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Vegetation Mapping of the Koo-Wee-Rup Swamp and Adjacent Grasslands

April 2005

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Report to
Cardinia Shire Council

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Project no. **4547**

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ABBREVIATIONS

DSE	Department of Sustainability & Environment, Victoria (formerly NRE Department of Natural Resources & Environment)
DPI	Department of Primary Industry, Victoria (formerly part of NRE Department of Natural Resources & Environment)
EPBC	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EVC	Ecological vegetation class
FFG	*Flora and Fauna Guarantee Act 1988* (Vic.)
FIS	Flora Information System (DSE)
NRE	Dept of Natural Resources & Environment (now DSE & DPI)

CONTENTS

1.0 INTRODUCTION

Biosis Research was commissioned by Cardinia Shire Council to undertake vegetation mapping of the natural extent of the Koo-Wee-Rup Swamp and adjacent grasslands. This mapping is to assist in locating remnants of these endangered ecosystems in order to inform future land use planning.

This report follows an interim report (Yugovic and Mitchell 2004).

The available pre-1750 vegetation mapping of the Department of Sustainability and Environment (DSE 2003) although helpful lacks the necessary detail and does not show the open core area of the Koo-Wee-Rup Swamp.

An understanding these ecosystems is only just emerging. Despite the previously extensive occurrence of the distinctive wet grassland adjacent to large swamps, modern recognition of this ecosystem occurred only recently (SAC 1994).

Similarly, it is not well known that the inner Koo-Wee-Rup Swamp was an extensive treeless reedswamp growing on peat, probably with bodies of open water. The fringes were dense *Melaleuca*, giving an impression that the scrub occurred throughout. Drainage and clearance of the Koo-Wee-Rup Swamp commenced in the 1880s and continued for many years (Roberts 1985).

Despite perceptions, many of the wetland flora and fauna species of the swamp still occur in the same locality today, now in association with drains.

1.1 Objectives

The objectives of this investigation are to:

- Map the inferred pre-1750 distribution of ecological vegetation classes (EVCs) in the Koo-Wee-Rup Swamp area, especially Plains Grassland.
- Describe the methods and results of the mapping exercise, interpret the findings, and make recommendations on further survey/research.

2.0 METHODS

Several sources were used to obtain data and information on the former extent of ecosystems within the study area (Figure 1):

1. *Early survey/exploration map of Urquhart (1847)*

Map showing in considerable detail the outer north-western edge of the 'Great Swamp', from Tooradin to Tynong, with a sharp boundary of 'impenetrable' Melaleuca scrub. Valuable annotations on adjacent vegetation.

2. *Plan No. 296 Yallock Station (1855)*

Map showing part of the southern edge of the outer swamp near Koo-Wee-Rup.

3. *Early survey map of Callanan (1859)*

Map of the outer edge of the Great Swamp from Cardinia to Pakenham area, of particular value as it shows crown allotments, thus allowing high resolution. Valuable annotations on vegetation in the Pakenham district.

4. *Plan L3335 (1866)*

Map of the southern, near-coastal edge of the Dalmore Swamp.

5. *Plan L2164 (1893)*

Map of a small area at Bunyip, showing the edge of *Melaleuca*. Not consistent with 6 below, possibly an artefact of clearing along the swamp margin.

6. *Plan rail 84c2 (no date)*

Railway survey map showing the eastern outer swamp edge, from Garfield to Yannathan. Covers a large area and thus valuable but the scale is small.

7. *Map of Torbonarach and Red Bluff (Moore & Martin's Yallock stations)(no date)*

Sketch map of the Yallock Grasslands/Woodlands, appearing in Gunson & Key (1968). Not to scale but informative.

8. *Map of land subsidence of Hills (1942)*

This remarkable map shows land subsidence up to 1914 by overlaying early contours with 1914 contours. Subsidence is due to loss of up to eight feet of peat from drainage, burning and general oxidation. The distribution of peat corresponds to the distribution of the treeless inner or core Koo-Wee-Rup

Swamp. The point where contours lines of the same height from the two surveys converge indicates the edge of the former peat deposit. Coverage is not complete hence the entire peat deposit is not indicated. Map also appears in Hills (1975).

