boort Centre.

The Department of Agriculture has no resident advisory agricultural officers in the area. However, it provides advisory services from its district irrigation office at Kerang, and conducts experimental work within the surveyed area from that centre.

Climate.

The meteorological data for Boort given in Table 7 indicate broadly the main climatic features of the Mid-Loddon Valley.

Table 7 – Rainfall, Temperature and Evaporation for Boort

Mean	Rainfall (30 years)	Temperature (34 years)			Tank Evaporation
		Max	Min	Mean	
	in	°F	°F	°F	in.
January	0.81	88.3	58.6	73.4	9.5
February	1.17	88.4	59.6	74.0	7.5
Mach	0.92	82.0	55.1	68.5	5.8
April	0.96	72.7	48.6	60.6	3.7
May	1.62	64.6	43.9	54.2	2.2
June	1.67	57.7	40.2	48.9	1.5
July	1.61	57.4	38.7	48.0	1.4
August	1.58	60.5	40.2	50.3	2.0
September	1.72	65.9	43.1	54.5	3.0
October	1.40	72.8	47.0	59.9	4.0
November	0.96	80.5	52.0	66.2	6.1
December	1.10	85.7	56.0	70.8	8.2
Year	15.47	73.0	48.6	60.8	54.9

The average annual rainfall is almost uniform over the whole area as shown by recordings of 14.3 in. at Kerang in the north, 14.6 in. at Pyramid centrally situated, and 14.6 in. at Fernihurst in the south. Somewhat higher annual rainfall (15.5 in.) is recorded at Boort. The average annual monthly values for Boort show that the winter rainfall is higher than the summer rainfall, 9.11 in. falling on the average in the months April to September, and 6.36 in. in October to March.

The rainfall varies considerably from year to year. Data are not given, but the summer and autumn rainfall is markedly more erratic than the winter and spring.

Monthly mean temperatures range from 48.0°F in July to 74.0° in February. Severe frosts (screen temperature of 32° or under) may be expected about 5 times, and light frosts (screen minima between 32° and 36°) about 20 times a year. Frosts occur mainly in the period May to October, earlier and later occurrences being rare.

Yearly evaporation (Table 7) exceeds the rainfall by about 39.4 in. June and July are the only months in which the average rainfall is higher than the evaporation.

Geology and Physiography.

The Mid-Loddon Valley lies within the vast Murray Basin, a large, shallow basin of tectonic origin. An exhaustive citation of literature dealing with its geology and geomorphology is given by Gutteridge et al. (1970).

The Murray Basin is filled with Tertiary and Quaternary sediments which rest on a basement of Palaeozoic rocks. The basement rocks outcrop 10-20 miles beyond the southern limits of the area and rise gradually to form the Central Highlands.
The oldest Tertiary strata are Eocene sands, silts and carbonaceous clays of the Knight Group; these extend over almost all of the Murray Basin. During the late Tertiary a broad gulf of the sea, the Murravian Gulf, extended eastward and marine limestones, marls, clays, and sandstones were laid down over the Knight Group in the western part of the Murray Basin. Following retreat of the sea, extensive, calcareous, littoral sediments were exposed and under prevailing westerly winds, and alternating wetter and drier cycles, the sediments were re-arranged as relatively high stranded beach ridges and as east-west aligned seif dunes. This broadly is the aeolian landform of the Mallee region in South Australia and north-western Victoria. South and north of Boort the materials of the stranded beach ridges are compacted to a soft sandstone. In the Wychitella area laterisation of the sand-stone has occurred giving rise to a conspicuous ironstone gravelly surface.

Alluvial sediments fill the Murray Basin eastward of the limits of the Murravian Gulf. These comprise sands, silts and clays laid down during a long period from the Oligocene to the Recent. They form the major physiographic unit known as the Riverine Plain which extends over much of southern New South Wales and northern Victoria.

The Leaghur Fault, running approximately north and south, marks the western limit of the Riverine Plain in Victoria (Macumber 1969). The Gredgwin Ridge and other stranded beach ridges west of the fault in the vicinity of Boort form part of an upthrown fault block. There is, therefore, a distinct physiographic separation between the Riverine Plain and the aeolian landform of the Mallee. However, there are other important physiographic features in the Mallee-Riverine fringe zone. These are the lake-lunette systems which extend northward from Woolshed Swamp just south of Boort. The lakes, now mainly dry or used for water storages, are considered to have developed as terminal basins during the final stages of prior stream activity (see below) where drainage further westward was impeded by the aeolian elements of the lands-cape. The crescentic ridges (lunettes) on the eastern perimeters of the lakes vary from a few feet to more than 100 ft. in height.

Another major and very conspicuous physiographic feature is Pyramid Hill in the Terrick Terrick Range. This is a granite monadnock rising about 340 ft. above the Riverine Plain in the east of the area.

