Coal Mining Heritage Study in Victoria

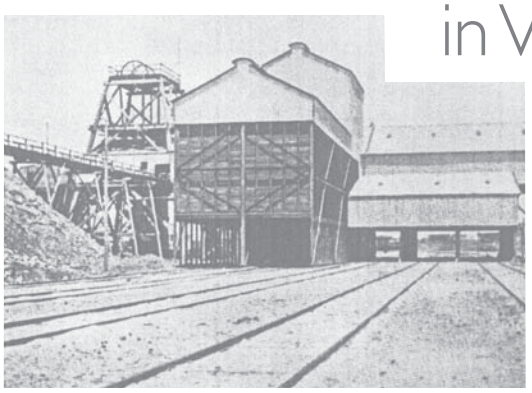
Prepared by Jack Vines

HERITAGE COUNCIL
HERITAGE COUNCIL
HERITAGE COUNCIL

Heritage VICTORIA

Victoria The Place To Be
Department of Planning and Community Development

Coal Mining Heritage Study in Victoria



Prepared by Jack Vines

HERITAGE COUNCIL
HERITAGE COUNCIL
HERITAGE COUNCIL

Heritage VICTORIA

Victoria The Place To Be
Department of Planning and Community Development

Published by the Heritage Council of Victoria, Melbourne, March 2008

Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

ISBN 978-1-74208-036-9 (print)
ISBN 978-1-74208-037-6 (online)
ISBN 978-1-74208-136-6 (CD-ROM)

For more information contact the Heritage Council on (03) 9637 9475 or at www.heritage.vic.gov.au

About the Author

This study has been prepared by eminent engineer and consultant Jack Vines.

After serving for four years in the AIF in World War Two, Jack completed a Bachelor of Civil Engineering Degree in 1948 and a Graduate Diploma of Town and Regional Planning in 1952, both at the University of Melbourne. In 1958 he completed a Bachelor of Economics Degree at the University of Tasmania. Jack currently retains membership as a Fellow of the Institution of Engineers Australia and as a Fellow of the Australasian Institute of Mining & Metallurgy.

Jack has had a lifelong passion for engineering heritage and in particular the development of the coal industry and has written extensively on the subject including detailed technical histories for the State Electricity Commission of Victoria.

Jack Vines has utilised his many years experience as a senior manager at the State Electricity Commission of Victoria and subsequent work as a consultant as the basis for this comprehensive account of the establishment of the coal industry from early colonial days to the present.

Contents

Coal Mine Sites Identification 57

List of photographs

List of Drawings

List of Tables

Introduction

In the 1990s a group called the Historic Mining Sites Assessment Committee was pursuing the conservation of mining heritage in Victoria, beginning with a heritage study of gold mining in Victoria.

In 1995 the new *Heritage Act* replaced the *Historic Buildings Act* and created the Heritage Council of Victoria, an independent statutory authority which was the state's main decision-making body on heritage matters. Heritage Victoria was created as the government agency responsible for administering the Act. The Historic Mine Sites Advisory Committee (HMSAC) was also established, superseding the earlier committee, to advise the Heritage Council on mining heritage. The HMSAC is now known as the Industrial Engineering Heritage Committee reflecting the broader understanding of the role and significance of industrial heritage.

In July 2001 the Heritage Council approved the HMSAC's proposal to undertake a study of the history and heritage of the coal industry in Victoria.

Stage 1 of the study was to collate:

- A history of the critical developments in the coal mining industry in Victoria, identifying its essential characteristics, techniques and physical distribution.
- An inventory of places relating to the coal mining industry, with a description of the mine development and operations for each site, including drawings, tables, photos and references.
- An initial assessment of the historic, scientific, economic and social heritage significance of each coal mine site. Further assessment for possible inclusion on the Victorian Heritage Register or local planning schemes will follow in Stage 2.

The *Coal Mining Heritage Study* was undertaken by Jack Vines from November 2003 – May 2007, under Heritage Victoria's management. Many people have contributed to this study which, it is hoped, will be indispensable to all future study of the state's coal mining industry.

Chronology

Coal Discovery, Mining and Utilisation in Victoria

1791 Convicts escaping from Sydney discovered coal seam(s) in a creek near Newcastle.

1797 Black coal seams were discovered to the south (Coal Cliff) and to the north (Newcastle) of Sydney. Mining commenced on Coal River (Newcastle) in 1797 or 1798.[1]

1798 The first overseas export of coal from the Colony occurred. Four thousand tons were 'shipped in 1799'.[2]

1800 Hunter River coal mines were being worked near Newcastle on a continuing basis under the control of the Governor of New South Wales using convict labour.[3]

1826 18 December: The first recorded discovery of coal south of the Murray River was by William Hovell. He was accompanied by two soldiers and two convicts on an official exploration from the small military and convict settlement at Corinella on Western Port Bay. This coal was observed in the shore cliffs in the area now known as Cape Paterson. A sample of the coal was taken by William Hovell and dispatched with a report to the Governor of the Colony of New South Wales located in Sydney.[4] No mining activity eventuated in this coal seam(s) for more than 20 years. Two coal seams were later identified and called the Rock and Queen veins.

1828 A private company, the Australian Agricultural Company (AACO) operating from Newcastle, NSW (at some stage this may have been called the Newcastle Coal Company), received a virtual monopoly from the Governor for a 30 year period over the mining of coal in the Colony. The monopoly was bypassed by several challengers but these had only minor success intruding the monopoly until the late 1840s. Political debate emanating from these challengers resulted in cancellation of the monopoly in 1850. Nevertheless a strong commercial cartel in the NSW coal supply remained for many years.

1831 Arrival in Sydney of the first steamship to visit the Colony of New South Wales occurred. As steam powered vessels progressively took over from the sailing ships, coal mining in the colony became a more vital and strategic industry.

Coal was found and extracted in small samples by settlers at Bass on Western Port Bay. The coal samples had been brought to the notice of Captain Lonsdale, Police Magistrate in charge of the Port Phillip District.

1837 Coal was found and extracted in small samples at Kilcunda on Bass Strait.[5]

1839 CJ La Trobe was appointed as the first Superintendent of the Port Phillip District of the Colony of New South Wales.

1840 Supply of convict labour to the NSW coal mines ceased.

Production of coal (all black coal) in NSW had reached nearly 35,000 tons per year.[6]

Veins of brown coal were reported in locations on the shore line in locations from Anglesea to Cape Otway.

1841 The first public company to mine coal in the Port Phillip District was formed. William Watson was appointed Mine Manager. A shaft was sunk at Cape Paterson to mine coal. Due to disturbances between Aborigines and whalers in the area, the operation was abandoned without producing coal.

1847 The Cape Paterson Coal Proprietary Company was formed but did not reach a mining stage.[7]

1847 Iron smelting was commenced at Berrima NSW, opening greater demand for coal fuel and strengthening the move towards secondary industry in the colony.

1840s Anecdotal collations assert that coal was discovered in a creek bed by settlers at Loy Yang. This coal was not specifically identified as brown coal at the time.

1850 The City of Melbourne Gas and Coke Company was formed. The Melbourne Gas Company came into service about six years later.

1850 Gold was discovered at Clunes. Further gold finds followed in the adjacent areas. Many finds were not initially disclosed.

1851 Disclosure of gold finds at Bathurst in February lead to the 'Gold Rush' in NSW, followed shortly after in August 1851 by a larger 'rush' to Victoria.

1851 Port Phillip District of the Colony of New South Wales was constituted as the Colony of Victoria taking effect on 1 July 1851 upon the issuing of writs for the first election of elective members of the Legislative Council. Charles La Trobe was appointed the first (and only) Lieutenant Governor.

1851 Production of coal (all black coal) in NSW had reached 67,000 tons per year.

1852 The Government of the new Colony offered a reward of £1000 in September 1852 for discovery of an economically workable coal seam(s). The reward was later claimed by Richard Davis for coal from Cape Paterson. 'The government subsidised sinking of a shaft 53 feet deep which intersected a seam three feet nine inches thick'.[8] Another version is that Davis opened a 2.7 metre seam at low tide level near Coal Creek at Cape Paterson.[9] The reward was only partly paid some years later. The shaft became known as Davis' shaft and was in the same coal seam area as originally discovered by William Hovell.

1854 Opening of the first steam railway, Flinders Street to Port Melbourne.

1854 Miners' Rebellion at Eureka, Ballarat, in December 1854.

1856 A Select Government Committee established to report on Coal Resources of Victoria reported unfavorably on the commercial prospects of coal as discovered to that time.

1856 Alfred Selwyn appointed to initiate a Geological Survey of Victoria.

1857 Carboniferous Deposit found at Lal Lal, south of Ballarat, described as lignite by the Geological Survey Department.

1857/58 Some coal mining occurred at Wormbete in the Otways. This was evidently not a successful venture and did not continue.

1858 A.R.C. Selwyn found coal in a hand bore about one mile north of the present town of Wonthaggi.[10] This was in the coal deposit later to be worked by the State Coal Mine.

A shaft was sunk into the known coal veins at Cape Paterson. The Victorian Coal Company commenced drilling in the Cape Paterson area to trace these coal veins. Subsequently, on Mining Lease 229, this company mined about 2,000 tons of coal from 1859 to 1864, transporting this coal by bullock wagons to whaleboats and thence to off-shore vessels at Cape Paterson.[11] Iron rail tracks were laid to improve the transport arrangements in 1863.

1859 The Electric Telegraph came into service on the eastern seaboard of Australia, vastly improving commercial communication.

1862 Mining at the Lal Lal lignite deposit commenced.

1862 Coal was discovered in the Narracan Creek valley south of Moe. A mining lease was taken out in 1864.

c1864 Mineral Statistics, a quarterly publication, was initiated by the Mines Department to provide a brief summary of mineral and coal discoveries and workings.

1860s Miscellaneous coal discoveries, not usually reported upon, were made by miners searching for gold throughout the colony.

1864 Several tons of coal were dug from a shallow pit a few kilometres east of Griffiths Point on shore off Bass Strait. Further extraction was abandoned due to thin and irregular seam(s).

1865 Coal was found at Kilcunda. This coal was subsequently to be mined by the Western Port Coal Mining Company.[12]

1867 The first recorded discovery of brown coal in central Gippsland occurred at Yarragon. Later, some mining of this deposit occurred. Further west, brown coal was found at Mc Kirley's Creek, north of Warragul, in 1869.

1867 A Select Government Committee was formed to investigate Coal Supply in Victoria. A major outcome in 1870 was an offer by the Government of £5,000 for the first delivery of 5,000 tons of coal to Melbourne from a Victorian mine.

1869 R. Brough-Smith, Secretary of the Mines Department, issued a report on the Carboniferous Areas of the Colony.

1870 The Western Port Coal Company commenced mining at Kilcunda with coal being hauled overland by bullock wagon to Griffiths Point, San Remo, from where coal was shipped to Melbourne. Installation of a three foot six inch gauge tramline from Kilcunda to San Remo was in service in 1874. This mine closed in 1883. (Quantities shown in the Mines Department annual *Mineral Statistics* indicate about 5,400 tons were mined to December 1874 and about 9,000 tons to December 1877. JC Knight, 1951, says 15,000 tons were delivered until the company ceased operations in 1883.) In spite of repeated requests and litigation, the mine operators apparently did not receive the £5,000 government bonus that had been offered in 1870.

1872 Cable communication with London came into service, greatly improving commercial and government communication to and from England.

1873 First recorded discovery of brown coal in the Latrobe Valley on the bank of the Latrobe River at the north east of Moe. Other finds followed at Moe in 1874 and at Toongabbie in 1875. Brown coal was also found in south east Gippsland at Yarram in 1875.

1873 RAF Murray confirmed black coal seams at Korumburra. Some small scale mining had occurred to discover the seam but did not continue at that time. Coal finds were also reported at Foster and Fish Creek.

1873 John Mackenzie, as a consultant to the Victorian Government, reported that 'no workable seam of coal had been opened in any part of Victoria'.

1874 The Kilcunda Coal Association sank a shaft to a thin coal seam at Kilcunda. Mining operations did not proceed until the mid 1920s.

1874 The Excelsior Coal Mining Company mined thin black coal seams at Billy's Creek in the Morwell River Valley. The coal proved to be of poor quality. This was the first coal mining in the Morwell, Narracan, or Latrobe Valleys.

1874 A black coal seam was found about seven kilometres west of Thorpdale. This seam was known as Ryan's Seam and was the first black coal found to the west of the brown coal fields around Thorpdale.

1875 *Geological Reports* Numbers One to Three by the Mines Department reported on extensive brown coal deposits in central Gippsland and the likelihood of black coal seams in south west Gippsland.

1876 Several strikings of brown coal occurred in the Latrobe Valley during excavation of cuttings on the rail track to Sale, indicating a widespread brown coal resource.

1876 Brown coal seams were discovered at Won Wron in south east Gippsland. Mining of these seams occurred around 1957.

1879–92 Government rail lines opened to Gippsland from Melbourne and were connected to Sale by 1879, Mirboo North by 1886, Thorpdale by 1888 and Leongatha by 1892. The rail lines presented a new opportunity for coal haulage to Melbourne, to major provincial towns and industries, and to coal storages for locomotives and shipping.

1880 Mining at Mosquito Creek at the south east of Moe was undertaken by the Gippsland Coal Mining Company. This was the first commercial scale black coal mining venture in the Narracan Valley but closed after about two years. The Moe Mining Company commenced mining in the same area in 1882. However the VR rail line into the Narracan Valley was not in service until 1887, after which several mining operations followed.

1880 The first Victorian International Exhibition opened in Melbourne. This demonstrated to the world that Victoria was an international trade competitor, and that Victorian commercial enterprises could arrange coal supplies (albeit from NSW) to foster industrial growth in the Colony and to provide coal requirements for shipping at its ports.

1881–82 Brown coal was found from boring at Newport/ Altona East.

1880–90 Leases were taken out by many individuals and companies for mining or exploration over most of the land in the Morwell River Valley for up to 10 kilometres south of the Latrobe River.

1882 A tunnel was driven at Silkstone (near Korumburra), from which the first block of Korumburra area black coal was displayed in Melbourne.

1882 The Mines Department commenced a drilling program in the Latrobe Valley coal deposits.

1883 Completion of the railway between New South Wales and Victoria opened up the opportunity for a lower cost of supply of NSW coal to Victoria.

1883–84 The Narracan Valley Company commenced mining at what was later known as Coalville and demonstrated the mine and coal quality to the VR Commissioners at the mine site.

1884 Mining of black coal at Narracan, (Coalville), south east of Moe, was undertaken by the Moe Coal Mining Company. This was to be the largest of the Narracan Valley mines.

1884 Brown coal was found in the Bacchus Marsh area. This area was subsequently mined until the present time.

1887 In August 1887, a syndicate took out a mining lease on a brown coal deposit on the north bank of the Latrobe River north west of Morwell. Development commenced via a shaft, but shortly afterwards operations were transferred to a second site some several hundred feet downstream on the same mining lease area. This mine was developed by the Great Morwell Brown Coal Mining Company and later by the Mines Department and finally by the SECV as Yallourn North Open Cut.

1887 Opening in Melbourne of the Second Victorian International Exhibition took place. This exhibition displayed innovation in secondary industry, much of which required power sourced from coal.

1887–88 The Maryvale Proprietary Mining Company drilled a bore at the Morwell township intersecting 760 feet of brown coal in seven seams. About 200 tons of coal was mined from a shaft but no contracts eventuated and the venture closed.

1888–90 Drilling by the Mines Department intersected black coal seams of commercial thickness at Korumburra. The Coal Creek Mining Company was formed and opened the mine via a shaft into black coal seam(s). By May 1890, tunneling had begun but the mine was waiting for the arrival of the South Gippsland Rail Line. Commercial scale mining did not occur until a VR branch line was connected to the mine in 1892.

1888 Black coal seams were found at Berry's Creek, south of Mirboo North. This seam was opened as Scarlett's Mine circa 1930 and again from 1957 to 1959 when it was known as Berry's Creek Coal Mine. At its closure in 1959 it was the only operating black coal mine in central Gippsland.

1888–89 The Haswell and Company Mine in 1889, and the Horrocks Co-operative Colliery possibly as early as 1885, opened small brown coal mining operations about four miles north east of Thorpdale. Both had a short life and had ceased

operation by 1894. Reactivation of mining of the Horrock's seam occurred in the late 1940s at low output and had ceased by 1950.

1888–94 Brown coal seams were found by John Rollo at Yarragon. The 'Rollo' Mine was opened by the Yarragon Brown Coal Mining Company in 1890 through a shaft adjacent to the Yarragon township area. Mining continued intermittently to 1894. The coal deposit was representative of extensive brown coal deposits west from Moe to Darnum.

1888 Several small brown coal mines opened in the Thorpdale area, but all had closed by 1894. These mines included Dickenson's, Henderson's, Willis's, Crisp's/Ferngrove and Rollo's Mines on the Yarragon Escarpment.

1889 In February 1889, the Great Morwell Brown Coal Mining Company NL took over the mining lease (originally taken out in 1887) located about seven kilometres north west of Morwell on the northern bank of the Latrobe River. By this time, tunnels had been driven into the exposed coal seam. A bridge across the river was built in 1889 and a rail connection to the main Gippsland rail line was in service in September 1890. This operation subsequently changed to an open cut operation and later existed as the Yallourn North Open Cut, a vital source of coal for the SECV from 1921 until closure of the mining in this open cut in 1963.

1889 On 15 July 1899, the Government established a Royal Commission on Coal which presented a final report in 1891. The submissions and discussions during this Commission highlighted lack of government initiative and support for the coal industry in Victoria, particularly reaching conclusions that the brown coal resource was of tremendous significance to the Colony.

1889 As part of a broader investigation of the drilling that had commenced in the Latrobe Valley in 1882, a drilling program was commenced in 1889 by the Mines Department to investigate the brown coal deposits at Loy Yang.

1889 The Mirboo Collieries Mine at Boolarra installed a shaft into a thick brown coal deposit. In 1890, coal deliveries of 5,412 tons of coal were made to the Mirboo North VR line.

Black coal seams were discovered at Jumbunna south of Korumburra.

1890–94 Extensive industrial strikes in NSW mines and ports severely decreased reliability and volume of coal supply from NSW to Victoria.

1890–94 Brown coal seams found in the Bacchus Marsh area were identified as part of extensive brown coal deposits eastwards to Altona and Port Phillip Bay, but largely overlain by basalt. Considerable mining occurred particularly from the 1940s in basalt-free areas at Bacchus Marsh.

1891–92 Coal was delivered from the Coal Creek Mine by road to the VR rail line at Korumburra in June 1891. By October 1892, a branch line had been extended to the mine site. Several other mining ventures followed in the Korumburra area from 1891. The Silkstone mine was reactivated in 1882. The Strzelecki Mine opened in 1893 and continued under several changes in ownership beyond 1922. The Korumburra Coal Company, the Korumburra and Jeetho Coal Mining Company, the Black Diamond Coal Mine NL, the Austral Coal Company, the Silkstone Coal Mine Company, and the Dudley Coal Syndicate were among the other active but intermittent black coal mines in the Korumburra area from the 1890s to the 1920s.

1892–30 At least nine black coal mining operations opened and closed in the Narracan Creek Valley between Moe and Coalville between 1892 and 1930.

1894 Mining of black coal seams commenced at Jumbunna, at Outtrim and at Howitt all with access to the South Gippsland rail line via branch lines to Korumburra from near the mine sites.

1894 At Altona Bay, mining of brown coal occurred from a shaft which was abandoned in 1896 due to flooding from aquifer water. A new shaft was installed in 1899. Mining was intermittent in small quantities to 1920 and was resumed from 1927 to 1931.

1895 At Benwerrin in the Otways, good quality brown coal was mined from 1895 to 1903. Subsequent attempts at reactivation occurred through to 1950.

1896 A briquette factory came into service at the Great Morwell Brown Coal Mine after an earlier factory had been burnt down before successful operation. This second briquette venture did not succeed technically or commercially.

1898 The Great Morwell Brown Coal Mining Company ceased operation. However, mining by subsequent lessees continued intermittently at low output until 1914. Mining was reactivated under Mines Department management in 1917, was transferred to State Electricity Management in 1924 and continued through to 1963, latterly being called Yallourn North Open Cut.

1899 Black coal output in Victoria, mainly from South Gippsland, peaked at about 260,000 tons per annum, representing about 50 per cent of demand. By about 1904, Victorian black coal output fell to about 60,000 tons per annum due to strikes and industrial disturbances and the closure of small uneconomic mining operations.

1900 Only three small black coal mining operations continued to be in operation in the Narracan Creek Valley.

1909 Following strikes severely restricting coal supplies from NSW, the State Coal Mine at Wonthaggi came into operation to mine the black coal seams in the Powlett River Valley, centered about five miles north of Cape Paterson. A VR rail connection to the State Mine was in service in 1910. By 1911, mining was progressing via three productive mines – Shafts Three, Five, and Ten. Eventually there were to be 12 separate mines in the State mine project which remained in production until 1968, being by far the major black coal mining project in Victoria.

1908, 1912 C Merz, consultant to the Government, recommended base load electric generation in the Latrobe Valley sourced on brown coal as well as peak load generation located in Melbourne sourced on black coal.

1910 Daly's Mine was opened into black coal seams on the Powlett River in South Gippsland. It continued in operation to 1926. It was the only new private mine brought into operation in this area of South Gippsland from the late 1890s.

1917 A State Government-appointed Brown Coal Advisory Committee recommended construction of a power station and a briquette factory to utilise brown coal from a defined area south of the Latrobe River in the Morwell River valley.

1914–19 Seven new mines were opened at the State Coal Mine at Wonthaggi, namely: Number Nine shaft, the McBride tunnel with three operating benches, the Station area tunnel and the Eastern Area with two operating benches. At the end of 1919, there were eight producing mining operations.

c1918 Mining of brown coal commenced at Wensleydale in the Otways shortly prior to 1918. Initially, underground mining was used probably to 1932. In 1943 mining of this deposit recommenced as a larger scale open cut operation by the Wensley Bray Coal Company, followed by operation by Roche Brothers until closure of operations in 1959/60 after the Anglesea deposit was opened.

1919 The State Government approved construction of a power station (50 megawatts) and a briquette factory at what was later called Yallourn, immediately on the south side of the Latrobe River and opposite the 'Old Brown Coal Mine' site. This approval also authorised a mining plan and proposals for mine plant as recommended by Lindsay Clark, mining consultant commissioned by the Minister of Public Works. This authorisation was prior to the appointment of the 'Electricity Commissioners'.

1919 Practically all the area in the Morwell River Valley for up to ten kilometres south of the Latrobe River was subject to exploration or mining leases between 1891 and 1919 as entrepreneurs sought opportunity for utilisation of the brown coal resource. This enthusiasm emanated from the 1889–1891 Royal Commission on Coal. However, the Government authorization in 1920 of a Public

Authority to operate an open cut mine, power station and briquette works at Yallourn lessened private enterprise ambitions for brown coal supply. None of the prospective private brown coal mining ventures in the Latrobe Valley reached a commercial ongoing production stage.

1919 At Lal Lal, mining of brown coal resumed after previous cessation in 1898.

1921 The State Electricity Commission of Victoria (SECV) was established on 1 January 1921. Among its immediate tasks associated with the management of electricity generation and supply throughout Victoria was the establishment a power station, briquette works and open cut at Yallourn. Site works had commenced in October 1920 by the 'Electricity Commissioners' to plans previously approved by Parliament. Included in the defined role of the SECV was 'the development of the brown coal resources of the State.' From 1921 to 1924 as overburden was removed to expose coal surface, a few hundred tons of coal in total was intermittently extracted for testing. Coal deliveries on an operational basis commenced on 21 August 1924.

1922 A brown coal seam 30 feet thick was found from drilling at Dean's Marsh in the Otways. This seam was mined from 1947 to 1950, latterly as the Globrite Colliery.

1924 The State Electricity Commission of Victoria took over operations of the Old Brown Coal Mine from the Mines Department with coal supply mainly to the new Yallourn Power Station. The old mine was subsequently named the Yallourn North Open Cut and also supplied coal to Newport Power Station and to industry in Melbourne and Gippsland. The mine operated from 1924 to 1930, again in 1934 and then continuously from 1941 to 1963. Lifetime total coal output was 17,039 million tons.

1927 At Yallourn Open Cut, major modifications were implemented to the Lindsay Clark mining concept with provision of higher capacity plant following German practice to meet substantially higher coal demand.

1929 Underground mining commenced at the Parwan Brown Coal Mine eight kilometres south of Bacchus Marsh. This was the first mining of the deposits at Bacchus Marsh and continued intermittently as a small operation until 1945 when spontaneous combustion led to sealing of the workings.

1936 Proposals were advanced for a new open cut in the vicinity of Yallourn with coal transport interconnection with Yallourn Open Cut to provide extra coal winning capacity and reliability for additional power and briquetting units.

1941 Yallourn North Open Cut was reactivated by SECV to substitute for black coal war-time shortages.

1942–45 Investigations and reports within the SECV continued into the provision of a new open cut in the Latrobe Valley to meet increasing demand for power generation and briquetting.

1944 Maddingley Brown Coal Mine Number One at Bacchus Marsh was opened in 1944 as an underground operation. In 1946 operations were changed to an open cut. This mine closed circa 1950.

1946 The Star Collieries Numbers One and Two each located a few kilometres south of Bacchus Marsh were open cut operations. Number One colliery commenced in 1946 and Number Two in 1950.

1946 The Lucifer Colliery, located a few kilometres south of Bacchus Marsh, opened in 1946 to mine brown coal as an open cut operation.

1947 The Moonomook, Corovuna and the Moolamoona Mines, located about five kilometres southwest of Thorpdale, were opened as adits into brown coal in 1947 and operated until 1965.

1947 The Globrite Colliery at Dean's Marsh commenced operations in the brown coal deposit found in 1922.

1948 Government approved the Maryvale Project as a briquetting complex integrated with a power station and supplied with coal from the new Morwell Open Cut adjacent thereto. Rail haulage

was to be used for transport of overburden and coal. Excavation was intended to be by bucket chain dredgers.

1948 Maddingley Brown Coal Mine Number Two commenced an open cut operation about two kilometres south of Bacchus Marsh. This mine has had continuous operation until the present time mainly delivering by VR rail to paper works at Fairfield.

1940s The 'Rollo' Brown Coal Mine at Yarragon was reactivated after its initial cessation in the early 1890s. 'At December 1950, the mine had produced 23,810 tons of coal and was still in operation'. (This statement from anecdotal sources requires verification.)

1949 The Boxlea Colliery located a few kilometres southeast of Bacchus Marsh commenced an open cut operation in 1949/50 after initially installing an adit in 1948.

1950 At Gelliondale in South Gippsland, an open cut commenced in 1923 and was shut down some time later after a small output. This mine was reactivated some time prior to 1950 and was worked until 1955. A small briquetting plant at the mine site had proved commercially unsuccessful. The coal resource at Gelliondale was of keen interest to entrepreneurs during the world oil crisis of the 1970s.

1951 Yallourn Open Cut introduced the first bucket wheel dredger in Australia, named Number Three dredger. Three ladder dredgers and several shovels and draglines were already in service at Yallourn.

1955 Yallourn North Extension Open Cut (YNX) was opened up by the SECV due to dwindling coal reserves at Yallourn North Open Cut (originally the Great Morwell Brown Coal Mine). The YNX mine utilised equipment from Yallourn and Yallourn North open cuts and effectively took over coal supplies previously derived from Yallourn North. The mine closed in 1969 with a lifetime total output of 9.3 million tons of brown coal, leaving an immediately accessible coal reserve of about seven million tons and a coal resource of about 40 million tons.

1955 The first coal deliveries commenced from Morwell Open Cut initially with transport by SECV rail trucks to Yallourn Power Station. About three million yards of overburden were excavated by mobile plant by October 1955. Bucketwheel dredger Number 21 was the first dredger in operation at Morwell, initially digging overburden from October 1955 with first coal supply in November 1955. This dredger, now out of service, has been preserved as a public exhibit at the entrance to Morwell Open Cut.

1956 A Lurgi Process Gasification Plant converting brown coal to gas came into operation at Morwell, initially using briquettes from the Yallourn Briquette Works and later from the Morwell Briquette Works. This gasification plant closed in 1969 on the advent of Natural Gas supply from Bass Strait.

1958 The first unit of Morwell Power Station came into service supplied with Morwell Open Cut coal.

1958 Mining of the small brown coal open cut at Won Wron commenced.

1959 The first half factory of the Morwell Briquette Works came into service supplied with Yallourn Open Cut coal.

1959 Coal supply to industry and institutions in the Geelong area from a Brown Coal Mine at Anglesea commenced, substituting for previous supply from the Wensleydale Open Cut. The new mine was initially operated by Roche Brothers.

1961 The Anglesea Mine was taken over by Alcoa of Australia for supply to the 150 megawatt Anglesea Power Station owned and operated by Alcoa. Western Mining Company carried out the initial mine planning and mine management. The Anglesea Mine continues in operation at 2007.

1963 Yallourn North Open Cut ceased coal mining. However its outloading plant continued outloading coal from YNX Open Cut to VR rail trucks.

1964 Operations at Yallourn North Open Cut ceased. As a component of a long term rehabilitation plan, portions of the open cut mined out area continue to be used at 2007 as a below natural ground level storage for ash hydraulically pumped from the nearby Yallourn W Power Station.

1964 The first unit of Hazelwood Power Station came into service supplied with Morwell Open Cut coal.

1968 The State Coal Mine at Wonthaggi closed down in December 1968 after mining 16.7 million tons of coal in its 58 year lifetime.

1970 Australian Char Pty Ltd established a coal to char conversion plant at Morwell using briquettes from the Morwell Briquetting works. High quality parameters were sought by Australian Char in coal selection at Yallourn Open Cut, the source of briquetting coal until 2002. This char plant was still in operation at 2007 but continuation of briquette supply seemed uncertain.

1970 The eighth 200 megawatt unit of Hazelwood Power Station came on line completing the generation plans based on Morwell Open Cut.

1976–77 Annual coal output of Morwell Open Cut reached a peak of 16,024 million tonnes.

1976–77 The Loy Yang Project to be located several kilometres south of Traralgon was authorised by Parliament as a 4000 megawatt power station to be fuelled from an adjacent open cut. Site works commenced in February 1977.

1981–82 Coal output from Yallourn Open Cut reached a peak of 22,275 million tonnes in the 1981/82 year.

1982 At the Loy Yang Open Cut, the first dredger (D14) commenced commissioning in July 1982 and went into commercial operation excavating overburden on 1 October 1982. The first coal deliveries occurred in July 1983, with commercial operation of the first 500 megawatt power unit officially on 30 June 1984.

1985–89 Morwell Coal was used in a solar dried coal slurry plant installed at a trial scale at the south of Morwell Open Cut. Economic viability for this process proved highly doubtful.

1985–90 Yallourn Coal was supplied to an outloading station at Morwell for use in the Brown Coal Liquefaction Victoria (BCLV) plant for conversion to oil. The conversion process proved technically feasible. The plant was taken out of service c1990 and largely dismantled.

1989 Yallourn North Extension Open Cut ceased coal mining operations due to APM Maryvale (the last remaining customer) converting fully to power generation from natural gas. Rehabilitation of the open cut has occurred such that mining of an approximate 40 million tonnes of coal could be viable in the future.

1992 At Loy Yang Open Cut, the fourth dredger (D27) went into normal operation on 1 June 1992. Provision has been made for a fifth dredger but no commitment has been made.

1992 At Loy Yang, a pulverized dried brown coal plant went into service with coal supply from Loy Yang open cut. This plant had a contract to supply dried coal as a start up fuel for Loy Yang B Power Station.

1996 At Loy Yang, the sixth 500 megawatt power unit (the last unit committed at 2004) was handed over for full time operation on 30 September 1996. Coal output averaged 30.7 million tonnes over the calendar years 1998 and 1999. An average annual output of 32 million tonnes is expected in current and future years.

2003 At Loy Yang, the Hyland Highway was diverted over a length of about five kilometres to allow for expansion of the open cut to the east and south.

2004 At Morwell, in January 2004, a fire in the briquette factory caused extensive damage. Some funding for restoration of damaged plant and buildings occurred providing for continuing operation at a lower output of briquettes. The integrated Morwell Power Station continues in operation at 2007.

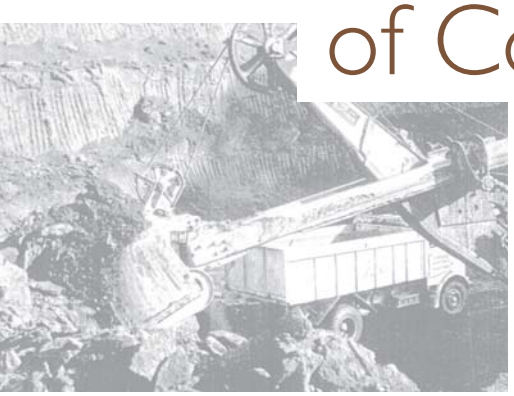
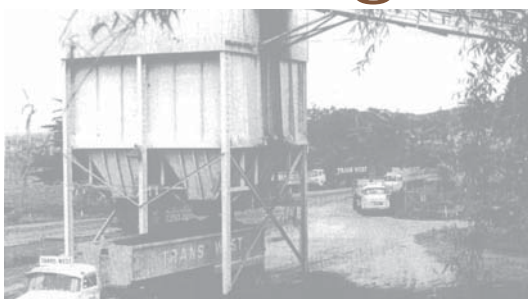
2004 At Yallourn Open Cut, all excavation was in the East Field and earthworks were in progress for a re-deviation of the Morwell River to provide for expansion of the open cut to the east and south. Coal excavation was in the process of change to dozer/mobile crusher/feeder plant on two or three levels loading to the existing conveyor systems.

2004 First deliveries of coal from the west field of Morwell Open Cut occurred.

2004 Government interest in brown coal utilisation, particularly of the Latrobe Valley resource, was evident in sponsoring specific research activities with opportunity for increased combustion efficiency and reduced greenhouse effects. Three consortia had been selected by government after tender, with development rights in specified areas from Driffield to Rosedale. The other potential development sites suitable for large scale brown coal mining in Southern Gippsland such as Gelliondale, Stradbroke and Alberton were not included in this government-sponsored initiative.

2005 Yallourn, Morwell and Loy Yang Open Cuts remain in service in the Latrobe Valley and the Anglesea Open Cut at Anglesea. The Maddingley Open Cut Number Two and the Yallourn North Open Cut are each being used as planned refuse disposal areas. Some minor excavation of brown coal at Maddingley Open Cut is being used in soil conditioning packages for distribution for horticultural use. All other coal mining activities in Victoria have been terminated.

A Contextual History of Coal Mining in Victoria


Dedication to Coal Miners

The centuries will burn rich loads
With which we groaned.
Whose warmth shall lull their dreamy lids,
While songs are crooned.
But they will not dream of us poor lads,
Lost in the ground.

Wilfred Owen, Collected Poems, 1946[13]

1 Coal Discoveries in Australia prior to the inauguration of the Colony of Victoria in 1851

The first recorded discovery of coal in the area of the Colony of New South Wales was by convicts escaping northwards from Sydney in March 1791. They had found coal in a creek near what is now Newcastle. This find was recorded in a manuscript lodged at Koepang by escapee Bryant circa 1792 and later re-recorded in notes by Captain William Bligh. In August 1797, coal seams of more economic significance were found at what is now known as Coal Cliff to the south of Sydney. About one month later in 1797, a substantial coal seam was found to the north of Sydney in coastal cliffs near Newcastle.[14]

Mining of coal in the Colony of NSW commenced almost immediately after the 1798 coal discovery in the Newcastle area. The first location to be mined was 'near the Nobbies on the Coal River at Newcastle.' By the end of 1800, approximately 4,000 tons of coal was being shipped out of the Newcastle area annually. In 1801, the Lieutenant Governor of NSW arranged to have drawn up 'a stratigraphic section identifying a number of (coal) seams' in the Newcastle area.[15]

The early coal mining in NSW was undertaken by the Crown using convict labour. Ownership of all coal seams and deposits was vested in the Crown. Initially mining operations were inefficient. But by about 1800 'the adits of the earlier years were being supplemented by shafts'. In 1828, a private company, The Australian Agricultural Company (at some stage this may have been called or was known colloquially as the Newcastle Coal Company), chartered in 1824, had received from the Crown a virtual monopoly on coal mining in the whole of the NSW colony for a thirty year period. The AA Company, initially operating from Newcastle, maintained this privileged position (although 'challenged from time to time') until it voluntarily relinquished its monopolistic rights in 1850.[16] Another more probable version is that political debate led to cancellation of the AA Company virtual monopoly in 1850.[17]

The first overseas export of coal from NSW had occurred in November 1801.[18] It was reported in the House of Commons Papers for 1812 that of the export trade from the Colony of NSW 'the trade in skins and coals were the most thriving.'[19]

A substantial increase in export quantities of coal occurred from about 1850 when supplies to South America were initiated.

The recorded history of coal discoveries in the Port Phillip District of the Colony of NSW later to be named Victoria date back to 18 December 1826, when William Hovell accompanied by two soldiers and two convicts[20] in an official exploration from the small military and convict settlement under the command of Captain Samuel Wright at Corinella on Western Port Bay found coal on the Bass Strait shoreline in the area now known as Cape Paterson. (The spelling Cape Paterson as listed in Australian Post Codes will be used throughout this history, although the spelling 'Cape Patterson' was also often used in early official documents.) The initial coal finds were not precisely at the point known now as Cape Paterson but at a location about 3.5 kilometres to the West. (These seams found by Hovell were subsequently accessed in the DAVIS SHAFT, the first formally acknowledged site of coal mining in the Port Phillip District of NSW. These seams were also the source of the coal mining in 1910 by the State Coal Mine based at Wonthaggi.) A report on this discovery and a sample of the coal was taken to Sydney by Captain Wetherall, commander of the vessel, the Dragon, to Governor Darling of the Colony of New South Wales under whose authority the settlement at Corinella had been established. Darling forwarded Hovell's report to London but a decision had already been made in London to close down the Western Port military base. No action followed from Hovell's report[21] at that time. The settlement at Corinella was abandoned in 1828.

In 1836, coal was subsequently found and extracted in small quantities (reputedly the first coal mining operation in Australia by non-convict labour) for domestic use by Samuel Anderson who had settled on Western Port Bay at Bass in 1835.[22] (The location of this operation has not been definitively established as yet by me, some references stating this to be at Cape Paterson, others state the location as at Bass. These locations are about 20 kilometres apart. It is important to resolve this location for heritage recognition. The location of Anderson's first house is shown in Horton & Morris p.107).

In 1838, settlers Anderson and Massie told Captain Lonsdale, Police Magistrate of the Port Phillip District, who had taken up duty on 1 October 1836, that there was abundant coal in the Cape Paterson area and had asked permission to extract it, but no official reply was received.[23]

CJ La Trobe, appointed in 1839 as the first Superintendent of the Port Phillip District of the Colony of New South Wales, visited the Western Port area in July 1840. Stimulated by the high social and economic value of a potential coal supply indigenous to the Port Phillip District, he showed considerable interest in encouraging private coal mining ventures in the Western Port area as the only known potential coal supply source in the Port Phillip District. In 1839, Captain WA Moore, of the cutter Prince George, and Robert Hoddle, a surveyor, were instructed by Superintendent La Trobe to undertake an expedition in search of coal along the southern coastline of the Port Phillip District of NSW. Their only coal discovery was 'a strata of coal about six inches thick below high-water mark level in Western Port near Griffiths Point.' 'It was not a successful expedition -they found no coal of any consequence in the areas searched.' They did not investigate the coastline to the east of Griffiths Point. Prior to 1840, Samuel Anderson had also found this coal strata at Griffiths Point identified by Moore and Hoddle but had not reported his find.[24]

In 1840, Captain Cole, subsequently a board member of two companies with interests in the coal trade, initiated coal mining 'from the cliffs between Kilcunda and San Remo' outloading 'a few tons of coal' into ship via lighters and transporting this coal to Melbourne.[25]

In October 1840, La Trobe instructed H Cameron to explore the Cape Paterson area for coal deposits. Cameron returned to Melbourne with coal samples and much enthusiasm reporting on 'the exhaustless black diamond treasures awaiting only the co-operative power of men and money.'[26] Resulting from this report, a company was formed in March 1841 and William Watson 'an experienced miner', was provided with men and equipment to commence a coal mining operation at Cape Paterson. Shortly after mining was initiated, this operation was closed down due to local attacks by and on aboriginal groups, Watson left the site and the project was abandoned without productive mining of coal having been achieved.[27] However, it had been found from this initial activity that the coal seams discovered were thinner than predicted. Nevertheless in 1847, a commercial enterprise named 'The Cape Paterson Coal Proprietary Association was formed to bore and work the coal, but very little work was done'.[28] (Captain Cole was a board member of this company).

In the 1840s, veins of brown coal in several locations along the coast between what is now Anglesea and Cape Otway were reported by the surveyor Smith.[29]

By the mid 1830s, private coal mining operations on the coast in central New South Wales were well established serving Sydney as well as exporting coal. At 1835, private coal exporters in NSW were well poised to provide coal by sea transport to serve the new settlement in Port Phillip Bay established in 1835.