9. Soil map of Sargeant et al. (1996) see references for web address

This modern soil map is the primary source on the original extent of peat and thus the distribution of the treeless inner or core Koo-Wee-Rup Swamp.

The map units Ko (Koo-Wee-Rup peaty clay) and Ko/sr (Koo-Wee-Rup peaty clay with sandy rises) indicate the extent of the former peat deposit (I. Sargeant, pers. comm.). These map units represent alluvial material originally below the peat, enriched with residual organic matter from the previously overlying peat layer now stripped. The exception is that some of the sandy rises rose above the level of the original swamp, while others were buried under the peat and are now exhumed as outcrops on the surface (Hills 1942, Goudie 1942).

The maps of Hills (1942) and Sargeant et al. (1996) do not agree, Hills indicating a much larger area of land subsidence (and thus the inner swamp). Preference is given to Sargeant et al. here as it accounts for the remnant vegetation at Bayles and is based on extensive fieldwork. However, the amount of residual organic matter now present in the soil is expected to be less towards the edge of the original peat deposit as the peat would have been thinner, hence some of the areas now mapped as Mo (Monomeith clay loam), which has normal amounts of organic matter, may have had some overlying peat now stripped. Accordingly, the Hills map is presented as the alternative hypothesis.

Map compilation

Mapping was undertaken using MapInfo GIS software and utilising the Cardinia Shire Council digital map base of roads and hydrology. Copies of the early survey plans were obtained from Land Victoria's Land Information Centre. The plans were scanned and then loaded into MapInfo where they were registered as accurately as possible, using reference points such as creek alignments, cadastral boundaries and, in the case of Urquhart (1847), Mount Ararat and Cannibal Hill. The swamp and grassland boundaries were then carefully traced so that the information could be combined into one composite map.

3.0 RESULTS

The main sources of map evidence in this investigation are shown in Figure 1.

This early survey evidence and the recent soil mapping are combined in composite Figure 2 to represent the inferred pre-1750 vegetation boundaries of the Koo-Wee-Rup Swamp area. Where there are discrepancies between sources, the best source in terms of resolution is given priority. Where no survey data was found, along sections of the outer swamp boundary, no line is indicated.

Due to constraints it was not possible to visit the entire study area to validate the mapping which therefore is partly a modelling exercise. The mapping here is simplified and intended for a scale of resolution of 1:100,000. While some of the mapping (Urquhart 1847, Callanan 1859) was remarkably detailed, vegetation patterns within the inner swamp were probably more intricate than shown here.

4.0 DISCUSSION

The Koo-Wee-Rup Plain contained at least three distinct swamp complexes (Rosengren 1984):

- Koo-Wee-Rup Swamp
- Dalmore Swamp, to the west
- Tobin Yallock Swamp, to the south

Grasslands occurred extensively on the fringes of these swamps, hence knowledge of the original swamp boundaries is useful in determining the distribution of the grasslands and zones where grassland remnants may survive.

4.1 Koo-Wee-Rup Swamp

Ecological vegetation classes (EVCs):
Outer swamp: Swamp Scrub
Inner swamp: Reedswamp / Aquatic Herbland Mosaic

The outer Koo-Wee-Rup Swamp was mostly a dense scrub dominated by Swamp Paperbark *Melaleuca ericifolia*. Sandy rises evidently occurred in this broad fringe and also extended into the inner reedswamp (Hills 1942); the vegetation of the rises was not described and is speculated upon later. The vegetation of the outer swamp occurred on mineral soil rather the organic peat of the inner swamp.

The core of the Koo-Wee-Rup Swamp was a quite different environment, being relatively open and dominated by reeds and rushes, particularly by Common Reed *Phragmites australis*. It consisted of a series of lake-like cells separated by dense reedswamp that acted as slowly permeable barriers to the flow of surface water. This was the largest swamp in Victoria, but it was a massive peat bog rather than a typical swamp since it had an average surface slope of 1.3 metres per kilometre and thus could not have held one continuous standing body of water. Fed mainly by the Bunyip River, the fibrous peat bed had risen 1.8 to 3.0 metres as it had grown over thousands of years, and being resistant to erosion, had acted as a local base level for streams (Hills 1942, Hills 1975).