An elaborate, braided system of non-functional or prior streams traverses the Riverine Plain in a north-westerly direction. Usually, the slightly raised levees of the prior streams and their high level channels are recognizable features of the landscape, but in places the stream courses have been obliterated. The prior streams and their flood plain sediments are held responsible for most of the superficial deposits of the Riverine Plain (Butler 1950), Deposition occurred during the second half of the Quaternary and the major period of deposi. tion is thought to have ended more than 40,000 years ago. The proposition that the uppermost layer over part, but not all of the Plain is an aeolian, calcareous clay (parna) has been put forward by Butler (1956). This, and other aspects of depositional theories as they apply to the Riverine Plain in Victoria have been mentioned by Skene and Poutsma (1962) and will not be repeated here.

The Loddon River, although a well-defined stream flowing northward to the Murray River has an extremely variable natural flow. For most of the year, there is little flow apart from water released for irrigation. However, periodically the river floods over the adjoining plains through a network of distributaries which leave and re-enter the main course Pyramid Creek or Bullock Creek which like the Loddon River has its source in the Central Highlands is a smaller and intermittent stream Local drainage from the plains finds its way through shallow depressions either to the Loddon River or to Pyramid Creek.

The principal recognizable landscape features are described as prior stream woodland, low woodland, and treeless plain in the Riverine Plain physiographic unit; mallee plain, ridge and lake complex, and ironstone gravelly]) ridgeland in the

aeolian unit; and granite high land. These are discussed in relation to the soils on them in the section, "Landscape Units and Guide to Soil Types" and are illustrated in Figure 2.

Vegetation.

The vegetation associated with the better drained landscape features has been greatly modified by clearing for agricultural purposes and only remnants of the original timber remain in places.

Grey box (*Eucalyptus hemiphloia),* buloke (*Casuarina Leuhmannii*), yellow box *(E. melliodora*) and black box *(E. largiflorens*) were the tree components of the savannah woodlands which originally covered much of the prior stream landscape unit. Grey box was generally dominant except in the lowest situations, most of which are still timbered with black box. Yellow box occurred with grey box on the levees of lighter-textured soils, such as Pompapeil sandy loam and Yarrowalla fine sandy loam. Buloke occurred irregularly on all but the poorly drained elements of the landscape unit.

Black box is the principal tree species throughout the whole area in situations of indifferent drainage. It is conspicuous on Boort clay and Wandella clay in the low wood-land landscape unit, and in the situations classified as swamps. Yellow gum *(E. leucoxylon*) is an associate on some situations of Boort clay. River red gum *(E. camaldulensis*) replaces black box where liability to inundation is greatest, such as on Loddon silty clay loam adjoining the Loddon River, and in the main drainage lines where the soils are Towangurr clay and, sometimes, Wandella clay. Lignum *(Muehlenbechia* cunninghamii) is an associate in wet situations and is also prevalent in drainage lines on the treeless plains.

Various species of mallee eucalypts are prominent on the aeolian landform. These include dumosa mallee *(E. dumosa*), bull mallee *(E. Behriana),* blue mallee *(E. fruticetorum*) , white mallee *(E. gracilis*) and red mallee *(E. calycogona*) . Other eucalypts are grey box, black box and yellow box; these species are all much smaller trees than the occurrences on the Riverine Plain. Casuarina species on the Mallee-Riverine fringe are buloke¸ drooping sheoke (*C. stricta*) and belar (*C. cristata*) . Murray cypress pine (*Callitris columellaris*) is a minor component. Other genera identified on the light soils of the ridges are sugarwood *(Myoporum* platycarpum), berrigan *(Eremophila* longifolia) and moonah *(Melaleuca pubescens).*

The granite highland originally carried fairly dense forest and is still thickly timbered in the State Forest Reserve near Mitiamo. The trees are Murray cypress pine, yellow box, grey box and buloke.

The ground cover of native grasses is dominantly wallaby grass (*Danthonia* spp.) and spear grass (*Stipa* spp.). Barley grass *(Hordeum leporinum*), Wimmera rye grass (*Lolium rigidum*), and burr medic *(Medicago polymorpha*) are other common components of volunteer pastures. Saffron thistle (*Carthamus lanatus*) is common on the gilgaied soils of the treeless plains.

Dillon bush (*Nitraria schoberi)* occurs on the treeless plains and is a conspicuous feature of uncultivated situations of Macorna clay and Kerang clay. The halophytic species commonly found on the very saline situations of these soils are seablite *(Suaeda maritima*), samphire (*Crithmum maritimum*) and various saltbushes (*Atripiex* spp.). Sea barley grass *(Hordeum hystrix*) occurs extensively on moderately salt-affected soils.

On the irrigated soils improved pastures are of the annual and perennial types. Annual pastures which are by far the most widespread consist mainly of subterranean clover *(Trifolium subterraneum*) and Wimmera rye grass. Phalaris (*Phalaris tuberosa*) replaces Wimmera rye grass in a few localities. Perennial pastures are based on perennial rye grass (*L. perenne)* and white clover (*T. repens)* , but paspalum (Paspalum dilatatum) is frequently an important component. Strawberry clover (*T. f ragiferum*) and cocksfoot (Dactylis glomerata) are sometimes present as minor constituents.

Cumbungi or bulrush (*Typha* spp.) is conspicuous as tall dense stands in many drains and some irrigation channels.