In New South Wales, the right of the Crown to coal on privately owned land was terminated in 1850. Private coal mining and exporting entrepreneurs had gained considerable political support at the time of the separation of the Colony of Victoria from that of NSW.

In the other colonies in Australia, coal discoveries and coal mining increasingly became of high significance to economic self-sufficiency and the potential to supply steaming fuel, for secondary industry, locomotives and shipping. Coal had been discovered near Hobart in 1803 and utilised there from 1805. Other discoveries followed in Tasmania through to the 1830s. A significant mining operation at Saltwater River to the South East of Hobart commenced in1834. However the coal resource was not large and no export occurred prior to 1850. In Queensland the first recorded discovery of coal was in the vicinity of Ipswich in 1825. The first mining of coal in Queensland took place in about 1845. However the competitive advantages for export of coal from the Newcastle and Coal Cliff mines at-seaboard virtually eliminated any potential for export of coal from the inland Queensland site. In 1839 in Western Australia, the Governor had offered a reward in the form of a land grant for the discovery 'of any considerable bed of coal south of Shark's Bay' in the WA colony. Seven years later the reward was granted for a discovery about 250 kilometres north of Perth which subsequently led to a small mining operation but without realistic potential for commercially viable export. In the Colony of South Australia, coal was first discovered in 1836 to the north of Adelaide but mining did not occur until decades later.[30]

On 31 July 1847 the decision of the British Government was announced to separate Port Phillip from New South Wales and to call the new colony Victoria. The relevant British legislation came into effect on 5 August 1850. The actual independence of Victoria was dated from 1 July 1851 when the writs were issued for the elections of the first Victorian Council. CJ La Trobe was sworn in as Lieutenant Governor on 15 July 1951.

At 1851, the politically supported and financially successful well established coal mining and delivery operations on the NSW central coast were now privately owned and operated. These operators and entrepreneurs were in effect the exclusive suppliers of coal to the embryo colony of Victoria.

There had been no significant coal discoveries and no commercially successful coal mining in the Port Phillip District of NSW. For the newly established colony of Victoria, exploration and development of Victorian coal mines close to the metropolitan and regional centres or on the coast were of high priority.

By 1951, the time of the first gold rush and the separation of the Colony of Victoria, production of coal (all black coal) in the colony of NSW had reached over 67,000 tons.[31]

2 Coal exploration and mining in the newly established Colony of Victoria 1851–1870

2.1 Increase in Government influence on coal exploration and mining in the 1850s

In 1851, CJ La Trobe, the Lieutenant Governor influenced the government to offer a reward of £1000 for the establishment of a commercially successful coal mining venture in Victoria. La Trobe strove diligently to encourage commercial independence with the political separation from NSW but not without strong opposition from entrenched business interests tied to NSW. However, although the Victorian Government paid some minor rewards for coal discoveries in the 1850s, no coal mining operation of significant commercial prospects eventuated in the 1850s.

Gold had been discovered near Bathurst as early as 1823. However, it was the discovery of gold by EH Hargreaves in the Bathurst district in February 1851 (announced in the Sydney Morning Herald, 15 May 1851) which began the gold rushes in NSW. Minor gold discoveries in Victoria had occurred from the early 1840s and in large quantities at Ballarat in August 1851. This started the great rush to Victoria.[32] The widespread exploration for gold (with associated discovery of coal seams and lignite deposits) and the influx to Victoria of skilled miners, many of whom were formerly coal miners in Britain, seemingly provided a potential for development of coal mining in Victoria from the mid 1850s.

In 1852, Alfred Selwyn of the Geological Survey of Great Britain was appointed to the newly declared colony as a geological surveyor to be attached to the Surveyor General's Department. Over the next four years he travelled extensively with one assistant on geological surveys throughout the colony. In 1856, a Select Government Committee established to report on the coal resources in Victoria, reported unfavourably on the commercial prospects of coal discoveries found to that time. In 1856, Selwyn was appointed 'to commence a Geological Survey of Victoria'. R Brough Smyth was appointed as Secretary of Mines in 1861 with responsibilities including Mining and Geological Surveys.[33] In 1863, the first Geological Map of Victoria was produced. Selwyn was responsible for Geological Surveys through the period of extensive gold discoveries and exploration until his resignation in 1869. His resignation arose through conflict on the interface between the geological surveyors and mine surveyors, which had arisen between Selwyn and R Brough Smyth.

In 1870, Brough Smyth submitted a report 'On the Present Condition of the Geological Survey of Victoria'. Appointment of three geological surveyors followed – namely RAF Murray, EJ Dunn, and FM Krause each of whom subsequently had a long and strong influence on the accumulation and interpretation of geological information throughout the colony. A new geological map of Victoria was issued in 1872. From 1873 onward the first of eleven progress reports of the Geological Survey was issued.[34]

A Geological Survey of New South Wales was not commenced until the New South Wales Department of Mines was established in 1875.

In 1857, a carboniferous deposit found at Lal Lal near Ballarat was described as lignite by the Geological Survey Department. This was the first identification made in the Colony of Victoria of this lower grade fuel. (This lignite deposit at Lal Lal was subsequently the first lignite/brown coal to be mined in Victoria albeit with mixed commercial success through several different mining companies intermittently over the next 90 years.)

In 1858, after initially providing a 25 pound sample of coal from the coal seam outcrops originally found by Hovell in 1826, a shaft was sunk by Richard Davis at Cape Paterson intersecting the two veins of coal. After much negotiation with the Government a reward of £110 was paid to Davis. (Some references including Knight [1940] state that the full payment to Davis was eventually £400). In 1863, Thomas Bury was paid £100 by the government to carry out some further examination and tests from this shaft.[35]

In 1858 the Victorian Coal Company was formed and commenced boring at Cape Paterson with the intent to prove and mine suitable coal seams.

In 1859 thin seams of good quality black coal were recorded at Bass.[36] It is probable that coal from these seams was that used domestically by the Andersons in the 1830s.

2.2 Widespread coal exploration and discovery in the 1860s

By the 1860s, discoveries of coal were being reported throughout the colony, particularly south of the Great Dividing Range, in South West and Central Gippsland and to the west of Melbourne. By this time, geologists and analysts from the Mines Department were separately classifying the various discoveries as either black coal, or as brown coal or lignite (eventually from about 1900, the broader nomenclature 'brown coal' was adopted, instead of lignite, for all the geologically younger coals). *Mineral Statistics*, issued annually by the Mines Department from about 1864, which included a brief summary of the coal and lignite discoveries and workings in the colony, traces the history of these early prospects. By 1864, it was noted that, in the area from Cape Paterson to Griffiths Point, 33 searching licences for coal or lignite had been issued and four mining leases were in operation.

The Victorian Coal Company between 1858 and June 1863 mined 1,933 tons of black coal from shafts into the coal near the original find of Hovell west of Cape Paterson. Two seams named the Queen and the Rock seams, each about 40 to 50 inches thick at the shore outcrop, were intersected.[37] The coal as mined was shovelled by hand into bags, then hauled in bullock wagons and outloaded into whale boats delivering to ships anchored off Cape Paterson. This company ceased operation in 1863 after considerable infrastructure costs had been expended to establish effective haulage over an iron rail tramway to the outloading point. At 1865 this company still retained its lease but stated its lack of activity was due to problems with shipping out the coal.[38, 39]

In 1865 the Western Port Coal Company was formed to work a black coal seam exposed at Kilcunda. It was intended to haul the coal about 11 kilometres to San Remo for delivery by ship to Melbourne. By 1870 a shaft 0.4 kilometres inland from the shore at Coal Creek near Cape Paterson was sunk striking good black coal at 100 feet in a seam 1.7 to 2.0 feet thick.[40] An undisclosed quantity of coal was hauled by bullock wagon to Griffiths Point but the haulage route quickly cut up and mining operations were suspended waiting for decisions and action on a better haulage provision. This company eventually continued through to 1883.[41] It mined about 15,000 tons having built a three foot six inches wooden rail tram track by 1906 later replaced with iron rails to a wharf constructed for outloading coal at San Remo/ Griffiths Point.

In 1868, another Select Government Committee on coal resources was established. The major outcome appeared to be the offer of £5,000 reward by the government in 1870 for delivery of 5,000 tons of black coal to Melbourne from a Victorian mine.

In 1869, R Brough Smyth, Secretary, Mines Department, issued a further report on the Carboniferous Areas of the Colony. He warned that successful competition by Victorian mines against coal deliveries from NSW black coal mining operations 'would require thick seams from locations which would permit the coal being brought to market in good condition and at no great cost'.[42] Nevertheless his report was timely and of high significance advocating increased exploration in areas depicted by him as being potential coal bearing areas. Many local discoveries of black and brown coal subsequently took place as prospectors explored in new areas and as land settlement in South and Central Gippsland occurred through the 1870s.

Coal proving activity in the Kilcunda to Griffiths Point area had been high due to the proximity of safe ship shelter. The New Griffiths Point Coal Company drove a deep bore towards 1000 feet but did not disclose their results in detail. In the late 1860s, coal extraction from shallow pits near Griffiths Point did not prove technically successful due to thin seams. In these and other embryo black coal mining ventures in the colony, high transport costs and thin seams were combined disadvantages.

By 1870, only 2,033 tons of black coal (all from South West Gippsland) and 997 tons of lignite (all from near Ballarat at Lal Lal and Sebastopol) are recorded as having been mined in the colony of Victoria to that time. It is highly probable that outputs from small coal mining ventures were not fully reported at this time. No black coal production had been recorded in the period 1865 to1869.

With respect to lignite or brown coal mining, the Lal Lal mines are the pioneer brown coal mines of Victoria. The Lal Lal deposit (adjacent to the current Geelong-Ballarat railway line) about 15 kilometres south of Ballarat had been assessed as 'being a bed of lignite more than 100 feet in thickness'.[43] In 1864, the first lignite mining took place via a shaft sunk by the Victorian Lignite Company with 200 tons raised and sold.

At June 1865, there were several shafts with four mining leases in force over 667 acres with four separate companies involved at Lal Lal.[44] However there was no market identified at the time for economic application of this high moisture coal either locally or at Ballarat, Geelong or Melbourne and further production did not occur until 1869.[45] Concepts of the mining lessees turned to coal drying and briquetting as well as use as a soil conditioner or fertiliser or for conversion to liquid fuels, lubricants, or other chemical by-products. These potential uses have remained to the present day as concepts, with some implementation, for effective utilisation of the vast brown coal deposits of Victoria.

At Lal Lal, a number of mergers and withdrawals of the mining lessees occurred resulting in the Victorian Brown Coal Company Ltd. being the sole operator by1874 with a mining lease of 475 acres. By this time only about 3,000 tons had been raised. Mining had been very intermittent. Maximum storage capacity under cover of the mined lignite was about 200 tons. Generally, this storage was full, waiting for sale of the stored lignite.

Another lignite mining operation occurred at Sebastopol near Ballarat by the Victorian Patent Manure and Chemical Company in late 1865 raising 35 tons only. Nothing further was recorded for this venture. There were other lignite finds recorded in the 1860s in central Victoria but apparently none of these reached a commercial mining stage.

By 1878, the progressive quantities mined as shown in *Mineral Statistics* of the Mines Department had risen to 8,971 tons of black coal and 4,589 tons of lignite. (Note that the quantities attributed to individual mines exceeded the total shown for all mines.)

In 1873, the first coal find in the Otways was recorded for lignite deposits 'of considerable thicknesses at Point Castries south west of Aireys Inlet'. These deposits were assessed 'to be widely spread but they do not in any one place cover a very large area'.[46]

2.3 Effect of infrastructure on coal supplies

2.3.1 Influence of the railways network on coal supplies

On 12 September 1854, the first locomotive in the Colony of Victoria travelled from Melbourne to Hobson's Bay on a rail line built by a private company.[47]

From the late 1850s, the advent of rail lines from Melbourne and Geelong to Ballarat, Bendigo, and beyond increased the market opportunities for coal delivered by sea from NSW. The Sydney-Melbourne rail link came into service in 1883. However, the difference in rail gauge at the junction of the Melbourne to Sydney rail line at Albury obviated the economic opportunities of coal deliveries from NSW by rail. It was not until the 1880s and later that the Victorian rail network into the coal bearing areas of Victoria presented opportunities for coal mined in Victoria to compete with NSW coal delivered by sea to Melbourne, Geelong or Portland.

With respect to Central Gippsland, the rail line between Melbourne and Sale was completed in 1879, a branch line from Melbourne to Mirboo North was progressively built from 1883 to 1886, and by 1888 a branch line from Moe to Thorpdale had been established.

In South Gippsland, the rail line between Melbourne and Leongatha was opened in 1892. Rail lines into South West Gippsland servicing Cape Paterson and into the Otway Basin serving Winchelsea followed as the network of rail lines 'spider webbed' the colony providing opportunities for scattered black coal mines to establish branch lines and sidings on the main lines.

Not only did the government rail network provide key transport routes to Melbourne, and thence to coal consumers at other centres on the rail network, but it also offered opportunities for coal supply to the locomotives and to the port-side coal storages for the extensive steam-ship traffic now using the Victorian ports.

2.3.2 Influence of increasing and scattered gas manufacture on coal supply

In 1849, the first gas light in Melbourne was in use at a confectioner's shop. In 1850 the City of Melbourne Gas and Coke Company was formed.[48] In late 1855 (1857?), another manufacturer/distributor, the Melbourne Gas Company, came into service.[49] Throughout the colony, gas produced from coal rapidly replaced oil for lighting in streets, and in homes and business premises. As well as at metropolitan and regional centres, many of the small townships had their own gas works requiring firm contracts for reliability of coal supply. (The structure of the gas supply industry progressively changed from multiple privately owned utilities to unification under the Gas & Fuel Corporation which became the sole distributor of gas in Victoria by 1974.[50] In the 1990s the gas industry was again privatised involving several companies.)

Gas supply in Victoria was based on black coal from 1849 to 1956 with increasing competition from oil refinery by products by the mid 1950s, from brown coal in 1956 and from brown coal briquettes from 1956. The advent of natural gas supplies from Bass Strait in 1969 led to immediate closure of the Morwell Gasification Plant and cessation also of brown coal and briquette deliveries thereto.[51] Black coal usage for gas production throughout the state progressively fell away as substitution by natural gas occurred.

2.3.3 Influence of growth of shipping trade on extent and reliability of coal supply to portside storages

The first steam ship to arrive in Sydney came in 1831, before the settlement of Melbourne commenced. By 1841, steam vessels had commenced regular goods and passenger transfers between Melbourne, Williamstown, Geelong and Sydney.[52] The first steamer to voyage direct from the Cape of Good Hope to Melbourne arrived in 1853[53] at the peak of the sailing trader traffic and a year or so after initial steam voyages from India.

By the 1860s, black coal storages were in service at all commercial ports in Victoria.

3 Coal exploration and mining in the Colony of Victoria 1871–1890

3.1 Influences on the Potential Development of Coal Mining 1871 to 1890

In 1873, Reginald Murray, Geological Surveyor with the Mines Department, undertook a geological investigation of the carbonaceous region in South and Central Gippsland. A Geological Sketch Map of South Gippsland and a report (*Geological Report No. 3*) were published in 1875 summarising his investigations. His report confirmed indications arising from *Geological Reports No. 1* and *No. 2* of 1873 and 1874 respectively that a very extensive deposit of brown coal (lignite) existed in Central Gippsland between Warragul and Rosedale, particularly to the East of the Haunted Hill(s). His report also indicated the likelihood of further discoveries of black coal seams in South West Gippsland. In his investigations he inspected a black coal seam found the previous year at a location now called Coal Creek at Korumburra. This was the first coal find (named by Murray as the Strzelecki seams) reported in South Gippsland.[54]

In 1873, John Mackenzie, NSW Examiner of Coal Fields, was invited to report on the potential for coal mining in Victoria. He reported that 'no workable seam had been opened in any part of Victoria'. Inter alia his examination of the two seams at Cape Paterson revealed that on the average of three different locations the seams were about 27 inches thick rather than over 40 inches thick as had been believed for the previous 20 years.

In the 1880s, there were little or no centralised marketing arrangements for the coal mining ventures in Victoria. Coal from scattered prospective suppliers was also of highly varying quality ranging from high moisture brown coal to high quality black coal compared with a reasonably standard quality from the well developed NSW mines. Large scale potential customers such as the government railways, the gas companies, and the coal vendors to the shipping trade were disillusioned with the varying quality and the intermittent supplies from the numerous small coal mining operations in Gippsland. They either refused to enter long term contracts, or alternatively set low rates of payment to individual suppliers both because of their low bargaining power as well as the unreliability of supplies.

3.2 Royal Commission into Coal in Victoria 1889 to 1891

There had been some shortages of coal from NSW through the 1880s due to industrial disputation on the NSW coal fields. Additionally, the NSW coal supplies were controlled by commercial cartels with very little price competition. These cartels also had invested in many of the prospective coal mines in the Gippsland area.

The *Gippslander and Mirboo Times* (10 June 1892), referring to a commercial take-over of the Mirboo Coal Company Ltd. in 1887 stated 'Although shares were taken up and large capital amassed, the company has not spent a single shilling in developing the mine. The preponderance of power for the management of the syndicate fell into the hands of a favoured few, who evidently intended to keep the mine locked up for purposes of their own, no doubt having a paramount interest in other large coal measures in a sister colony'.

In 1889, the Government of Victoria established a Royal Commission into Coal in Victoria.

Intermittently, during the tenure of the Royal Commission from 1889 through to its final report in 1891, a series of strikes in the NSW mines caused serious coal shortages in Victoria further emphasising to the Royal Commission the desirability of a reliable indigenous Victorian Coal Industry. The Royal Commission's inquiries were broad. It assessed that the black coal resources of the colony were mainly confined to South and South West Gippsland and were unlikely to be a major source of long term challenge to the NSW coal cartels even after the completion of the South Gippsland railway would provide reduced transport costs to the Melbourne area. More significantly, the Commission's final report acknowledged the existence of large resources of brown coal. Its investigations noted the proven expertise already existing (in Germany) for conversion to gas, to hard fuel (briquettes) for domestic and industrial heating, and as a raw or crushed dried fuel for steam raising in electricity generation and in industry. The conversion of the raw coal to a pulverised fuel for locomotives was envisaged as a strong possibility, and conversion to liquid

fuel had been demonstrated to the Commission. The technical feasibility and economic potential of long distance transmission of electricity at high voltage from a power station at the mine site with transformation and distribution at low voltage to industrial and domestic consumers were also acknowledged by the Commission as being of likely feasibility.

The Commission's final report strongly recommended that Victoria must promote the utilisation of brown coal as a key economic and strategic objective as well as to provide a competitive alternative to all uses of NSW black coal.

3.3 Black Coal Mining Activities in South West Gippsland 1871 to 1890

At 1870, the Western Port Coal Company (WPCC) mine at Kilcunda was the only active coal mine in Victoria but mining had been suspended while the company regrouped and built a wooden rail tramway from the mine to a wharf built by them at San Remo. Subsequently the wooden rails were replaced by iron rails with horse drawn trucks. Provision of a locomotive was intended but did not eventuate. In 1872 the WPCC sank two new shafts and sent a 10 ton sample of coal to Melbourne for exhibition and as a call for political support.[55] At1874, this company mined 2,879 tons of coal from a seam 20 to 321inches thick with a third shaft in operation.[56] The Western Port Coal Company had anticipated being eligible for the government reward of £5,000 by 1875 by which time they had mined about 8,000 tons. However in spite of many requests and litigation in ensuing years they did not receive any reward. Evidently this was partly due to the long period since the reward was 'on the table' and partly due to other support the company had received from government in establishing its haulage and outloading infrastructure. This operation at Kilcunda closed in 1883 having mined about 15,000 tons of black coal.[57]

In South West Gippsland, there were various black coal seam finds in the 1870s and 1880s but little significant black coal mining other than by the WPCC occurred to 1889 in this region.

3.4. Black Coal Mining Activities in South Gippsland 1871 to 1890

Following the confirmation in1873 by Reginald Murray of black coal seams near the present location of Korumburra (Coal Creek) other finds occurred at Foster and Fish Creek. In 1873, mining was reported near Korumburra (at Silkstone) but did not continue due to the remoteness and high transport costs to markets. In 1882 a tunnel was driven at Silkstone (a few kilometres south east of Korumburra) from which the first block of Korumburra coal was exhibited in Melbourne.[58]

In 1889, the Mines Department commenced drilling in the Korumburra area and two deep bores had been sunk at the town site and nearer to Coal Creek by the end of 1890. The second bore intersected more than eight seams about four of which appeared to be of good black coal thick enough for commercial mining.[59]

In 1889, the Coal Creek Mining Company sank a shaft and commenced a small operation (after seeking finance for six years). At May 1890, 'a tunnel 50 feet long had been driven intersecting three good seams of coal'– this was inspected during a visit to Korumburra by the Royal Commission into Coal in May 1890.

However production from this or other prospective mines in South Gippsland was waiting on the railway line to Melbourne.

3.5 Black Coal Mining Activities in Western and Central Gippsland 1871 to 1890

3.5.1 Coal Deposits assessed as Black Coal

At 1873, coal finds were being reported widely outside the original coal discovery area of black coal in South West Gippsland. In Central Gippsland, black coal seams were found in the valleys of the Morwell, Narracan, and Tyers rivers and their tributaries,[60] generally at the extremities of the younger brown coal fields.

3.5.2 Morwell River Valley

In the Morwell River Valley, a small coal mining operation by the Excelsior Coal Mining Company commenced in1874 in outcrops of thin coal seams (15 inches to 28 inches thick) on the banks of Billy's Creek near the present area of Jeeralang Junction. A shaft with a drive following the dip of the main seam was used to extract coal of rather poor quality 'scarcely marketable as a fuel'.[61]

In December 1874, the Hazelwood Coal Mining Company took out a coal mining lease on land about seven miles south of the present town site of Morwell[62]and in the vicinity of the Excelsior operation. The Hazelwood mine worked for a few years but was found to be uneconomical and phased out by 1879. In June 1879, the Prince of Wales Coal Mine commenced operations at the former Hazelwood Mine site. The completion of the Melbourne-Sale rail line in 1879, had lead to the declaration of coal discoveries perhaps previously known but not reported. Proliferation of search and mining leases for coal occurred widely.

In addition to the mines mentioned above, the following mining endeavours were of some significance:

- The Royal Standard Mine initiated about 1886 at the Southwest of the Hazelwood mine.
- Burke's Black Coal mine initiated in 1886 about one mile from Boolarra.
- Mirboo Collieries initiated in 1886 was still operating at 1889.
- Mirboo Proprietary Coal Mine Company was in production with deliveries by rail in 1889.
- In 1889 Pratt's Boolarra Mine was working at three shifts per day.
- In1889, Batt's coal seam at Boolarra was reported at 'three feet five inches of dense black coal.'[63] Some mining of this seam occurred.

There were some other mines closer to Morwell and Yinnar which found the close to surface coal was brown coal and lacking an economic market. Stephen Legg[64] summarised as follows: 'There were 15 workable seams found between 1873 and 1890, 10 syndicates were formed to mine in these seams, all but one were failures.'

3.5.3 Narracan Creek Valley downstream of Narracan

At the Narracan Creek Valley, coal had been found in 1862 and the first coal mining lease had been taken out in 1864. At Narracan, a store/hotel had been established by 1874 and a school and a Mechanics Hall by 1878. The first mining operations were by the Fear Not Coal Mine in 1879, the Gippsland Coal Mining Company at Mosquito Creek in 1880, and by the Moe Coal Mining Company about six miles South East of Moe in 1882/84.[65] By 1891, the mining township of Coalville was the largest town in the shire of Narracan.[66]

Progressively from 1882, the Government funded a coal drilling program which in addition to confirming the vast extent of the brown coal deposits of Central Gippsland also revealed the existence of some thin coal seams in the older geological structures on the fringes of the Latrobe Valley Depression. Most of these finds were initially considered to be black coal largely because of their colour and relative hardness compared with the thick brown coal seams found in the Morwell River flatlands.

The Morwell River Valley and Narracan Creek Valley branch rail lines from the Central Gippsland rail line, completed in 1886 and1888 respectively, offered access to existing metropolitan and regional markets for black coal. However coal seams were thin and rail transport costs were high. In several ventures the coal quality as a fuel was below expectations. Many small mining ventures in these valleys failed to gain adequate capital or failed to achieve economic production, and either were liquidated or taken over by more successful operations.

Among the many coal finds in the Narracan Valley from the 1870s to 1890, some details of ventures some of which reached the mining stage are as follows:

In 1877/8 black coal was found as a seam 60 cm thick at the head of Mosquito Creek in the Narracan Valley. Shafts were sunk and the Fear Not Coal Mining Company was formed in 1879. No evidence has been found that this venture reached a commercial mining stage.[67]

In 1880, the Gippsland Coal Mining Company mined from a 25 feet deep shaft into a seam two feet wide further down Mosquito Creek about five miles south of Moe.[68] The venture closed about two years later with no ready market. However it stimulated interest by others and fuelled demand for a railway into the Narracan Creek Valley.

From 1884 the Moe Coal Mining Company worked a lease on Deep Creek mining from a seam 70 cm thick close to the surface about five miles south of Moe and to the east of the other mines. This mine outloaded the first trainload of coal to be carried on the Moe to Thorpdale branch rail line on 28 June 1887.[69] At mid 1990, one hundred men and three ponies were working at this mine.[70] The company survived until July 1897.

The Narracan Valley Company took out a lease in the same area about 1.5 kilometres south of Coalville Station in about 1883. The Narracan Valley Company in late 1883 demonstrated at the mine site to the Railways Commissioners 'several hundred tons of some of the finest coal ever raised in Australia.'[71] It sold its lease to the Narracan Company in 1887 which sold out to the Coalville Central Company in 1888. This latter company continued a financially successful operation until the mid 1890s.[72]

From 1887, the Grange Colliery was also in the same area but west of the Narracan Creek opposite the Moe Coal Mining Company workings. It closed by 1890. It despatched a small quantity of coal to Melbourne.[73]

The Emersley Park Company erected a poppet head and machinery near Coalville in 1890 but could not raise further finance. The potential operation closed prior to 1891.[74]

The Coalville Central Company opened operations at Coalville in 1888 but was not economically successful and had ceased operations by 1894.

Other black coal mines which commenced operation in the Narracan valley downstream of Narracan are referred to in Section 4.2.

3.5.4 Westwards beyond Thorpdale

Discoveries of black coal seams west of Thorpdale occurred from 1875, the first find officially recorded as Ryan's Seam. Subsequent discoveries also tended to be known by the name of the land occupier or discoverer and included Whelan's, Unger's, Rollo's 'Carpe Diem' mine and Scarlett's (Berry's Creek) mine. These seams all discovered before 1890 were generally thin seams discovered as outcrops and all off the west and southern perimeter of the Latrobe Valley Brown coal field. All these mining ventures were small scale operations, some except for the Berry's Creek mine having a short life or becoming local domestic suppliers disadvantaged in the area where wood fuel was readily available.

The advent of the VR rail terminus at Thorpdale in 1888 and at Mirboo North in 1886 proved insufficient opportunity to render mining of the thin seams as profitable ventures. The Berry's Creek seam, a few miles south west of Mirboo North, although found in 1889 was mined commercially in the 1930 year and again in 1957–1959.

3.6 Black Coal Supply Constraints

By the late 1880s, in the commercially unorganised coal mining industry in Victoria many mining ventures were in potential financial collapse with operations having been suspended or not having reached production due to lack of assured contracts. Unlike the NSW coal supplies to Victoria, there was considerable variation in the quality of coal mined in the Morwell River and Narracan Creek Mines as it was progressively found that some of these seams were of older age brown coals and not of black coal heating value.

Shortages of coal supplies from NSW in the 1880s had reactivated some Victorian Government support for an indigenous coal mining industry. In 1888, the Minister of Mines had announced that rail lines would be constructed to any payable coal seam. He also announced that the Government would buy at a predetermined price (25 shillings per ton in 1888), at the customers storage, all production from Victorian coal mines – this price was nominally the same as that for NSW coal.[75] However, no rail freight concessions or Government subsidies were granted to Victorian coal producers.

Up until 1890, only about 55,000 tons of black coal had been mined in Victoria. In the 1890/91 year, annual output had increased to about 20,000 tons, but this was still only about 3 per cent of Victoria's black coal demand.

3.7 Brown Coal Mining Activities to 1890

3.7.1 Gippsland Brown Coal Discoveries – 1871 to 1890

By 1876, 32 locations in Victoria were listed by the Mines Department as identified brown coal (or lignite) deposits. The first recorded discoveries in Central Gippsland were at Yarragon in 1867 and north of Warragul at McKirley's Creek in 1869 – small scale mining for local users in both these areas subsequently occurred but without achieving commercial success. The first discovery in the Latrobe Valley area was in 1873 at the north of the Haunted Hill(s) on the bank of the Latrobe River.[76] This location was later marked on Mines Department plans as Davis's Cut.

Further discoveries were recorded at Moe (1874), Sale (1878), Toongabbie (1875) and Yarram (1875) in the Gippsland region.

3.7.2.The Great Morwell Brown Coal Mine to 1890

A mineral lease No. 773 had been taken out in August 1887 over an area of 217 hectares which extended northwards from a brown coal deposit outcropping on the elevated north bank of the Latrobe River about seven kilometres north west of Morwell and about two and a half miles downstream from the original brown coal discovery in the Latrobe Valley in 1873. By October 1888, under the same lease, tunnelling into the river bank had been undertaken accessing a single thick brown coal deposit. With a substantial coal resource envisaged, the Great Morwell Coal Mining Company was formed in October 1888 and acquired the initial lease. The mining concept was initially envisaged in 1888 as a shaft operation. However the mining site was relocated in 1889 about 600 feet further eastwards as a tunnelling operation.[77]

A bridge across the Latrobe River was built by 1889 and a branch rail line from the main Gippsland line to the mine site was built in 1890. Output in 1890, the first year of operation was recorded as 1000 tons.[78]

The Great Morwell Mine aimed at obtaining a Government bonus, recommended by the 1889 Royal Commission, for successful manufacture of briquettes at a rate of not less than 1,000 tons per month. It also envisaged extensive use of the coal in Government railway locomotives. This pioneer mine was of significant importance to Victoria at various times through to closure of mining in 1963.

3.7.3 Mirboo Collieries Mine at Boolarra to 1890

In 1889, Mirboo Collieries Company, also known as the Mirboo Collieries Proprietary No. 1, had installed the Boolarra Shaft which penetrated into a brown coal deposit 162 feet thick beginning at 134 feet below surface.[79] This shaft was located about three miles North East of Boolarra and about one mile east of the Morwell River. In 1890, during a maritime workers' strike affecting supplies from NSW, this mine extracted 5,412 tons of brown coal delivering over a rail line from the mine to the VR line Morwell to Mirboo North.[80] (Some writers have indicated this mine as excavating black coal at this location but the seam thickness and geological assessment indicate the mine product as brown coal and continuous with thick brown coal deposits between Boolarra and Morwell. It appears more likely that this uncertainty has arisen because the same company, the Mirboo Collieries Proprietary No.1, operated a black coal mining venture near the Darlimurla Railway Station.)[81]

3.7.4 The Haswell Mine

The Haswell and Company Mine, located about 4.2 miles north east of Thorpdale, commenced a tunnelling operation in 1888/89.[82] This operation was into a brown coal seam 13 feet thick below basalt. This mine remained open with some intermittent mining in low quantities until about 1950. See Section 7.5.2.

3.7.5 The Horrocks Colliery

Horrocks Co-operative Colliery, located about half a mile upstream from the Haswell operation, commenced in 1888. This was also a tunnelling operation into a brown coal seam about 20 feet thick. This Horrocks operation ceased commercial operation in the early 1890s. Colloquial information indicates that some manual small scale extraction of coal may have continued in subsequent years. Re-activation of mining in this locality in the late 1940s is referred to in Section 7.5.3.

A cross section of the Horrocks seam shown as Plate No. 5 in J Stirling (1899) depicts the brown coal seam under basalt with a thin black coal seam several strata lower below Mesozoic sandstone. Stirling considered this general structure applied through to the west of Thorpdale including the Haswell

operation. Also see Plate No. 6 by Stirling (1899) and his comments that it is probable that these seams 'form part of a connected deposit extending down the western watershed of the Narracan Valley and easterly under basalt towards Boolarra'.[83]

3.7.6 Crisp's Mine

Outcrops of black and brown coal at Childers were typical of many coal finds in the hills south of Yarragon towards Thorpdale and Leongatha. At Crisp's, a 12–15 metre deep deposit of a dark brown coal, identified by the Mines Department as the Ferngrove Seam,[84] was being 'worked with a few men' in 1888.[85]

3.8 Maryvale Proprietary Coal Mining Company and other Brown Coal Mining Ventures in the Morwell River Valley to 1890

In 1888 on the Maryvale Proprietary Mining Company lease about one kilometre north east of Morwell Railway Station, a bore hole to a depth of approximately 1,000 feet proving a brown coal thickness of 760 feet in seven seams was recorded by the Mines Department.[86]

(This location is still identifiable on a housing lot in Morwell). Although sinking of a shaft about 100 metres deep and erection of a poppet head were achieved, and excavation of 200 tons of coal occurred,[87] commercial contracts for the high moisture coal were not forthcoming and this mining venture faltered. Subsequently the lease changed hands three times but mining did not progress further. Nevertheless, by 1890 further drilling in this locality proved to the satisfaction of the Royal Commission and to private entrepreneurs the existence of extensive thick brown coal near surface deposits in the Latrobe and Morwell River valleys. This Maryvale operation is of heritage significance with respect to activities which followed there from.

In 1889, the Gippsland Railway Coal Company commenced boring and sank shafts close to the railway and near the siding known as Hernes Oak. Although these shafts did not reach the production stage, they reinforced knowledge of the quality and thickness of the brown coal deposits.

The Gippsland Gold Fields Syndicate took out a lease over 613 hectares of freehold land west of the Morwell River and south of the Latrobe River.[88]

In the Morwell River Valley by 1890, mining/exploration leases existed on nearly all the land for about five kilometres south of the Latrobe River. However, although some of these raised small quantities of coal for testing and appraisal, most of these prospective ventures did not reach the production stage. Some of these other ventures still existing after 1890 are referred to in Section 5.2.

3.9 'Rollo' Mines (including the Yarragon Brown Coal Mining Company) to 1890

In 1884, the Narracan Coal Prospecting Company was the first of several coal prospecting groups searching for coal on the flat lands west of Moe.[89]

In 1888 boreholes intersecting three brown coal seams from 17 feet to 67 feet thick above basalt were drilled by John Rollo on the escarpment south of Yarragon. A mine, known colloquially as Rollo's Mine, was opened on the west of the escarpment by 1890. Opportunities for this mine were presented to the Royal Commission in 1890. Coal samples were taken to Germany for testing for briquetting suitability. The tests reputedly proved satisfactory.[90] However this mine did not prosper and had ceased operation before the mid 1890s.

In 1890, the Yarragon Brown Coal Mining Company initiated a mining activity in the township allotment area of Yarragon where John Rollo had found brown coal which was confirmed by diamond drilling by the Mines Department. This company sank a shaft, erected a poppet head and commenced mining in 1890. The mine was connected by tramway to the Yarragon Railway Station on the main Gippsland line. In 1895 the company surrendered its lease.

From 1887 coal seams had been found in the hillsides further south of Yarragon at various locations but none reached commercial mining viability after initial enthusiasm.[91]

3.10 Coal Mining Activities West from Melbourne 1871–1890

3.10.1 Lal Lal

As stated in Section 2.2 above, brown coal (or lignite) in Victoria was first mined at Lal Lal, south of Ballarat, intermittently from 1863 to 1878 via a shaft intersecting the top seam of lignite about 40 feet thick with top surface about 70 feet from ground level.[92] A total of about 4,500 tons was mined until the mine was shut down in 1878.[93] However mining did resume in1894 in a long but intermittent life for this mine. The continued operation at Lal Lal is outlined in Sections 5.3.1 and 7.1.

3.10.2 Altona to Bacchus Marsh

Brown coal had been found near Bacchus Marsh during the Melbourne to Adelaide rail line construction in 1884.

In 1881/82 two bores were sunk (Melway 55F4 to F6 in the Newport/ East Altona area) by the Williamstown (Taegtow) Coal Prospecting Company seeking black coal. Only brown coal and water were found.[94] Nevertheless the existence of brown coal deposits was confirmed.

A shaft was sunk by J Hosie at Altona in 1890. A small quantity of brown coal had been mined before the shaft was deepened and intersected strata bearing sub-artesian water which flooded the workings.[95] Activity did not resume until 1894.[96] Subsequent mining at Altona is outlined in Sections 5.3.2 and 7.2.

3.10.3 The Otways

- In the 1840s, veins of coal were reported in various outcrops along the coast from the Port Phillip entrance to Cape Otway. In 1857/8, some coal mining occurred at Wormbete but this was apparently not a commercial endeavour and was not further reported.[97] In 1873, a bed of lignite was found and examined near Stony Creek at the Southwest of Airey's Inlet.[98] In 1884, the Geelong and Western District Coal and Mineral Processing Company drilled a bore about nine miles south of Winchelsea.[99]
- Subsequent mining of brown coal in the Otways is outlined in Sections 5.3.3 and 7.3.

4 Black Coal Mining Activities in Victoria 1891–1920

4.1 Black Coal supply situation to 1910

From 1891, the return of reliable supplies of NSW coal, priced with the objective to reduce competition from Victoria, was to have an adverse effect on Victorian black coal mines. However, Victorian black coal production rose from about 9,000 tons per year in 1888 to about 237,000 tons per year in 1896 – nearly all of this from South Gippsland, with small quantities of varied quality coal from the Morwell and Narracan River Valleys. By 1899, with annual black coal output at 260,000 tons, Victorian supply was meeting 50 per cent of Victoria's demand. Severe strikes in the South Gippsland mines in the early 1900s led to cancellation of commercial contracts and to the closure of several mines. Victorian black coal output fell to about 160,000 tons per year at 1906.

4.2 Mining of Thin Coal Seams in West and Central Gippsland in the 1890s

Many of the thin coal seams found as outcrops in the gullies and hillsides of Gippsland were initially assumed to be black coal. However many of these on later examination were assessed as brown coal. 'Tabular Statements' differentiating coal discoveries were presented in RAF Murray's 1889 report on the 'Development of the Coal and Lignite Resources of Victoria'.

Geological evidence submitted to the 1889 Royal Commission had indicated that the coal seams existing at Korumburra, and at the Powlett River were larger and of better quality than those in operation at Coalville and Moe in the Narracan Valley. Investor interest in black coal mining turned towards South Gippsland with the arrival of the South Gippsland rail line in 1892. Nevertheless there was much activity in black coal mining in Central and West Gippsland in the 1890s.

In the Morwell River Valley, several new mining companies had come into operation particularly in the Boolarra and Mirboo areas in the late 1880s. Coal discovery had evolved into coal mining reality with the advent of the railway network. However, mining costs were too high in the thin seams, rail freight charges were too high and coal quality too variable for economic competition with the coal supply from NSW and from South Gippsland. A seam (known as Scarlets and found in 1888) was located on Berry's Creek, south of Mirboo North, but was not mined commercially until 1930 as black coal producing about 2,000 tons[100] for local consumption including milk factories. All coal mining in this valley except for the Great Morwell Brown Coal Company operations on the Latrobe River had closed by 1896.

In the Narracan Creek Valley to the north of Narracan, consolidation of mining companies occurred in endeavours to achieve economies of scale but by 1910 only three mines remained in operation, and had little commercial success thereafter. The mines included:

- The North Coalville Mining Company which commenced mining in May 1892 in several tunnels outloading to a rail siding north of Coalville and east of the Narracan Creek. By early 1893, output was 200–300 tons per week. However from January 1895 the Railways Commissioners restricted their deliveries from the Narracan Valley transferring to coal supplies from the Outtim mines. The North Coalville Mining Company ceased operation in early 1895.[101]
- The New North Coalville Company which was established in the mid 1890s but had Victorian Railways contracts withdrawn and did not survive.[102]
- The Moe Coal Mining Company, referred to in Section 3.5.3, continued in operation until late 1892 when legal disputation with respect to their lease caused cessation of mining. Mining resumed by 1895 but by this time competition from the South Gippsland mines led to both reduction of demand and lower prices for Narracan Valley coal. On 17 July 1897 the Moe Coal Mining Company went into liquidation after 15 years of pioneering work for little profit to its promoters.[103]
- The Tipton Vale Co-operative Company which took over the Moe Coal Mining Company area but had Victorian Railways contracts withdrawn and closed by about 1899.[104]

- The Coalville Central Company, referred to in Section 3.5.2, which closed in the mid 1890s.
- The Coalville Co-operative Black Coal Company, which opened in1904 but failed shortly after.[105]
- The New Moe Company was formed in August 1908 and mined a seam one metre thick from shafts on the west side of Narracan Creek near the Coalville Station to which it was connected by a tramline. In early 1909 it was taken over by the Dudley Colliery Company. This company had disputes about pay rates and closed its operations in May 1911 not being willing to operate in a higher cost scene. From 1908 to 1911 this mine had been the most successful mine in the Narracan Valley area, selling coal as far away as Geelong.[106]
- The Gladiolus Company which operated from 1929 to 1930.[107]

4.3 Initiation and growth of Black Coal Mining in South Gippsland

4.3.1 The Korumburra Area Coal Mines to circa 1920

As noted in Section 3.4 above, the Coal Creek Mining Company was ready for significant coal deliveries as soon as the rail connection from Korumburra to Melbourne was in service in June 1891.[108] Some coal was delivered by road from the mine at Coal Creek to the Korumburra Rail Yards until a branch line three quarters of a mile long had been connected from the main line to a siding at the mine. The first train to leave from the mine site was on 25 October 1892. Several seams of good black coal (main seam four feet six inches thick) were worked.