The deep peat deposit was derived from *Phragmites* and other organic matter that had not fully decomposed due to anaerobic conditions arising from permanent submergence under water. Organic peat is technically not a soil.

The original vegetation of sandy rises that reportedly rose above the level of the peat within the soil map unit Ko/sr is unclear. Rises were reportedly used by early European settlers to access the swamp for stock grazing (Hills 1942).

Only one such ridge appears on Urquhart's (1847) map (Figure 1). This is the Rythdale arcuate ridge, which is a site of state geological significance due to its unusual nature, and its precise mode of origin is unknown (Rosengren 1984). From its curved shape and consistency with similar features further west (Sargeant et al. 1996), it appears to be the remnant of a wind-formed (aeolian) dune on the downwind side of a former lake (a lunette). It is therefore likely to be different in origin to the many sandy rises of soil map unit Ko/sr, which are alluvial deposits. If this prominent feature is the source of the report that ridges were used to enter the swamp, it casts doubt on the possibility that the alluvial rises, which are lower in height, were above the level of the peat.

From remnant vegetation, the natural vegetation of the Rythdale ridge is/was Grassy Woodland dominated by Manna Gum, at least in the highest part. Other vegetation types, such as Damp Sands Herb-rich Woodland, Swampy Woodland and Swamp Scrub, may occur in lower parts in order of increasing wetness (decreasing height above the swamp surface). The tip of the Rythdale ridge was annotated 'point of timber' on Urquhart's map, indicating it supported trees, possibly Swamp Gum *Eucalyptus ovata* or Blackwood *Acacia melanoxylon*.

A site of regional geological significance at Pakenham South on the northern margin of the former Koo-Wee-Rup scrub consists of a number of narrow sinuous ridges rising very slightly above the former swamp surface (Rosengren 1984). They are well outside the inferred peat deposit and would have been under *Melaleuca* scrub. These abandoned levees and bed deposits are also now exposed on much of the former peat area. However, their small dimensions suggest that individual ridges would not have taken stock far into the swamp even if they has been above the peat surface.

The apparent proximity of the inner and outer swamp boundaries at Tynong is of interest. This may be an artefact of the mapping but peat is mapped in this area and it seems that there was a relatively abrupt change from Grassy Woodland on the granite slopes to Reedswamp on the alluvium. A fringe of *Melaleuca* was probably present. This would have been a highly productive area for Aborigines, providing the only easy access to the inner swamp around the Great Swamp's entire perimeter. Fish and waterbirds would have abounded in the inner swamp.

The main outlet of the swamp was Yallock Creek, which issued from the southern end of the swamp at Bayles and was essentially the lower course of the Bunyip River which entered the swamp in the north-east (Rosengren 1984).

Levees line the old channel of Yallock Creek; these support remnants of Swampy Riparian Woodland (SRW), a priceless example of which occurs at Bayles. It is unclear whether levees also lined the old Bunyip River channel. There is no evidence of levees at Rosengren's sites 28 and 29, but SRW is mapped by DSE along the old channel north-east of Bunyip. A ribbon of SRW along the Bunyip River is indicated in this mapping. It is noted that SRW is modelled in this mapping exercise in order to complete the map and that this linework is the only new linework in the study, all other data being obtained from previous surveys. The notional width of the SRW is 100 metres on each side of the stream.

In terms of ecological vegetation classes (EVCs), the fringe of the swamp was Swamp Scrub, while the core area was Reedswamp / Aquatic Herbland Mosaic. Aquatic Herbland occupied bodies of water within the core swamp.

4.2 Dalmore Swamp

Ecological vegetation class (EVCs): Swamp Scrub

Before it was drained and cleared, the Dalmore Swamp was known for its dense Swamp Paperbark *Melaleuca ericifolia*, being almost impassable (Goudie 1942). Originally the dense *Melaleuca* of the Dalmore Swamp was joined with the *Melaleuca* fringing the Koo-Wee-Rup Swamp. Thus a continuous, sharp edge of *Melaleuca* was mapped by Urquhart (1847) to delineate the unexplored 'Great Swamp' consisting of the Koo-Wee-Rup and Dalmore Swamps in combination.