In January 1891, 3 mining companies were actively prospecting for other potential mine sites, each sinking a shaft to inspect and sample discovered seams. By May 1891, the 'giant drill' of the Mines Department had completed its third bore in the local area again proving several seams. At 1891, seven seams of thickness two feet six inches to five feet had been proven. By 1908, 40 bores were drilled in the area to trace seams in a wider area.[109]

In the first quarter of 1894 the Coal Creek Mining Company delivered 24,649 tons of coal. However the company needed funds for development of the mine and went into voluntary liquidation. In May 1895, the Coal Creek Proprietary Company Ltd. was formed and took over the original mine. In October 1895, the company lost VR contracts for supply of coal and were forced to take lower prices to survive. In 1905, the company took over part of the Black Diamond Mine assets, but in 1907 was split into two new companies, Kay & Company, and J Cook & Company Both of these companies closed in 1920, the former then continuing as Sunbeam Collieries Pty Ltd from 1922 to 1959.

In March 1890, the Strzelecki Coal Mining Company NL was registered. Its mining lease was located a few miles south east of Korumburra at a site where coal had been discovered in 1873. However this first Strzelecki Mine operation closed down in 1893 having sunk a shaft which intersected good coal seams but not the main seam. In November 1893, the Strzelecki Consolidated Colliery Company recommenced activity with increased capital, a new manager and a new shaft from which mining of the main seam commenced. In 1894/5 a VR branch line about two and a quarter miles long had been installed between the VR branch line from Korumburra to Coal Creek and a railhead about half a mile from the mine mouth. (Dr LL Smith, the local State Parliamentary Representative was a board member of this company). Wire rope haulage from the mine mouth to the rail head was installed by September 1895. However the mine did not prosper and closed in March 1897. The mine was reopened in 1905 by a new company the Strzelecki Coal Mining Company Ltd. which mined 947 tons before closing in 1906. Between 1907 and 1910, three different companies in succession failed to make this mine profitable, mining a total of 9788 tons of coal. In 1911 the Austral Coal Company acquired part of the Strzelecki Mine leases but the mine was not reactivated until 1922 as the Strzelecki Co-operative Syndicate.[110]

In April 1892, the Korumburra and Jeetho Coal Mining Company was formed. It operated the Jeetho Mine at a location some 250 feet west of the Coal Creek mine. It constructed a shaft and tunnel, but soon found that water pumping was needed continuously. It merged with the Coal Creek Extended Coal Mining Company to form the Korumburra Coal Company in July 1894. (The Coal Creek Extended Coal Mining Company, registered in August 1892, commenced mining coal in January 1894 with prospects of output of 150 tons per day[111]). The Korumburra Coal Company mined about 5,000 tons in the first part year of operation in 1894 and then at an annual output of about 15,000 tons,[112] (There is some disagreement with output

figures from different sources). The company was not satisfied with the price offered by the VR for deliveries in the 1897 year and closed in financial difficulties in mid 1897.[113]

The Black Diamond Coal Mine NL, registered in April 1894, located south-east of Korumburra, commenced coal deliveries in late 1898 after installation of machinery from the nearby Silkstone mine and with chute access to the Silkstone-Strzelecki branch rail line. To December 1899 this mine delivered 3,940 tons of coal. In 1900 the Black Diamond Mine was taken over for operation by the Coal Creek Proprietary Company which continued operation until 1905 when the lease was abandoned. The mine machinery was transferred to the Coal Creek Proprietary Company and to the Korumbunna and Jeethro mines. In 1907, the previous Black Diamond Mine lease was taken up by the Austral Coal Company.[114] Shortly after it found a seam four feet six inches thick which was worked until the mine closed in 1943.[115]

In November 1891, the Silkstone Coal Mine Company Pty Ltd was registered. By July 1892 it had installed a shaft and a 130 feet tunnel at a location southeast of Korumburra close to the Coal Creek Extended mine (at the embryo Newcastle township land subdivision).[116] The company was reformed as the Silkstone Colliery Company NL in November 1893. A light railway 390 feet long connected the mine to the Silkstone-Strzelecki VR branch line which had reached the Silkstone siding by January 1894.[117] (The Silkstone-Strzelecki branch line served 9 separate mines over its lifetime.) Mining commenced in April 1895, but much pumping was found necessary and the mine was closed down as uneconomic late in 1895.[118] Two shafts had been sunk, the output from the principal shaft down to a depth of 77 feet, was 45 tons per day.[119] The mine was reactivated by the Dudley Coal Syndicate in 1923.

4.3.2 The Jumbunna Area Coal Mines to circa 1920

Coal discovered at Jumbunna East in 1889/90 had been reported on favourably by RAF Murray as a four feet six inch seam. Initially the Jumbunna True Coal Mining Company was formed but was transformed into the Jumbunna Coal Company before the mine commenced in 1894. A VR branch line three and three quarter miles long from Korumburra to a railhead about one mile from the Jumbunna Mine was in service in May 1894.[120] An aerial ropeway (steel cable about two miles in length) was installed for haulage and automatic unloading of a quarter of a tonne skips at the rail siding. By February 1896, the VR branch rail line had been extended two and a quarter miles to Outtrim to service coal mining in that area. The branch line extension ran closer to the Jumbunna Mine and a new outloading facility was installed. From 1894 to 1903 average annual output was about 54,000 tons, maximum 73,652 tons.[121] In 1903/4 there was a major strike for about 15 months, predominantly caused by attempts by mine owners to apply lower wages following lower prices being offered by the VR for Victorian black coal following price cuts applying in NSW. Coal seam faces below the main seam flooded during 1903 resulting in the termination of mining of these lower seams. From 1906 to 1912 annual production improved averaging greater than 60, 000 tons. However, output then fell away due to continuation of industrial stoppages and counter threats of mine closure. The lack of skilled manpower was also of significance as miners transferred to the regime of higher wages and better working conditions at the new State Coal Mine at Wonthaggi.[122] In 1916 there was a major fire which resulted in closing of part of the mine. The mine continued to operate until 1939.

The West Jumbunna Coal Company was registered in June 1893 but sold out to the Jumbunna Coal Mining Company in 1896 without working its mining lease.

4.3.3 The Outtrim Area Coal Mines to circa 1920

A coal seam outcrop was found in a creek bed at a location later called Outtrim in October 1892. A shaft was sunk by the property lessee. This shaft disclosed a black coal seam four feet thick.[123] The Outtrim Coal Company and the Howitt Coal Mining Company were each registered in November 1892.[124] In July 1894 these two companies, before they had commenced mining, amalgamated with the British Consolidated Coal Company to form the Outtrim, Howitt and British Consolidated Mining Company (OH&BCMC). The mine location was about eight miles south of Korumburra. Initial mining was carried out through a tunnel close to the initial exploratory shaft. A VR rail link two and a quarter miles long from Jumbunna to Outtrim was opened on 27 January 1896. Mining with delivery by bullock wagon to the railhead at Jumbunna and a stockpile of over 8,000 tons of coal at the mine mouth had preceded the arrival of the rail connection to Outtrim.[125] 'The company had anticipated a yearly production of 66,000 tons of coal. But in the first year of operation 126,000 tons were produced.'[126] The mine continued to produce over 100,000 tons per year with three tunnels in operation and delivery to the railhead by an endless rope haulage.

By 1908, the OH&BCMC was aware of depleting coal reserves with closure imminent a few years ahead. Fires at the mine in 1911 and 1912 accelerated cessation of mining. In 1913 the company had purchased coal leases of the Kilcunda Coal Mining Company and transferred some mine machinery thereto[127] but found the seams too thin for commercial success. In 1914, the company closed their Outtrim mine. In 1915 the company ceased all operations. During the company's operations one and a half million tons of coal had been produced from the Outtrim area of which 1.375 million tons were produced by this company. The township of Outtrim with its population of 4,000 people was due to and reliant on the mine operation. Many of the Outtrim community and buildings were transferred to the burgeoning township of Wonthaggi.

There were some very small mining operations also outloading coals at the Outtrim rail head with output totalling about 122,000 tons over a 20 year period to 1915 when the VR rail service to Outtrim was terminated. 'When the mines (on branch lines to the main line at Korumburra) reached maximum production up to nine trains per day left Korumburra. Two trains a day ran regularly on the Outtrim-Jumbunna-Korumburra branch line and a special late train on a Saturday night.'[128]

In 1892, an outcrop of black coal proving to consist of three seams each under three feet thick was found at Kongwak but mining of this coal did not occur before 1910. Anecdotally some coal mining did occur in the Kongwak area about half way between Jumbunna and Wonthaggi, but verification of this has not been sighted.

Mining ventures which came into operation in the Outtrim area between 1921 and 1957[129] will be referred to in Section 6.3.

4.4 Government Restriction on coal exploration and mining leases in South Gippsland 1910

In 1890 the Government had inserted in the *Coal Mining Act* the following:

'All minerals, ores and metals, other than gold and silver, in or below the surface of all lands in Victoria not alienated in fee simple from the Crown on or before the first day of March , 1892, shall be and remain the property of the Crown.'

From 1910, granting of new exploratory leases for coal in the South Gippsland area was greatly restricted by the Mines Department.[130] This action severely limited private mining companies in their search for new potentially commercial coal resources and for long term planning as existing operating mines ran out of economic coal reserves. This action inter alia lessened future competition against the State Coal Mine. This restriction of private exploration for coal was applied mainly in South and South West Gippsland and was lifted by 1920.[131]

4.5 Continuation of Black Coal Mining in South West Gippsland 1891 to 1920

4.5.1 Daly's Mine at the Powlett River to circa 1920

At 1891, there was no active black coal mining proceeding in South West Gippsland.

In 1910, the Powlett River Company commenced a mining operation on land owned by JP Daly about six miles inland adjacent to the Powlett River. The mine known colloquially as Daly's Mine was operated by two sets of tunnels each driven to a different seam with shallow ventilation shafts. A rail line one and a half miles in length north from the Melbourne to Wonthaggi VR line was installed about 1911/12. The mine closed in 1912 but was reopened in 1916 by the Powlett and North Woolamai Colliery NL. This company found that seams were getting thinner to about 15 inches rather than over four feet as predicted from a Mines Department bore.[132] This company continued to persevere beyond 1920 as described in Section 6.5.

4.5.2 The State Coal Mine at Wonthaggi to circa 1920

In early 1908 drilling by the Mines Department on the Powlett River flats had passed through three distinct seams of black coal, the largest being three feet in thickness. Bores subsequently put down to prove the extent of these seams found that they merged into one seam nine feet thick. A thickness of eight feet of black coal close to surface was also found in drilling for water.[133]

On 17 November 1909, following strikes on the NSW coal fields and in the shipping industry, the Victorian State

Government authorised the formation of a State Coal Mine based on the Powlett River black coal seams. This mine was initially (for six months) under the control of the Minister for Mines but was then transferred to the Railways Commissioners on 1 July 1910. The mine proved a vital source of supply to locomotives, and later to the Railways Power Station at Newport, during vagaries of supply of NSW coal. The mine opened up about five miles north of Cape Paterson.

Mining operations commenced promptly. By the end of November 1909, coal had been excavated; hauled 11 miles by bullock wagons to Inverloch Jetty and shipped to Melbourne. By mid December 1909, shafts one to four had been sunk. A Rail line at VR gauge was constructed between Nyora on the Main South Gippsland rail line and Wonthaggi. This came into service on 22 February 1910. Until this date 3,526 tons had been shipped to Melbourne via Inverloch. About 10,000 tons was also at surface waiting on completion of the rail line.[134] By April, mine output was 400 tons per day railed to Melbourne. By November 1910 the mine was producing 1,300 tons per day with 900 employees. Shaft three was the initial source of coal followed by shaft five sunk in 1910. Shafts nine and ten were sunk by 1911 at the west of the central area. Shafts one, two six, seven, eight and eleven were used for ventilation. All this initial activity was in the 'Central Area' of the State Coal Mine.

Basically there were to be 12 separate mines known collectively as the State Coal Mine. Seven of these mines each produced over one million tons of black coal. However, 'after 1913, very few of the coal seams were five or six feet high as was the case in the earlier mining of the seams'.[135] It had also been found that the coal was more friable and weathered more rapidly than had been expected. Slack coal averaged about 45 per cent.[136] This poor quality coal could be used in Victorian Railways Newport Power Station albeit with some technical and production penalties but the Railways Commissioners preferred not to accept these penalties and sold slack coal to private buyers at prices below that which the private mines could match. This action tended to capture the market for slack coal in Victoria thus freezing out opportunities for the private black coal mines to sell their slack coal profitably. During the lifetime of the State Coal Mine, the technical and economic feasibility of briquetting the slack coal from the State Mine came under consideration intermittently. However proposals evaluated in 1913, 1928, 1932 and 1933 did not receive approval.[137]

Sale of screened coal other than to the Railways Commissioners did not occur until 1922 as Victoria contended with interruptions in supply of NSW coal caused by industrial action, by wartime shipping shortages, by post-war labour shortages and by deferred expansion of the NSW coal industry. By 1913, the State Coal Mine was supplying more than 50 per cent of the VR consumption of hard black coal at a rate of 925 tons daily.[138]

In 1915, the McBride Tunnel (destined to be the largest producing mine in the Powlett River area) came into production in the 'Central Area' of the State Mine to substitute for Shaft three (worked out in 1914), Shaft five (worked out by 1917), Shaft nine (worked out by 1920) and Shaft ten (worked out in 1921). This tunnel was driven at a one in five grade to intersect the top seam at 518 metres from the tunnel portal. Eventually the tunnel was extended to 1,490 metres from the portal intersecting three lower seams. Each of the four seams was worked on benches established on either side of the tunnel.[139]

In 1916, opening of the Eastern Area Mine occurred. This was about two and quarter miles easterly from the Wonthaggi town centre. Development of this mine was on three operating benches accessed from incline tunnels one for coal haulage and the other for ventilation.[140]

In 1919, mining commenced in the 'Station Area', just to the north of the township. 'By 1919, a tunnel had been driven 259 metres to intersect a seam nine to 1.4 metres thick at 91 metres from the surface.'[141]

In 1912, production of the mines at Korumburra, Jumbunna and Outtrim was about 10,000 tons per month and at Wonthaggi about 30,000 tons per month. For the 1914/15 year, annual output for the Wonthaggi State Coal Mine was 550,000 tons and from other mines about 67,000 tonnes. There was a fall in production during the war years with output bottoming at about 370,000 tons in 1919 with subsequent increases to a peak of about 670,000 tons in 1930 (see Knight (1970), p. 61).

By 1918, the State Coal Mine was virtually the only producer of black coal in Victoria but had limited coal reserves available for the future. By this time, it was clearly evident to the public, to Government and to private enterprise that the brown coal resource was the prime source of fuel available to the State.

Activities of the State Coal Mine beyond 1920 are outlined in Section 6.4.

5 Brown Coal Mining 1891–1920

5.1 Technical Investigations into Brown Coal Utilisation 1891–1920

The 1889 Royal Commission, as well as stimulating brown coal mining in the Latrobe Valley, and at Altona, Newport, in the Otways and at Lal Lal also firmly established Government interest in brown coal utilisation. This led progressively towards the concept of long term centralised Government control of electricity generation and distribution, and of coal supply for electricity generation, for briquetting, for gas, liquid fuels, locomotive fuel, and for conversion to chemical usage.

The influences of the 1889 Royal Commission continued over the next 30 years.

Scientific personnel from the Mines Department were sent overseas in 1891 (Newbery) and 1901 (Stirling) specifically to investigate brown coal utilisation in Germany.

Charles Merz, an English electrical engineer, was commissioned by the State Government to report on electricity generation in 1908 and again in 1912. In each report he recommended investigations into the establishment of a base load power generation plant at a suitable mine site 'at Morwell', with a peak load power generation plant burning black coal to be located at Melbourne.

In 1912, a German mining engineer, C Hoffmann, investigated on behalf of a group of large British and German private companies the commercial opportunities for private development of the state's brown coal resource to supply electricity to Melbourne, as well as to utilise the coal in chemical processes. His report strongly advocated the advantages of the 'Morwell' coal field compared with developing the brown coal deposits at Altona. He advocated the Morwell field as being suitable for the use of electric powered deep digging ladder dredgers and train haulage systems as used in the German Brown Coal open cuts. The business conglomerate he represented, the Victorian Mineral Development Company, proposed development of an open cut, power station and transmission lines to Melbourne as a private venture.

In 1912, the Government decided to proceed with a State owned power station to be built at Newport, operating on black coal, managed by the Railways Commissioners with the prime purpose of electrification of the metropolitan rail system. The government decision was based largely on proven practice with black coal furnaces, rather than the unproved (in Australia) techniques of combustion of brown coal. The shorter lead time for construction of a 'conventional' power station, and the expected assurance of firm contracts for coal supply from established black coal mining and transport organisations were also major factors in this decision not to use the indigenous source of brown coal. The State Coal Mine at Wonthaggi, operated by the Railways Commissioners, was also expected to be a strategic alternative or supplementary source of coal for the Newport Power Station.

The decision for this station to be Government owned and operated was a direct result of the recommendations of Charles Merz, in 1912. These recommendations incorporated the concept of the need for Government to take over control of the standardisation of electricity supply and its regulation and distribution throughout the State from the plethora of private and municipal electricity supply organisations then existing. Charles Merz's associated firm recommendation was that Newport Power Station would need to be supplemented within a few years by further generating capacity for general electricity supply other than railway electrification, and that planning for base load thermal power stations and for hydro-storage peak load power stations should be instituted forthwith. He also favoured the Latrobe Valley as the site for a base load power station supplied with brown coal.

5.2 Increased investigation of the Brown Coal Resource 1891– 1920

In 1913, the Government directed the Mines Department to undertake a comprehensive drilling survey of the brown coal resource to aid in the selection of a site for a power station. Hyman Herman, recently appointed Director of Geological

Survey, supervised this drilling task. By 1916, the drilling program was concentrated in the 'Morwell Coal Field' area.[142]

In the Morwell River and Narracan Creek Valleys, there were at least 20 companies involved in brown coal mining/exploration leases. However, most of these did not reach the production stage.

Mining leases at the northern end of the known brown coal deposits in the Morwell River Valley, where subsequently the major mining developments were to occur, included:

- The Australian Commonwealth Mines Ltd., the Australian Commonwealth Fuels and Oils Ltd., and the L & N Brown Coal Ltd., each of which subsequently took over the Maryvale Proprietary Lease just north of the Morwell township. The latter company was liquidated in 1927, ending the commercial interest in this lease.
- A. Davey et al, on the south of the Latrobe River immediately opposite Davis's Cut, the first recorded location of brown coal in the Latrobe Valley. The lease was granted in March 1889. A Mines Department plan of this lease area shows RAF Murray as having an involvement in this land.
- The Albion Coal Mining Company just south of the Latrobe Rive near Davis's Cut, first leased in 1891.
- The Buln Buln Coal Mining Company Ltd. adjacent on the west of the Albion lease, first leased in 1891.
- The Victorian Brown Coal Development Company immediately to the north of 'Old Sale Road'.
- The Great Moe Company on the south of Old Sale Road.
- The King Edward V11 Coal & Briquette Company on the north and south of the Gippsland Railway.
- The Great Gippsland Railway Coal Company, the Great Gippsland Coal Syndicate, the Narracan Coal and Briquette Company, and the Victorian Briquette Company all on the south of the Gippsland railway.

5.3 Specific Brown Coal Mines 1891–1920

5.3.1 Lal Lal to circa 1920

The discovery and early mining efforts at the Lal Lal lignite deposit have been outlined in Sections 2.2 and 3.10.1.

The original mining efforts had terminated in 1871 after mining approximately 1,000 tons of lignite.[143] In 1873, the Victorian Brown Coal Company commenced mining from a new shaft and excavated about 4,000 tons of lignite to 1878 and continued to closure in 1892. Lifetime output from Lal Lal to 1892 is quoted by one writer (P Griffiths (1988)) as 44,000 tons but a much lower figure is recorded in Mines Department tables.

Emanating from the Royal Commission of 1891, the Mines Department drilled seven bores to identify the Lal Lal deposit more fully but although proving a larger deposit than previously recorded 'no definite structure of the basin was established'.[144]

Armed with this recent information, the Lal Lal Lignite Company was formed in 1894 and worked a new shaft which 'was in coal from 70 feet to 220 feet'. However, attempts to make and market briquettes failed economically. Some pulverised coal for deodorising and fertilising was marketed but was not profitable. H Herman (1922) reports that 2,300 tons was mined by this company to 1898. Mining of the deposit was again shut down reopening briefly in 1914.[145]

Analyses of drilling carried out in 1919 indicated a coal deposit of about 40 million tons covered with layers of sand and clay.[146] Subsequently, practical coal reserves from an area of 30 acres were assessed at 2.5 million tons.[147]

In 1919, the Victorian Central Coal and Iron Mining Company sank a new shaft. Mined coal was dried in a rotary kiln and pulverised for sale. 4,000–5,000 tons of coal were sold in 1921. However problems with flooding from the adjacent old shaft and workings occurred, and the underground workings were again closed.[148]

In 1921 an open cut operation was commenced but abandoned within one year without producing coal. In 1952, a new open cut venture commenced with larger excavating plant but this venture was also abandoned within a year without producing coal.

5.3.2 Altona at Altona Bay; Newport and Williamstown Coalfields to circa 1920

Section 3.10.2 refers to the initial investigations into the brown coal deposits in the Altona Bay area. In 1891, the Melbourne and Altona Colliery Company was formed. In 1894 this company sank a bore and a shaft at Altona at a location about three miles north west of Williamstown and about one mile west of Shaft No. One.[149] The Williamstown and Newport Coal Prospecting Company sank a shaft deepened by a bore to 311 feet intersecting five seams in 1894.[150] The Newport Coal Prospecting Company sank a shaft at Newport during the 1890s. These bores and shafts referred to in Thomas & Baragwaneth (1950) p.12 did not reach a commercial mining stage.

The profile of No. One bore at Altona Bay about four miles south west of Newport showed a brown coal seam 70 feet thick at 329 feet overlain by sands, clays, shale and basalt, the latter 23 feet thick.[151] Other bores tended to show thinner and split seams, making geological interpretation of the deposit rather complex. At 1899, J Stirling considered that the brown coal beds 'in all probability extended towards the Werribee River and north westerly towards Bacchus Marsh'. These deposits were also considered to extend under Port Phillip Bay and be associated with brown coal beds on the eastern shores of this bay.

Some coal was raised to the surface from a shaft at Altona Bay in 1894/95 but the shaft was inundated with artesian water during deepening of the shaft which was then abandoned in 1896.

In 1899, a new shaft was installed a few hundred yards east of the flooded first shaft. The rail line was extended from Altona Station to the site. Several companies, including the Victorian Electric Light Heat and Power Distribution Company with RAF Murray as a director, took up and then withdrew from the challenge of a commercial operation while much negotiation took place with municipal councils to gain monopolies on supply of electric power from the Altona area coal deposits. Work at the site did not resume until January 1905. The wooden poppet head was renewed, and equipment upgraded, but negotiations with the Government and municipalities through to 1908 did not provide American (with Herbert Hoover as mining consultant) and British entrepreneurs with assurance of long term coal supply. Mining did not resume at this stage.[152]

S Priestley (1988 an) p. 95 states that the location of the pioneer bores at Newport – Altona are shown on a 1902 plan of coal leases (not yet sighted by me). Borehole and shaft locations later than 1902 have also not been definitively identified by me. The location at Harrington Square of the shaft and poppet head of the Altona mine is shown in a photo in Priestley (1988) p. 99.

The Melbourne and Altona Collieries NL was formed in 1908 and in late 1909 took over mining in the 1899 shaft. By November 1910 it had a production capacity of 50 tons per day from two shifts with excavation from drives into the top of the coal seam. From 1911 to 1919 this company extracted 26,332 tons of coal.[153]

In 1911, a London Syndicate offered to develop the Altona deposits if the Government would grant it a monopoly over power supply in the Melbourne area. This offer was declined but significant political and business advocacy continued through to 1920 to have the Altona deposits worked by private enterprise rather than have a government owned integrated large scale mining, power and briquetting complex in the Latrobe Valley. At 1912, it was announced that 'the property containing the brown coal deposits at Altona Bay has been sold to an American and British Syndicate'.[154] However this announcement was premature and negotiations continued until the outbreak of war with Germany in August 1914.
In 1913, the Government had called tenders from private companies for electric supply of five to 25 MW for railway electrification to supplement supply from Newport Power Station then under construction.[155] No action resulted due to the onset of war.

Mining from Altona continued with a skeleton workforce through the war years, some lower level drives were worked, and coal was sold at a profit in war time fuel shortages.

On 25 November 1915, Altona Beach Estates purchased a large portion of land previously intended for underground coal mining. Subsequently in April 1920 this land development company absorbed the remaining undeveloped land in this area of potential mining.[156]

At 1918, local hopes in the Altona area were centred on post war prospects of briquette manufacture without necessarily abandoning grander thoughts of power generation. By

1919, political and technical preference had swung towards advocacy for large scale development of the Latrobe Valley brown coal deposits rather than the smaller scale potential of the Altona-Newport deposits in spite of their location advantages close to the consumption centre of Melbourne. It is interesting to note the comparative cost assessments for the Altona and Latrobe Valley coal supplies.[157]

From output figures quoted by Herman (1922) p. 7, there was no significant output from the Altona shafts until 1911, with over 26,000 tons mined from 1911 to 1919. This output is probably that reported to the Mines Department. Output quantities and years of operation quoted by Drucker (1984) p. 48, are inconsistent with Herman and seem to be incorrect. S Priestley (1988) p.104, quotes an estimate of 75,000 tons being extracted between 1910 and 1919.

From 1911 to 1914 Altona had the highest annual output of brown coal in Victoria.

'Nearly all the (brown) coal obtained (in Victoria) during 1911 to 1916 (totalling 21,754 tons) came from the Altona mine, which produced also 3,643 tons in 1918 and 1,445 tons in 1919, since when it has been non productive.'[158]

At 1920, mining of the Altona deposit had gone into recess but was subsequently reactivated as described in Section 7.2.

5.3.3 Benwerrin and other Coal Ventures in the Otway Basin to circa 1920

A deposit of high heating quality brown coal at Benwerrin about five and a half miles south east of Deans Marsh Railway Station was first worked in 1895. After a quantity reputedly of less than 2,000 tons had been excavated the Great Western Colliery took over the operation. In 1899, J Stirling of the Mines Department reported the seam being worked by the Great Western Colliery as being eight feet thick.

In the Mines Department Progress Report No. 12 of 1900, a map by OAL Whitelaw showed location of the mine and identified a seam averaging six feet thick of excellent quality brown coal with a resource of 200,000 tons.[159]

Between 1899 and 1903, at Benwerrin, the Great Western Colliery Company mined 6,849 tons through two tunnels.[160, 161] Initially coal was hauled to Deans Marsh rail station by horse and dray and thence by rail to Birregurra (South West of Winchelsea) on the Geelong to Colac main rail line.[162]

In 1901, a VR gauge rail line was built by the company from the mine to Deans Marsh Station.[163] The mine delivered to the VR terminus at Deans Marsh over a tramway.

The coal was mined from a deposit of thickness six feet or more considered to exist over an area of about ten acres with estimated mining reserves of 75,000 tons.[164] The mine closed in 1903 due to high costs and lack of sales in Geelong and the local district. In Herman (1922) the terminology 'Deans Marsh tunnel' is used for this Benwerrin mine.

In 1912, S Hunter, Mines Department Engineer for Boring, reported that the old workings were waterlogged and that the seam was five to six feet thick over 15–20 acres. About 1918, the Western District Mining Company commenced working a mine at Wensleydale which was worked through to 1959. This mine and other mines which opened in the Otways area post 1920 are referred to in Section 7.3.

5.3.4 The Great Morwell Coal Mine to 1920

The opening of this mine has been outlined in Section 3.7.2.

In the 1890s, output was about 3,000 to 4,000 tons annually. Although a second briquetting plant was constructed after the first was destroyed in March 1895 when a bush fire entered the open cut, the expected coal demand for locomotive use, and successful briquette making from the German designed Australian manufactured plant, did not eventuate.

The operation was not financially successful and closed down in 1898. The mine had produced about 28,000 tons of coal and about 1,200 tons of briquettes.[165] The mining lease passed through several hands in ensuing years and from time to time some mining was recommenced to retain the lease. From 1905 to 1914, the Morwell Brown Coal Company operated the mine on a very intermittent low output basis mainly for tests of briquettability and processing, mining only about 1,500 tons in this ten year period.[166]

This mine was re-opened by the Mines Department under government instruction in 1916 during war time fuel shortages caused by extensive strikes in the NSW coal fields and shortage of shipping and rail transport. However, the NSW strikes terminated shortly after, with only 130 tons of coal excavated from the former Great Morwell Coal Mine before cessation of activity at the mine.[167]

In the winter of 1917, mining activity at the Great Morwell Coal Mine was renewed again by the Mines Department to offset shortages of coal in Victoria due to diversion of shipping to other war time priorities. Approximately 35,000 tons were excavated by the end of the year. Coal deliveries were by horse haulage to the Hernes Oak siding until the branch line to the mine could be restored for loco use. By the end of 1917, the mine had a capability of 1,000 tons per day.[168] From 1916 to 1920, recorded production from this mine was 370,981 tons.[169]

From 1918, some deliveries were made to the Spencer Power Station operated by the Melbourne City Council where a boiler had been converted to carry out combustion testing on this brown coal. This testing was considered to be vital in technical considerations for a proposed power station on the Latrobe Valley Coal Field.

A brief description of the mining methods used at the Great Morwell mine to 1920 is provided in Herman (1952).[170] A more detailed description is collated in an article 'Power for Victorian Industries' (1921).[171]

The decision of the Government to take over operation and ownership of the mine followed a similar decision with respect to the State Coal Mine at Wonthaggi. Both decisions demonstrated that a public mining enterprise could swing into action at short notice and achieve continuity of outcome in adverse economic conditions not attractive to private investment. The decision was also a foretaste of the trend of political action in the 1910 to 1920 era to establish State enterprise management of production and infrastructure projects.

The story of the Great Morwell Mine in its private ownership years has been collated by Bill Morley. Its operation under Mines Department control from 1916 has been compiled by H Herman (1922). Its subsequent activities from 1924 under SECV control, eventually named Yallourn North Open Cut, have been recorded in histories by RJ McKay (to 1947), by GF Rusden (to 1965) and by JA Vines (to 1987).

Many highly significant aspects evolving from the operations at the Great Morwell Mine influenced the future direction of brown coal mining and utilisation from the 1920s. Firstly, the production 'deficiencies' of the two briquette plants at the mine highlighted the necessity for direct and close application of proven German practice and plant to the briquetting process. Secondly, the reasonably effective utilisation of this coal in conventional type furnaces led to assumptions that all brown coal in the area would be similarly applicable. (It appears that the higher in-situ moisture content of the brown coal south of the Latrobe River was recognised by Mines Department technical personnel by 1915 or earlier. However it was evidently assumed that air drying during the mining and coal storage operations would allow the moister coal to revert to a drier coal similar to that of the coal in-situ in the Great Morwell Mine. This latter mine was located on the high river bank not subject to the flooding and swamp conditions of the brown coal area intended for the power generation. Hence, the wide variations in moisture content of the Latrobe Valley coals seem to have been attributed prior to about 1921 to the extent of drying in-situ, in sampling, in transit and in testing.)

5.3.5 West Gippsland Brown Coal Mines 1891–1920

The brown coal deposits referred to in this chapter were of the Narracan Group of Brown Coal Deposits, generally overlain with basalt and older geologically than the Brown Coal Deposits of the Latrobe Valley and northern Morwell River Valley. The locations of the mines are shown in Thomas & Baragwanath (1951) p. 9.

Most of these Western Gippsland mines were found as exposed outcrops by land occupiers rather than by intentional drilling. It is probable that these outcrops were known locally without reporting to the Mines Department and were not worked as commercial ventures until the VR rail line at Thorpdale from Moe was in service in 1890.

Among the mine sites identified in Mines Department records were the following:

- The Rollo Mines in Yarragon and on the Yarragon Escarpment.

As outlined in Section 3.9, in 1890 the Yarragon Brown Coal Mining Company opened a mine in the township of Yarragon on a coal seam found by John Rollo. This mine ceased operation by 1895.

In 1890, John Rollo opened a mine in a brown coal outcrop on the Yarragon Escarpment. The mine had access to a tramline provided mainly for timber cartage to the VR rail line at Yarragon. The extent of coal output has not been ascertained but anecdotally is assessed at below 1,000 tons before the operation closed in the early 1890s as commercially

unsuccessful. A second outcrop further east on the escarpment was also identified by Rollo but was not worked commercially.

Hasswell's Mine

In 1889 a mine was opened about four miles North East of Thorpdale by the Haswell Coal Mining Company. The venture was unsuccessful commercially and closed down by 1894. It was to be reopened later.

Horrocks' Mine

The Horrocks' Mine about three and a half miles North East of Thorpdale was reputedly opened about 1885 as a tunnel operation into an exposed seam. It was not a commercial success and closed in the early 1890s. This mine was reactivated later and was worked between late 1940s to 1950.

Dickenson's Mine

This mine located about three miles West of Thorpdale was opened in 1889 but was not a commercial success and closed in the early 1890s.

Willis' Mine

This mine located about two and a quarter miles South of Thorpdale was opened in 1889 but was not a commercial success and closed by the early 1890s.

Crisp's/Ferngrove Mine

This mine located about three and a half miles South West of Thorpdale was opened in 1889 but was not a commercial success and closed by the early 1890s. The mine was reopened in 1947 as the Moononook Mine with sequent adjacent operations of the Corovuna and Moolamoona Mines through to 1965 (see Section 7.5.4).

6 Black Coal Mining in Victoria 1921 to 2003

6.1 The Korumburra Area Mines post-1920

As noted in Section 4.3.1, Sunbeam Collieries Pty Ltd was formed in 1922 and reactivated the mining operations at Coal Creek commenced by the Coal Creek Mining Company as the first mine in the Korumburra area in 1894. Mining was conducted from a series of tunnels and eventually tapped the same seam as worked by the Austral mine. From 1922, the State Coal Mine at Wonthaggi commenced sales of coal to private industry rather than to the Victorian Railways only. From the early 1960s, briquette supply from Yallourn brown coal was progressively available in greater quantities for private industry. Supply of brown coal from Yallourn North Open Cut to industry as well as to Newport Power Station also became available by the early 1950s. As a consequence of this competition, from the early 1950s output from the Korumburra, Outtrim and Jumbunna mines gradually decreased due to increased availability of alternative fuels as well as inability to compete on a price basis.

For the Sunbeam Collieries mine, the last remaining customer was the Korumburra Butter Factory which also changed to briquettes as their fuel in 1959. The last load of coal left the Sunbeam Colliery on 15 April 1959. The mine was the last to close in the Korumburra district[172]. Local organisations, mining companies, mine workers, and people complained bitterly that their private mines had been put out of business by State Government enterprises.

In 1922, a new company, the Strzelecki Co-Operative Syndicate was formed to reactivate the part of the original Strzelecki Coal Mine not sold to the Austral mine. However mining of 30 tons from the old workings was the only production before closure in 1922. The mine was reopened again in 1930 by Lucas & Greenwell and produced approximately 300 tons per fortnight until the coal appeared to be petering out. In the late 1930s, the lease was taken over by the Korumburra Coal Mine but production was not restored. This mine closed in April 1939.[173]

The Austral Coal Company which took over the Black Diamond Mine in 1908 produced 433,745 tons of coal averaging over 12,000 tons annually over 35 years until its closure in 1943. There were still workable coal reserves but the company found difficulty in obtaining labour under wartime conditions. In 1948, the company offered the mine to the Government. This offer was accepted. However the mine has not been reopened.[174]

In 1922, the Cardiff Colliery Company commenced mining at a location near the former Silkstone Colliery. A tramway was installed from the mine to the Silkstone-Strzelecki branch line. The mine produced 31,635 tons to 1925 when the company was liquidated. Operations were revived between 1937 and 1939 during which time 59,483 tons were produced.[175]

In 1923, the Dudley Coal Syndicate took over operation of the former Silkstone Colliery and worked this mine to 1927 producing about 27,000 tons. The operations encountered faults in the coal seams and threat of water entry from old mine workings of the Korumburra and Jeetho mine. Another company with the same name operated the mine from 1932 to 1934 producing 4,447 tons until it shut down in 1934.[176]

Preservation of the social heritage of features of coal mining in the Korumburra, Jumbunna, Outtrim and Howitt has been included in displays at the Coal Creek Heritage Park at Korumburra.

6.2 The Jumbunna Area Coal Mines post-1920

As noted in Section 4.3.2, by 1921 the fortunes of the Jumbunna Coal Company had been adversely affected by industrial disputes, by flood, by fire and by dwindling coal reserves. Although the calorific value and ash content had significant advantages of the order of 20–30 per cent compared with coal from the State Coal mine, commercial arrangements achievable from the Victorian Railways did not reflect these quality aspects. The company limped along until in 1928 the mine was offered to the Government for

£12,000 on a walk in–walk out basis. At that stage, the mine was delivering only about 50 tons per day from a seam two feet four inches thick. Eighty feet below this was the main seam three feet six inches thick. The offer was considered by management of the State Mine but was not favoured. Hence, the offer by the company was not accepted by the government.[177] The Jumbunna Mine closed in 1929. During its lifetime from 1894, coal deliveries of 1,304 million tons of coal were achieved from this mine.

6.3 The Outtrim Area Coal Mines post-1920

As noted in Section 4.3.3, operations of the major mine in the Outtrim area, theOuttrim, Howitt and British Consolidated Mining Company, ceased in 1915. From 1921 to 1957, small groups of investors and miners formed themselves into companies, obtained a mining lease and began mining coal mainly from the previous mines. Small companies which sent 'mandatory' reports to the Mines Department included:[178]

Outtrim Coal Syndicate	1921–1928	17,790 tons
Outtrim Extended	1921–1925	7,326 tons
Mount Pleasant	1923–1928	2,436 tons
Roy's Extended (North Outtrim)	1924–1928	9,068 tons
Howitt Colliery	1926–1936	56,990 tons
(Korumburra)Station Area	1932–1933	2,587 tons
Outtrim West (G.A. Foote)	1944–1951	13,357 tons
Blackmore, Leighton & Murray	1946	1,045 tons
Outtrim North (Willoughby)	1847–1948	1,847 tons
Howitt Colliery (McBride)	1947–1949	3.396 tons
Hillside Colliery	1953–1956	3.925 tons
Blackmore & Leighton	1956–1957	1,836 tons
Webster, Axford & Hodges	1950–1962	

At 1962 no further coal mining in the Outtrim area was reported. The State Coal Mine at Wonthaggi remained the only black coal mining operation in Victoria

6.4 The State Coal Mine at Wonthaggi post-1920

The initial years of the State Coal Mine project have been outlined in Section 4.5.2. At 1921, the four pioneer mines, shaft numbers three, five, nine and ten all in the central area, had been worked out. Number nine shaft had yielded 0.976 million tons from 1914 to 1920. Number ten shaft had yielded 1.395 million tons from 1911 to 1921.[179]

In 1924/25, the Dudley Area at the north west of the known Powlett Coal Field was opened with number 16 and 17 shafts.[180]

From 1926 to1930, the number 18 shaft in the Eastern Area was opened up initially as a down cast shaft for ventilation to number four bench.[181] This was an extended development from the three bench workings in the Eastern area which subsequently closed in 1931 after 12 to 15 years production totalling about 1.24 million tons. Number 18 shaft was the source of 1.94 million tons from 1930 through to 1946.[182] From 1930 it was the main production source from the Eastern Area.[183]

In 1928, the Station Area tunnel was closed down after nine years of production totalling 0.302 million tons.[184]

In the 1929/30 financial year the State Mine Complex produced 0.662 million tons with personnel average for the year of 1776. This was the peak annual output and work force.[185]

In 1931, numbers 19 and 20 shafts in the Northern Area were opened to help maintain total output from the State Mine at 0.5 million tons a year. These compensated for the closure of the three level Eastern Area bench operations. Production from the number 19 and number 20 totalled 1.718 million tons to their closure in 1962.[186]

In 1934/35, the Western Area was opened from numbers 21 and 22 shafts. These operations took over from the McBride Tunnel in the central area which had produced 3.063 million tons from its commencement in 1915 to its closure in 1935. Total output from number 21 and number 22 shafts to their closure in 1968 was 1.869 million tons.[187]

In 1938, the Kirrak area was opened with number 23 shaft at a location about two miles north east of Wonthaggi. This was the last mine opened in the State Mine complex. Operations from this shaft were suspended from 1945 to 1955 and thereafter

mining was somewhat intermittent due to higher costs and falling demand. Between 1939 and cessation of operations at the State Coal Mine complex in 1968, total output from the Kirrak area all through number 23 shaft was 0.464 million tons.[188]

Mining operations at the State Coal Mine ceased in December 1968. Total output from the project was 16.695 million tons.[189] (JL Knight states 16.736 million tons.) The State Coal Mine had been commenced with enthusiasm, but without adequate drilling information on the quality, thickness and conformity of the coal seams. Each of these aspects proved to be more adverse than anticipated. Initial arduous working conditions prior to application of mechanised mining continued as coal seams became thinner and led to the return to manual mining. Establishment of the Wonthaggi township with strong social cohesion in its single industry base was a highly commendable feature of the State Coal Mine operation. Outputs from the complex of individual mines in the project were of vital importance to the economy of the State during shortages of coal supply from NSW, particularly in the first and second world wars. The State Coal Mine was the last significant producer of black coal in Victoria.

Wonthaggi remains a thriving rural township with some small manufacturing enterprise, some servicing of rural activities, and with a growing tourism function. A State Coal Mine Historic Reserve exists over part of the former mining areas and some preservation of the former mining activities is maintained.

6.5. Daly's Mine on the Powlett River Coal Field post-1920

The initiation in 1910 of Daly's mine is referred to in Section 4.5.1. In 1922, the Gippsland Coal Company took over the mine from the Powlett and North Woolamai Colliery NL until 1924, when it transferred operations to the Hicksborough Coal Company. All working closed in 1926 after a total production of 132,757 tons. By this time, the Dudley Mine of the State Coal Mine was in operation adjacent to the Hicksborough operation.[190]

Daly's Mine was the only new private black coal mine brought into operation in South Gippsland from the late 1890s until the early 1920s due largely to government restrictions on exploration and mining leases in endeavours to preserve black coal resources for use by government utilities.[191]

7 Brown Coal Mining in Victoria 1921 to 2003

7.1 Lal Lal post-1920

Activities to 1921 at the brown coal deposit at Lal Lal have been outlined in Section 5.3.1. The Victorian Central Coal and Iron Mining Company which took over operations at site in 1919 did not prosper and closed down in 1922, although producing about 4,000 to 5,000 tons in 1921.[192] The mine was flooded in 1921.

During 1940 a new shaft was sunk about 100 yards west of the old shaft but operations were suspended after a small quantity of coal of indifferent quality had been dug.[193]

In 1949, fresh boring was commenced after a gap of 30 years.[194]

An open cut operation commenced at the Lal Lal site in 1921 but was abandoned in 1922,[195] the location being depicted in Figure 40 in Thomas & Baragwanath (1950), p.15. A water-filled excavation perhaps 400 feet long by 100 feet wide on the east side of the railway and off Coal Mine Road about two to three kilometres south of Lal Lal township may be the site of this open cut. Herman (1952) does not mention this open cut operation.

In 1950, the Ballarat Courier announced the initiation of a new open cut at Lal Lal but the cost of overburden removal and dewatering proved the project uneconomic and the venture closed[196] without producing coal.

Output from the operations at Lal Lal has been stated as producing 25,376 tons to the end of 1950.[197] Anecdotally, there was no mining at Lal Lal after 1950. Mines Department statistics do not list any output from Lal Lal after 1950.

7.2 Altona post-1920

As outlined in Sections 3.10.2 and 5.3.2, underground mining of the brown coal deposits at the Altona area had occurred from the 1890s intermittently until 1919 when the mine at Harrington Square had gone into recess.

In 1927, the Altona Colliery Company revived. It attempted to persuade the State Electricity Commission to develop the Altona coal resource for electricity generation and briquette manufacture, the production of which had difficulty meeting demand, or alternatively to endorse the company to carry out these activities and sell in bulk to the SECV. The SECV rejected the proposal. The company then sought public support for extracting oil and gas from the Altona deposit and utilising processing residues for char, briquettes and fertiliser. Their proposals did not gain financial support.[198]

In 1928, the Altona Colliery Company sank a new shaft about one mile west of Harrington Square, moved plant from the old mine site and began extracting coal by 1930. Three drives were worked but water ingress was a significant problem and marketing the coal against competition from briquettes and brown coal from the Latrobe Valley was difficult. The venture closed in 1931 after production of 600 tons only. The company offered their mining rights to the SECV in 1938 and in 1940, but these offers were rejected.[199]. No further mining of the Altona deposits occurred thereafter to the present time 2005.

7.3 The Otway Basin post-1920

At 1921 there was no active coal mining operations in the Otway Basin or Ranges.

7.3.1 The Benwerrin Mine (see also Section 5.3.3) post-1920

In 1925, the mining lease at Benwerrin was taken up again and worked by various parties until 1930. Three seams were proven in this operation at 71 feet, 108 feet and 172 feet.[200] The output for this period has not been identified.

In 1941, the lease was taken up by VT Ekberg, the three seams previously identified being exposed in a gully. Two tunnels were installed. A seam nine feet thick was worked at 112 feet deep from a shaft. Installation of pumping plant and haulage track was carried out.[201] In 1947, the Mines

Department installed 10 bores resulting in a revised estimate of 75,000 tons of winnable coal.[202]

At 1946, the mine was averaging about 30 tons per week output. By 1948, output was averaging about 20 tons per week[203]. It was noted in the 1948 *Annual Report* of the Mines Department that only 'a small tonnage' was being achieved from the tunnels at Benwerrin and that the mine was experiencing difficulties with water ingress and from labour shortages. No subsequent output has been identified in Mines Department records. Herman (1952), p. 49, states the mine was not in production in 1950.

A production of 11,393 tons is listed by Herman to 1950.[204] It is likely that the lifetime output from Benwerrin was higher than officially recorded due to the low and intermittent output from this isolated site. Lifetime output probably did not exceed 30,000 tons. A winnable deposit of at least 70,000 tons remains.

7.3.2 The Globrite Colliery at Deans Marsh post-1920

In 1922, bores sunk by the Mines Department about two miles north of Deans Marsh in the Parish of Bambra disclosed a coal seam up to about 30 feet thick at 60 feet deep.[205]. In 1947, the Globrite Colliery sank a shaft 100 feet deep into this seam. Forty tons of coal was extracted for trials. Further boring northerly from this shaft showed variability in the thickness and continuity of the seam. In 1950, an adit was installed from which a weekly output of 50–60 tons was achievable. Also in 1950, the first year of operation, 756 tons was extracted.[206] Anecdotally, remains of an old derrick of the mine are still evident on the south side of Parkers Road about three kilometres north from Dean's Marsh Village.[207] No further information has been ascertained.

7.3.3 The Bambra Coal Mine post-1920

The Bambra Coal Mine is noted to have existed prior to or at 1922.[208] No confirmation has been found. Perhaps this was the Globrite Colliery at Deans Marsh in the Parish of Bambra.

7.3.4 The Wensleydale Mines post-1920

Anecdotally, some mining of brown coal from the Wensleydale area south of Winchelsea had occurred before 1918 when the Western District Mining Company attempted commercial operations.[209] (The location of the mine was about eight kilometres south from Winchelsea along the Winchelsea to Deans Marsh Road and thence 1.5 kilometres east along a road now known as Coal Mine Road.) By1922, mining was taken over by the Otway Coal Company outloading coal by an aerial ropeway three and a half miles to a siding at Wensleydale on the Mount Moriac to Wensleydale V rail line. At this time mining was via a series of tunnels[210] later converted to an open cut operation. A total production of 16,848 tons is recorded as the mine output from 1923 to 1932 when the operation ceased. The Otway Coal Company went into liquidation in 1936.[211]

In August 1943, the Wensley Bray Coal Company[212] reopened the workings as an open cut operation hauling coal by road to Winchelsea railway station and to local and regional customers suffering fuel shortages due to war time restrictions. Mining was initially at the rate of a few hundred tons per week but by 1946 was averaging over 700 tons per week. From recommencement in 1943 to December 1947, total coal output was approximately 100,000 tons.[213]

At 1948, JL Knight of the Mines Department estimated coal reserves in an area of 38 acres at about 3.75 million tons with a maximum seam thickness of 152 feet. [214]

On 1 July 1948, the Wensleybrae Coal Mine Pty Ltd reached agreement for Roche Brothers to operate the mine on a royalty basis.[215] In the early 1950s, in a period of acute fuel shortages in Victoria, the government purchased the mine and reached agreement with Roche Brothers to work the mine for five years and in that time to produce one million tons of coal for which Roche Brothers would pay a royalty to the Government.[216]. Roche Brothers upgraded the mine plant and reached a peak production of 10,000 tons per week with up to 200 men employed in the mine. The coal was hauled by heavy trucks mainly to Winchelsea Railway Station but also to Geelong and other Western Victoria centres.

By 1955, Roche Brothers were concerned about dwindling coal reserves at the Wensleydale mine and commenced a drilling program in the Otways coal deposits under technical guidance of the Mines Department. This drilling proved an extensive coal deposit at Anglesea.

In 1959/60, the Wensleydale coal mine ceased to operate because of the discovery and progressive transfer of operations to the Anglesea Coal Field which could be more profitably worked. Total lifetime production of the Wensleydale mine was probably of the order of approximately two to two and a half million tons.

Anecdotally, a small mining venture had taken place on the northern side of Coal Mine Road prior to the mining operation later known as the Wensleybrae Mine. I have not found written verification of this. (Visibly, there is an excavation on the north side of Coal Mine Road about half a mile eastwards of the major mine but this appears to be a farm water storage rather than an old open cut. Further research may clarify this issue.) The overburden heaps and some disused plant of the mine on the south side of Coal Mine Road are clearly visible.

No other coal mining operations reaching a commercial stage have existed in the Winchelsea area.

7.3.5 Anglesea Brown Coal Mine

In 1959, Roche Brothers, a company which for many years had operated a brown coal open cut at Wensleydale, south of Winchelsea in the Otway Basin, commenced an open cut mine in a brown coal deposit in an area some two kilometres to the north of the coastal township of Anglesea.

The Wensleydale mine was closed down by 1960 after the Anglesea mine was opened sufficiently to continue the reliable supply of run-of-mine coal to industries and institutions in the Geelong region. However, demand for brown coal for steam raising in industry and institutions (particularly country hospitals) in Victoria was decreasing due to the increasing availability of other fuels and electricity. A successful economic future for the Anglesea mine was in doubt.

By 1961, Western Mining Company (WMC) acquired the mining right to the Anglesea Mine with the objective of supplying coal to a nearby 150 megawatt Power Station to be operated by Alcoa of Australia supplying electric power to an aluminum production plant to be established at the Port of Geelong, with reliability of electric supply being enhanced by connection to the State Electricity Transmission System. In the associated State Legislation, the *Mines (Aluminum Agreement) Act of 1961*, Alcoa was granted 'a 50 year exclusive right to explore and mine over some 7,350 hectares of leasehold land.'[217]

The WMC undertook an extensive drilling investigation and relocated the mining operation to the east of the original Roche Brothers operation. The revised operation provided access to a larger coal reserve with a 50 million tons mine plan and was closer to the Power Station Site. Total thickness of the coal seams is about 140 metres. Total economic mineable reserves in the main upper seam have been estimated at 70 million tons with a further 90 million tons in lower seams. [218] The mine continues to operate at 2005, with overburden being stripped and backfilled into the mined area by earth moving contractors and coal mining now by Alcoa using a conventional operation with shovels and trucks. At 1992, '[the] overburden to coal ratio averages around two and a half to one with an average coal thickness of 27 metres'. Annual coal production averages about 1.1 million tonnes with coal supply now exclusively to the 150 megawatt Power Station.[219]

At 2005, output to date is of the order of approximately 35 million tonnes.

7.4 The Bacchus Marsh Coal Mines post-1920

7.4.1 Identification of Brown Coal Seams in the Bacchus Marsh Area

The first recorded find of thick brown coal seams in the Bacchus Marsh area was in 1894 at the Werribee River on the main railway line from Melbourne. A thin seam of brown coal had been found previously in 1890 in the bed of the Parwan River at Yaloak Vale.[220]

Subsequently, from the 1890s, partly as a secondary outcome of drilling for water, extensive brown coal deposits covered by thick flows of Newer Basalt were disclosed from Melbourne on each side of Port Phillip Bay westwards to Bacchus Marsh and southward to Geelong. A main seam near Bacchus Marsh known as the Mattingley Seam locally exceeds 40 metres in thickness and continues towards Altona.[221]

7.4.2 The Parwan Brown Coal Mine

In 1929, an underground mining operation commenced at a location about eight kilometres south of the Rowsley railway station. This was known as the Parwan Brown Coal Mine or colloquially as the Parwan Shaft and was operated by the Bacchus Marsh Coal Mine Company Ltd.[222] A shaft 510 feet deep was sunk passing through basalts and thin fossiliferous clays to a 103 feet thick coal deposit which bottomed at 405 feet depth. The shaft and a 200 feet drive were completed in 1930/31.[223] A small quantity, probably below 1000 tons, of good quality brown coal was extracted but the venture did not achieve commercial success and closed by 1931.

Two subsequent attempts to re-activate the mine did not succeed commercially until taken over by the Bacchus Marsh Coal Mine Company in 1941. Mining via the shaft of the Parwan Brown Coal Mine was carried out from two levels,[224] the third level remaining flooded from previous operations. The mine operated intermittently to 1944/5 when spontaneous combustion of coal in the workings led to closure of mining operations and sealing of the shaft. Subsequent attempts to recommence mining led to renewed fire outbreaks and resealing of the shaft. This mine did not operate after 1945.[225] Lifetime production from the Parwan Shaft was recorded by Herman (1952), p. 81 as about 13,000 tons, and on p. 49 as 10,119 tons for the period 1943 to 1950.

From the mid to late 1940s, in a time of fuel shortages in Victoria, several other companies commenced mining operations in the Bacchus Marsh area south of the Werribee River and south and east of the VR Railway where the overburden is free of basalt. All of these operations used open cut mining with an overburden to coal ratio better than one to one.

7.4.3 Maddingley Brown Coal Mine Number One

About half a kilometre south west of Bacchus Marsh Railway Station, mining commenced in 1944 via an inclined adit into a coal seam about 70–80 feet thick under about 80 feet of overburden. Colloquially this operation was initially known as the Maddingley Tunnel but subsequently was called the Maddingley Brown Coal Mine Number One and was operated by the Maddingley Brown Coal Company. At 1946 the underground mine was operating at about 250 tons per week.

In 1946, the Australian Paper Mills purchased an interest in the mine to ensure supply. The mine converted to an open cut operation quickly reaching an output of 1000 tons per week through a new outloading plant adjacent to the mine outlet. Output in the year 1947 was 67,641 tons.[226] The mine phased out of coal winning operation from 1968 as Maddingley Number Two came into service. Total output from Maddingley Number One to June 1950 is recorded as approximately 100,000 tons.[227] The mine continued to provide access for coal winning until about 1952 in case of problems restricting supply from Maddingley Number Two Open Cut. The largely worked out Number One Open Cut was progressively filled with overburden from Maddingley Number Two.

7.4.4. Maddingley Brown Coal Mine Number Two

In early 1948, the Maddingley Brown Coal Mine Number Two commenced an open cut operation at a location about Two kilometres south from Bacchus Marsh Railway Station. This mine was owned by Australian Paper Manufacturers and output was mainly dedicated to their Fairfield Mill, with direct rail transport from Bacchus Marsh by rail to a siding at the mill. (Yallourn North Open Cut coal was also delivered directly by VR rail trucks from the VNOC mine to the Fairfield rail siding.)

At the mine entry coal seam thickness was about 125 feet under about 30 feet of overburden. Output to June 1950 was recorded as 406,341 tons.[228] At 1954, output was averaging 10,000 tons per week with output in the 1954 year recorded as 504,467 tons.[229] This was the peak year of production. Output stayed above 400,000 tons annually through to 1967 after which natural gas began to supplant brown coal usage. By 1980, annual output had fallen to about 100,000 tonnes.

In 1972, the operations were transferred to APM Minerals Pty Ltd. In 1989, the operation was taken over by Melbourne Quarries and in 1992 by Calleja Nominees with all usage by the Fairfield Paper Mills having terminated. The open cut remains available for a small coal demand for fertiliser, soil conditioner, and combustion trials. The open cut is being used commercially for selected refuse disposal in conjunction with landscaping of the multilevel former coal benches.

The Maddingley Brown Coal Mine Number Two has reserves available for further usage.

7.4.5 The Star Collieries (The Star Open Cuts Number One and Number Two)

- In July 1946, an open cut operation, known initially as the Star Colliery but later called the Star Open Cut Number One, commenced at a location about 1.6 kilometres south east of the Bacchus Marsh Station adjacent to the Parwan Creek. The coal deposit mined was 100 feet thick under 35 feet of overburden.[230] The mine operator was Star Collieries Pty Ltd
- In 1947 the Star Number One open cut excavated 48,995 tons of coal averaging about 1000 tons per week rising to 1450 tons weekly in 1948. However the leased mining area was too constricted and it was decided to open a new open cut about one mile to the south where coal winning commenced in May 1950.

- By 1950, the Star Open Cut Number Two had an average output of about 1,500 tons per week. By December 1950, total output to date of the two open cuts was reported as 209,243 tons[231] of which about 200,000 tons probably came from the Number One open cut which closed in 1951 and was subsequently used as an overburden dump.
- Star Number Two open cut continued at an annual output generally of over 50,000 tons to 1969 when it was taken over by the Bacchus Marsh Briquetting Company Ltd. which continued mining but did not venture into briquette manufacture. Annual output fell dramatically in 1970 to 18,480 tons. Further dramatic falls occurred to 1973 after which output was generally about 1000 tonnes annually until the closure of coal winning in 1978.

No further excavation occurred from 1869. The open cut remains visible as a water-filled lake south of Maddingly Number Two open cut.

7.4.6.The Lucifer Colliery

In October 1946, a company named Lignite NL commenced an open cut operation immediately to the south of and adjoining the Star Open Cut Number One. At the mine site the coal deposit was about 100 feet thick under 30 to 35 feet of overburden. By mid 1947, coal output was averaging 850 tons per week. At 1950, this mine had an average output of about 1000 tons per week with a total output to December 1950 reported as 161,808 tons.[232] However, coal reserves in the confined mine lease area were dwindling.

In March 1951, this operation was taken over by the Maddingley Brown Coal Pty. Ltd, operators of the larger Maddingley Number Two Open Cut immediately adjacent to the Lucifer Colliery. In the year 1951, 55,459 tons were mined but the mine ceased operation in June 1952 with a lifetime output of about 230,000 tons.

The largely worked out mine was then used as the main site for overburden disposal from the Maddingley Number Two Open Cut. At 2005, the former Lucifer Collieries site has been restored to natural landscape.

7.4.7 The Boxlea Colliery

Circa 1945, an adit was installed about half a kilometre north of the subsequent site of Star Open Cut Number One declining southwards to intersect the brown coal seam. This mining endeavour was known as the Boxlea Colliery. In 1947, before any commercial coal output via this adit, the Fuel & Chemicals Pty Ltd took over the operation, cancelled the underground venture and commenced an open cut operation immediately to the east (separated by a public road) of the Star Number One Open cut. By June 1950, an output of 463 tons of coal was reported as having been extracted.

In September 1950, the operation was taken over by the Sunshine Fuel and Brown Coal Company. The initial coal output from the Boxlea Open Cut was in 1950, production to December 1950 being recorded as 562 tons.[233] However mining apparently ceased by March 1952.[234] No mention is made of the Boxlea operation in the *Mining & Geological Journal* after this date. The mining lease area was small. From an inspection of the current site it appears that mining ceased before sufficient overburden was removed to develop multi-level coal faces. Colloquial information indicates that the open cut mine produced up to 30 tons per day. No definitive information on lifetime output from the open cut has been ascertained, but total output was likely not to have exceeded 10,000 tons.

The former open cut site remains as a water-filled hole on the east side of the public road. The external overburden dump at the east of the open cut has blended into the natural landscape.

7.5 West Gippsland Brown Coal Mines post-1920

The brown coal mines in West Gippsland have been referred to in Sections 3.7, 3.9 and 5.3.5. The locations of other brown coal mining endeavours in West Gippsland in the upland country around Thorpdale are shown in Fig 54 of Thomas & Baragwanath (1951), p. 9. Those which survived or had potential for reactivation from 1921 are referred to below.

7.5.1. The 'Rollo' Mines post-1920

- Yarragon Coal Mining Company on the flat lands
- On the Yarragon Escarpment

The Rollo mine at Yarragon is referred to previously in Sections 3.9 and 5.3.5. It surrendered its lease in 1895. It was not reactivated in subsequent years as suggested colloquially but not confirmed in publication or records sighted. Operation of the mine beyond the 1890s is also negated from specific discussions with the land occupier of the last 50 years. This was the only mine on the Moe to Warragul flat land area which survived beyond initial proving shafts and adits.

The Rollo Mines on the Yarragon Escarpment did not survive beyond the early 1890s and were not reactivated subsequently.

7.5.2 The Haswell Mine post-1920

As stated in Section 3.7.4, some intermittent mining in low quantities occurred but ceased before 1950 from the Haswell tunnel located about seven kilometres northeast of Thorpdale.[235]

7.5.3 Campbell's Mine (The Narracan Brown Coal Mine) post-1920

In 1941 a second adit was installed adjacent to the previous tunnel of the Horrocks mine on Campbell's property located about five kilometres northeast of Thorpdale. The brown coal seam was 10 feet thick. This was also known as the Narracan Brown Coal Mine. A small quantity of brown coal was extracted.

In 1948, the Mines Department prepared a mine plan and carried out a mine survey of Campbell's Brown Coal Mine. A plan and section of the mine is shown in Fig. 56 in Thomas & Baragwanath, (1951). This mine ceased operation by 1950 and has not re-opened.[236]

7.5.4 The Monoonook, Corovuna and Moolamoona Mines post-1920

In 1947, an underground mining operation known as the Monoonook Mine was initiated about five kilometres southwest of Thorpdale. This mine accessed the coal seam previously developed as the Crisps Mine (see Section 3.7.6). In 1948 the mine was taken over and operated as the Corovuna Mine. In 1948, the Mines Department undertook a mine survey and prepared a mine development proposal.[237] After 8,695 tons output was recorded, the mining operation was suspended in 1948.[238]

In 1950, a new mine known as the Moolamoona Mine was commenced adjacent to the former Corovuna mine. The layout and sections of these mines at 1951 are shown in Figure 55 in Thomas & Baragwanath, (1951). In 1951, the Moolamoona Mine intentionally broke through into the former Corovuna workings to improve ventilation and improve the development prospects for more extensive working of the seam. In 1954, new ownership took over the operation enthusiastically installing further tunnels into the outcrop. From this time through the 1950s the mine output averaged 4,000 to over 5,000 tons annually. However in the year 1961 a dramatic fall in output to less than 1000 tonnes occurred. Output then declined continuously until the last recorded output of 12 tons in 1965.

Combined total output from these mines to 1950 was recorded as over 23,816 tons.[239] The lifetime output from the mines has not been ascertained in this study but would probably be of the order of 60,000 tons.[240]

7.6. The Great Morwell Mine 1921 to 1924

Sections 3.7.2 and 5.3.4 refer to the working of the Great Morwell Brown Coal Mine until 1920. At 1921, the Great Morwell Coal Mine continued in operation under Mines Department management with excavation by hand. Coal delivery from the mine was by VR trucks to outlets on the VR rail system.

From April 1921, this mine played a significant role in providing the initial coal supply requirements of the State Electricity Commission of Victoria at Yallourn, supplying coal to the Yallourn temporary Power Station which generated power for construction use and for the domestic use of on-site construction workers at Yallourn. [241]

Operation of the mine was transferred to the State Electricity Commission on 1 April 1924. The first unit in Yallourn Power Station became operational on 15 June 1924 and the temporary power plant was shut down on 1 September 1924.

7.7 Yallourn North Open Cut (The 'Old Brown Coal Mine') from 1924–2005

The operation of the Old Brown Coal Mine was taken over by the SEC at the commencement of the Yallourn Power Station in 1924. It supplied coal to Yallourn Power Station on a continuous basis blended with coal from the new Yallourn Open Cut until 1927 and thence intermittently during coal supply shortages from Yallourn Open Cut. The open cut was closed down in September 1930 with the Yallourn Power Station then relying on Yallourn Open Cut for all coal deliveries. The old open cut was reactivated briefly when emergencies occurred in Yallourn Open Cut resulting from flood (1935) and fire (1944). In late 1940, the State Government requested that the mine be prepared for emergency supplies of fuel during the war time period. Deliveries of coal recommenced in May 1941.[242]

This mine subsequently played a vital role in the post war years 1945–1963 as a source of coal for Newport Power Station replacing black coal in short supply from NSW. Raw brown coal from this mine also substituted for shortfalls in briquette deliveries from Yallourn and Morwell briquette plants and was a vital fuel for many small manufacturing enterprises, hospitals, and Gippsland milk factories. Brown coal from Yallourn North (and later from YNX) was also used at the rate of about 70,000 tons per year with briquettes in the Gasification Plant at Morwell.[243] The availability of this mine as an emergency and as a supplementary source of coal supply during coal supply difficulties from the Yallourn Open Cut emphasised the strategic security value of interconnection between open cuts and alternative sources of coal supply.

Until about 1921, the operation was largely by manual labour. It was then converted to rail haulage of overburden. Horse drawn coal dobbins were replaced by conveyor transport of coal within the mine from 1941. From the 1950s, excavation was by draglines, shovel excavators, a bucket wheel excavator, scrapers and other mobile plants. Coal removed from this mine totalled about 30,000 tons to 1915, approximately 650,000 tonnes from 1916 to 1924, and 16,358 million tons from 1924 to closure of excavation in 1963,[244] ie. a lifetime total of 17.039 million tonnes. Further details of YNOC Coal Excavation Outputs Annually 1924–1963 are shown in Table 1.1/3 of Vines (1989).

Outloading facilities direct to the VR rail line continued in use until June 1964, receiving coal from Yallourn Extension Open Cut to maintain traditional coal supplies from the old brown coal mine. Subsequently the open cut was used as a disposal area for demolition materials from the decommissioning of Yallourn Power Station and for disposal of hard clean waste from the construction of Yallourn W Power Station and from the Yallourn Works Area. From the late 1980s, the old open cut has remained in use for ash disposal from the Yallourn W Power Station. Rehabilitation and revegetation of overburden dumps has been carried out progressively from the 1950s.[245]

7.8 Yallourn North Extension Open Cut

In 1953, in view of depletion of coal reserves in the Yallourn North Open Cut mine plan area, the SECV initiated investigations to determine future options. In 1954, drilling proved a substantial near surface deposit later assessed to be of the order of 50 million tons of coal of similar quality to that of Yallourn North Open Cut at a location about three miles east of the Yallourn North Open Cut. On 5 July 1955, the commencement of the Yallourn North Extension Open Cut (YNX) at this site was authorised.[246]

Overburden was removed predominantly by contract and deposited in an external gully of coal to the north west of the planned open cut.

The coal excavation and conveying plant was progressively transferred from Yallourn North Open Cut. Coal haulage from the YNX outloading station was to road vehicles on contract to customers or to SECV trucks hauling to the Yallourn North VR loading station. Yallourn North Open Cut ceased mining in May 1963. Yallourn North Extension had commenced coal winning in July 1956.

The open cut was developed as a multi bench operation with face heights of about 27 feet high to suit the reach of the electric shovels employed. Each shovel loaded to a separate mobile primary crusher/loader which loaded to the in-pit conveyor system.

In the late 1950s, problems arose due to the tendency for exposed coal faces to smoulder with potential spontaneous combustion. This coal heating was attributed to high sulphur content in specific areas and at varying depths in the open cut. Subsequently, in 1966, the mine plan was amended to bypass the high sulphur areas.[247]

Annual output averaged over 300,000 tonnes from 1957 to 1989 with a total lifetime output of 9.3 million tonnes.[248] At closure in 1989, the immediate planned mining area held about seven million tonnes of coal. After closure, a long term rehabilitation plan was implemented from 1991 to provide a stable, non-erosive condition to the mine and overburden dumps while ensuring visual harmony with the mine surroundings. Objectives were also to maximise opportunities for effective land use while preserving the option to reopen the mine in the future.[249]

7.9 Yallourn Open Cut

The occurrence of a large deposit of brown coal in the Morwell River Valley on flat land immediately south of the Latrobe River had been known to Mines Department geologists from the 1870s (see Section 3.1). The opening of the Great Morwell Brown Coal Mine in 1889 on the north bank of the Latrobe River in this area lead to increased investigation and mining leases immediately south of this mine.

Interest from private companies and the Victorian Government in various forms of economic development of this coal deposit continued through to 1910, by which time the feasibility of long distance transmission of electricity demonstrated the potential for this coal to be a prime energy source for the State. From 1916 to 1918, various professional and government appointed committees recommended that the Morwell Coal Field be mined for fuel supply to a power station to be built adjacent to this new mine.

In June 1918, the Premier committed the Government to the inauguration of a State Enterprise to develop and utilise the brown coal resources of the State. In December 1918, an Australian Mining consultant, Lindsay Clark, commissioned by the Minister of Public Works, submitted a report on the procedure and cost of coal winning from a specified one square mile site south of the Latrobe River, a site chosen in 1917 by the State Brown Coal Advisory Committee evidently on the technical advice of its chairman Hyman Herman. Subsequently, the State Government appointed Electricity Commissioners in November 1919 who recommended inter alia the opening of the Morwell (later to be called Yallourn) Brown Coal Field.

Lindsay Clark was appointed by the Commissioners in October 1919 as Consulting Mining Engineer on a part time basis. It was to the mine plan and subsequent plant installation using available British and American open pit mining equipment as directed by Lindsay Clark that the SECV, established in January 1921, operated the mine as an open cut.[250]

The mine was named Yallourn Open Cut. Initially horse drawn scoops and skips were used, then steam shovels and locos until conveyors for overburden disposal and ropeways for coal haulage were introduced by June 1922. Lindsay Clark's engagement as Consulting Engineer was terminated on 30 June 1924, after which all mine planning and plant specification was carried out by SECV staff. Equipment as used in the German brown coal open cuts had become available and was progressively installed as coal demand expanded to supply additional power station and briquette manufacture installations. An electric rail system for both overburden and coal haulage was introduced by 1927 replacing conveyor and rope haulage systems. Three ladder dredgers of German design and manufacture were installed from 1928 to 1931.[251]

In 1936, recommendations were made for the establishment of a new open cut to provide the extra coal winning capacity for a new power station and greater reliability against flood, fire and earth movements. However, action on these proposals was deferred by the higher priority for fund allocation to defence and the availability for some additional security of coal supply by reactivating Yallourn North Open Cut.

Some additional excavating capacity was provided from shovel and dragline plant in the 1930s to 1940s, until purchase of equipment from Germany was again available in the 1950s. The first Bucket Wheel dredger (SECV Number Three Dredger) came into service in November 1950. From 1955 to 1985, six other dredgers came into service in Yallourn Open Cut as older small capacity excavators were phased out.[252] The progressive commissioning of a four unit 1,450 megawatt power station, Yallourn W, from 1973 to 1981 necessitated significant upgrading of YOC overburden and coal excavation and delivery plant.

Conveyor systems replaced train haulage systems progressively from 1962, rail systems being fully phased out within the open cut by 1984. The interconnecting railway between Yallourn and Morwell Open Cuts reverted to a delivery system to Morwell only from 1985 and retained this one way delivery until 2003. Road transport of briquetting coal was then used with sourcing of briquetting coal also from Loy Yang Open Cut (or from Morwell Open Cut as a less acceptable option for briquetting quality).

Major relocations of plant systems had occurred over the years as operations swung southwards, then westwards and then northwards, eventually excavating the area previously occupied by the Yallourn Township which from the 1940s had over 5,000 inhabitants. At 2004, all excavation was in the East Field, an extension to the east of the initial open cut workings. Earthworks were under way for an extension of the East Field further east and to the south by a westward deviation of the Morwell River via an embankment to be built through the earlier open cut operational area. It was planned that four trunk conveyors from the mine extension would be placed in tunnels through this embankment and under the Morwell River deviation. This deviation opened up access to a further readily minable coal reserve. At 2004, only two dredgers (numbers 12 and 13) were retained in service, predominantly for overburden excavation, the coal excavation process being in course of change to downhill dozing to mobile crusher/loader (feeder/breaker) plant loading conveyors on two or more levels. Each feeder/breaker was envisaged to have a throughput capacity of up to 3,000 tons of coal per hour. This revised excavation mode phased out the coal selection procedures employed from the late 1920s to identify sand seams 'woody' coal, high moisture coal and dark lithotype coal and to selectively dig, store and blend such coal to avoid its delivery to the briquette factories.[253]

Output from the open cut increased progressively from 1924 reaching an annual output in 1981–82 of 22.275 million tonnes.[254] Demand then decreased as units of the Yallourn Power Station were retired and as briquetting coal deliveries to Morwell decreased as demand for briquettes declined. Output in the year ending December 2002 was 17.276 million tonnes.[255] Total output from commencement in 1924 to December 2003 was of the order of 840 million tonnes.

7.10 Morwell Open Cut

The concept of opening a new open cut, as recommended by German consultants in 1936, was advanced by investigations and reports from 1942 to 1945. These strongly recommended Maryvale South immediately to the south of the township of Morwell as the preferred site for a new open cut to supply coal to a briquette manufacturing works and integrated power station at Morwell. An interconnecting rail line between the Morwell and Yallourn Open Cuts was included in the project. Reservation of a large coal resource at Loy Yang for future power generation was also a key component of the recommendations.[256]

The Maryvale South (Morwell) Project was approved by the State Government on 13 July 1948. Site works in the Morwell Open Cut commenced on 11 April 1949. However an economic recession from 1951 to 1954 restricted funds and delayed plant procurement such that coal excavation did not commence until November 1955, initial coal supply being to the Yallourn Power Station.

Initially, the open cut was designed to use rail transport for overburden and coal removal. However decisions to supply coal from this open cut to a 1200 megawatt power station to be built at Hazelwood involving about four times the coal output capacity of the Morwell Open Cut at that time lead to a major review of the open cut plan and a conversion to conveyor haulage within the open cut. The Hazelwood Power station was subsequently extended to a 1600 megawatt installation, the extra coal demand on Morwell Open Cut being partly offset by decisions to continue supply to the Morwell Briquette Works with low ash coal from Yallourn Open Cut.[257]

Excavation was carried out by the following dredgers:

Number 21 Bucketwheel	1956 to1992 now maintained as historical plant
Number 20 Bucketchain	1957 to1970 now dismantled and sold
Number 3 Bucketwheel	1959 to 1982 now dismantled and sold
Number 19 Bucketchain	1961 to1990 now dismantled and sold
Number 9 Bucketwheel	1964 and continuing

Number 10 Bucketwheel	1970 and continuing
Number 11 Bucketwheel	1971 and continuing
Number 24 Bucketwheel	1987 and continuing but available for sale
Number 25 Bucketwheel	1990 and continuing

Number 3 dredger had been built at Yallourn in 1951, transferred to Morwell in 1959 and returned to Yallourn in August 1982. The Number 24 Dredger had been built at Yallourn in 1984 and transferred to Morwell in June 1987.[258]

Morwell Open Cut was excavated to the base of the Morwell Number One seam, underlain by about 10–15 metres of soft clays and sands above the Number Two seam. The Number One seam was overlain by about 10–15 metres of soft clays with occasional silicified boulders of up to three cubic metres. At the northwest of the excavation, the edge of the Yallourn seam coal was mined as a separate small operation separated from the top of the Morwell seam by about five to ten metres of clays. The main excavation was carried out on up to 8 levels eventually with conveyor transport on four levels and each dredger planned to excavate on top and bottom sides of a face conveyor. Thickness of the coal seam was about 130 to150 metres. The coal to overburden ratio as mined was about three and a half to one. Special attention was required to evaluate and minimise the effect of earth movement, to control aquifer pressures from aquifers under each coal seam by a managed pumping program, and to the selection and blending of coal to contend with areas of higher fouling coal.

Major changes in haulage systems were necessary to move excavation from the initial East Field into the Northwest Field, then into the Southeast Field and the present movement into the West Field. Major deviations of the Morwell River and relocation of highways to Thorpdale and to Yinnar had been necessary.

On 4 February 2004, the first deliveries of coal from the Morwell Open Cut West Field occurred. Installation and commissioning of a blend of new and reconditioned conveyor equipment had been achieved while meeting full demand from the Hazelwood and Morwell power Stations. Transfer of operations from lower operating levels in the South West Field was planned for oncoming years with coal supply to be from three conveyor systems in the West Field. Coal from the West Field was expected to meet demand from Hazelwood Power Station for 25 years.[259] The coal to overburden ratio in the West Field is assessed as 4.5 to one compared with 3.8 to one in the existing Southeast Field. The coal seam to be mined in the West Field is up to 130 metres thick compared with about 90 metres in the Southeast Field.[260]

Coal excavation reached one million tons in 1960, ten million tons in 1968, peaking at 16.024 million tonnes in the 1976/77 year. Annual output fell progressively to 14.120 million tonnes in the 1992/93 year followed by highly significant fall in coal demand from Hazelwood Power Station from 1994 as Loy Yang Power Units came on stream at a higher electricity system scheduling basis. At 30 June 1995, total coal output from the Morwell Open Cut from 1956 was 400 million tonnes.[261]

In December 1994, the SECV was disaggregated, the public authority taking control of Morwell Open Cut and Hazelwood power Station becoming Generation Victoria and then Hazelwood Power Corporation. This latter entity was sold by the Government in August 1995 to a private consortium, then passed through changes in share ownership until at December 2005, International Power Hazelwood (IPRH) was the managing entity.

Over several years from 1996, as Hazelwood Power Station was restored to eight operating units, Morwell Open Cut commenced internal dumping of overburden. The long term plan of moving operations to a West Field was implemented as the existing operational multi level benches were worked out, with dredger operation in the West field commencing in February 2004. Government approval was granted in August 2005 for all matters associated with deviation of the Morwell River and two tributary creeks, for highway deviations, for environmental management and for mining of a coal reserve expected to suffice for 25 years. At December 2005, lifetime output from Morwell Open Cut totalled approximately 570 million tonnes. A record output of 19.77 million tonnes occurred in the year 2001.

7.11 Loy Yang Open Cut

In October 1945, the Premier, on advice of the SECV, stated that in addition to a new open cut and briquette factory at Morwell being under consideration, establishment of a power station and another open cut in the vicinity of Traralgon may be necessary. However as noted in Section 7.10 above, the utilisation of the coal from Morwell Open Cut was diverted to power generation as the Hazelwood Power Station was progressively brought into service through the 1960s.

From the early 1960s, detailed concepts for a new open cut located south of Traralgon at Loy Yang were developed by the SECV after extensive drilling and coal evaluation had occurred. However incremental increases in power generation capacity were obtained by natural gas fired plant at Newport and Jeeralang and by the Yallourn W brown coal fired plant at Yallourn. On 23 November 1976, legislation was passed for the Loy Yang Project as a 4000 megawatt plant fuelled from an adjacent open cut. Site works commenced on 15 February 1977.

Removal of top soil and preparatory earth moving for roads and drainage and removal of 2.570 million cubic metres of overburden took place by contract until the first dredger, number 14, commenced commissioning with overburden excavation on 29 July 1982. The official date for completion of number 14 Dredger commissioning and for commencement of open cut operations was 1 October 1982. The first coal deliveries took place on 6 July 1983 for test runs of the coal conveyor systems. Initial combustion tests in Loy Yang Power Station commenced in February 1984.[262] Commercial operation of the first 400 megwatt units officially commenced on 30 June 1984.

Number 15 dredger (D15) came into service in the open cut on 16 February 1984 in time for combustion testing in the Power Station. The D15 was then used predominantly for overburden excavation and D14 for coal winning.[263] Coal quality was a problem initially as several million tonnes of weathered coal and high ash coal from burn holes in the cal surface were delivered to the power station rather than being disposed of as waste.[264] All excavation was carried out by dredger, the configuration of three conveyors on each dredger including a telescopic intermediate conveyor and separately crawler mounted discharge boom having flexibility for three bench operation to a movable face conveyor.