The Dalmore Swamp had the extensive Clyde-Tooradin grassland on its west boundary (Cook and Yugovic 2003), and another, smaller 'open grassy plain' (Urquhart 1847) occurred where Cardinia Creek entered the Dalmore Swamp.

4.3 Tobin Yallock Swamp

Ecological vegetation classes (EVCs): Swamp Scrub, Plains Grassland

The extensive Tobin Yallock Swamp occurred south of Yallock Creek. George Sythe's early survey map (Smythe 1843) shows extensive Swamp Scrub and Plains Grassland in a complex mosaic. The annotation for the relatively open areas between belts of 'Tea Tree Swamp' is 'Rich black soil wooded with Lightwood – good grass', a typical description of Plains Grassland, which is likely to have been an open-woodland maintained by Aboriginal burning.

Tobin Yallock Swamp is not mapped in this investigation.

4.4 Plains Grassland

Native grassland was locally extensive on the fringes of the major swamps. Much was treeless and large areas were lightly wooded with Blackwood.

The most detailed descriptions of this distinctive seasonally wet grassland ecosystem are in the Flora and Fauna Guarantee (FFG) Act nomination for *Plains Grassland (South Gippsland)* and subsequent Scientific Advisory Committee Final Recommendation (SAC 1994):

> Although there are few remnants in existence, the original vegetation is likely to have been an open-woodland which included areas of very sparsely treed tussock-grassland, and shrubby zones associated with drainage lines' (SAC 1994).

Aboriginal burning is likely to have maintained these grasslands and open woodlands. Soil factors may have played a part as the ecosystem is restricted to black soils (Quaternary alluvium). By the time of the early surveys, the previously fire-suppressed woody vegetation had increased in cover, particularly Blackwood *Acacia melanoxylon*. Although Blackwood open-woodland on black soil must have been a familiar part of the landscape to Aborigines and early Europeans, it is now extremely rare in Victoria, having been cleared extensively for agriculture. It is far more rare than the familiar but also endangered dry Kangaroo Grass grassland of the volcanic plains west of Melbourne.

Explorer Captain Samuel Wright was the first European to see the extensive grassland on the floodplain of Yallock Creek, describing it in 1826 as follows:

> 'in point of quality' . . . 'equal to any he ever saw in the Colony, it appeared like beautiful Meadows in England, very thin of Timber, grass excellent'
> (Wright in Gunson and Key 1968)

Soon after, explorer William Hovell described the same area:

> I took two soldiers with me to trace up the course of the river, at half past seven we left, and [at] the distance of about one mile from the tent, I came to a fine open level country, very thinly covered with trees, soil of a good quality, and the grass long and fresh. . . . the only objection to it [the country] is that I think it lies too flat to be perfectly dry in rainy seasons. The water is exceedingly good and the timber on the side of the creek or river is good also. (Hovell 1827)

'It was this natural grassland which made the Yallock area, just south of the swamp, so attractive to early squatters' (Key 1967).

The timber beside Yallock Creek was a ribbon of Swampy Riparian Woodland that followed the creek through the Yallock grassland. This woodland was/is situated on natural levee banks on either side of the creek. The levees provided enough drainage for tree growth while the backflats were grassland. An extremely valuable remnant of this levee bank woodland occurs at Bayles.

The Yallock grassland is mapped in the *Map of Torbonarach and Red Bluff* (Moore & Martin's Yallock stations) in Gunson and Key (1968). More precise mapping is in Smythe (1843) but is not presented in this investigation.

Fringes of the major Westernport swamps supported these extensive open to lightly wooded areas of grassland and open woodland. The 1290 ha Clyde-Tooradin grassland, on the western edge of the Dalmore Swamp, was 'quite clear of trees for several miles square' for when encountered by William Hovell in January 1827 (Cook and Yugovic 2003). The extensive grassland was first mapped by Urquhart (1847) along with the nearby treeless Cardinia Grassland which occurred where Cardinia Creek entered the impenetrable Great Swamp.