For the 1986/87 year, coal output reached 10.782 million tonnes, with a record monthly output in March 1987 of 1.314 million tonnes and three units of the power station in service.[265]

Number 16 dredger (D16) commenced excavation testing in the open cut on 30 October 1987. After a protracted period of intermittent operation while the contractor rectified faults and attended to contract obligations, the D16 was taken over for commercial operation on 8 March 1988.[266]

A second overburden disposal system was commissioned on 25 January 1991. This plant consisted of a tripper/stacker straddling a new dump conveyor fed by a new overburden trunk conveyor. This plant duplicated the initial overburden system and provided for two dredgers simultaneously outloading overburden, interseam or inferior coal.

The number 27 dredger (D27) commenced excavation testing in the open cut on 19 May 1992. The D27 went into normal operation on 1 June 1992. The early planning for the Loy Yang mine had been based on a four dredger complex, all of the same configuration and capacity of about 3,750 tonnes of coal per hour and providing for ready interchange and flexibility. However, as early as 1982, electricity demand forecasts were lower than the forecasts of the mid-1970s, resulting in a delay program being developed for Loy Yang Power units after unit. Decisions were made to achieve economies by providing D27 as a 'compact' excavator at smaller capacity and size to the other three dredgers while leaving open the option of providing for another 'compact' machine and a fifth conveyor route if power station units 7 and 8 were approved. The D27 proved to be an effective addition to the dredger fleet at Loy Yang.

In December 1992, a pulverised dried brown coal plant came into service with a contract to supply pulverised dried coal to Loy Yang B power station for auxiliary firing (start up and flame stabilisation). The plant had a 150,000 tonnes per year output capacity of dried coal at about 15 per cent moisture content and provided a potential for further coal conversion processes.

Coal output increased progressively as the six 500 megawatt units of Loy Yang Power Station came on stream. The sixth unit at Loy Yang reached first steam to turbine on 4 December 1995 and was handed over for full time operation on 30 September 1996.[267]Coal output in the year ending 30 June 1997 was 27.808 million tonnes.[268]

Subsequently, coal output rose progressively to 30.655 million tonnes in 1998 to the present yearly record of 30.747 million tonnes in the year 1999. Subsequently, as the six Loy Yang units competed to meet electricity demand in the more highly interconnected interstate transmission systems, generation from Loy Yang decreased partly due to plant overhauls and maintenance and coal output fell correspondingly to 28.750 million tonnes in the 2003 year.[269]

Quality control of coal deliveries to the power stations required assiduous attention contending with high sodium coal, over-burden contamination, burnholes with high ash, interseam intrusions, and moisture content variations (partly from Yallourn Seam coal in the north of the mine).

Controlled depressurising of aquifer water was an essential feature of the mining operation to balance uplift forces on the coal seam. Dirty water control and treatment was assiduously applied to meet environmental obligations.

At 2000, '[the] mine is about half the length it is planned to be and is progressively extending to the north. We have about 250 metres to go north before the Dredger 16/conveyor L100 operation face reaches full length and about three to four kilometres (eastwards) to reach our eastern boundary. The mine will continue to develop the base to full depth, a further 30–35 metres (it is currently 150 metres deep).'[270] The mine will then be about 58 metres below sea level. At December 2002, the mine was 160 metres deep, (66 metres below sea level), and covered 245 hectares. Twenty two kilometres of conveyors were in service.[271]

In November 2003, the Hyland Highway south of Traralgon was deviated along a four and a half kilometre length to provide for imminent extension eastwards of the mine. This deviation freed up mine expansion options to the east and south.

Total coal output from the Loy Yang mine to 31 December 2005 was about 470 million tonnes. Forward annual budgets showed an expected annual coal demand at about 32 million tonnes to be met on a continuing basis with existing excavation plant at a supply reliability of over 99.8 per cent.

7.12 Gelliondale Open Cut

The existence of close-to-the-surface brown coal deposits on the South Gippsland coastal flat lands from Toora to Yarram had been known since the late 1800s. (Some reports refer to this deposit or area as Hedley, which is the adjoining railway station to the west of the Gelliondale Station.) Drilling by the Mines Department, particularly in the period 1918 to 1921, had indicated the area from Gelliondale westwards to Hedley as potentially suitable for an open cut operation with soft overburden and an overburden to coal ratio of less than one. 'The Gelliondale Seam, typically 50 metres or more thick but split in places to form the Gelliondale A and B seams, has properties similar to those of the Yallourn Seam in the Yallourn area' although ash content is significantly higher at about six per cent compared with run of mine two per cent at Yallourn.[272]

In 1923, an open cut was commenced on the Gelliondale Brown Coal Deposits about three kilometres south west of the Gelliondale station on the South Gippsland Railway. Mining of the deposit was expected to have to contend with sub-artesian and interseam water.

A small briquetting plant was placed into service circa 1924 but was not successful technically or commercially. A photo of the mine is shown in Thomas & Baragwanath (1950), p.16. A total output of 13,940 tons of coal was recorded until December 1950.[273] (It is probable that the output to 1950 was higher than in these Mines Department official records as quoted in Herman 1952.) Gloe (1948), p. 99, states that the Gelliondale Open Cut was operating intermittently sometime in the period 1941 to 1955. No further excavation occurred from this area from then onwards.

Nevertheless, the potential opportunity for development of the 'ready recoverable' economic reserves at the Gelliondale lease (estimated as 1,050 million tonnes economically recoverable coal in 1982),[274] had come under consideration in government and private investigations. These investigations included the Brown Coal Advisory Committee of 1917 which recommended a Yallourn Development; the John Bridge (SECV) reports of the early 1940s which recommended a Morwell Development followed by a Loy Yang Development; and the SECV reports of the 1980s which recommended a Driffield Development. A

mining lease area of the Gelliondale deposits passed through several hands from the 1920s. At 1984, the leaseholders were ARCO Australia Ltd.[275]

Keen interest by groups contemplating coal to oil conversion processes was evident during the 1970s in particular. The Government had indicated the availability of the Gelliondale resource to private ventures rather than preserving for the State its potential for power generation by the SECV.

7.13 Won Wron Open Cut

A deposit of brown coal north of Yarram, at what is now Won Wron, was reported in 1876, being the most easterly brown coal deposit found in Victoria at that time. Mines Department reports in 1892, 1899 and 1902 refer to further discoveries in the Won Wron area, the most definitive being by Stirling J (1899).[276] Shallow shafts were sunk into the Won Wron deposit in 1892.

Drilling to define the Won Wron deposit took place between 1922 and 1929. Brown Coal at one location was 140 feet thick under eight feet of overburden.[277] However, the drilling showed the local deposit to be quite small with total reserves of about two million tons.[278]

In 1927, an open cut was commenced at Won Wron about 14 kilometres north of Yarram by the Won Wron Brown Coal Pty Ltd. This operation is depicted and described in Knight, J (1957).[279] Total output and destination of the coal supplies have not been ascertained in this study. It is conjectured that the open cut operated for only a few years and its output was less than 50,000 tons.

8 Coal Mining in Victoria at 2005

At March 2005, there was no mining for black coal proceeding in Victoria. There were no highly significant black coal resources suitable for economic mining ventures, although there were localities in Gippsland where black coal in thin seams was known to exist or where mining had ceased leaving unmined reserves. It appeared that resurgence of black coal mining in Victoria was an unlikely investment area for private entrepreneurs or a likely area for priority of economic support from Government.

At 2005, private industry was operating brown coal open cuts at Anglesea, at Maddingley Number Two, at Yallourn, at Morwell and at Loy Yang. Substantial economically winnable reserves of brown coal have been identified in the Latrobe Valley and in eastern Gippsland although a significant portion of the most economic deposits have been deleted from potential mining development by planning for township and industrial site expansion, by environment preservation assessments and by associated buffer zones.

Additional knowledge of extensive brown coal deposits in north western Victoria generally at greater depth than in Latrobe Valley deposits has been acquired through a surge in drilling for minerals, gas and water from the 1970s. A greater understanding of the brown coal deposits and identification of specific 'mining fields' has also been achieved in the Gelliondale to Foster, Boodyarn, Alberton and Stradbroke areas of south west Gippsland.

Largescale new ventures in the utilisation of the brown coal deposits of Victoria have not developed beyond laboratory or pilot plant stage since the 1980s. From that time, significant research on modified techniques to reduce greenhouse gas emissions from combustion of brown coal has been proceeding. One group prominent in this research is the Co-operative Research Centre for Clean Power from Lignite, a joint venture between government and private industry. The outcome of such research is likely to be the main influence on the extent of brown coal mining in Victoria for several decades. The availability and economic competitiveness of natural gas may also continue to defer expansion of electricity generation from brown coal as well as offering an alternative to its industrial use for steam raising.

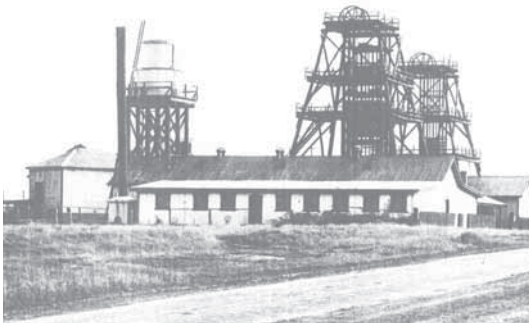
In 2002, the State Government called tenders for exploration licences over brown coal deposits in four areas in the Latrobe Valley covering 764 square kilometres in the Driffield/Narracan and Flynn/Gormandale areas. Three companies, Loy Yang Power, HRL Ltd, and Australian Power and Energy Ltd. (APEL), were selected from 12 applicants with sole rights for exploration and mining licence application over specified areas. This concept was intended to provide greater certainty on the access to identified brown coal deposits to the selected companies in their investigation of the viability of proposed new coal combustion or processing technology.[280]

In January 2004, a fire in the Morwell Briquette Works destroyed some plant and reduced briquette manufacture by about 50 per cent. At December 2005 only partial restoration of the Briquetting Plant capacity had been adopted, mainly to continue briquette supply as a start up and flame stability fuel at Loy Yang A and Hazelwood Power Stations, and to the Morwell Char Plant. Final closure of the Morwell Briquette Works has been deferred by this partial restoration. Hazelwood, Morwell and Loy Yang A power stations, all of which used briquettes as a re-start fuel, tested options for alternative fuel blends including black coal, to achieve optimum re-start reliability and economy. Other industrial users of briquettes such as Australian Char at Morwell were also considering their options.[281]

The Anglesea Open Cut was continuing to operate at about 1.1 million tonnes annual output with adequate reserves for at least 25 years for its dedicated supply to Alcoa.

The Maddingley Number Two Open Cut currently in intermittent use for low quantity supply for soil conditioning and process testing remains available for reactivation in the short term.

Coal Mine Sites Identification



1 Definitions

Imperial/Metric Measurements and Quantities

In this Coal Heritage Study, measurements and quantities have been stated in imperial notation, i.e. inches, feet, chains, miles, acres, tons, etc. with respect to exploration and mining activities through to the mid 1970s. From that time, usage of metric parameters was legislated by the Commonwealth Government and became prevalent in recorded documentation. For some specific activities continuing post the mid 1970s metric notation has been used when quoted directly from sourced documentation. Where activities pre- and post- the mid 1970s are tabulated or compared, conversion of imperial notation to metric has generally been adopted.

Brown Coal/Lignite Nomenclature

'Until 1889, (the year of commencement of the *Royal Commission on Coal* in Victoria), all the Tertiary (era) coals of Victoria were classed as lignite[1].' In 1889, RAF Murray, Mines Department Geologist, had noted that the term 'brown coal' could be widely applied across the distinct woody structure of lignite through to deposits in which the woody structure is largely obliterated.[2]

'In the USA, the term 'brown coal' is applied to the unconsolidated type of lignitic coal as differentiated from true lignite which is consolidated due to deeper burial and folding'. 'In Germany and neighbouring countries in Europe all coals of Tertiary age are designated as brown coals – this classification includes common brown coal, earthy brown coal and lignite.' Thomas and Baragwanath (1949) state 'The variability of Victorian brown coal in colour, texture, degree of consolidation, water, ash, and sulphur content is great and the view has been adopted that the Tertiary coals of Victoria are better included in the general term 'brown coal'.'[3]

The broad terminology 'brown coal' has been adopted for this Coal Mining Heritage Study although the term 'lignite' has been used in general for pre-1890 activities. In some cases the terminology 'lignite' has been used in post 1889 activities where this usage is quoted directly from published documentation.

In this Coal Mining Heritage Study, no conscious attempt has been made to distinguish between the terminology 'lignite' and the more general terminology 'brown coal' on the basis of coal quality parameters.

Black Coal Nomenclature

The nomenclature 'black coal' has been used in this Coal Heritage Study for all coals of higher calorific value than that classified as lignite within the American ASTM (1979) classification system i.e with Net Wet Specific Energy greater than 19.3 MJ/kg.[4]

2 South West Gippsland Early Black Coal Mines

Drawing 2.1/1 Map of Coal streams on shore line in the Cape Paterson Area. Copyright State of Victoria, Department of Primary Industries.

Photo 2.1/1 Outloading area on beach at Cape Paterson where whale boats were loaded with coal in 1860s. (from J Coglan, *The Early History of South Gippsland Coal from 1826–1909*)

2.1 Cape Paterson Black Coal – Early Scattered Discoveries

Map Reference: **8020-4-3 Cape Paterson, at Hovell Monument 3764 57201**

Municipality: **Shire of Bass Coast**

Land Use/Status: **Mainly private**

Site History

In December 1826, William Hovell, on an exploration mission from the military settlement at Red Point (near the present township of Corinella) on Western Port as instructed by the camp commander, Captain Samuel Wright, found thin black coal seams exposed on the shore of Bass Strait at the west of Cape Paterson.[5] (Cape Paterson had been named by Lieutenant Grant in 1801 in honour of Lt. Colonel William Paterson, second in command of the Botany Bay (Sydney) battalion.) These seams were in later years rediscovered and subsequently named the Queen and the Rock seams.

Hovell took samples of the coal which were then dispatched in December 1826 from the Western Port settlement in a vessel in the charge of Captain Weatherall to Governor Darling in Sydney. No further history of this sample has been traced. This was probably the first 'mining' of coal in what was later called the Colony of Victoria.

In 1837, about two years after the first settlement on the Yarra River, Samuel Anderson and Robert Massie, occupants of land near the present township of Bass on Western Port since September 1835, rediscovered the coal seams originally discovered by Hovell. In early 1838, they told Captain Lonsdale, the initial Commandant of the Melbourne District from 1 October 1836, of the existence of abundant coal in the South West Gippsland area and asked permission to extract coal from this area. No official reply to this request has been traced.[6]

In mid 1839, Charles La Trobe, recently appointed Superintendent of the Melbourne District, 'instructed Captain Moore and Robert Hoddle to carry out a survey of coal deposits along the southern coastline'. Their search was largely unsuccessful although on the shoreline at Western Port, south of the Bass River, they found a thin seam of coal. They did not investigate further east due to refusal of the local land occupiers to disclose the locations of their continuing coal finds.[7] Perhaps stimulated by this refusal, La Trobe with Captain Lonsdale visited Anderson and Massie at the Bass River and elicited information and inspected coal finds known to them at that time. Anderson and Massie again requested permission to mine coal from the South West Gippsland area. Instead, La Trobe encouraged H. Cameron to inspect and report on the coal seams in the area. After an inspection and report by Cameron, a company was formed which in late 1841 appointed William Watson to commence a mining operation in the known coal seams near Cape Paterson.[8] However in October 1841 although a small mining operation commenced with Watson and two miners, problems arose with Aborigines in the area, the mining crew withdrew and the mine closed down without excavating any coal.[9]

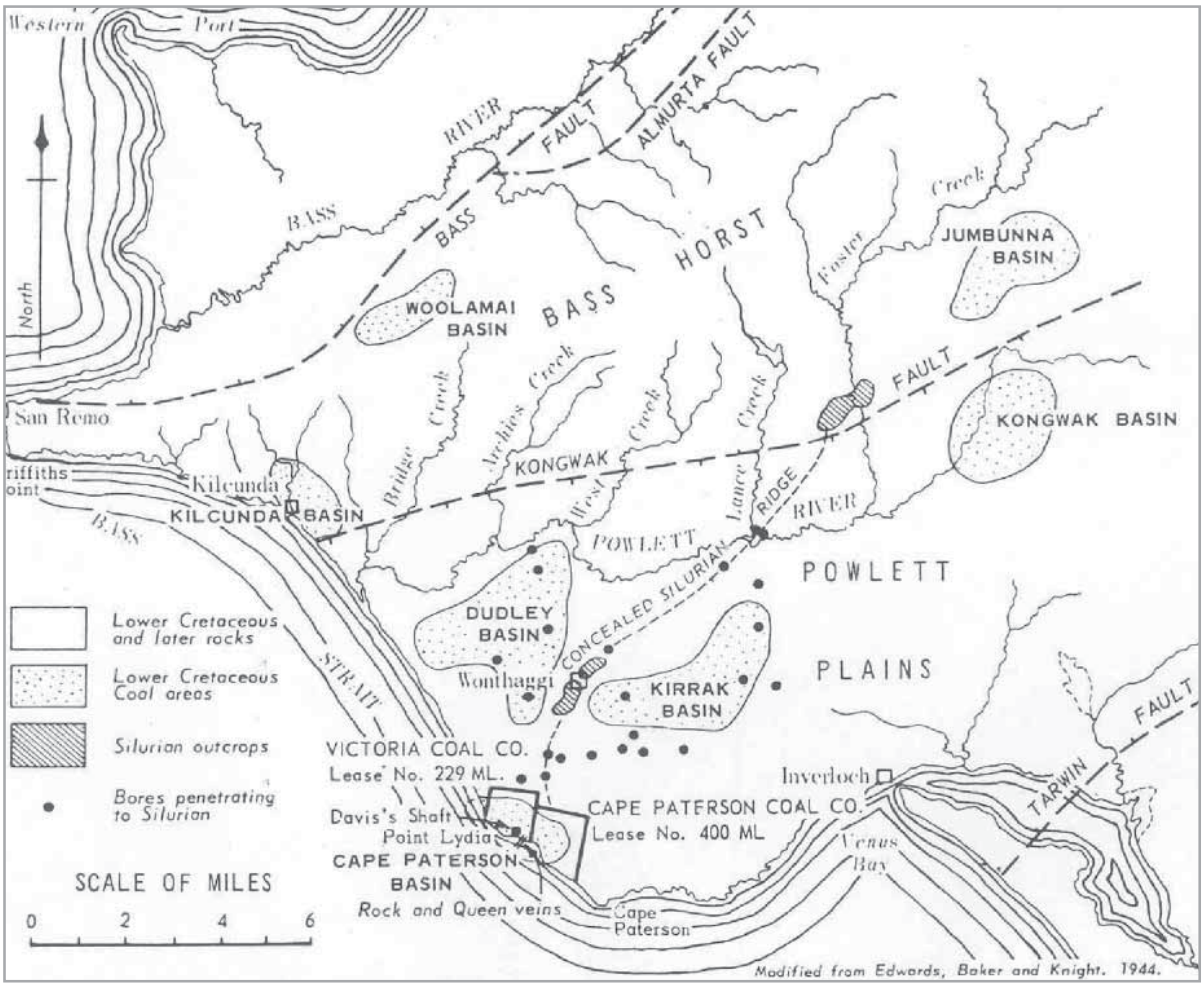
In 1840, Captain Cole mined a few tonnes of coal from the cliffs between San Remo and Kilcunda and sent it to Melbourne for appraisal.[10]

About 1843/4 Richard Davis had carried a sack of coal from the beach at Coal Creek about 2.2 miles north west of Cape Paterson to La Trobe in Melbourne. This was some nine years previous to the proclamation of the availability of a reward of £1000 for discovery of a workable black coal field within the Colony of Victoria.11 Davis subsequently received £400 from the Government.[12]

In 1847, the Cape Patterson Coal Proprietary Association was formed to bore and mine coal[13] but no production eventuated. This venture was probably that shown on Drawing 2.1/1 as Lease Number 400 ML to the Cape Paterson Coal Company located just to the east of the Queen and Rock Seams outcrops.

In 1853, when Crown land was sold in the Cape Paterson to Griffiths Point area, many allotments were marked as 'to search for coal' indicating the Government awareness of the undeveloped coal resource in this area.

In 1858, Richard Davis sank a shaft 85 feet deep about 460 feet inland from coal seam outcrops on the shoreline at Cape Paterson. This shaft intersected the Queen and Rock

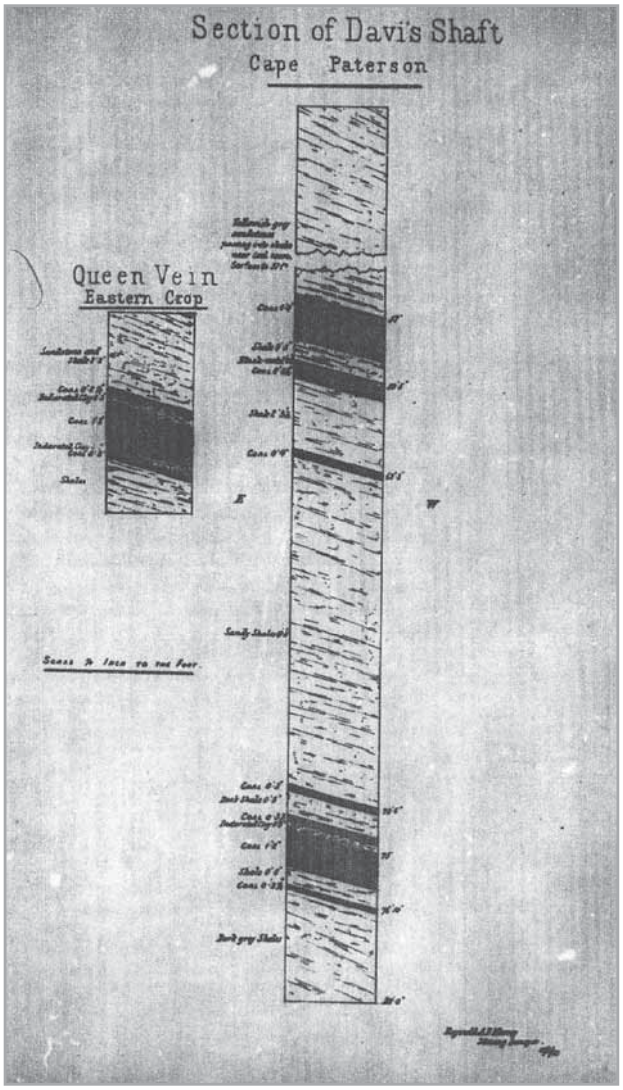


Drawing 2.1/2 Locality Map of Powlett River and Cape Paterson coal fields. (from Knight, JL (1970)). Copyright State of Victoria, Department of Primary Industries.

coal seams. (See Drawing 2.1/3 showing a section through the Davis shaft.) He was subsequently paid a small bonus of £110 from the Government for this effort. This shaft was deepened in 1864 by Thomas Bury, lessee of land surrounding the shaft. Bury's investigations continued to 1867 but evidence of a third seam was inconclusive and not accepted by the Mines Department. Bores installed in the lease area indicated that the seams may decrease in thickness inland from the shore and may also be subject to faulting and intrusions.[14] At 1869, the Queen Seam was assessed as from 3 feet 6 inches to four feet in thickness; and the Rock Seam as about 3 feet 6 inches at their respective outcrops.[15]

In 1858, Alfred Selwyn, Government geologist, found coal when boring by hand about 5 miles north of Cape Paterson[16] indicating the possibility of a widespread occurrence of coal in the area. This location (now the Wonthaggi Golf Course) on the northern outskirts of the present township of Wonthaggi was later mined by the State Coal Mine from 1910.

Photo 2.1/2 Remains of Victorian Coal Company mine at Cape Paterson (from A. Quilford, *The State Mine*, 1977).



Drawing 2.1/3 Section through the Davis Shaft near Cape Paterson (from Geological Survey Progress Report Number 3, 1876).

The Victorian Coal Company operated at Cape Paterson from 1859 to 1864 on Mineral Lease No 756 (as stated by Knight 1951, p.40), (probably also on Mineral Lease No 229 as depicted in Drawing 2.1/3). The location of the Victorian Coal Company shaft was about one mile south east of Davis' shaft and about one mile north west of Cape Paterson.[17] This company raised about 2000 tons of coal which was delivered to Melbourne. Initially 'the coal was taken from the pithead to the beach by bullock team, loaded into whale boats and transhipped into larger boats anchored in deep water off the Cape'. The mining operations were confined to a strip of land close to the beach. A tramway was subsequently laid from the mine to the loading point at shore. However the VCC could not obtain insurance cover at reasonable rates, found the coal seam thinner than expected and ceased mining in 1864. The leases were retained by the original lessee until 1907.[18] In 1866/67, this company sank two further bores to 400 feet on their lease area without intersecting coal.[19] This company was the first to achieve a commercial output of black coal in the Colony of Victoria.

(The Western Port Coal Company was formed in 1865 to work a seam of coal at Kilcunda. From this time black coal mining ventures spread further afield from Cape Paterson. These other locations are reported elsewhere in this study.)

At 1864, there were four leases of land granted for coal mining purposes and over 30 licences issued for coal searching between Cape Paterson and Griffiths Point.[20]

On a lease block near Cape Paterson and west of Coal Creek, the lessees at 1864 had sunk a shaft 100 feet deep and had installed 'a horse whim, poppet heads, a windlass and iron buckets'. However it was reported that only 6 to 10 tons of coal were raised previous to 1864 and none in 1864 or in 1865.[21]

Mines Department Statistics show a total quantity of 1933 tons of coal had been raised by all lessees at Cape Paterson by 31 December 1864.[22]

By 1865 coal mining interest turned westwards to the San Remo area and much later to the Kilcunda area and the Powlett River flats.

Photo. 2.1/3 Old rails at the Coal Outloading Point at Cape Paterson (from A. Quilford, *The State Mine*, 1977).

Assessment of Heritage Significance

Historical Significance

The black coal seams at Cape Paterson were found prior to the occurrence of a permanent civilian settlement at the potential ports on the south east coast of mainland Australia. Successful commercial development of black coal resources at the north and south of Sydney had been readily achieved. By 1851, at the establishment of Victoria as a separate colony from NSW, the known black coal seams at Cape Paterson and further finds in the area westwards to Western Port Bay presented anticipation of Victorian independence from NSW coal supplies.

Discovery of gold in Victoria through the 1850s diverted labour and investment to gold exploration and mining and diverted investment away from exploration and mining of coal.

Nevertheless, the Victorian Coal Company from 1859 to 1864 at Cape Paterson, as the first black coal mining operation in Victoria to reach a commercial output, indicated that supply of coal to the Melbourne market was potentially feasible from the Cape Paterson to Griffiths Point coal seams. This company struggled with the difficulties and costs of overland and shipping transport demonstrating the need for government support in the provision of transport infrastructure.

Scientific Significance

Until about 1870 there was little interest in Victoria relating to utilisation of black coal other than as a fuel. From that time, other coal finds in Victoria were more economic than the thin seams at Cape Paterson. No specific scientific investigations or outcomes for coal conversion occurred with respect to Cape Paterson coal.

Economic Significance

Exploration for black coal in the Cape Paterson area was spasmodic from the 1840s with shallow hand boring and shallow shaft sinking indicating thin and broken seams with low economic prospects for commercial ventures.

In retrospect, the opportunity for interpretation of substantial black coal resources adjacent to Cape Paterson in the Powlett River flat lands was not taken up by private industry. It was not until about 1905 that extensive drilling by the Mines Department proved the Powlett Coalfield and lead to its mining by the State Coal Mine which mined this coal for nearly 60 years.

Social Significance

The quantity of black coal recovered from the embryo mining activities at Cape Paterson was insufficient to make inroads to established black coal distribution in Victoria from NSW. From the early 1950s for at least 20 years, the attention of mining entrepreneurs and potential mining explorers and mine workers was directed almost exclusively to gold. In this climate, exploration and mining in the South West Gippsland area west of Cape Paterson did not receive investment funding until about the 1880s by which time other coal fields were in competition for development investment.

Mine Infrastructure Features

Tramlines on the beach out-loading point, Cape Paterson.

Queen and Rock Seams on the beach west of Cape Paterson.

Remains of Victoria Coal Company Mine at Cape Paterson.

Monument to Hovell near the shoreline west of Cape Paterson.

References

Brough Smyth, R. 'Goldfields and Mineral Districts', Carboniferous Rocks, 1869

Coglan, John 'The Early history of South Gippsland Coal, 1826–1909', *The State Coal Mine at Wonthaggi, 1909–1968*

Horton, T and Morris, K, *The Andersons of Western Port*, Bass Valley Historical Society, 1983

Knight, JL '*The Story of Black Coal in Victoria*', *Mining and Geological Journal* Vol. 4 No. 4, 1951

Mineral Statistics, Mines Department, 1864

Royal Commission on Coal, 18 December 1891

Selwyn, A, *Cape Patterson Coal Fields*, Mines Department, 1867

Note: An 1893 depiction, attributed to James Stirling, of the Cape Paterson Coal Seams is available via the Victorian Department of Primary Industries in a map labelled as the Kilcunda Coal Fields, Parish of Woolamai, Geological Survey of Victoria.

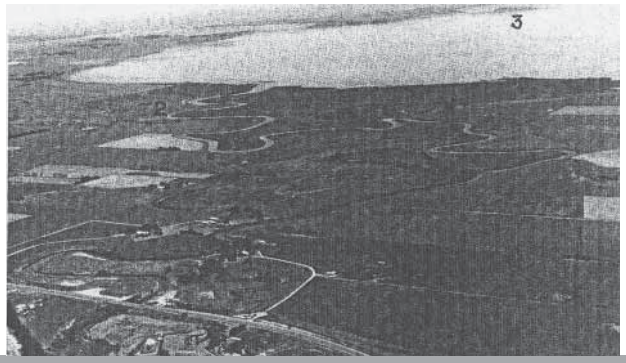


Photo. 2.2/1 Aerial View Bass River Plains (from Horton & Morris, *The Andersons of Western Port*, 1983). Copyright Bass Valley Historical Society.

2.2 Bass Region Black Coal Early Scattered Discoveries

Map Reference: **7921-2-2 Corinella**

Municipality: **Shire of Bass Coast**

Land Use/Status: **Private**

Site History

At 1867, at Corinella and at Queens Ferry, both on the eastern shore of Western Port Bay, boring and sinking of shafts had been undertaken by the Mines Department 'to test seams discovered by the Geological Survey in 1859'. 'All the evidence shows that the seams are, as was supposed, not of workable thickness.'[23] At 1867, the Corinella Coal Mining Company also (or in conjunction with the Mines Department) sank shafts and bores but did not undertake a commercial mining operation.

In 1874, a seam of coal reported to be two feet thick at its outcrop was discovered at Lang Lang located about seven miles from the proposed South Gippsland Railway.[24] In 1875, a shaft at this location was visited by RAF Murray who found four seams from 9 to 11 inches thick. Murray pronounced these seams and other Lang Lang seams as not likely to be profitable.[25] He correlated these seams with others being found in outcrops in the valleys of creeks and tributaries in the area.[26]

In 1897, the Great Victoria Colliery Company began a VicRail (VR) gauge line from Queensferry Jetty to a point near the Woolamai rail station using rails recovered from the Kilcunda to San Remo tramway. However the venture did not succeed and no coal was carried over this route to Queensferry jetty.[27]

In Progress Report Number 10, 1899, *Report on the Brown Coals and Lignites of Victoria*, Government Geologist J Stirling, reporting on the occurrence of thin coal outcrops on the Bass River about three miles east of Queensferry, classified these outcrops as brown coal. He also assessed that these beds were unlikely to exist over a wide area but were likely to be confined to separate basins. This report appears to have eliminated further speculation of the existence of economic black or brown coal seams in the Corinella/Bass onshore area.

(In the 1955 *Annual Report* of the Mines Department, a black coal mine is mentioned as being worked at Glen Forbes, a hamlet on the Bass River and some 16 kilometres south easterly of Corinella. No statistics are stated. The mine is not mentioned in earlier or subsequent Annual Reports.)

Assessment of Heritage Significance

Historical Significance

Some early writers have stated that coal outcrops were mined on the Bass River by the Anderson family, initial occupiers of land in that area from 1836, and that small quantities were used by them for domestic and foundry purposes. There was early anticipation from the 1840s that the Bass River area and the coastline plains around Corinella to Lang Lang would contain profitably minable seams of coal. Over the ensuing years, these hopes were not fulfilled.

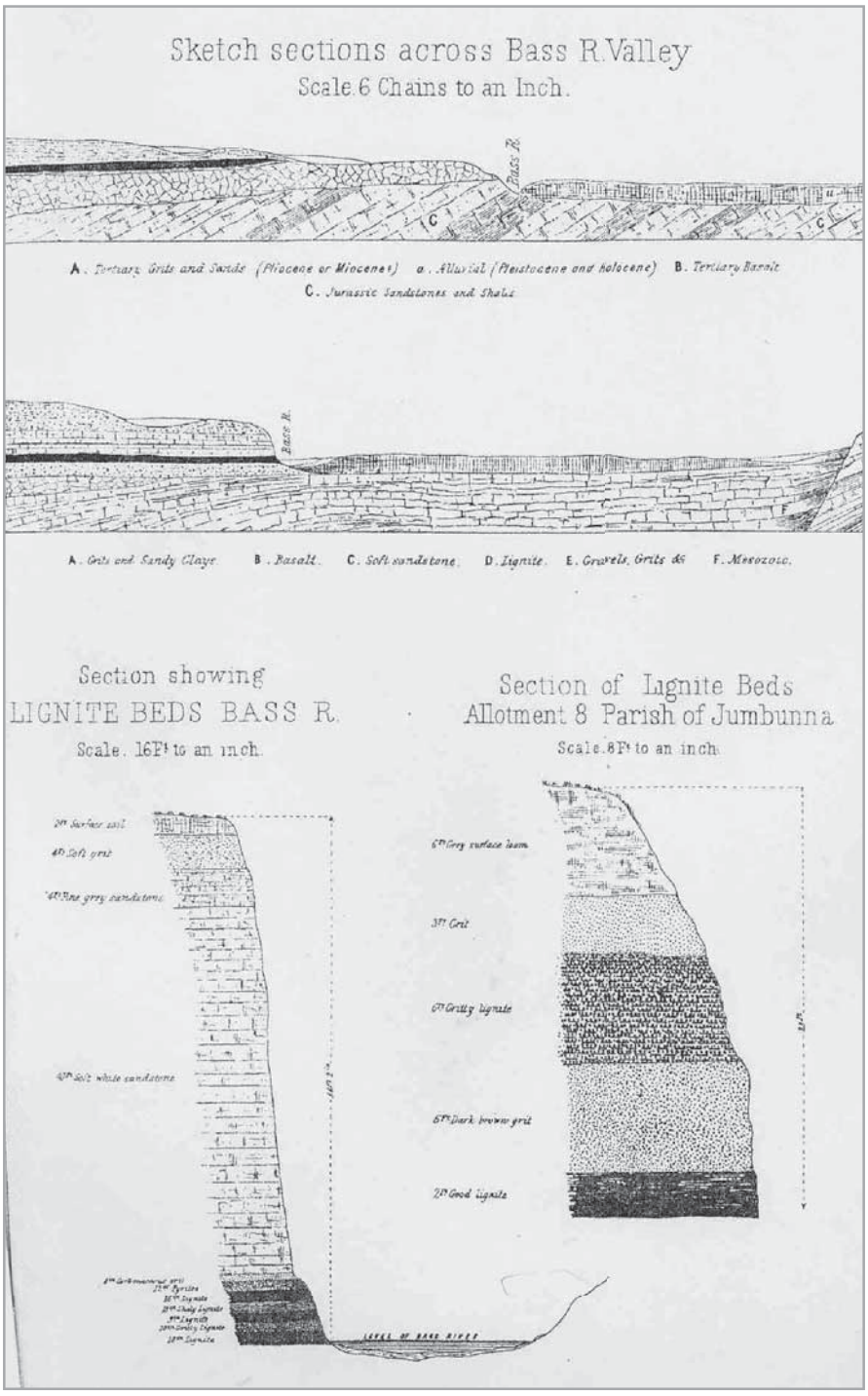
Drawing 2.2/1 shows sections of lignite beds in the Bass River Valley as depicted in 1899. By this time the coal seams in the Bass Valley had been classified as brown coal. As the sections in Drawing 2.2/1 show the seams were thin and declared to be uneconomical to mine.

Scientific Significance

No specific scientific significance is associated with the small coal resource scattered through the Corinella / Bass area. Basic analyses of samples were carried out in the mid to late 1800s but no other scientific investigations were undertaken.

Economic Significance

Hopes were high from the 1830s to about 1900 that the black coal outcrops discovered in the Corinella/Bass area indicated the possibility of economically mineable black coal seams at depth. These hopes had been somewhat offset by adverse results of drilling by 1859. However the advent of the VR rail line into the area in the 1880s improved the economic prospects of coal from the area although the seams were by then classified as brown coal. Subsequent discoveries of black coal outcrops renewed hopes from time to time but no commercial scale black coal mine eventuated.



Drawing. 2.2/1 Bass River Valley Sections of Lignite Beds (Copy of Plate Number 11, Geological Survey Progress Report No 10, 1899 by J Stirling).

Photo. 2.3.2/1 Disused Railway Bridge at Kilcunda . Photo Anne Sedgley.

Social Significance

No significant employment was associated with the spasmodic discovery and subsequent investigations of the coal seams in this area. Some landholders may have envisaged successful coal mining as being more lucrative than agricultural usage of their land but no significant investment in coal mining or introduction of skilled miners occurred to alter the social fabric of the Bass/Corinella area.

Mine Infrastructure Features

Queens Ferry Jetty Site Coal outloading site.

References

Coglan, John 'The Early History of South Gippsland Coal, 1826–1909', *The State Coal Mine at Wonthaggi*, 1909–1968

Mineral Statistics, Mines Department, 1874

Mineral Statistics, Mines Department, 1875

Murray, RAF, *Report on the Geology and Mineral Resources of South West Gippsland*, Mines Department, 1875

Selwyn, Alfred, *Report on Coal Seams, Cape Patterson*, Mines Department, 1867

2.3 Kilcunda/San Remo

Map Reference: **For Kilcunda Mines, see 7920-1-1 Kilcunda 3660, 57322**

For San Remo/Griffiths Point Mines, see 7921 Spec. Philip Island 3573, 57344

Municipality: **Shire of Bass Coast**

Land Use/Status: **Mainly Private**

Site History

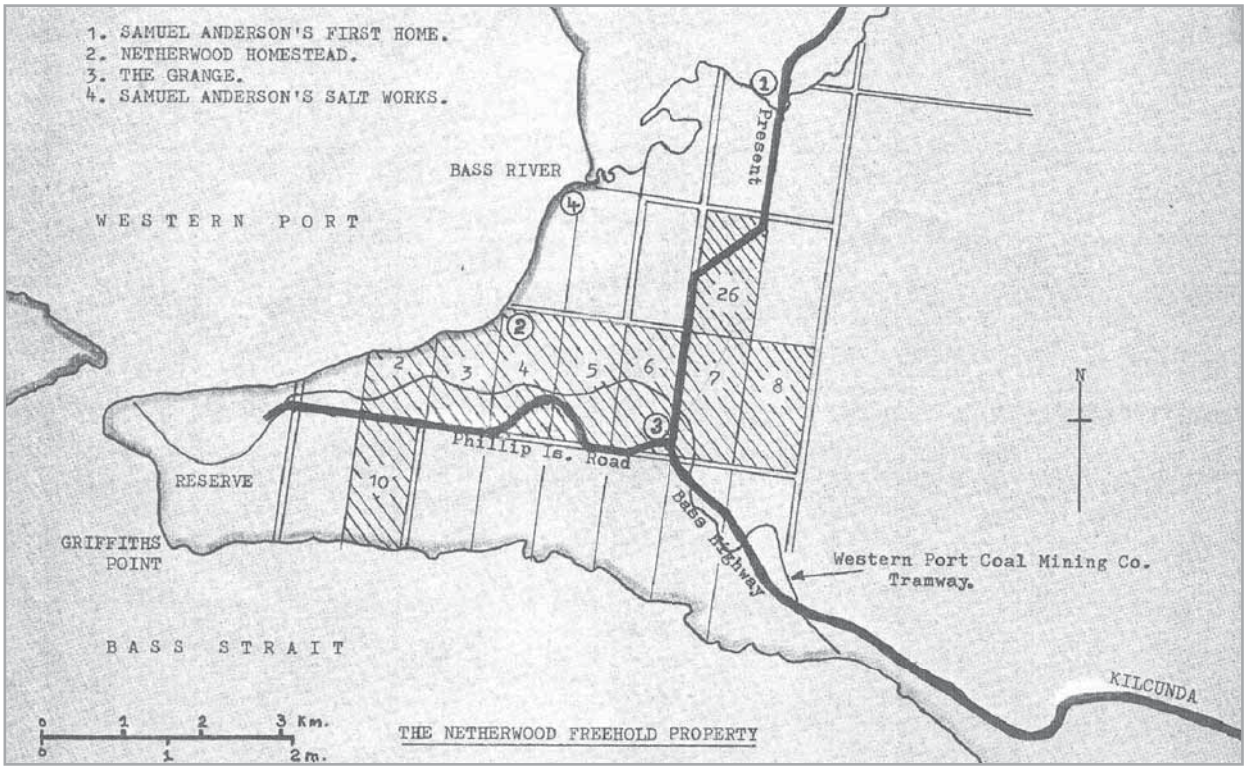
2.3.1 Initial Coal Extraction at Griffiths Point

About 1864, (J Coglan says 1867), several tons of coal were dug from a shallow pit (on Allotment 10) at about three kilometres east of Griffiths Point. (See Drawing 2.3.2/1). This embryo mining venture did not progress further 'due to the patchy and irregular character of the seam'.[28] The person involved has not been ascertained in this study. (However this find and the evidence of numerous outcrops of black coal in thin seams on the coastline from Griffiths Point to Cape Paterson drew attention to the probability that the earlier coal finds at Cape Paterson were part of a much wider occurrence of black coal in South West Gippsland.) A small mining operation at San Remo (Griffiths Point) took place in 1906 reputedly producing 220 tons.

2.3.2 The Western Port Coal Mining Company at Kilcunda, 1870–1883. Shaft at 3662, 57322; Adit at 3659, 57321

In 1870, the Western Port Coal Mining Company was formed to mine coal at Kilcunda[29] (at about six kilometres east of the present road junction of the Bass Highway and Phillip Island Road). At about 0.4 kilometres inland, a shaft was sunk to a depth of 30 metres into a seam which outcropped on the cliff face at one metre thick.[30]

Initial supply was by bullock wagons to Griffiths Point over an unmade route of about 13 km. In November 1871, construction of a private rail track was approved by Government. By 1872, a 10 tonne sample of coal was sent to Melbourne for exhibition.31 At 1873, 500 tons of coal had been mined but was stored at



Drawing. 2.3.2/1 Tramway route for coal haulage from Kilcunda to San Remo (from Horton & Morris, 1983). Copyright Bass Valley Historical Society.

the mine site awaiting completion of the rail track.[32] By 1874 a tramway using timber rails was in service. An adit and a third shaft were installed with the seam thickness being 20 to 31 inches. By early 1875, about 8,000 tons of coal had been shipped from Griffiths Point to Melbourne.[33]

In 1878, the WPCMC suspended mining operations due to financial difficulties including the non receipt of a £5000 Government Bonus for the first person to deliver 5000 tons of Victorian Coal to Melbourne. In mid 1879, the company was revived with additional capital. The mine was dewatered. The VR loaned steel rails. A small steam loco and larger wagons were brought from Tasmania.[34]

In 1883, the Western Port Coal Mining Company again ceased operations. It is reported in some references that this company had mined 15,000 tons of coal since its inception (some references state that 15,000 tons was achieved by 1877) but only 7,000 tons were recorded in the Mines Department Annual Reports.[35] The WPCMC remained in existence to at least 1895 in dispute with the VR and local landholders over the haulage route easement and other matters. The company sought the Government offer of £5,000 on several occasions. Apparently this was never paid. By 1899, all steel rails on the haulage route had been removed.[36]

2.3.3 The Kilcunda Coal Association; Kilcunda Coal Mining; [Kilcunda] Cooperative Colliery; Victoria Coal and Coke Company; Outtrim-Howitt at British Consolidated; South Gippsland Coal Company; Kilcunda Coal Mining Company

Several small mining operations at Kilcunda some bearing the Kilcunda nomenclature occurred.Their precise location and proven recorded output have not been definitively ascertained in this Coal Heritage Study. Among these were the following:

In 1873, the Kilcunda Coal Association sank a shaft but found only thin seams up to 3 inches thick. In 1874 this operation ceased.[37]

From 1908 to 1914, a venture named Kilcunda Coal Mining produced 6938 tons of coal. This mine was about one mile west of the Kilcunda township where a VR rail siding had been established in 1913.

The (Kilcunda) Co-operative Colliery Ltd. operated from 1910 to 1914 producing 4172 tons of coal.

The Outtrim-Howitt & British Consolidated Coal Mining Company purchased the Kilcunda Coal Mining Coy (Mitchell's) in 1913, closed its mining operation at Outtrim and transferred workforce and plant to an operation at Kilcunda producing about 2000 tons of coal between 1914 and 1921.

The South Gippsland Coal Company worked a tunnel operation at Kilcunda from 1921–1931 producing 78,236 tons of coal. Its workings were later further developed by the Victorian Coal Company (see below).

A venture named Kilcunda Coal Mining Company commenced operation in the late 1920s, probably 1927. This operation produced about 130,000 tons with low output after 1935. It ceased operation in September 1946 'taking out all available coal'.[38] Its plant was sold and its employees transferred to the Victorian Coal Mining Company tunnel[39] (see below).

Mining at a small area south of the Kilcunda Coal mine workings and recovery of coal from other previous workings of the coal seam at Kilcunda took place from 1948.[40] The production and working life of these small operations and other mines of less than 500 tons lifetime output at Kilcunda/San Remo have not been identified in this study.

2.3.4 The Victorian Coal Mine, Kilcunda 1932–1951

The Victorian Coal Mine, Kilcunda (in some documentation listed as the Victorian Coal Company) in 1932 commenced a mining operation by dewatering and reconditioning the former South Gippsland Mine Tunnel (Thompson's Tunnel?). By September 1946 it drove a tunnel to connect with these old workings and mined a two foot six inch seam at the west of the previous workings. At 1946, reserves were estimated at less than 100,000 tons.[41]

At December 1946, its output was averaging 108 tons weekly from a longwall operation. In 1948, annual output was 6,480 tons using 28 mine workers.[42] At March 1950, it drove a new tunnel on the north of its workings but encountered faults.[43] For the 1951 calendar year, output was 5578 tons, and 5487 tons in 1952.[44] The company finally found the fault conditions uneconomical and somewhat unpredictable.

The Victorian Coal Mine, Kilcunda, ceased operation in June 1953 having excavated 1725 tons in that part year[45]. Lifetime output was over 170,000 tons.

2.3.5 The Coast Coal Mine at Kilcunda 1948–1966

At 1947, Coast Coal Kilcunda was mining a 24 to 30 inch coal seam in a small area to the south of the old Kilcunda Company's workings.[46] It was mining at the rate of 30 tons per week.[47] By 1948, it drove through into the old workings and began developing by the longwall method on the north side of its tunnel[48]. Output was suspended in 1949, the mine output being 2,634 tons.

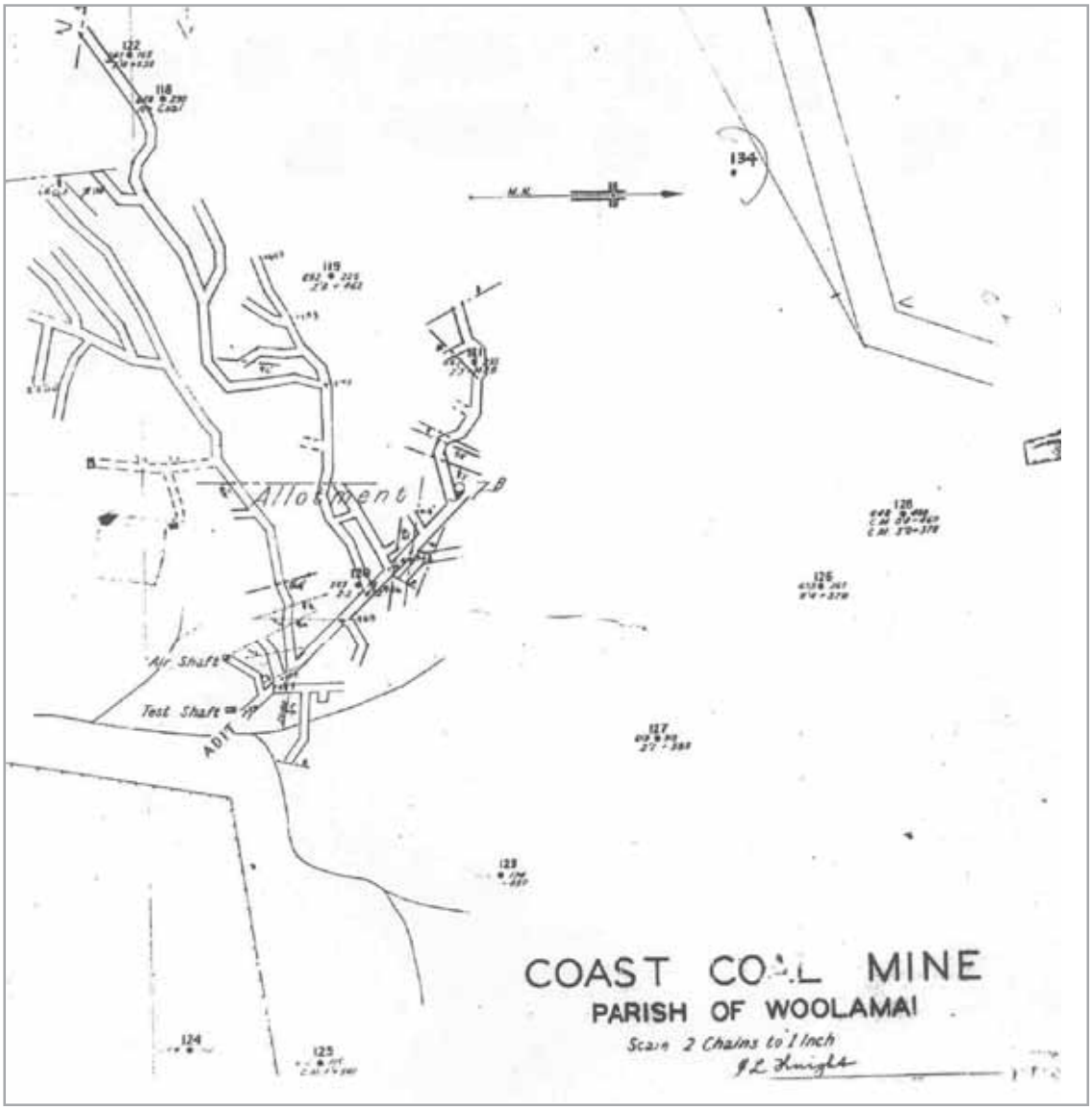
In 1952, the Coast Coal Mine, Woolamai/Kilcunda, was reopened by the Mabilia Bros., who continued mining on Mineral Lease Number 7313 in Allotment 97, Parish of Woolamai. A main tunnel was driven at a dip of about 1 in 6 north westerly from the outcrop of a seam 20 to 27 inches thick.[49] At September 1952, output was at 20 tons per week[50] while expenditure was applied to access roads, screening and loading bins and mine development. For the 1954 year production was 5432 tons.[51]

At May 1957, coal had been worked along the strike for some 700 feet. The longwall system had been used exclusively, with production over the five years to the end of 1956 totalling 17,207 tons.[52] Minor faults were encountered but faults of 60 and 100 feet were indicated ahead. Boring was carried out to determine the future direction of development. Drawing 2.3 5/1 shows the development at 1957 with westward development from the adit having extended to over 900 feet.

Mining continued at an annual rate averaging about 4,500 tons until 1960 and then declining gradually to 1234 tons in the 1966 year. The Coast Coal mine closed in November 1966. Total production from the mine situated in Allotment 97F, Parish of Woolamai from 1952 to 1966 was (recorded as) 52,544 tons.[53] At 1964, the Coal Coast mine was the only operating black coal mine in Victoria except for the State Coal mines at Wonthaggi.

Other mines of low or nil output referred to in some references but possibly associated with the mining ventures outlined above included:

- The Bass Valley Coal Company from 1908–1914 with 163 tons produced.
- The Woolamai Collieries in 1910 with no production.
- Woolamai Proprietary in 1927 with 63 tons produced.



Drawing. 2.3.5/1 Layout of underground operations by Coast Coal Kilcunda at 1957. (from Knight, JL (1957)).

The Mines Department *Annual Report* 1965 p.7 commented 'Production of black coal for industrial power generation and transportation purposes from Wonthaggi and Woolamai coal resources has ceased to be economical in competition with brown coal briquettes and fuel oils, a contributing factor being the faulted nature of the black coal measures which inhibit mechanisation for low cost production.' The availability of natural gas competitively taking over the market of the gas manufacturing plant at Morwell from 1969 was also a major factor leading to final closure of commercial scale black coal production in Victoria.

Total coal output from the Kilcunda/Woolamai area to 1966 was about 450,000 tons.

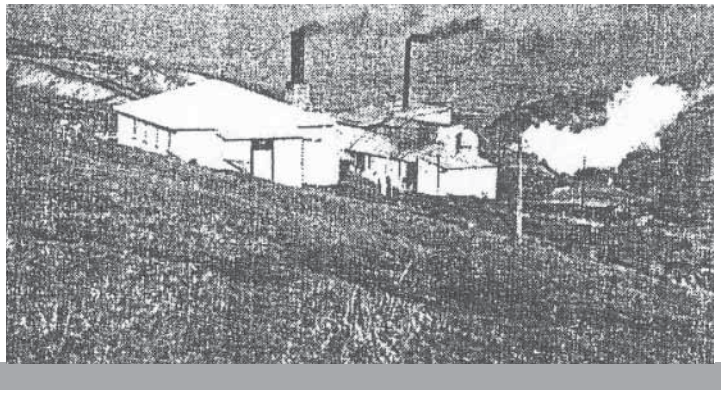


Photo. 2.3.4/1 Victoria Coal Mine, Kilcunda-Mine facilities (from Knight J, *The Story of Black Coal in Victoria*, 1951).

Assessment of Heritage Significance

Historical Significance

Successful mining of the Kilcunda black coal resource from 1865 followed closely on the first commercial level mining at Cape Paterson.

The 'light tramway' with its wooden rails over a 13 kilometre haul route, indicated to Government the need for Government facilitation if not financial support for outloading infrastructure for coal deliveries from mine to market.

Scientific Significance

No specific scientific investigations were undertaken associated with the usage of this coal as fuel. The Government eventually awarded to the Western Port Coal Mining Company a part of its proposed bonus for the first deliveries of 5,000 tons of coal to Melbourne indicating its acceptance of this coal meeting the criteria for black coal.

Economic Significance

The several ventures to mine the coal seams at Kilcunda, intermittently from 1865 to 1966, met with mixed commercial success. Eventually mining ceased due mainly to the rather unpredictable occurrence of faults in the seams.

Output from the various mines appears to have been influenced adversely by the mining difficulties and low investment rather than the ability to compete or gain access to the Melbourne coal merchants.

Social Significance

There appears to have been little co-ordination between private companies involved in mining the same coal seams on neighbouring leases. The geological interpretation of the seams seems to have been inadequate in the identification of faults such that mining of some seams had to cease abruptly on encountering an unpredicted fault. This situation also applied to the numerous coal mines in the Korumburra area as distinct from the regional mining made available to the State Coal Mines at Wonthaggi.

The intermittent initiation and demise of the several mining ventures at Kilcunda did not have a significant impact on the number and skills of mine workers in the area. The land occupiers in the area predominantly retained their agricultural base rather than being diverted to a coal mining community as was conjectured in the mid to late 1800s.

Mine Infrastructure Features

'Some tunnels, an old steam winch and a black stope dump are still visible' at Kilcunda.

Timber Trestle Railway Bridge at Powlett River entrance.

References

Brown, George 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948

Coglan, John 'The Early History of South Gippsland Coal, 1826/1909', *The State Coal Mine at Wonthaggi, 1909–1968*

Horton, T & Morris, K, *The Andersons of Western Port*, Bass Valley Historical Society, 1983

Knight, JL 'Coast Coal Mine Woolamai', Mines Department memo to Chief Government Geologist, 3 May 1957

Annual Reports, Mines Department, 1947–1967

Mineral Statistics, Mines Department, 1872–1874

Mining and Geological Journal, Mines Department, March 1947 to September 1955

Note: Gary Wilson, a current researcher on aspects of the coal mines and communities of South West Gippsland, is a valuable resource of anecdotal and recorded history of the Kilcunda and Powlett River area coal mines. He is accessible through the Wonthaggi Historical Society.

Photo 3.1.1/1 Steam Locomotives at Korumburra. Copyright Australian Railway Historical Society.

3 South West Gippsland—Later Black Coal Mines

3.1 Korumburra Area Mines

Map Reference: **8021-2-3 Korumburra, Coal Creek Mine 3979, 57441**

Municipality: **Shire of South Gippsland**

Land Use / Status: Private

Site History

3.1.1 Exploration and discoveries of Coal in the Korumburra Area.

In 1872, a black coal outcrop was found by James Brown in Coal Creek, South West Gippsland[54] . In 1873 the seam was inspected by RAF Murray who found a party boring in the Coal Creek seam. About the same year and in the vicinity of Coal Creek, Eyre, a surveyor, discovered what was later known as the Strzelecki Seam. In future writings, Murray included the Coal Creek Seam as part of the wider Strzelecki Seam.

By the early 1870s, many outcrops of black coal were found by settlers and prospectors in the countryside within 15 kilometres or so to the South and East of Korumburra. Many of these outcrops were not reported to the Mines Department. Murray states that 'from late 1874, land selection was spreading into all the South Gippsland forest country.'[55]

In 1876, seams of coal 18 inches and 33 inches thick, identified as the Strzelecki seam, were found about two kilometres south of Korumburra.[56] Although there were three companies formed for coal mining before 1891, there was no profitable outcome before that time.[57]

At 1889, stimulated by the *Royal Commission on Coal*, the Mines Department engaged five diamond drills searching for black and brown coal in Victoria. In 1889, black coal was found in the Powlett River flats at Jumbunna and at Mirboo.[58] In1890, at Korumburra six seams from two feet six inches to four feet eleven inches thick were found (Drawing 3.1.1/1). At Jumbunna a five feet thick seam was recorded.[59] In 1891, another seam five feet thick was discovered.[60]

With these finds and the advent of the South Gippsland Railway through Korumburra in 1891, the time was ripe for successful black coal mining in the Korumburra region. To the end of 1894, 46 groups of individuals formed syndicates or companies and took up leases in and around Korumburra, Korumburra South, Konwak, Jumbunna, Kardella and Outtrim.[61]

Between 1889 and 1908, forty deep bores were installed in the Korumburra Region by the Mines Department.[62]

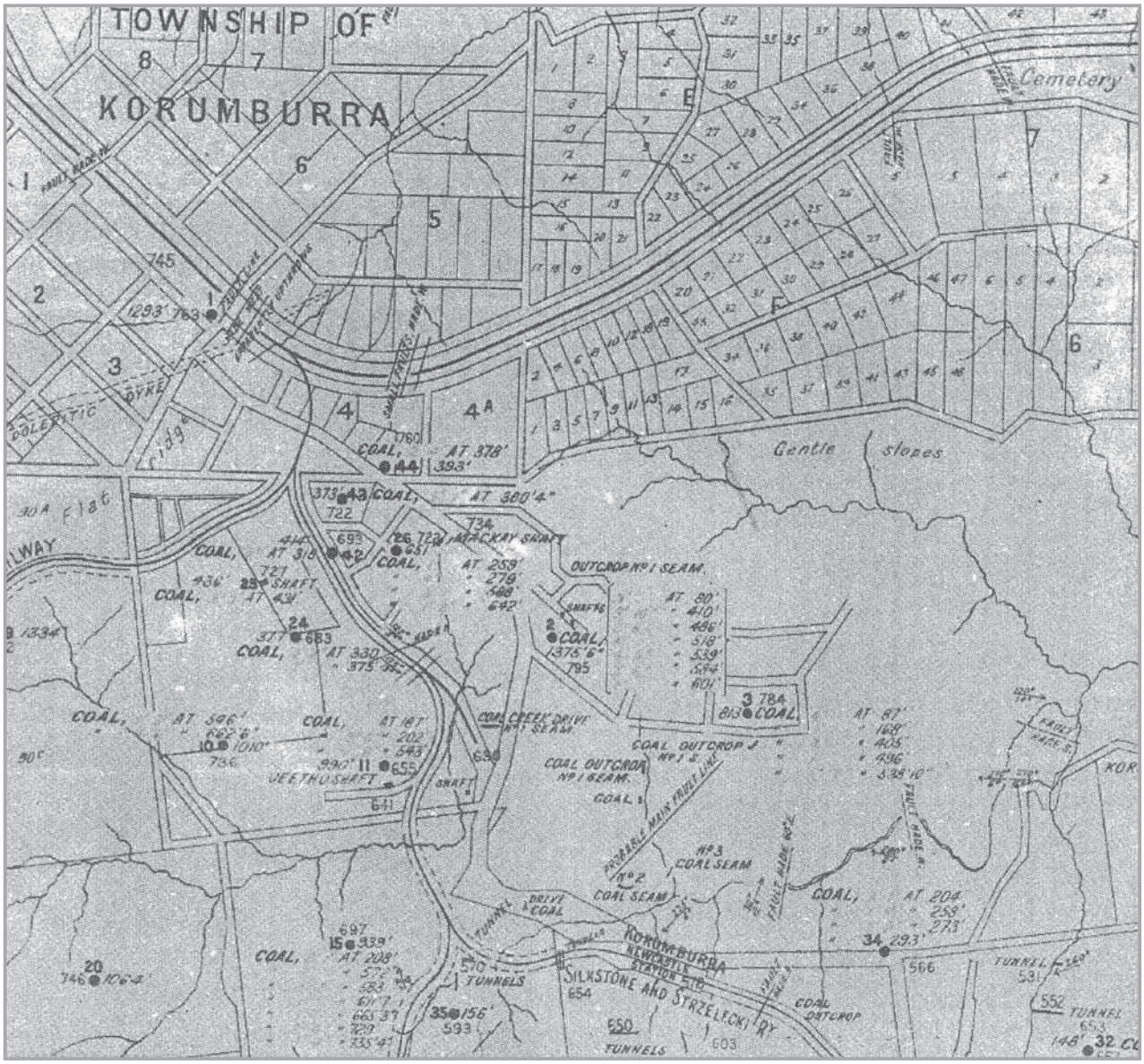
3.1.2 The mine at Silkstone
Silkstone Coal Mine NL; Silkstone Colliery Company NL63; Dudley Coal Syndicate (Wynne's Mine)

In 1872/73, 20–30 miners were working at a mining operation at Silkstone, a few kilometres south of Korumburra. Lack of transport from the mine resulted in only a small output for local consumption. However the venture was reactivated in 1882 via a tunnel. A block of the coal was sent to Melbourne for exhibition in 1882. This is thought to be the first coal from the Korumburra region to reach Melbourne.[64]

The Silkstone Coal Mine, located about four kilometres south of Korumburra, was operated by the Silkstone Coal Mine NL from 1891 to 1892. A tunnel 130 feet long was inspected by the VR official party at the opening of the VR railway through Korumburra in 1892.

The mine was taken over by the Silkstone Colliery Company NL in November 1893, with an official opening in January 1894.[65] The mine operated through two shafts delivering over a light railway 390 feet to a siding on a VR branch line off the Coal Creek Branch line. At April 1895, output was at about 300 tons per month, but much pumping was required. The Silkstone mining operation was found to be uneconomic compared with other mines in the area and ceased operation in 1895 after a contract to sell coal to the VR was lost.[66]

Photo 3.1.3/1 The first coal train to leave Coal Creek siding, October 1892. (from Victorian Historical Society).



Drawing 3.1.1/1 Township of Korumburra showing coal shafts, tunnels and railways and sidings. Copyright State of Victoria, Department of Primary Industries.

In 1923, the Dudley Coal Syndicate, in an operation known also as Wynne's mine, reopened the old Silkstone mining operations. However it encountered faults in the seams and experienced danger from influx of water from old workings of the adjacent K & J mine. The operation proved uneconomic, the last coal being sent out in 1927. Over its five year life approximately 27,000 tons of coal were mined including 10,116 tons in its peak production year 1925.[67]

The Dudley Coal Syndicate reformed in 1932 and operated the old mine until 1934, producing 4,447 tons of coal.[68]

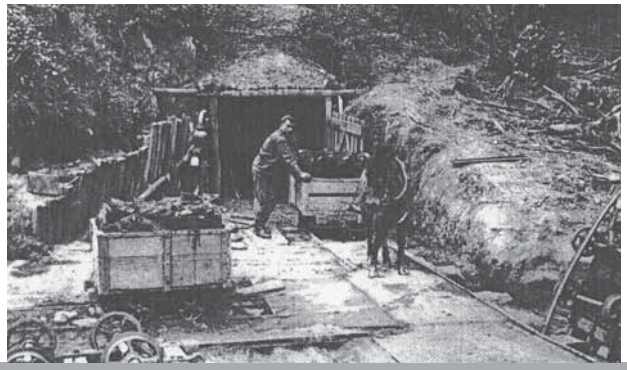


Photo 3.1.3/2 Small mine at Korumburra showing horse drawn skip and adit entrance (from Martin et al. (1993)). Copyright The Australian Institute of Mining and Metallurgy.

3.1.3 The Coal Creek Mine (including Sunbeam Collieries); Coal Creek Mining Company; Coal Creek Proprietary Company Ltd.; J Cook & Company; Kay & Company (Coal Creek Sunbeam). Sunbeam Collieries Pty Ltd

Following the coal discovery at Coal Creek in 1872, an area had been set aside in 1879 at Coal Creek as a coal reserve.[69] In 1888, the Coal Creek Mining Company[70] was formed to mine at about one kilometre east of the present town centre of Korumburra. In May 1890, the *Royal Commission on Coal* visited the mine site where 'a tunnel 50 feet long intersected three good seams of coal.'[71]

In 1892 a branch rail line at VR gauge was completed from Korumburra to the Coal Creek mine. On 25 October 1892 the first trainload of coal left the Coal Creek Siding (Photo 3.1.3/1). Previously for about one year coal from this mine had been hauled by road to Korumburra Station (Photo 3.1.3/2). At 1892, the mine workings at Coal Creek comprised its tunnel and two shafts with several seams being worked including the main seam four feet six inches thick with skiplines delivering from the mine to the VR rail siding.

At 1894, new capital was needed to expand the workings. The original company went into voluntary liquidation and the Coal Creek Proprietary Company Ltd. (CCPC) was formed to progress the mine.[72]

In the first quarter of 1894, outloading to rail from the Coal Creek Mine was 24,649 tons, and from the two other operating mines 2,132 tons.[73]

In October 1895, the CCPC and the Silkstone mine lost contracts to sell coal to the Victorian Railways. The CCPC continued in operation at lower output until, in 1907, the CCPC was in financial difficulties. It was taken over in part by J Cook & Company who operated until 1920 and in part by Kay & Company (known as Coal Creek Sunbeam) who operated until 1922 then reforming as Sunbeam Collieries Pty Ltd[74] (This company continued to mine the two upper Coal Creek seams until 1958/59). At 1942, the Sunbeam mine was producing 300 to 500 tons per week and about to commence a new tunnel[75] in war time conditions of high demand but restricted manpower. In 1947, a longwall face was being opened up. A shaft had been sunk to 540 feet to test a five foot seam known as the deep seam but subsequently this seam was not worked because the coal was assessed as poor quality and gaseous.[76]

Sunbeam Collieries continued to work the mine through a series of tunnels. In 1950, intentionally and by arrangement with the Mines Department, it broke through via one of its drives into the disused workings of the adjacent former Austral Mine to fully work the contiguous leases and gaining access to 16,000 tons of coal. Output in 1951 was 5,578 tons and rising to over 8,000 tons in each of 1955 and 1956. From the 1950s, the colliery had been contending with faulting and with driving through stone to follow the seams.[77] In 1955, a tunnel was opened into the outcrop to mine some pillar coal from previous workings. It ceased mining in September 1958 with production in that year of 5,957 tons. The last load of coal left the Sunbeam Colliery on 15 April 1959, this representing the end of black coal mining in the Korumburra district.

In the Mines Department *Annual Report* for 1961, mention is made of the Coal Creek Syndicate mining 102 tons of coal. No prior or later mention was made of this small venture.

From the end of World War II, output of black coal from the privately operated collieries gradually declined as briquettes became more available and *The State Coal Mine at Wonthaggi* took over fuel supply to the VR locos. The Korumburra Butter Factory, the last commercial customer of Sunbeam Collieries, converted to briquettes in 1958/59.

3.1.4 The Strzelecki Coal Mine Strzelecki Coal Mining Company; Strzelecki Consolidated Colliery Company: Strzelecki Coal Mining Company Pty Ltd; New Strzelecki Coal Mining Company Ferguson Quick Proprietary Company, Quick & Company; Strzelecki Co-operative Syndicate; Lucas & Greenwell; Korumburra Coal Mine

By 1875, a seam of black coal, later called the Strzelecki Seam, was found by surveyor Eyre at about 14 miles north of the mouth of Screw Creek at Anderson's Inlet.[78] Exploratory tunnels and a shaft 102 feet to coal were installed.[79]

It was not until 1890 that mining operations commenced following registration of the Strzelecki Coal Mining Company. This company was wound up in 1893 and replaced by the Strzelecki Consolidated Colliery Company with additional capital. The renewed company with a new manager installed

Photo. 3.1.5/1 The former Korumburra-Jeetho poppet head and coal out-loading plant (from Martin et al., (1993)) Copyright The Australian Institute of Mining and Metallurgy.

a new shaft into the main seam. In 1895 the VR installed a branch line with a railhead about a half mile from the pit mouth to which it was connected by a wire rope tramway on 24 September 1895. However this operation shut down in March 1897.[80]

In March 1905, the mine was reopened by a new company, the Strzelecki Coal Mining Company Pty Ltd, which mined 947 tons before closing in June 1906.

Other ventures followed between 1907 and 1910 which sold 9,788 tons of black coal in attempts to achieve commercial success –these groups were successively the New Strzelecki Coal Mining Company, the Ferguson Quick Proprietary Company, and Quick & Company. The mining lease was forfeited in 1911.

In 1911 the Austral Coal Company was formed, bought part of the former Strzelecki mining equipment and commenced a mine on a different sites (see Section 3.1.6).

In 1922 the Strzelecki Co-operative Syndicate was formed to open the old mine but closed down within one year after mining only 30 tons.

In 1930, a venture by Lucas & Greenwell reopened the mine producing approximately 600 tons per month at its peak and 16,912 tons of coal until its closure in April 1939 due partly to the coal seam petering out. In 1939, the mining lease was taken over by a new group who renamed the site as the Korumburra Coal Mine but mining did not eventuate as much of the former equipment had been sold[81].

Thus the original Strzelecki Coal Mining Company NL mine had been operated intermittently from 1875 to 1939.

3.1.5 The Korumburra & Jeetho Mine. Korumburra & Jeetho Coal Mining Company; Coal Creek Extended Coal Mining Company; Korumburra Coal Company NL

The Korumburra & Jeetho Coal Mining Company was formed on 4 April 1892. Its mine was located about 100 yards west of the Coal Creek Mine. The company purchased most of its plant from the Boolarra Coal Company, and constructed a shaft but found that pumping was needed continuously (Photo 3.1.5/1). This company drove a tunnel to a main seam estimated to be five feet six inches thick. The K & J Company had access to a VR branch line off the Silkstone line from January 1894 (Drawing 3.1.5/1). In July 1894, the K & J Company amalgamated with an adjacent mine, the Coal Creek Extended Coal Mining Company, to form the Korumburra Coal Company NL.[82]

The Coal Creek Extended Coal Mining Company had been formed in August 1892 and commenced mining coal from a tunnel in January 1894 at the south east of the K & J mine and on the south of the CCPC mine. By the end of March 1894, it had sold about 1,500 tons of coal and had a capacity of about 150 tons a day.[83] It was probably working the same seam as its neighbour the K & J Company.

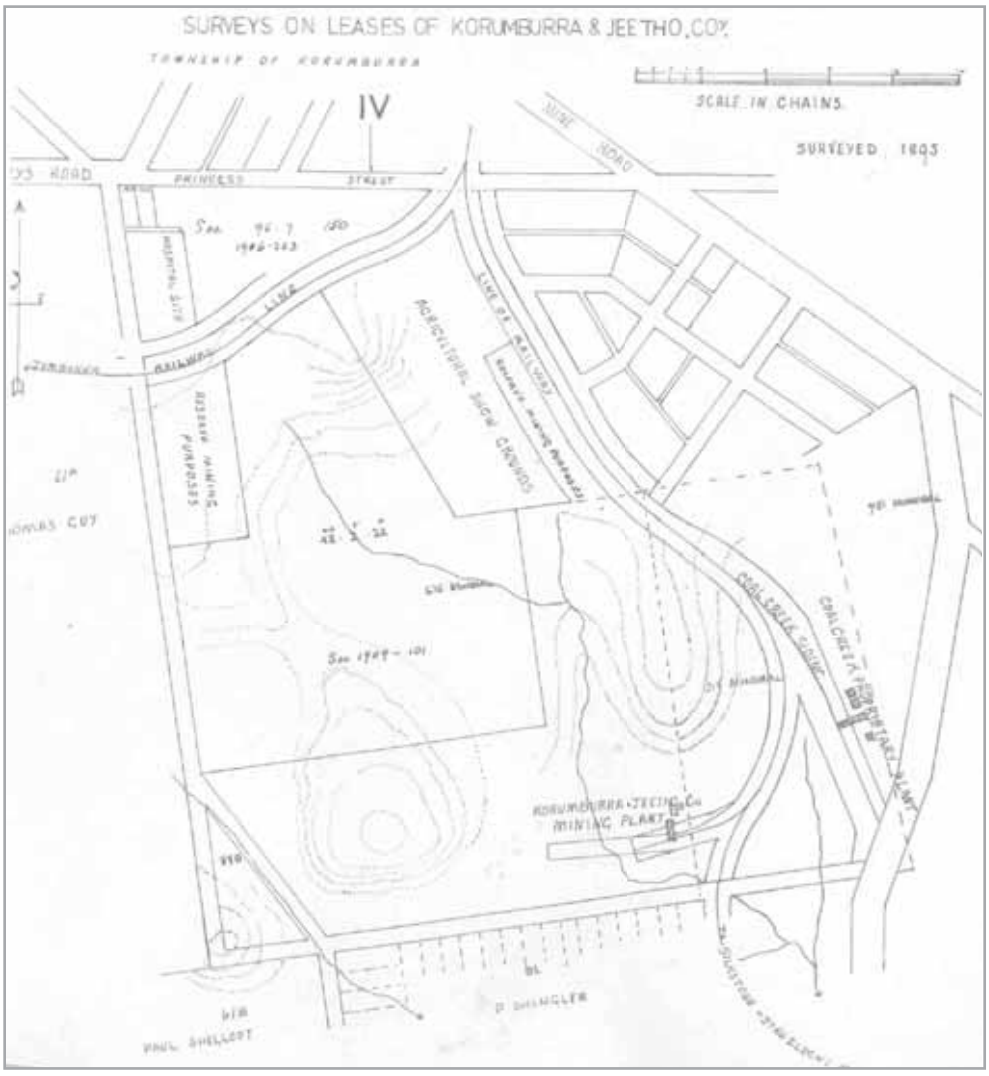
The Korumburra Coal Company NL newly formed from the amalgamation noted above, held four leases over 450 acres at the south of Korumburra. From its tunnel operations, 4,985 tons were extracted until the end of 1894 and a total of 31,957 tons to mid 1897 when the company ceased operation due to financial difficulties mainly caused by low prices on offer from the VR.[84]

Anecdotally, an offer was made by the Coal Creek Proprietary Company to take over the mining operation but this has not been confirmed.

3.1.6 The Black Diamond Mine – The Austral Coal Mine: Black Diamond Coal Mine NL; Coal Creek Proprietary Company Ltd.; Austral Coal Company

The Black Diamond Coal Mine NL was registered in April 1894. It operated on the east side of the Strzelecki VR branch line through two tunnels delivering coal to the Silkstone VR branch line over 'nine chains of tramway trestles', but did not start coal deliveries until late 1898. It purchased some of its equipment from the Silkstone Mine. To December 1899 it produced 3,940 tons of coal but found the project uneconomical due to low coal prices on offer.

In 1900, the mine was taken over by the Coal Creek Proprietary Company Ltd. which operated this mine as well as its Coal Creek Mine until 1905 when it abandoned its lease on the Black Diamond Mine. In 1907, the lease was taken up by the Austral Coal Company. In 1908 this new operator worked in a four feet six inches seam which it followed until its cessation of operation in 1943. The mine acquired the name of the Austral Mine. It produced 433,745 tons of coal from 1908 to 1943 averaging 12,393 tons annually.

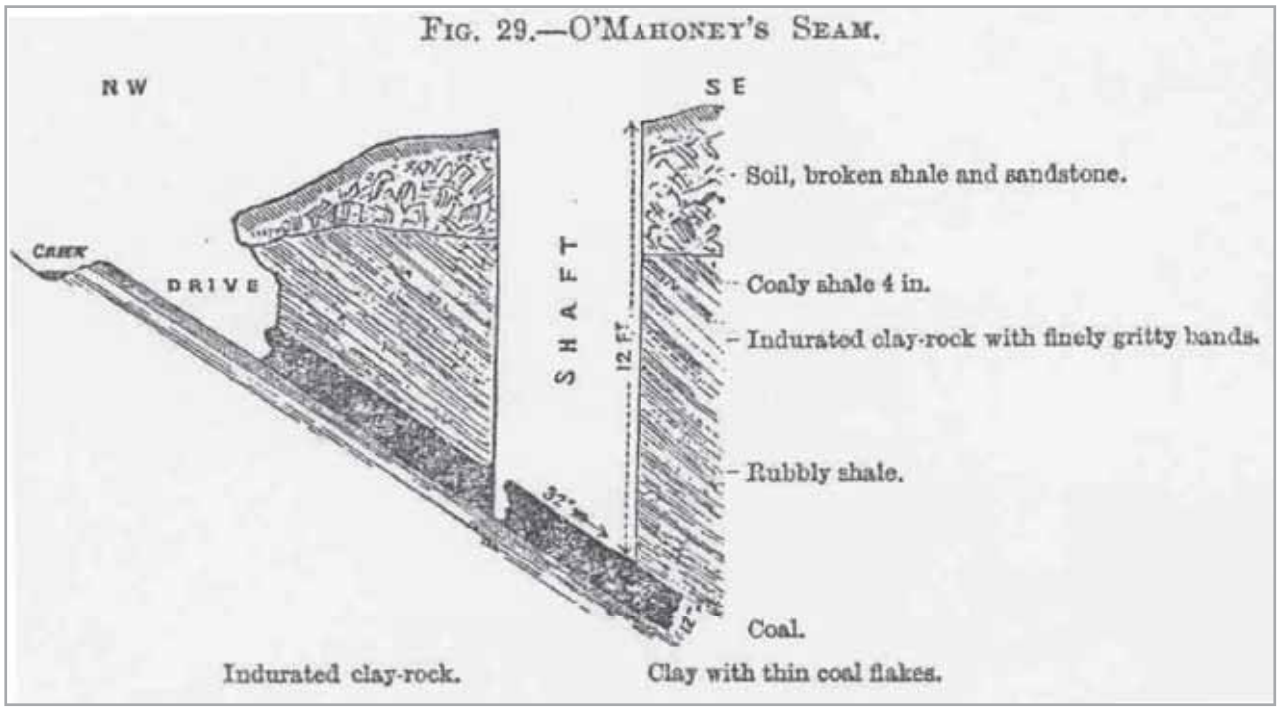


Drawing 3.1.5/1 Early Mine Leases at Korumburra, Coal Creek & Korumburra-Jeetho leases and rail sidings. Copyright Joseph White.

The Austral Coal Company considered re-opening the mine in the late 1940s when coal supply was in crisis but found it could not obtain sufficient skilled mining personnel available in the immediate post World War II scene. In 1948, the Austral Coal Company offered the mine lease and equipment 'free' to the State Government. This offer was accepted but the mine was not subsequently reactivated except by the adjacent Sunbeam Collieries intentionally breaking through the lease boundary following its seam to gain access to a small tonnage on the previous Austral lease.[85]

3.1.7 The Cardiff Colliery Company Mine

A company registered as the Cardiff Colliery Company was formed circa 1906 to take over the Coal Creek Proprietary operations. It did not succeed with its objective and did not



Drawing 3.1.9/1 O'Mahoney's Black Coal Mine: Section through drive and shaft (from RAF Murray, *Geological Survey, Progress Report* No. 3, 1876).

enter the mining stage. A second company with the same name (named Cardiff Collieries Number One) was formed in 1922, mining 31,635 tons of coal until it was liquidated and all assets sold in September 1925. The mine was located south of Korumburra with coal haulage over a tramway to the Silkstone-Strzelecki VR branch line at Wynne's siding.[86]

The mine was reactivated in 1937(named Cardiff Collieries Number 2) and operated until 1943, mining 59,483 tons in this latter period.[87]

3.1.8 The Mine Road Colliery, Korumburra

The Mine Road Colliery was opened by 1949 when it recorded an output of 1107 tons.[88] No further information has been ascertained in this study. It appears to have been the last mine opened at Korumburra. It probably had ceased operation by 1951 as no further references to its operation have been found.