All the early European explorers of Western Port noted that large areas of land were burnt, and many of the grassy areas observed by early Europeans may have been created by Aboriginal burning (Gaughwin 1981). Coastal areas of Western Port were Bun wurrung territory (Clark 1990). It is likely the open grassy areas were maintained by Aboriginal burning for access and hunting, the alternative being impassable *Melaleuca* scrub. With the cessation of the Aboriginal fire regime around 1835–1840 (G. Vines, historian, Biosis Research, pers. comm.), tree cover probably increased rapidly, particularly Blackwood *Acacia melanoxylon* which is a tough persistent species tolerant of periodic waterlogging and capable of suckering and thus surviving frequent fire. It was probably already present on the plains in the form of suckering copses and isolated trees.

Early surveyors were instructed to record information on the 'economic topography' of the land, including water sources, tree cover and grass cover. This information has often proved extremely useful in uncovering vegetation patterns that have since been destroyed by European land use.

In the 1840s, W.S. Urquhart (1847) surveyed a large part of West Gippsland, mapping in considerable detail the north-western boundary of the 'Great Swamp'.

In the 1850s, N. Callanan (1859) surveyed the Pakenham area. The area around the former Pakenham Airstrip, which has remnant Plains Grassland today, has the annotation 'Good pasture land very wet in winter & moderately timbered'. This description is consistent with the Plains Grassland, probably responding to cessation of the Aboriginal fire regime 20 years earlier with an increase in tree cover, particularly from 'Lightwood' *Acacia melanoxylon*. This persistent tree

species still occurs on the adjacent Koo Wee Rup Road roadside today.

It is noted that Pakenham is outside the natural geographic range of River Red-gum *Eucalyptus camaldulensis*. The only eucalypt that could have occurred in the wet fertile habitat of the Airstrip area was Swamp Gum *Eucalyptus ovata*.

The description 'very wet in winter' is crucial as distinguishing Plains Grassland, which occurs on wet soils in winter, from Plains Grassy Woodland which is relatively well-drained. They have distinct although overlapping flora and fauna composition and are very different ecosystems. The description of 'moderately timbered' is crucial in ruling out another ecosystem, Plains Grassy Wetland. The latter system is typically annotated on early survey maps as 'marshy open plain'.

4.4.1 Distribution of Grassland

Remnant native grassland may be predicted to occur along the former margin of the Great Swamp when this margin is within the Gippsland Plain Bioregion.

Grassland and grassy woodland were locally extensive on the edge of the Great Swamp as defined by the line of *Melaleuca*. Plains Grassland occurred on damp black alluvial soils, probably where Koories were burning back the edge of the swamp. Grassy Woodland (treeless form) or Central Gippsland Plains Grassland occurred on relatively dry Tertiary sediments and granite, but the vegetation was usually a structural woodland. These grasslands were largely or entirely restricted to the Gippsland Plain Bioregion.

Some of the eastern margin of the Great Swamp is likely to have had little if any grassland, such as in the north-east area where the Highlands Southern Fall Bioregion formed an edge with the swamp (Tynong to Bunyip). Here *Melaleuca* apparently extended right to the break of slope defining the bioregional boundary. However the rail survey map with this evidence was compiled after cessation of the Aboriginal fire regime, so *Melaleuca* may have spread outwards.

5.0 CONCLUSIONS

An understanding these highly distinctive Australian ecosystems is only just emerging. More historical information may be available in archives. The diaries of Wright and Hovell, the first European land-based explorers of Western Port, contain valuable insights but they have not been published or fully transcribed.

Detailed field investigation would further define these ecosystems and improve the accuracy of the vegetation mapping, the results of this study forming a basis for more detailed research. There is much to be learnt about these ecosystems and historical landscapes, and the ecological picture is far from complete.

Precious remnants of these endangered, once extensive ecosystems survive, even in the Yallock Grassland, and all are in need of protection and management.