3.1.9 Mahoney's Black Coal Mine North of Korumburra

This mine was located about 13 kilometres south of Warragul[89] and 17 kilometres north of Korumburra. The mine location is depicted on the Mines Department original 1890 drawing of the County of Buln Buln Coal Field. The outcrop of the main seam was about 12 inches to 18 inches thick (Drawing 3.1.9/1). A drive into the outcrop and two shafts were sunk.

However the seams were too thin to be of commercial prospects with lack of transport facilities to either Warragul or Korumburra. Commercial mining did not proceed.

3.1.10 Warne's Black Coal Mine North of Korumburra

This mine was located about seven kilometres north-east of Korumburra. The mine location is depicted on the Mines Department original 1890 drawing of the County of Buln Buln Coal Field. [This location is several kilometres south of that

stated by Kenny in 1947.] The seam was outcropped at one foot, 10 to 15 inches thick. A syndicate was formed, a shaft was sunk to 15 feet and a drive proceeded for 30 feet until the seam disappeared in a fault. The mining venture did not proceed further.[90]

Assessment of Heritage Significance

Historical Significance

The development of the black coal mines at Korumburra was highly significant in the history of coal mining in Victoria. At the 1872/3 discovery and confirmation of the black coal find at what was later to be called Korumburra, the only commercial black coal mines were small operations in thin seams at Cape Paterson and at Kilcunda. However the Korumburra area was remote from transport to Melbourne and although some minor mine openings occurred in the 1880s, it was not until the VR rail line from Melbourne to Korumburra came into service in 1891 that black coal mining in the Korumburra area became commercially viable.

The delay of some 19 years between discovery and commercial mining had however provided time for a wide investigation of the coal resource and the organisation of syndicates with prepared mining plans ready to commence when the rail connection became available. The coal quality had been proved highly suitable for use in the VR loco fleet and mining ventures were able to commence with assurance of an available market. These factors lead to a higher level of plant mechanisation in the mining activities at Korumburra compared with the other black coal mines at Jeeralang, Boolarra, the Narracan Valley and around Thorpdale which had arisen in the 1880s with limited technical input and initially without access to an assured market.

The Korumburra mines gained a large proportion of their mine workers from the other black coal mines as well as from the gold explorers. There was a high level of political involvement with the various mining syndicates and in the land subdivisions, housing, commercial and servicing activities.

In outcome there were too many individual mines, on adjoining leases, without adequate co-ordination of optimum extraction of the coal resource. This lesson was learnt in the subsequent establishment of the State Coal Mine at Wonthaggi where the one enterprise was given the mandate and responsibility to mine the total coal resource of the Powlett River coal field.

Scientific Significance

No specific scientific significance was associated with the Korumburra black coal utilisation. The coal was used predominantly by the VR Commissioners and by gas companies substituting for usage of NSW coal. Economic utilisation of the slack coal (fines) not acceptable to the VR Commissioners for locos or for Newport Power Station presented an unsolved challenge.

Economic Significance

In the 1880s, the potential coal output from the Korumburra Mines was viewed enthusiastically by the Government of Victoria ostensibly prepared to support a Victorian black coal industry as opposed to dependence on coal from NSW for the VR locos and power stations at Newport, Richmond and central Melbourne.

The VR Commissioners set the price for Korumburra coal at the usage location based on its calorific value compared with that contracted for NSW coal at the same usage point.

Social Significance

The potential of the Korumburra black coal resource lead to the installation of the South Gippsland rail line which opened up South Gippsland for closer settlement and for commercial outlets for its timber and primary produce.

The influx of mine workers in the 1890s lead to a rapid development of the town of Korumburra as a vigorous district centre. Mine workers from the Korumburra mines progressively transferred to the State Coal Mine at Wonthaggi from 1910 as various small mines at Korumburra phased out of operation in their separate uncoordinated mining of the same seam(s).

Mine Infrastructure Features

The Coal Creek Museum at Korumburra preserves various relics and reminders of the mining activity.

A replica coal mine opened in March 1984 is a feature of the Coal Creek Museum.

No other remains of the Korumburra mines have been identified in this study.

References

Annual Report, Mines Department, 1889 and 1949

Bowden, K *Early Days of Korumburra*, 1967

The Korumburra Times, 5 September 1968

Mining & and Geological Journal, Vol. 6 No. 2, Mines Department, 1957

Murray, RAF, *Geological Survey Progress Report*, No. 3, 1876

Murray, RAF, *Early Coal Exploration in Gippsland, Land of the Lyrebird*, Shire of Korumburra, 1920

Company Records Nos. 4651, 5109, 5187, 8732, Public Records Office

The Southern Mail, 27 May 1895

Sykes, Barry, *Compilation of the Mines, Rail lines and Social Development of the Wonthaggi*, Outtrim and Jumbunna areas, unpublished manuscript, 2007

White, J, T*he History of the Shire of Korumburra*, 1987

Note: The details of individual mines in the Korumburra area have largely been collated from the writings of Joseph White in *The History of the Shire of Korumburra*. A large and detailed assembly of the research notes and associated documentation by Joseph White (now deceased) has been bequeathed by his family to the Korumburra Historical Society. Barry Sykes, a current researcher on aspects of the coal mines and communities of the Korumburra, Jumbunna and Outtrim areas, continues to collate a detailed history of these areas. Barry Sykes is an associate member of the Wonthaggi Historical Society and is accessible for detailed information on mine sites in the South West Gippsland area.

3.2 Jumbunna Coal Mines

Map Reference: **8021-2-3 Korumburra. Jumbunna Rail Stn. 3930, 57413**

Municipality: **Shire of South Gippsland**

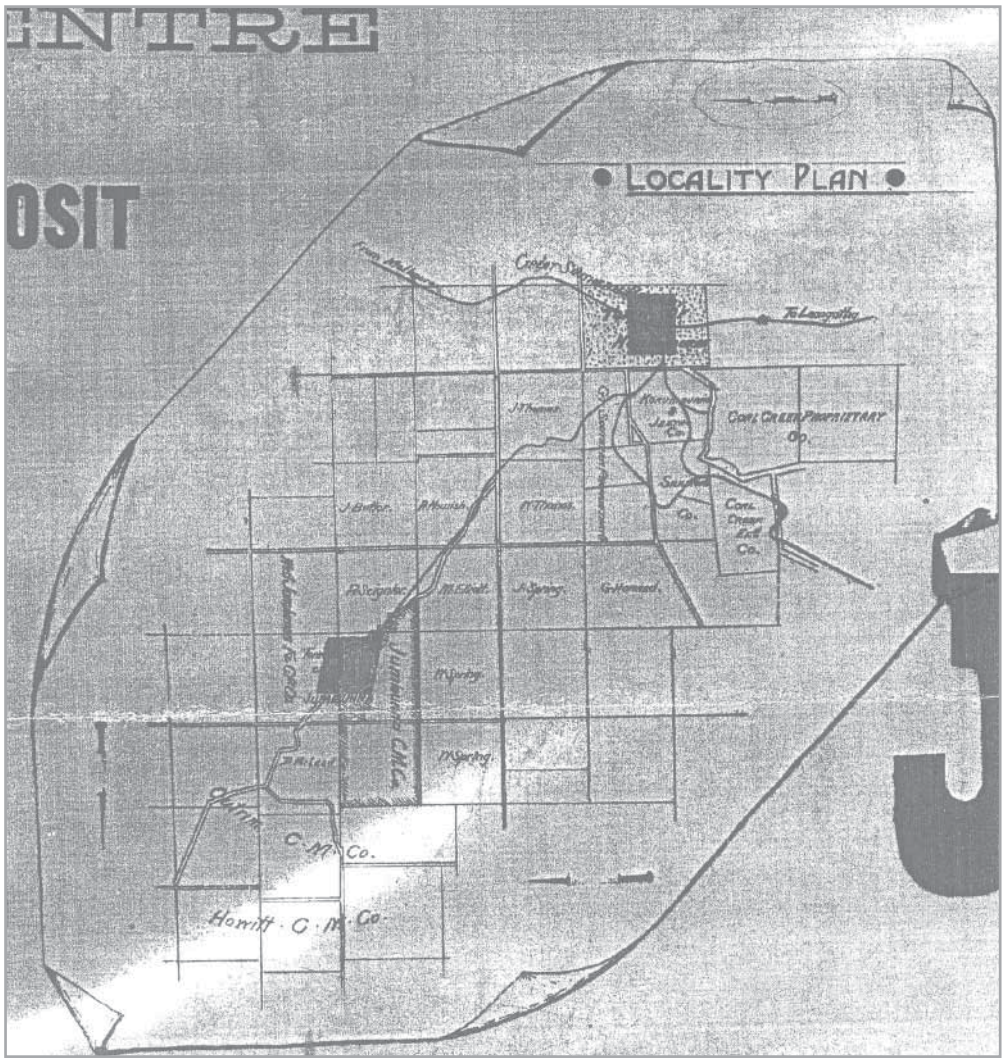
Land Use/Status: Private

Site History

Black coal was discovered at Jumbunna East (Drawing 3.2/1) in the early 1880s but was not reported at the time. In 1889, at or near the same site, coal was reported on land owned by Thomas Horsley and was known as Horsley's Seam.[91] It was reported on favourably by Mines Department Geologist RAF Murray as a four feet six inches 4' seam. The Jumbunna True Coal Mining Company was formed but did not reach a commercial operation stage. Land subdivision for the township of Jumbunna took place in August 1893 (Drawing 3.2/2). At 1893, the subdivision advertisement stated 'Jumbunna is the centre of the largest deposit of black coal in the Colony'. 'Contracts have been let for opening up a second tunnel.' [It is indicated in some sources but not confirmed from official documentation that some extraction of coal commenced in 1890.]

In 1894, the Jumbunna Coal Mining Company NL (JCMC) commenced commercial operation of the mine[92] located about six miles south west of Korumburra. (Drawing 3.2/3 & Photo 3.2/1). A VR branch line three and three quarter miles long to Jumbunna from the Coal Creek Mine branch line officially opened in May 1894 to serve the mine and the new township[93].

The entrance to the main tunnel of the JCMC mine was about one mile south of outloading bins on the VR branch line at Jumbunna with an aerial ropeway connection from the mine outlet to the bins (Photo 3.2/2).[94] The ropeway came into service in June 1895 with an expected capacity of 30 tons per hour which was not achieved and resulted in output capacity from the mine being lower than envisaged. This delivery system stayed in service until the VR railway extension to Outtrim was in operation in February 1896. This VR extension brought the railway line closer to the Jumbunna Coal Mine. A new haulage system about 400 feet long from the pit head

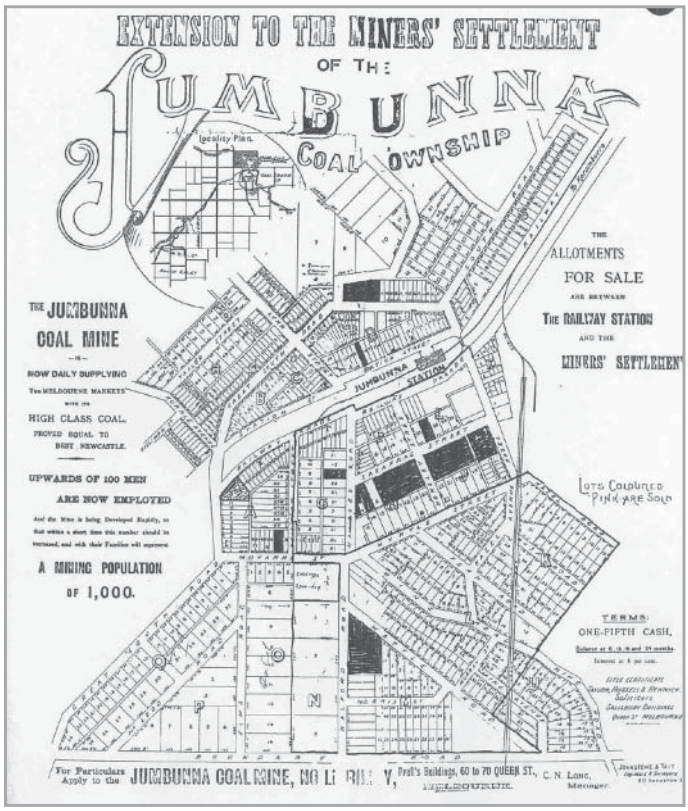


Drawing 3.2/1 Major mine sites at Jumbunna, Outtrim & Korumburra.

to a VR loading point was installed.[95] Later the aerial tramway and its subsidiary plant were dismantled and sold. [96]

The West Jumbunna Coal Company was registered on 3 June 1893, before the township land auctions, on a lease a mile or so west of the initial Jumbunna Mine. This company sold out to the Jumbunna Coal Mining Company(JCMC) in 1896 without working its lease.

From 1894 –1903, average output from the JCMC mine was about 54,000 tons per year. In 1903/1904, there was a major strike for 70 weeks, during which the workings of the main (lower) seam were flooded, followed by a recovery phase of two years before returning to full production. From 1906–1912, production averaged over 60,000 tons per year before output fell away due to better wages and conditions at the State Coal Mine causing strikes and threats of closure at Jumbunna. In 1916, a disastrous fire caused closure of part of the mine.[97] JCMC continued at low output until 1921. In 1920, it had approached the Government for financial assistance or purchase without success. Total coal deliveries from this company from 1890 to 1921 were 1.223 million tons.



Drawing 3.2/2 Jumbunna – Extensive speculative housing lot land subdivision circa 1894.

In March 1921 a new company Jumbunna Coal Pty Ltd took up the workings but wound up in October 1925 after a strike. Total production by this company was about 50,000 tons.

In early 1926 ,the Jumbunna Colliery Pty Ltd (owners Wimpney & Coy) took up operation of the initial mine including attempts to reopen the north tunnel of the mine taken out of operation after the 1916 fire. In 1928, with the mine producing about 50 tons per day and uneconomical due to price competition from the State Coal Mine and the SECV production of briquettes, the Jumbunna mine was offered to the Government for £12,000 as a going concern. Evaluation of the mine by the General Manager of the State Coal Mine acknowledged the advantages of the Jumbunna coal with its low moisture and ash but stated the 'mine output was insufficient for profitable working' in the two feet four inches top seam being mined. He assessed that new shafts of 1,000 feet would be necessary to access the three feet six inches lower seam which had not been reworked since its flooding in 1903. The offer to purchase the mine was not accepted by the Government and the mine suspended operation in 1929[98] after excavating some 36,000 tons.

A sequence of small mining companies had continued operating the mine from 1929 until a further suspension of commercial operations in 1939. Barry Sykes includes the following:

- 1931–1934 Jumbunna Colliery Syndicate (Mac's) 3,194 tons,
- 1935 Bright Star (McLeans) 403 tons,
- 1936–1939 J Durkin et al probably well below 1,000 tons,

Drawing 3.2/3 Location of Jumbunna from Korumburra. (from Topographical Map 8021.2.3, Korumburra). Copyright The State of Victoria, Department of Sustainability and Environment.

Another reactivation reputedly occurred from 1936 to 1939 by the Jumbunna Colliery Pty Ltd excavating about 18,000 tons.

[Quantities, dates and nomenclature listed above vary somewhat between sources. Definitive reconciliation has not been undertaken in this Coal Sites Identification study.]

The Mines Department *Annual Report* 1947 states that some mining of outcrop coal and pillar coal at 1,330 tons in that year from mine workings at the Jumbunna Coal Mine was being undertaken by Messrs. Blackmore, Leighton and Murray.[99] Output 1946 –1948 is stated by others as 3,750 tons.

Reactivation of the mine occurred in 1949 when the three feet six inch seam was struck from a lower tunnel and an air rise was installed. Intentions were to follow the seam dip. In mid 1950, the Jumbunna Coal Mining Company (known as the Jumbunna Colliery Syndicate) amalgamated with the Outtrim West mine to mine through the contiguous lease boundaries. They utilised the merged workforce to commence a new tunnel into dwindling coal reserves.

The Mines Department Annual Reports continued to refer to the Jumbunna Coal Mine or the Jumbunna Colliery at

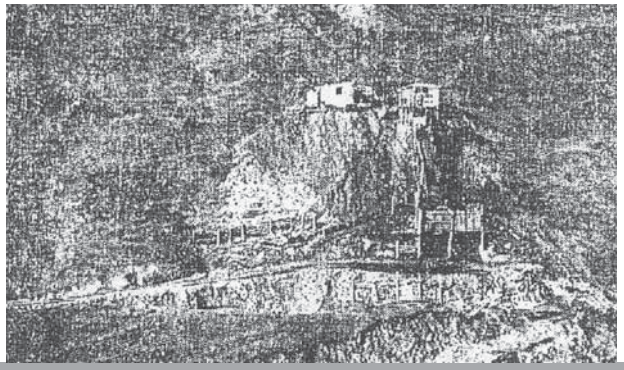


Photo 3.2/1 Jumbunna Coal Mine at Jumbunna.

Photo 3.2/2 Aerial Ropeway about one mile long from Jumbunna Mine to VR rail line at 1894 (from Halford, M *The Coal Industry of South Gippsland*, c.1910).

Photo 3.2/3 First Coal from the Jumbunna Mine circa 1894. (from Halford, M *The Coal Industry of South Gippsland*, c.1910).

Jumbunna or Jumbunna South as the only commercially significant mine at Jumbunna. Nomenclature used in Mines Department reports and various sources varies confusedly including Jumbunna Coal Company, Jumbunna Coal Pty Ltd, Jumbunna Coal Mining Company, Jumbunna Coal Syndicate, Jumbunna Coal Pty Ltd and Jumbunna Colliery Pty Ltd. The Annual Reports show production averaging about 4,000 tons per year by 1957 and then gradually declining to 714 tons in 1960, its last full year of operation. Production from this mine from 1930 to 1961 was probably of the order of 40,000 tons. Over its operational lifetime from 1894–1960, the mine at Jumbunna had produced about 1.4 million tons of black coal. [See also the reference to the Jumbunna Colliery at the end of the Section on the Outtrim Mines.]

From 1910, no exploratory leases for coal had been granted in the south west Gippsland area in a policy of preserving the coal resources for development for public purposes. This policy prevented the JCMC and other private mines from long term planning and survival as coal resources on existing mining leases dwindled.[100]

Assessment of Heritage Significance

Historical Significance

The discovery of the Jumbunna black coal deposit in 1889 occurred when syndicates at Korumburra were preparing to open their mining operations as soon as VR rail transport to Melbourne was available. The prospects of a widespread coal field beyond the Korumburra known seams appeared good. Land speculators took a leading role in the subdivision of land into township allotments adjacent to the proposed mine. Mine workers were attracted by offers of housing blocks paid for by direct deduction from wages.

Scientific Significance

The coal quality at Jumbunna was highly satisfactory and could substitute adequately for coal from NSW. The Jumbunna coal was used predominantly for steam power and gas production using technology developed on NSW black coal. No specific scientific applications were sought for the Jumbunna coal.

Economic Significance

Opening of the Jumbunna Mine was postponed until a VR branch line had been brought into service to the new Jumbunna Township to serve the Jumbunna mine. The mine output was of significant importance to Victoria from inception in 1894 until about 1914 by which time the State Mine at Wonthaggi had come fully into service. The VR Commissioners responsible for the State Mine complex was fully committed to the success of the State Mine and considered the Jumbunna mine as a competitor. VR freight rates for coal haulage from Jumbunna were higher than expected. The customer price for slack coal from Wonthaggi was set by the VR Commissioners to ensure disposal of all such Wonthaggi coal forcing Jumbunna slack coal to be sold below cost.

The coal resources at the Jumbunna mine were not fully worked out, a lower seam requiring substantial capital investment to be mined. The Jumbunna area did not receive the extensive exploratory and proving drilling applied to the Wonthaggi site by the VR Commissioners in their determined efforts to maximise coal recovery from the Wonthaggi coal field.

Social Significance

The establishment of a new town specifically to house the Jumbunna mine workers was a short term profit making venture by land speculators supported by the extension of the VR line and the rapid opening of the mine. This mine appeared to have a successful commercial outcome until the advent of *The State Coal Mine at Wonthaggi* with pricing policies applied to disadvantage private coal producers.

The township of Jumbunna had a short life influenced significantly by the transfer of mine workers to Wonthaggi from about 1910 by offers of higher pay.

Mine Infrastructure Features

Site of Jumbunna VR rail station.

Site of aerial ropeway from mine site to VR rail siding.

References

Harper, P, *The Wonthaggi Coal Fields*, E.I. Advertising, 1987

Annual Reports, Mines Department, 1945–1961

Mining and Geological Journal, Mines Department, March 1947

Murray, RAF, *Remarks on the Development of the Coal and Lignite Resources of Victoria*, 1889

Murray, RAF 'Recollections and Experiences', *Annual Report*, Mines Department 1891

VR 'Jumbunna and Outtrim Railway Map', No. 138, 1895

Sykes B., *Compilation of the Mines, Rail lines and Social Features of the Jumbunna and Outtrim areas of South West Gippsland*, unpublished manuscript, 2007

White, J, *The History of the Shire of Korumburra*, 1987

3.3 Outtrim Mines

Map Reference: **8020-1-4 Drumdlemara 3925, 57370**

Municipality: **Shire of South Gippsland**

Land Use/Status: **Private**

Site History

3.3.1 The Outtrim Howitt and British Consolidated Mining Company Mine at Outtrim.

Map Reference: 8020-1-4 Drumdlemara 3925.57370

A two feet six inches seam of black coal was found by McLeod on his selection [101] about 12 miles by road from Korumburra circa 1890, after the coal finds at Korumburra and Jumbunna. From 1891, active prospecting for coal then followed in the area. [RAF Murray, former Mines Department Geologist, took up a selection adjoining the Mc Leod selection.][102] In October 1892 Johnson found an outcrop in the same area and sank a shaft which intersected a four feet seven inches seam.

The first mining activity was by the Outtrim Coal Company (originally named the Hopetoun Proprietary Coal Mining Company) which in November 1893 registered a mining lease covering the original discovery location (Drawing 3.3/1). By this time, search leases had been taken out over a wide area around the Johnson find.[103] (The mining venture was named after the Minister of Mines.[104]) Some mining of the exposed seam, probably on a manual basis, occurred and a small sample was sent to Melbourne for testing.

The Howitt Coal Mining Company was registered on 21 November 1893[105] on leases about one mile west of the Outtrim operation. A third company, the South Outtrim Murray & Stirling Amalgamated Coal Company was registered on 18 June 1894. A fourth company, the British Blocks (Colliery?) Syndicate was also registered about this time. There was much overlapping of significant shareholdings in these companies which had been inspired by a geological assessment (by Mines Department geologists Murray & Stirling) of a six million tons coal resource.

Drawing 3.3/1 Location of Outtrim (from Topographical Map 8020-1-4, Drumdlemara). Copyright The State of Victoria, Department of Sustainability and Environment.

In 1894, these 70 week companies went into voluntary liquidation and their assets were sold into a new company, The Outtrim, Howitt, and British Consolidated Mining Company which was registered on 4 July 1894.[106, 107] This company was to be the major mining company of many which subsequently operated at Outtrim.

The OHBCM Company commenced operation by driving a tunnel south westerly from a location later to be near the south end of the Outtrim rail station. Initial coal deliveries were by bullock wagon to the railhead at Jumbunna. Considerable negotiations with the VR Commissioners were necessary before agreement was reached on an extension of the VR line by 2⅜ miles from the existing terminus at Jumbunna. The extension came into service on 5 February 1896 with anticipation in the South West Gippsland community that the rail line would subsequently be extended to Inverloch (Photo 3.3/3).

The OHBCM Company initial tunnel used an endless ropeway haulage with small skips. The company installed two additional tunnels (known as Mc Leod's tunnels) in a northerly direction and worked a seam approximately five feet thick. Haulage from these two tunnels was by a two feet gauge tramline.[108]

The OHBCM Company had anticipated sales of 60,000 tons per year. In the year 1896, output was 126,000 tons and rose to 140,000 tons in 1898 out of a total from Victoria of 240,000 tons. Practically all coal from the OHBCM Company mine was sold to the VR for locomotive use. OHBCM initially won a three year contract with Victorian Railways undercutting prices by other Victorian mines and NSW.

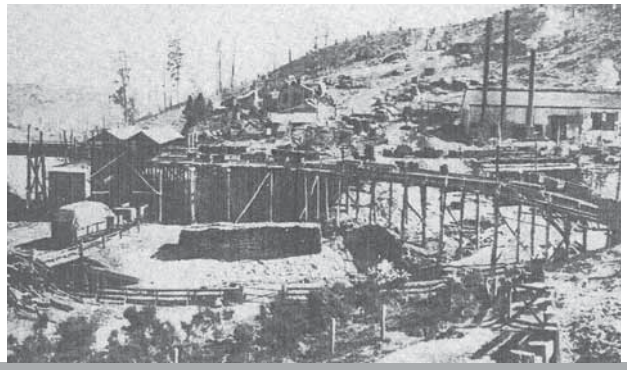
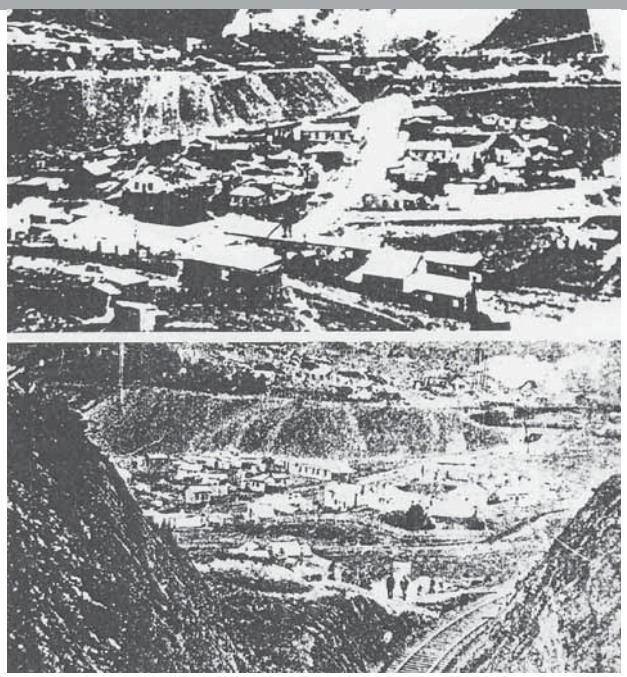


Photo 3.3/1 Outtrim-Howitt Mine at Outtrim circa 1900.

Photo 3.3/2 The Mine and Town at Outtrim, 1914.



In 1900, the NSW collieries reduced their price to the VR; the VR responded by reducing the price it was prepared to pay for Victorian black coal; the OHBCM Company responded by reducing wage rates; the mine workers responded with strikes and work interruptions including a strike in 1903/04.

By 1908 the company was aware of dwindling coal reserves in their mining lease and was experiencing problems with faulting and thinning of seams. The Government had refused exploration licences outside current mining leases in an endeavour to control future coal winning and reserve resources for public utilities.

With labour strikes again in 1908, and the opening in 1910 of the State Coal Mine in direct competition for workers and in price, the OHGMCC opted for closure of its Outtrim operation. The company purchased coal leases from the Kilcunda Coal Mining Company at Kilcunda in 1913 and transferred equipment, miners and houses from Outtrim to Kilcunda. The OHGMCC ceased commercial operation at Outtrim in 1915 (last recorded output of about 7,500 tons). It terminated all its activities by 1924 including its operations at Kilcunda and at Korumburra in the Cardiff Colliery. During the company's operations about 1.375 million tons of coal were mined at Outtrim. [One reference states output as approx. 0.975 million tons only.]

3.3.2 Chronological listing of smaller mines at Outtrim 1921–1962

From 1921 to 1957, small groups generally ex-miners formed and reformed into companies, obtained mining licence(s) and began mining coal from the old OHGMCC workings normally extracting pillars rather than extending the workings. There was also some near surface new workings commenced into outcrops some known previously and others found since the Government embargo on exploration and mining licences for coal had terminated. Underground interconnection between the OHGMCC workings and the Jumbunna mines also occurred.

The following listing of small mining companies and mining lease holders recorded as mining at Outtrim between 1921 and 1957 as extracted from their reports to the Mines Department are copied directly from the writing of James White (1987), pp.132, 133.

Outtrim Coal Syndicate	1921–1928	17,790 tons
Outtrim Extended	1921–1926	7,336 tons
Outtrim West Syndicate	1924	251 tons
Mount Pleasant	1923–1928	2,436 tons
Roy's Extended North Outtrim	1924–1928	9,068 tons
Howitt Colliery	1926–1936	56,990 tons
Wallis & Party	1927	259 tons
Melrose Colliery	1931	90 tons
Station Area	1932–1933	2,587 tons
Station Area Extended	1932	170 tons
Outtrim West (GA Foote)	1944–1951	13,357 tons
Blackmore (Leighton & Murray)	1946	1,045 tons
Outtrim North (Willoughby)	1947–1948	1,847 tons
Howitt Colliery (Mc Bride's)	1947–1949	3,396 tons
Hillside Colliery	1953–1956	3,425 tons
Blackmore & Leighton	1956–1957	1,836 tons
Webster (Axford & Hodges)	c1950–1962	not ascertained

This latter group was the last to be working the original Outtrim mine.

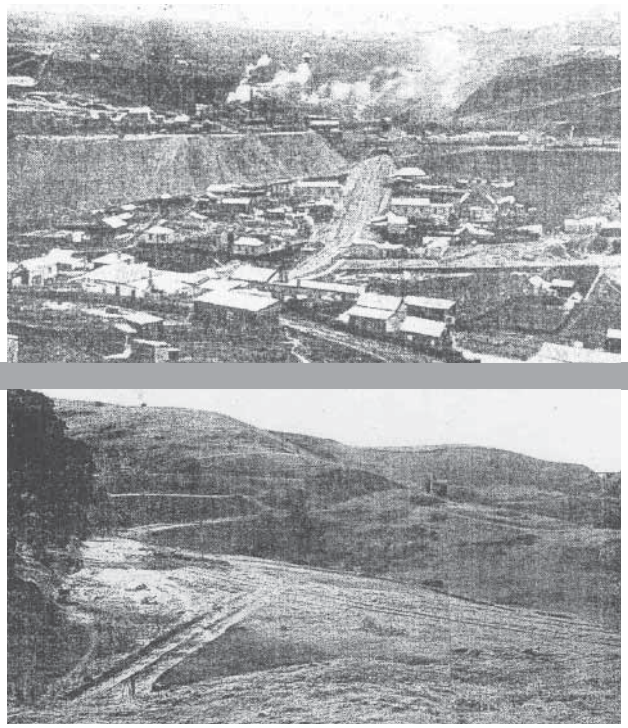


Photo 3.3/3 Outtrim Township: Rise (top) and Demise (bottom). Copyright Printed courtesy of the *South Gippsland Sentinel Times.*

Comments on some of these minor mines in the Outtrim area which were significant enough to be recorded in the Mines Department *Annual Reports* were as follows.

Five mines at Outtrim were recorded as being opened between 1921 and 1924, all being phased out by 1928 with a total production of about 36,000 tons.

The Outtrim Coal Mining Syndicate mine (also known colloquially as the Perseverance mine) tunnelled below the main street in Outtrim. It became flooded in 1929 bringing its operations to a close.

The Outtrim Extended mine operated from a tunnel about 500 yards south of the Outtrim Station.

Roy's Extended (North Outtrim). Registered in 1924 this became known as Atkinson & Gleeson Mine. It opened a tunnel north of the Outtrim Rail Station and broke through into former workings in McLeods Tunnel at the east of its lease.

Howitt Colliery commenced operation in 1926 by reopening old workings. This mine was known as Howitt Colliery Number One and operated until 1936 mining about 57,000 tons of coal working out its available coal. Howitt Colliery Number Two (Mc Bride's) operated in the Western Area of the initial lease taking out about 3,400 tons of coal between 1947 and 1949. This was the largest producer of the smaller mines.

Station Area Mine. This had a brief life of less than two years with an output of less than 3,000 tons.

Outtrim West (GA Foote) This mine tunnelled into an outcrop at the west of initial lease area, operating over 7 years from 1944 to 1951 with an output of about 13,000 tons.

Outtrim North. Two small mining ventures occurred with this name, one in 1923–1926 excavating some 1,000 tons in the vicinity of McLeods tunnels and the second in 1946 to 1949 extracting some 2,100 tons.

Blackmore, Leighton & Murray. From 1945 intermittently to 1957, a syndicate, Blackmore, Leighton et al. mined at Outtrim and at Jumbunna. In 1945/46, this syndicate mined under the former VR rail reserve at the North East of the Outtrim township. Output has been variously written as between 1,000 and 1,667 tons. A renewed syndicate Blackmore & Leighton has been recorded as operating in 1956/57 mining some 1,800 tons of coal. The location of this operation has not been ascertained by me but would most likely have been removal of pillars in old workings. This group was the last coal mining operation at Outtrim mentioned in the Mines Department Annual Reports. At Outtrim, total coal production by this group was about 3,000 tons.

Hillside Colliery. This mining activity was on the south side of the initial lease area extracting pillar coal and following a thinning seam.[109] At 1954, this was the only black coal mine listed in the Mines Department *Annual Report* as operating at Outtrim. The Hillside Colliery closed in 1957 after total recorded production of 3,425 tons.

Activities of a group called Jumbunna Colliery has been outlined in the Jumbunna mine sites sub chapter as having operated at Jumbunna at times intermittently from 1926 to 1961 under some variations of nomenclature including Jumbunna Colliery.

Barry Sykes writes in his collation on Outtrim Mines that a syndicate called Jumbunna Colliery operated from 1948 to 1962 located several hundred yards south east of the original Jumbunna Mine and adjacent to the Outtrim West (GA Foote) mine. He writes that the two operations merged in 1951 continuing as Jumbunna Colliery, with local customers only, the operation eventually winding down due to availability of SECV briquettes. He locates the mine as being an Outtrim mine with a lifetime production from 1948 of 29,517 tons. I have included the mine as a Jumbunna Mine outlined in my subchapter on Jumbunna Mines while noting that another information source refers to this operation under the Jumbunna Coal Company nomenclature producing 30,870 tons from1948 to 1962.

Some further reconciliation in nomenclature, location, and output between information sources is required.

Photo 3.3/4 Loco in deep cutting at Outtrim. Copyright State of Victoria, Public Transport Division, Department of Infrastructure.

Assessment of Heritage Significance

Historical Significance

Substantial mining of black coal in the Outtrim area occurred from 1896 only six years after initial coal discoveries in the area. An extension of the VR line from Jumbunna was installed with strong strategic proposals for extension of this line to Inverloch thus opening opportunities for extended agricultural development of this area of South Gippsland. Within a year or so after opening of the Outtrim/ Howitt mine in 1896 about a half of Victoria's black coal production came from this single mine at Outtrim.

Scientific Significance

No specific scientific significance was associated with the discovery, mining or utilisation of the Outtrim Coal.

Economic Significance

Mining commenced at Outtrim before a VR rail line extension to the new town and mine at Outtrim was in service. An efficient mining operation succeeded commercially for about five years only until price reductions and industrial disputes jeopardised long term development.

As with other black coal private mining ventures in Victoria from the early 1890s, Government support was either spasmodic or not forthcoming. Decline of the economic prospects of the Outtrim mine occurred from about 1910 with aggressive competition from The State Coal Mine at Wonthaggi and restriction on coal exploration licences. The major mine at Outtrim closed in 1915 virtually frozen out of existence by State Government influence.

Small scale mining of the Outtrim coal seam took place from 1921 to about 1960, providing income for small domestic scale operations supplying small scale local industrial usage such as in milk processing and for heating in local hospitals.

Social Significance

The mining operation at Outtrim was predominantly by one company producing over 90 per cent of total Outtrim output. Establishment of a new town served the domestic requirements of the one company. Survival of this township depended on commercial success of this company. From 1910, the Outtrim-Howitt mine provided a reservoir of mine workers for the early years of the Wonthaggi State Coal Mine where higher pay and long term employment attracted transfer of the Outtrim Mine workers and their families. Some small scale mining operations continued until 1960 as Outtrim area residents in small syndicates worked separate local leases or the old workings of the Outtrim-Howitt mine.

Mine Infrastructure Features

Site of the Outtrim-Howitt mine.

Site of the township rail siding.

References

Gleeson, K 'The Rise and Fall of Outtrim', *The Korumburra Time*s, 16 September 1965

Mining and Geological Journal, Vol. 6 No. 2, Mines Department, 1957

Murray, RAF 'Recollections and Experiences', *Annual Report*, Mines Department, 1891,

Company Records Nos. 4792, 5145, Public Records Office

Wells, John, *Gippsland: A People, a Place,* and their Past.

White, J, *The History of the Shire of Korumburra*, 1987

Photo 3.4/1 The initial tent city at Wonthaggi circa 1910 (from Quilford, (1977)). Copyright Arthur Quilford

3.4 The State Coal Mines, Wonthaggi

Map Reference: 8020-4-4 Dalyston Number 5 shaft 3757, 57259

8020-4-1 Kongwak Kirrak area 3810, 57273

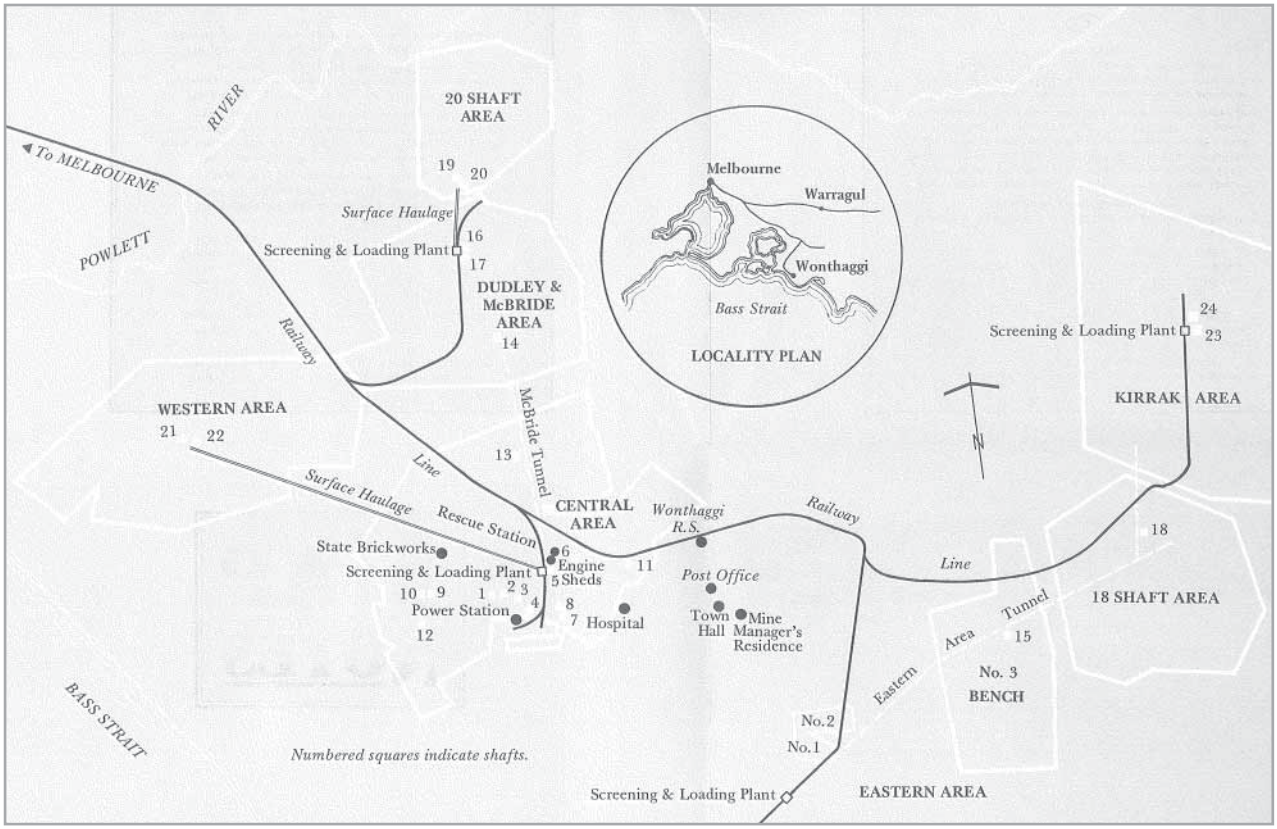
8020-4-4 Dalyston No 20 shaft 3754, 57291

Municipality: Shire of South Gippsland

Land Use/Status: Public and Private

Site History

The existence of black coal seams inland from the coast in the Powlett River plains was known from 1858 from boring carried out by the government.[110] However subsequent spasmodic drilling had shown the coal seams to be highly faulted such that an understanding of the seam geology had been difficult. 'Deep boring in the Powlett River Valley was undertaken (by the Mines Department) from 1886 to 1889 with only moderate success.' Systematic drilling was not undertaken [again]) until 1908–1909'.[111] Although this latter drilling generally revealed multiple scattered seams up to three feet thick, in some locations seams merged to 9 feet in thickness. The existence of 'a splendid and extensive field of coal'[112] was declared. This assessment was substantially reinforced by the discovery of a seam or seams six feet and eight feet thick at 16 feet and 39 feet below surface, in a well and in a shaft respectively.