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FIGURES

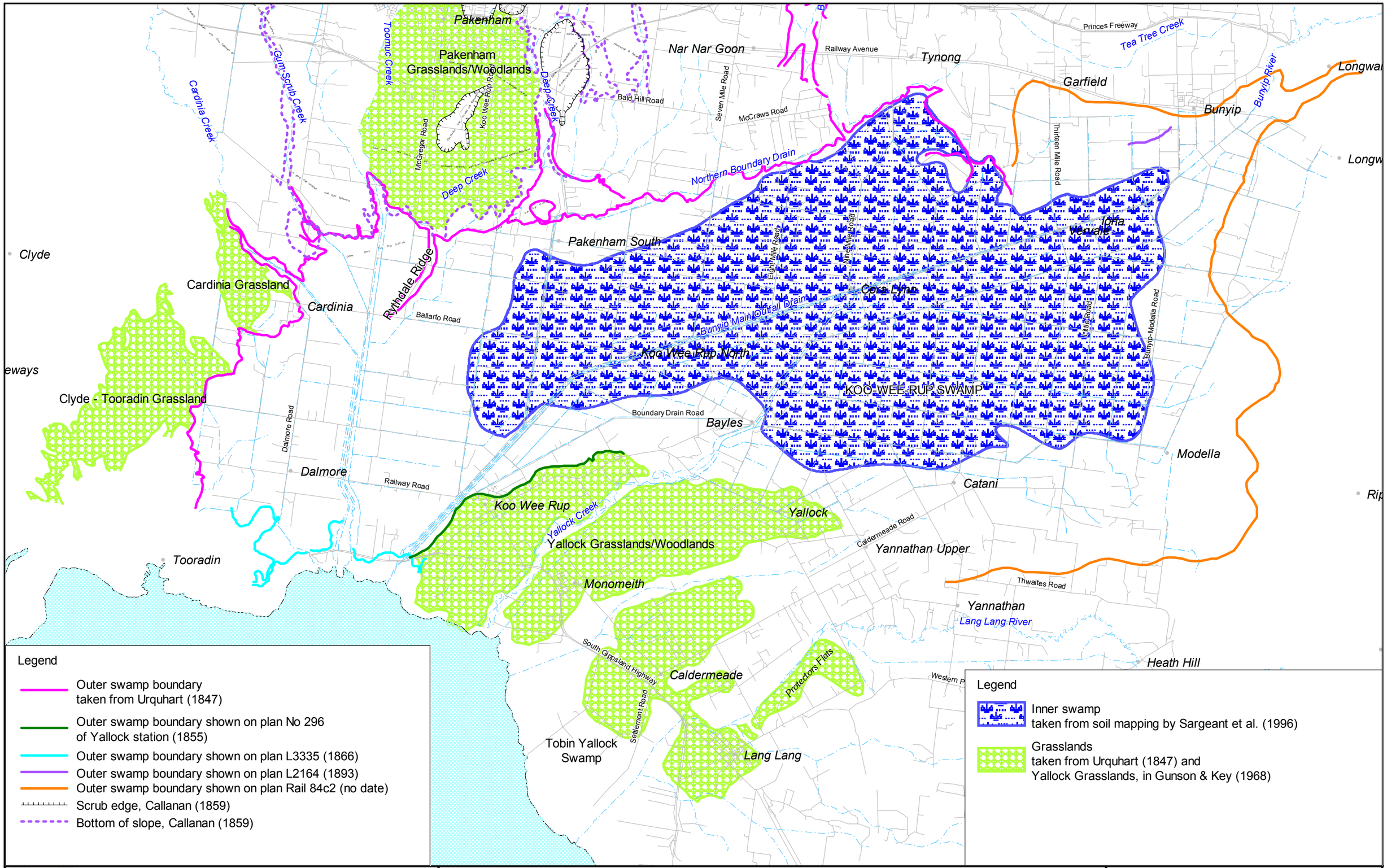

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Figure 1: Collated linework from historic plans and recent soil mapping, Koo-Wee-Rup Swamp area.

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Figure 1: Collated linework from historic plans and recent soil mapping, Koo-Wee-Rup Swamp area.

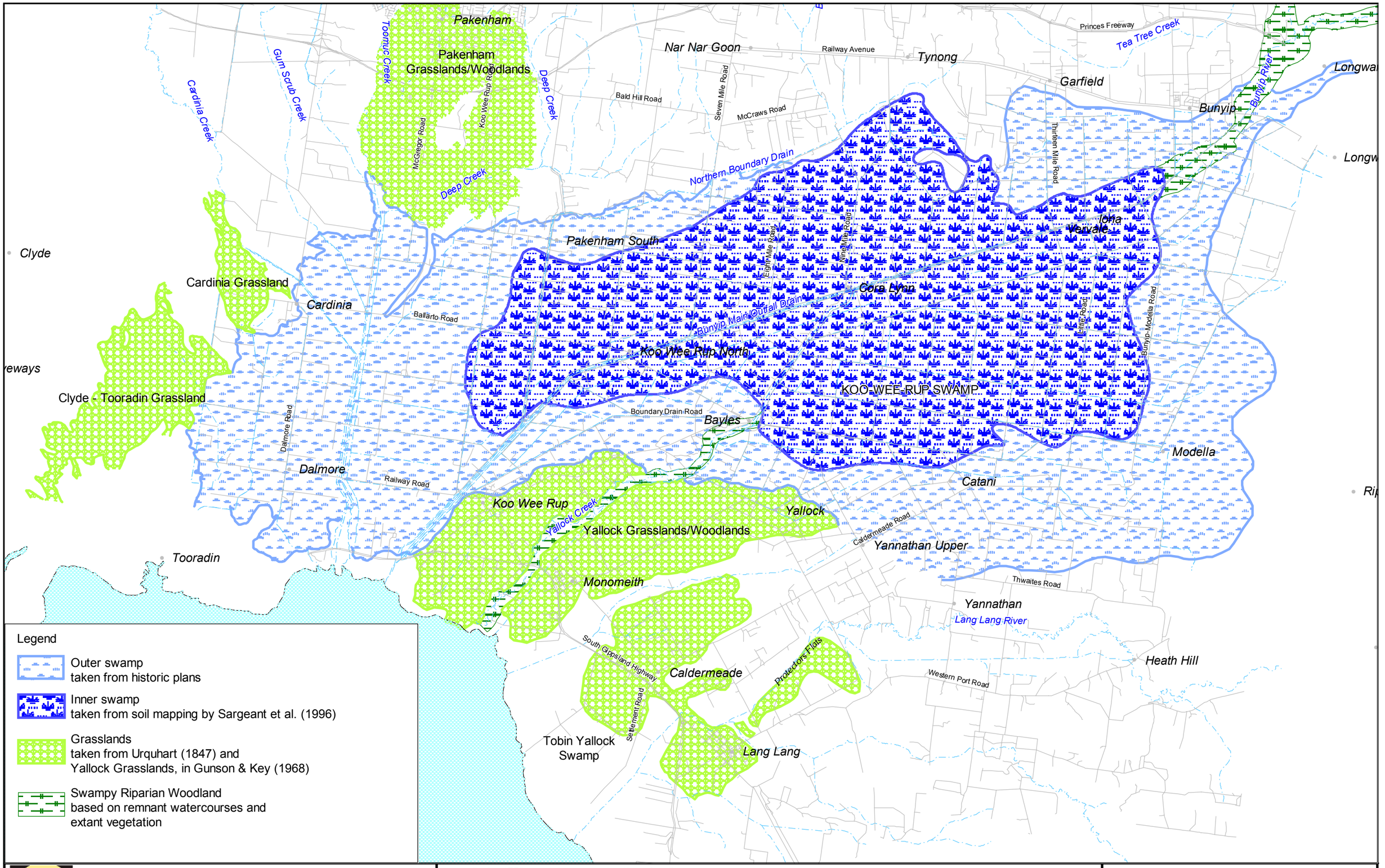

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Figure 2: Pre-1750 vegetation map, Koo-Wee-Rup Swamp area.

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Figure 2: Pre-1750 vegetation map, Koo-Wee-Rup Swamp area.