Drawing 3.4/1 Location of Installation of the Wonthaggi Mines (from Quilford, *The State Mine*). Copyright Arthur Quilford.

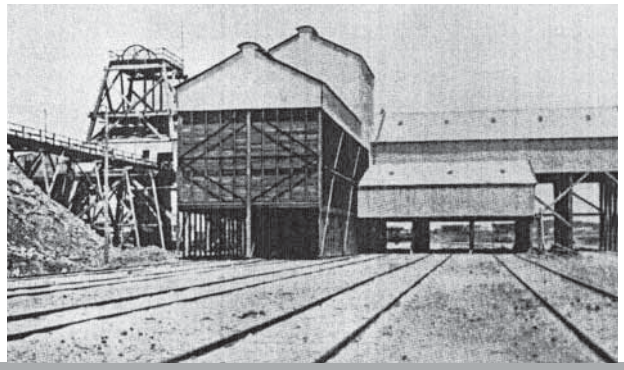
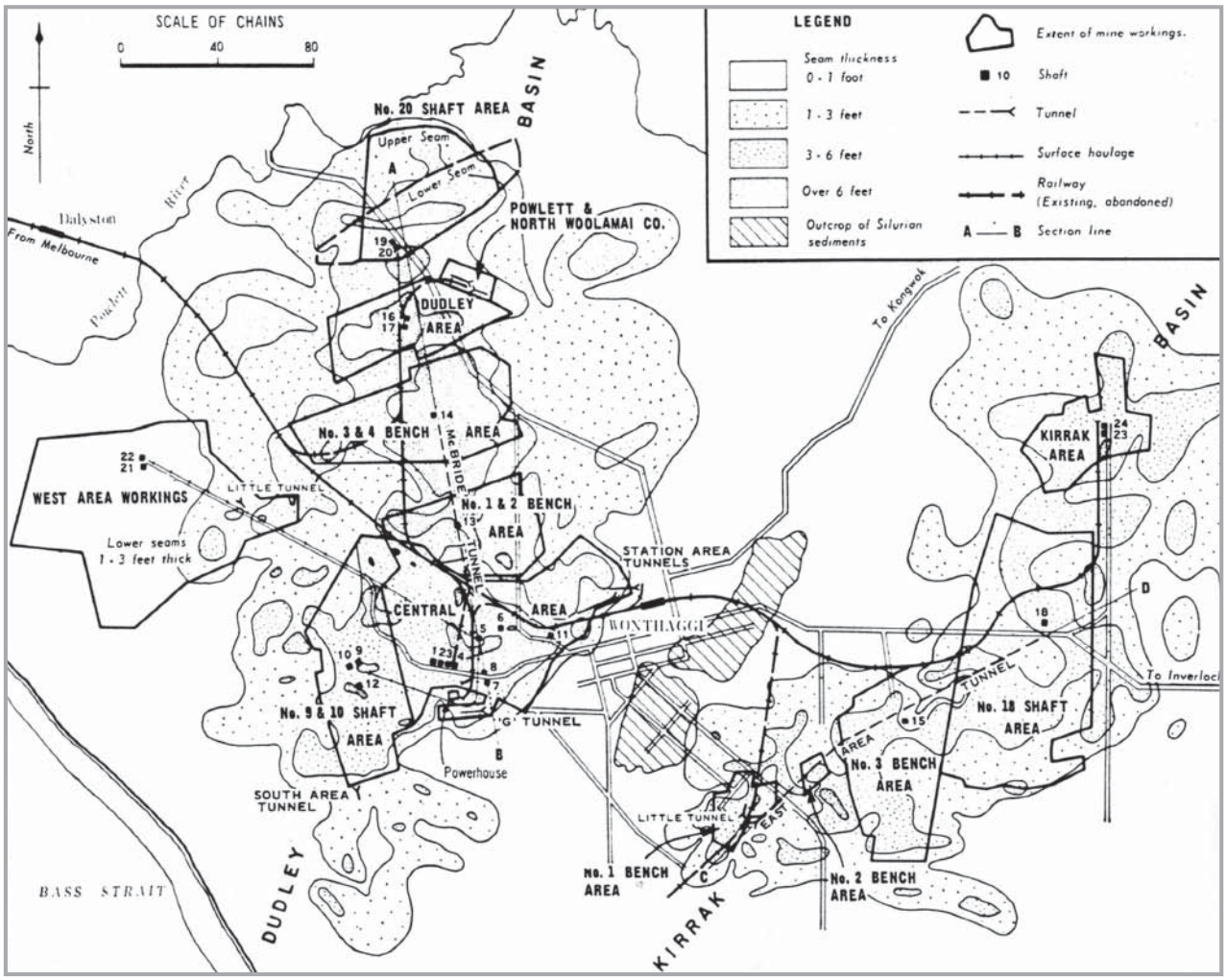
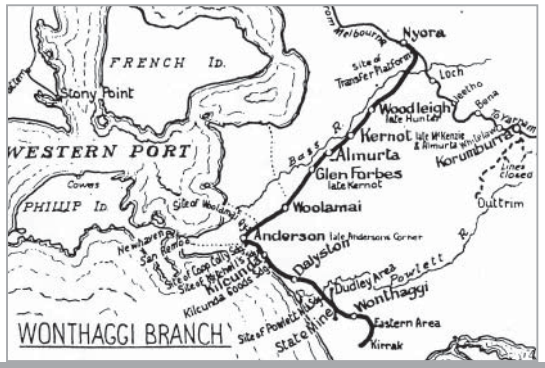


Photo 3.4/2 Number Five Shaft & Out-loading Station November 1911.



Drawing 3.4/2 Detailed Map of the State Coal mines at Wonthaggi (from Knight (1970), p. 56). Copyright The State of Victoria, Department of Primary Industries.

On 11 November 1909, in reaction to a shortage of coal from NSW due to strike action in NSW, the Victorian State Government sanctioned the opening of the Powlett River coalfields under the control of the Mines Department.[113] Site work commenced immediately. Table 3.4/1 'Chart of Operations 1909–1968' (adapted by J Coglan from JL Knight, *Mining and Geological Journal*, Vol.6, No. 6, 1970), shows details of the names, working periods and production from the various shafts, tunnels, and benches of the State Coal Mine, identifying 12 designated mines (Drawing 3.4/2). The location of the first mine opening was about eight miles north of Cape Paterson. The township of Wonthaggi commenced as a tent town for men only (Drawing 3.4/1 & Photo 3.4/1). On 24 February 1910, the Government reserved land for a planned township named Wonthaggi which was laid out eastwards of the mine opening and intended to provide housing to the mine workers and service providers without land speculator involvement. Subsequently, land speculation did occur outside the planned township boundaries with the land subdivision of satellite dormitory suburbs. In 1911 the Commonwealth census counted 3,200 inhabitants in Wonthaggi.[114]



Drawing 3.4/3 VR Rail Line extensions to the Wonthaggi Coal Field 1910.

Chart of Operations 1909—1968

Mine No.	Area and Mine	Working Period	Seam Worked and Thickness in Inches	Area Worked Acres	Production to Nearest 50 Tons
	Dudley Basin				
1.	Central Area.....**No. 3 Shaft**	1909—1914	Top.....60—96	200	782,000
2.	Central Area.....**No. 5 Shaft**	1910—1917	Top.....60—96	200	973,600
3.	Central Area.....**No. 9 Shaft**	1914—1920	Top.....78—80	240	975,900
4.	Central Area.....**No. 10 Shaft**	1911—1927	Bottom.....26—48	220	1,394,750
5.	Central Area.....**McBride Tunnel** Nos. 1 and 2 Benches	1915—1921	Top.....58—84	140	917,000
	No. 3 Bench	1917—1934	Top.....43—84	230	1,368,000
	No. 4 Bench	1919—1936	Bottom.....33—40	230	778,000
6.	**Station Area Tunnel**	1919—1928	Top.....34—54	71	301,600
7.	Dudley Area.....**No. 16 Shaft**	1925—1938	Top.....60—114	210	1,993,650
			Bottom.....24—42	210	
8.	Northern Area.....**No. 20 Shaft**	1931—1962	Top.....36—96	220	1,718,400
			Bottom.....24—42	100	
9.	Western Area.....**No. 21 Shaft**	1936—1968	Top.....18—50	536	1,868,750
	and		Bottom.....15—36		
	Little Tunnel	1956—1959	Top.....18—28	10	19,150
	Total Dudley Basin				**13,090,800**
	Kirrak Basin *(The only seam worked is equivalent to The Top Seam, Dudley Basin)*				
10.	Eastern Area..**Nos. 1—3 Benches** Nos. 1 and 2 Benches	1919—1931	30—33	50	107,000
	No. 3 Bench	1919—1931	30—39	300	1,133,000
11.	Eastern Area.....**No. 18 Shaft**	1930—1946	34—54	475	1,941,550
12.	Kirrak Area.....**No. 23 Shaft**	1939—1968	42—90	145	463,700
	Total Kirrak Basin				**3,645,250**
	GRAND TOTAL				**16,736,050**

Kirrak Area closed from 1946—1955.

*Note—Due to the inclusion of dirty and splinty coal in the gross weight of coal won from each mine, the total production from individual mines exceeds the actual published figures by 41,058 tons.

Adapted from *"The Closing of The State Coal Mine, Wonthaggi"*, by J. L. Knight, p.62, in **Mining and Geological Journal**, Vol. 6, No. 6, (Mines Dept., Victoria, 1970).

Table 3.4/1 Chart of Operations, State Coal Mine, Wonthaggi 1909–1968. Copyright The State of Victoria, Department of Primary Industries.

The first mining operation involved the sinking of four shafts, Nos.1–4, to the top coal seam (Drawing 3.4/4). This work was completed within 3 weeks. Coal was cut by hand tools, hauled to the surface in wicker baskets via poppet heads assembled from old drilling rigs (Photos 3.4/3 & 3.4/5). Coal was loaded into bullock wagons and hauled over a 10 mile route on unmade tracks to shallow draught vessels at a makeshift port at Inverloch. By 30 June 1910, a total of 42,274 tons was delivered to Melbourne by this means. Equipment, materials and supplies were transported to the mine either from the Inverloch Port or from the nearest railhead at Outtrim. A VR rail extension from Nyora on the Great Southern Railway was rushed into service by the 20 February 1910, with completion of ballasting achieved by June 1910 (Drawing 3.4/3).

Number Five shaft was opened in 1910 following which Numbers One, Two and Four shafts were used as ventilation

Photo 3.4/3 Underground rail junction at Wonthaggi. Copyright State of Victoria, Public Transport Division, Department of Infrastructure.

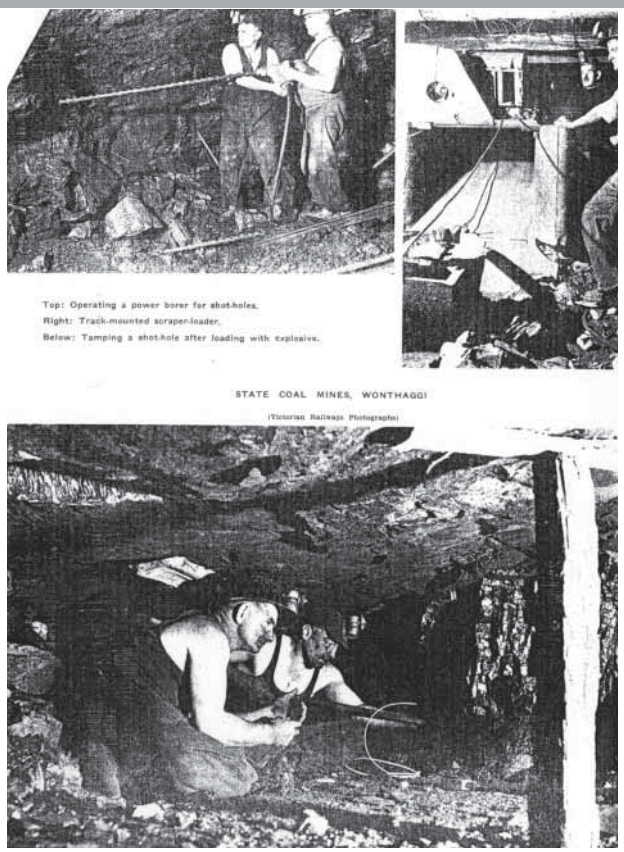


Photo 3.4/4 Miners at Wonthaggi. Copyright State of Victoria, Public Transport Division, Department of Infrastructure.

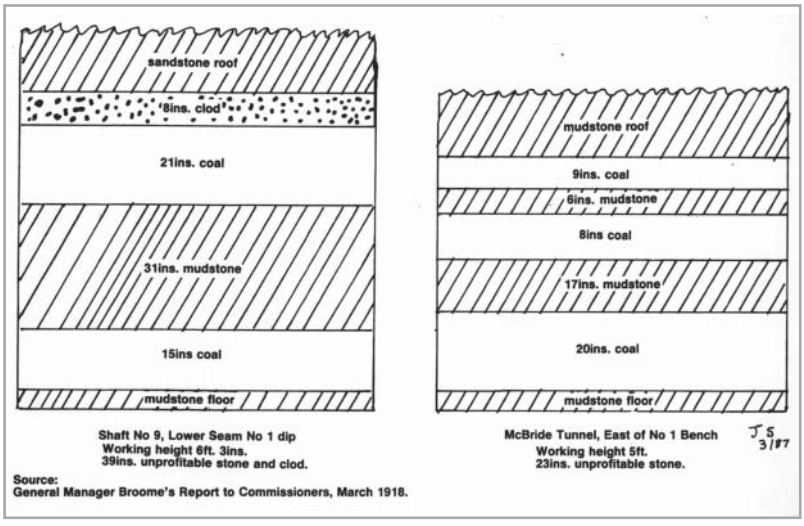
shafts. Number Five shaft was located about 200 metres north east of the cluster of the first four shafts (Photo 3.4/2).

On 1 July 1911, the Government transferred management of the State Coal Mines from The Mines Department to the Railways Commissioners in accordance with the intention in the initial legislation for the Powlett River Coal to be dedicated to the VR for their use in locos and in the VR Newport Power Station.

Drilling was continued over the years to determine the structure of the faulted mining area and to determine mining strategy.

Numbers Nine and Ten shafts were located about 600 metres west of Number Five shaft and were connected to the train outloading facility at Number Five shaft by endless ropeways (Photo 3.4/5). Drives from Numbers Nine and Ten shafts were at depths of 52 to 82 metres working in seams of two and one metre thick respectively. The four production shafts Numbers Three, Five, Nine and Ten were progressively worked out until 1927 producing over 31 million tons of coal.

Mc Bride's Tunnel was installed in 1915 developing new mine workings northwards from Number Five shaft area on four levels, the lowest of which continued until 1936. Total production from the Mc Bride tunnel workings was over 3.3 million tons all outloaded through the Number Five brace outloading facilities. A second tunnel operation, the Station



Drawing 3.4/4 Typical Sections of Wonthaggi Mines.

Photo 3.4/5 Numbers Nine and Ten Shafts at Wonthaggi.

TABLE 3.—RESERVES OF BLACK COAL AT WONTHAGGI AND OTHER VICTORIAN COALFIELDS

Location	Seam Details	Thickness in Inches	Number of Bores in Area	Reserves in Tons Gross
1. WONTHAGGI				
a. Eastern Area No. 1 Bench	Unworked areas and pillars	30–33	50	197,000
b. „ „ No. 2 Bench	„ „ „ „	30–36	88	296,000
c. „ „ No. 3 Bench	„ „ „ „	36	10	99,000
d. Kirrak Area	„ „ „ „	36–68	115	1,843,000
e. Western Area	Top seam	18–40	100	1,178,000
	Bottom seam	15–30		
f. Area between Western and Dudley Areas	Top seam	24–40	27	2,448,000
	Bottom seam	18–30		
g. Area between West Area and No. 9 Shaft	Top seam	30–48	45	232,000
h. West of West Area Shaft	Top seam only	24–30	9	367,000
Total Wonthaggi Area			444	6,660,000
2. OTHER AREAS				
Jumbunna	Main seam	24–40	50	150,000
Korumburra	Top seam	20–30	160	300,000
	Main seam	30–36		300,000
	Mid seam	30–36		200,000
	Deep seam	36–55		800,000
Outtrim	Main seam	24–40	70	100,000
Kilcunda–Woolamai	Main seam	18–26	152	150,000
Cape Paterson	"Rock and Queen" veins	16–32	15	40,000
Mirboo North–Berry's Creek	Scarletts seam	38–48	39	500,000
Coalville		23–31	8	100,000
Total Excluding Wonthaggi			494	2,640,000
Grand Total			938	9,300,000

Table 3.4/2 Reserves of Black Coal in Victorian Coalfields (from Knight (1970), p.69). Copyright State of Victoria, Department of Primary Industries.

Area tunnel, north of the Wonthaggi Railway Station, produced over 0.3 million tons between 1919–28 (Photo 3.4/6).

Three other production shafts: Number 16 and Number 20 (Photo 3.4/8), 2.5 kilometres and three kilometres to the north respectively from Number Five shaft and Number 21 at 2.7 kilometres to the west came into service from 1925 to 1936. Number 16 and Number 20 outloaded to a VR branch line on or near the route previously used by the private 'Daly's Mine'. Number 21 shaft was connected by surface haulage to the Number Five brace outloading plant [there was also a small tunnel operation in the vicinity of Number 21 shaft which produced over 0.019 million tons in a thin top seam between 1956 and 1959]. These three production shafts produced a total of over 5.6 million tons sequentially closing in 1938, in 1962 and in 1968 respectively. All of the above mining was carried out in the area designated as the Dudley Basin which lay to the west of the Wonthaggi Township.

At a separate mining area (in the Kirrak Basin) at the east of the township, mining on three separate bench areas occurred from 1919 to 1931, producing over 1.2 million tons. At 1930, at about 3.5 kilometres east of Wonthaggi Railway Station, Number 18 production shaft (Photo 3.4/7) was installed producing over 1.9 million tons to closure in 1946. In 1939, at about four kilometres north east of Wonthaggi Railway Station, Number 23 production shaft (Photo 3.4/9) was installed producing over 0.46 million tons to closure in 1968.

The peak year of production was the 1929–30 financial year with 0.662 million tons of output by 1770 employees. Table 3.4/1 shows 12 separate mines in the State Mine complex.

Total production from the State Mine complex until its closure in 1968 was over 16.7 million tons. A Government Select Committee of 1910 had assessed that five million tons was a liberal estimate of the coal readily recoverable from the Powlett River area. Subsequently in 1913, the General Manager of

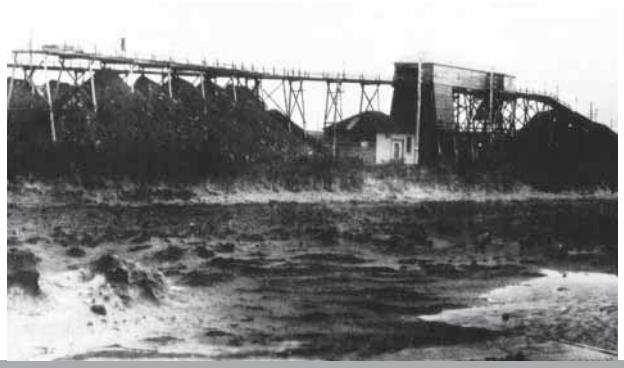
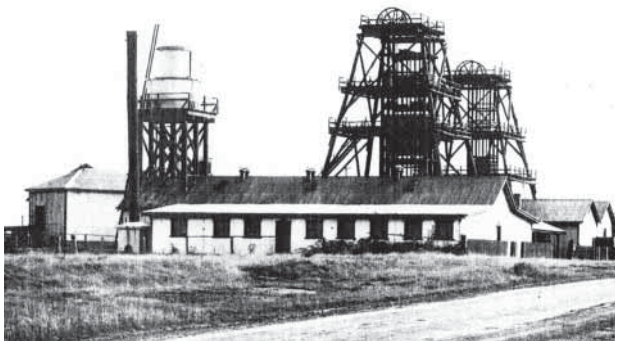


Photo 3.4/6 Station Area Mine 1920 at Wonthaggi.

Photo 3.4/7 Number 18 Mine Shaft 1930 at Wonthaggi.

Photo 3.4/8 Numbers 19 & 20 Mine Shafts at Wonthaggi.



the State Mine estimated that '69 per cent of the total coal reserves of 28 million tons were not recoverable profitably'. The quantity subsequently recovered was well above these early estimates. This high recovery was an outcome of extensive drilling to map the recoverable reserves and of socially influenced perseverance in mining thin and faulted seams not competitively economical to mine.

The reservation by the Government in 1909 of the coal resources of the Powlett River valley for development exclusively by a State Authority was controversial. In October 1909 the Minister for Mines had stated that it was not the intention to enter into competition with private enterprise[115] (from Victoria). However the State Mine within two years became a privileged competitor [116] against the private mines at Korumburra, Jumbunna and Outtrim for coal supply to the Victorian Railways with production from the State Mine being more than three times that of all other black coal mines in the State. The State Mine also sold a large proportion of its 'slack' coal (about 30–55 per cent of total production) to private industry at prices well below those previously available to the private mines.[117] The State Mine also recruited extensively from the experienced employees of the south west Gippsland private mines by offering better wages and housing subsidies.

Considerable mining difficulties were encountered with coal seams generally becoming thinner than first mined and with extensive faulting requiring new shafts and tunnels as seams 'disappeared' at expected or unpredicted faults. The Wonthaggi coal was more friable than anticipated resulting in a high proportion of 'slack' coal and in general had only about 82 per cent of the calorific value of the benchmark coal from Maitland NSW.

In 1913, a private group, the Patent Fuel Syndicate Pty Ltd, obtained from the Government, as recommended by the Railways Commissioners, a lease of land at the north of Wonthaggi to manufacture briquettes from 'slack' coal from the State Mine. However this project did not proceed further.[118] Two later proposals for manufacture of briquettes by the State arose, the second in 1928 not favoured by the VR Commissioners on the basis of cost[119] and a third in 1932 not supported by the VR Commissioners on the basis that limited coal reserves should not be made available at a subsidised price for a long term briquetting project.[120]

Closure of the State Mine had been mooted seriously from about 1939 due to continuing industrial disputation and resulting higher costs per ton. In the 1940s, the mine output was vital during World War Two and economic recovery thereafter. By the mid 1950s, the future place of the State Mine in Victoria's energy needs again came under review. The VR loco fleet was changing to diesel fuel and electrification. The Morwell Briquetting and Power project was under way based on brown coal. In 1956, the VR Commissioners proposed

closure of the State Mine to the Minister for Railways. However the Government was concerned about unemployment in this sole industry area and in September 1958 directed that closure should be implemented gradually with a 'last on, first off' basis. This directive was subsequently modified to provide for early retirement of mine workers from age 58.

By mid 1965 operations had been reduced to one shift per day and in the following mid year the works power station was closed down with electric supply now received from the SECV system. By December 1967, the workforce had been reduced to only 112 men. Further improvements to redundancy payments and retirement benefits occurred with general satisfaction of the last group of mine workers acknowledging the clear inevitability of closure.[121]

'Closing of the 1050 feet deep Kirrak Shaft on 20 December 1968 ended 59 years of continuous black coal mining at Wonthaggi by the State Coal Mine'.[122] Closure coincided with the Christmas holidays of 1968. Total output from the State Coal Mines at Wonthaggi was over 16.7 million tons.

The Railways Commissioners moved quickly with the dismantling of equipment and buildings. 'What could not be sold was allowed to rot.' In its last years, the State Coal Mine was a 'bizarre form of social security benefit for the miners and the Wonthaggi community'. After the achievements of the first two decades this was a sorry end for an initially successful incursion by Government into a field traditionally left to private enterprise.'[123]

The gross reserves of un-worked black coal at Wonthaggi and other Victorian Coalfields determined from bores are set out in Table 3.4/2. For the Wonthaggi Coal Fields 'much of the coal included as reserves would be difficult to extract due to the proximity to old workings and other factors'[124] including stone bands not previously detected and the thinning of seams and occurrence of faults.

'It is most unlikely that black coal mining operations on the scale of those of the State Coal Mine [at Wonthaggi] will ever again occur in Victoria'.[125]

Various relics of the State Coal Mines have been preserved at Wonthaggi, some in-situ at their operating location and some in local museums available to the public. At the initial mine site, conducted underground visits were available for several years to 2005 to inspect the upper coal seam. These underground visits were suspended in 2005 for reconsideration on public safety aspects. A State Mine Park Project has been initiated 'dedicated to preserving what remains of the once extensive State Coal Mine operations. The main project, located on the site of the old Dudley Area, is the creation of a park containing the recently restored Number Five Brace building, the old Rescue Station, the Powder Magazine, Mc Bride Tunnel Entrance, and other facilities'.

Assessment of Heritage Significance

Historical Significance

Mining of the Powlett River Coal Fields by the specifically formed State Coal Mine organisation was the first public authority mining venture in Victoria.

The success of the mining activities , the determined search for additional coal resources and the strategic mine planning resulting in a total lifetime coal output of over three times the estimate at inauguration of the mine set an example for the establishment of other public enterprise ventures in Victoria.

Scientific Significance

No specific scientific applications involving coal composition or usage were initiated for the Wonthaggi coal which was intended and occurred almost exclusively for railway locomotives and the VR Newport Power Stations utilising well established steam raising techniques using black coal.

At least three private enterprise proposals to utilise slack coal for briquette manufacture reached Government consideration between 1913 and 1932 but had inadequate conceptual support from the VR Commissioners or the State Government and did not proceed beyond the concept stage.

Economic Significance

The State Coal Mine(s) at Wonthaggi proved of vital economic significance to Victoria especially from 1910 to about 1932 by which time the SECV's utilisation of brown coal in the Latrobe Valley was taking up the increasing demand for power generation and supplementing hard fuel supply with briquettes.

Output from the State Coal Mines at Wonthaggi was also of extreme importance to Victoria during the 1940s when war time coal shortages and deterioration of fuel supply from other sources existed.

By 1914, the excavation fro the Wonthaggi complex was 0.55 million tons for that year being 90 per cent of the Victorian black coal output and was stated to be 'the largest producing coal mine in Australia'. The 16.7 million tons lifetime output from the 12 separate mines at Wonthaggi greatly exceeded the prediction of five5million tons at inauguration of the Wonthaggi Project.

By the mid 1950s the significance of the Wonthaggi continuing operations had reduced significantly as VR locos converted to diesel fuel and briquette supply from the Latrobe Valley increased.

Social Significance

Establishment of the Wonthaggi mines involved the creation of a planned township and connection to the VR rail system thus presenting opportunity for closer development in south west Gippsland.

The rapid development of the mining operation from 1910 did involve the progressive transfer of much of the mining communities from the other black coal mining operations in south Gippsland.

The protected trading position of the Wonthaggi mines with its 'owner' being its major customer and with its policy to undercut 'slack' coal prices below production costs of the private black coal mines to achieve total disposal of this poorer quality fuel from Wonthaggi lead to the demise of the black coal mines elsewhere in Victoria.

Considerable downsizing of the workforce occurred from about 1932 and by 1939 closure of the mine was being mooted as coal seams were found to be decreasing in thickness and major faults were necessitating opening of new shafts to intersect the faulted deposits. A reprieve in the mine's prospects occurred in the war years 1940 to 1946 as other fuel sources suffered problems in supply. From about 1950, continuation of the mining operations became uneconomic and the VR Commissioners formally proposed closure in 1956. From that time the mine operation was closed down progressively with Government oversight as staged depletion of the workforce was managed in attempts to avoid abandonment of the Township and large scale unemployment. Transfer of mine workers to the SECV burgeoning open cut, power generation and briquetting operations at Yallourn and then at Morwell assisted with the decreasing reductions in the Wonthaggi operations albeit with some adverse industrial relations affects from militant elements of the previous Wonthaggi workforce.

One description of the graduated closure of the Wonthaggi Operations has defined this arrangement as 'a social security benefit for the miners and the Wonthaggi Community.'

The success of the early years of the State controlled Wonthaggi Mines followed some 20 years of spasmodic and generally unsuccessful coal mining ventures by private entrepreneurs, some mines initiated by land developers seeking rail extensions and township land subdivision. This public enterprise success lead to rejection by Government of private industry development proposals of brown coal mines at Altona and at Morwell requiring exclusive rights to power generation and electricity. The success of the Wonthaggi operation by 1915 influenced considerably public support for Public Enterprise to manage the opening of the Latrobe Valley brown coal resources and the hydro electric resources of the State in a co-ordinated electricity supply and distribution throughout the State.

The staged withdrawal from the Wonthaggi operation was successful in reducing the impact of unemployment with the township having a high level of retirees which has continued as the township stabilised as a tourist resort and regional centre.

Mine Infrastructure Features

Visitors centre and underground inspections – Central Area Mine.

Mining Museum – Central Area.

Wonthaggi Historical Society Museum – at Old Wonthaggi Rail Station.

Poppet Head – at Old Wonthaggi Rail Station area.

Number Five Mine Shaft Brace – at West of township.

Old Power House – at West of Township.

Number 20 Shaft Northern area.

Number 18 poppet head Kirrak area.

VR rail route Wonthaggi to Kilcunda preserved as a walk trail.

References

Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948

Coglan, JM, *The State Coal Mine and Wonthaggi*, 1979

Fahey, C, *Wonthaggi State Coal Mine*, Wonthaggi Coal Mine Committee, 1987

Harper, P, *The Wonthaggi Coal Fields*, E.I. Advertising, 1987

Knight, JL 'The Story of Black Coal in Victoria', *Mining and Geological Journal*, Vol. 4, No. 4, 1954

Knight, JL 'The Closing of the State Coal Mines, Wonthaggi', *Mining and Geological Journal*, Vol. 6, No. 6, 1970

The Melbourne Age, 28 October 1909

Quilford, A., *The State Mine: a Pictorial History*, *The Gumnutt Press*, Wonthaggi, 1977

3.5 The Powlett River Mine (Daly's Mine)

Map Reference: **8020-4-4 Dalyston 3755, 57289 approx**

Municipality: **Shire of South Gippsland**

Land Use/Status: Private

Site History

Until about 1908, the existence of thin and scattered coal seams in the Powlett River valley had been known mainly from intermittent drilling by the Mines Department. However a more systematic drilling program in 1908–09 revealed the existence of merged seams up to 9 feet in thickness leading to a decision by Government in 1909 to mine these coal seams as a State Enterprise and to prohibit mining by private companies of the main coal bearing areas, as interpreted from the drilling information.

Immediately outside the north west of the reserved area, a land owner, J P. Daly, became a shareholder of a company, the Powlett River Company, formed in 1910 to mine coal on his property. Location of the mine known colloquially as Daly's Mine, was just south of the present junction of the Loch-Wonthaggi-Dalyston roads (Drawing 3.5/1).

Two seams were mined through separate tunnel systems. [These seams were the same as those worked later in the adjacent Dudley Mine but the coal was of poorer quality.[126]] A rail connection about one and a half miles long south to the VR line to Wonthaggi was installed. A coal burning power plant was installed for electrification of machinery and ventilation.[127] However the mine did not prosper initially and production ceased in 1912.

In 1916, with war time shortages of coal from NSW, the Powlett and North Woolamai Colliery NL reactivated the mine. However the seam thickness progressively deceased in thickness, one seam predicted from three Mines Department bores to be over four feet thick had reduced to 15 inches.[128] The coal seams also proved to have more shale lenses than predicted.

In 1922, the Gippsland Coal Company took over the mine which subsequently changed hands to the Hicksborough Coal Company in 1924. 'All working closed in 1926 after a total production of 132,757 tons.'[129]

Drawing 3.5/1 Locality of Daly's Mine. (from Topographical Map 8020-4-4 Dalyston). Copyright State of Victoria, Department of Sustainability and Environment.

The mine was not reactivated, but the seams that had been worked in Daly's mine were also worked in the Dudley area and in Number 20 shaft workings of the State Coal Mine. Rail track and some equipment from Daly's mine were reused in the State Coal Mine workings in the Dudley area.

Assessment of Heritage Significance

Historical Significance

Daly's Mine was the only privately operated mine on the Powlett River coal field area. Compared with the black coal mines in the Korumburra to Outtrim area, Daly's mine had advantages of proximity to the growing township of Wonthaggi with its community facilities and especially to the VR Wonthaggi branch line.

This private mining venture was commenced within the first year of the State Coal mine to supply the same market as the Wonthaggi mines while the Mines Department was still in charge of the Wonthaggi mines. However the financial viability of Daly's Mine was subsequently disadvantaged by pricing policies of the VR Commissioners both in rail freight charges and in demanding equivalence with NSW coal deliveries on a calorific value price. The VR Commissioners virtually forced the private mine to go into recess as an emergency unmined resource available for reactivation Daly's Mine, with changes in financial syndication, was reopened for brief periods finally closing in 1926 with a recorded lifetime output of under 140,000 tons, this output being the lower than any of the 12 operational areas of the State Mine complex.

Scientific Significance

No specific scientific significance was associated with the utilisation of coal from Daly's Mine which was of somewhat lower quality to the coal extracted from the much larger mining output of the neighbouring State Coal mines.

Economic Significance

The private coal mining operators in Victoria were not organised effectively as a bargaining group. They operated predominantly as price takers subject to fluctuating demand from major users. Daly's Mine was not of sufficient output or coal resource to influence the market price. The VR Commissioners' strategy was to use Victorian Black Coal resources as a reserve coal stock combined with stockpiles of coal at depots throughout the State to counteract vagaries in coal supply and price upgrade demands from NSW.

The small mining operation at Daly's Mine had only low economic significance on the State or local area and suffered the same fate as the other private black coal mines in Victoria being subject to restrictions imposed by the VR Commissioners with respect to demand and price.

Social Significance

Daly's Mine initially appeared to be in a competitive position with respect to that of the adjacent operations of the State Coal Mine Complex with the advantage of access to the Wonthaggi infrastructure for social support and services. However housing preference in the Wonthaggi Township was given to State Coal Mine employees resulting in the growth of small shanty groups for housing of those not employed directly by the State Mine or those in-waiting for employment.

Employment at Daly's Mine was intermittent as the mine struggled for survival and as the Daly's workforce tended to transfer to the growing requirements of the State Mine Complex.

Mine Infrastructure Features

Some of the concrete foundations of former plant of Daly's Mine reputedly still exist on the private property of the former mine site.

References

Harper, P, *The Wonthaggi Coal Fields*, E.I. Advertising, 1987

Knight, JL 'The Closing of the State Coal Mine', *Mining and Geological Journal*, Vol. 6, No. 6, 1970

Sleeman, J, *Black Coal in Gippsland*, 1976

4 Central Gippsland-Black Coal Mines

4.1 Narracan Creek Valley Black Coal Mines

Map References: **8121-1-3 Yallourn**
Broad vicinity of 4356, 57675

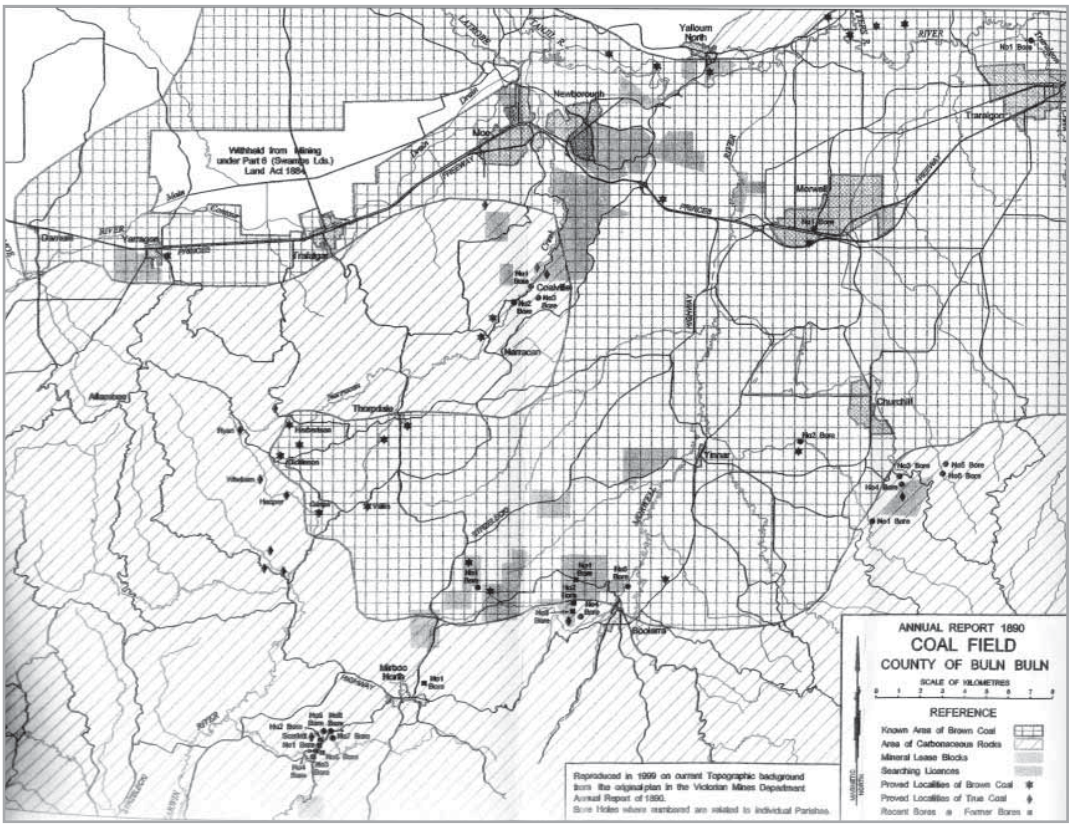
Approximate locations only are shown below for individual mines. All mines listed below were within two kilometres of map reference 356-675. A detailed map has not yet been found depicting mine locations with greater veracity than stated below.

Municipality: **City of LaTrobe**

Land Use/Status **Private**

Site History

Drawing 4.1.1/1 reproduced from a Mines Department map of 1890 depicts the known area of Brown Coal in the county of Buln Buln south of the Princes Highway at that time. This map shows the boundary of the brown coal deposits at about two kilometres to the east of the Narracan Creek valley at the site of Coalville, with all the mines at and north of Coalville being determined as black coal mines. However the original map also showed a small area about three kilometres to the south east of Coalville which was also depicted as a 'Known Area of Brown Coal' where subsequently two brown coal mines at the middle reaches of the Narracan Creek valley south west



Drawing 4.1.1/1 Coal Field, County of Buln Buln (Redrawn form Mines Department *Annual Report* 1890 depicting known areas of Brown Coal and showing black coal locations).

of Coalville were developed. These brown coal mines are referred to respectively in Section 6.3.2 as Haswell's Mine and in Section 6.3.3 as Horrock's Mine.

4.1.1 Early Black Coal Discoveries – The Fear Not Coal Mine

Map Reference: Vicinity 359, 675 approx., The Gippsland Coal Mine

In 1862, George McDonald found black Coal seams in the Narracan River Valley during his pioneering survey for a route from central Gippsland to Western Port.[130] This location was probably on the ridge about two kilometres east of the Narracan Creek.

In 1864, a mining lease was taken out on the Narracan Creek by a prospector William Gladman, who is reported to claim he found coal there in 1860.[131]

In 1876, 'fine bituminous coal' was found in a 60 inch seam just below surface at the head of Mosquito Creek a few miles south of Moe. In February 1877, a black coal seam two feet thick was found as an outcrop in Mosquito Creek.[132] By 1879 a local company the Fear Not Coal Mining Company (approx. vicinity 359.675) was operating in two shafts to mine the coal. The quality of the coal was assessed as equivalent to that found at Cape Paterson and Kilcunda. However, the venture was not successful and the mine did not reach a commercial stage before expiring by 1880.[133]

In 1879, a little further down Mosquito Creek, probably in the same seam as being worked by the Fear Not Mining Company, a private venture sank a shaft 20 feet deep (John Wells says 25 metres deep) which was inspected by officials from the Victorian Railways in 1879. The Melbourne to Sale rail line had been completed in 1879 and the VR Commissioners were evaluating the possibility for a reliable and economic coal supply for their locomotives from sources near this Gippsland Main Line. The Gippsland Coal Mining Company (Approx. location: 356 674) was formed and commenced a mining operation from the shaft in about 1880. Some coal was mined but the company did not prosper and the venture closed down evidently by the early 1880s. No support or contract emanated from the VR for coal from this mine.

4.1.2 The Moe Coal Mining Company and the Tipton Vale Co-operative Company

(Approx. location: 351 677)

Circa 1882, the Moe Coal Mining Company took out an exploration licence of 1,000 ha in a location about five miles south of Moe, westwards from the Narracan Creek and somewhat south along the Narracan Creek valley from the earlier mines. This location may have been chosen from a drilling program commenced by the Mines Department in Central Gippsland in 1882.

The Moe Coal Mining Company sank several bores before selecting a site west of the Narracan Creek on the banks of Deep Creek about eight kilometres south of Moe or about a half mile north west of Coalville. Via a tunnel, this mine initially worked a seam of 70 centimetres thickness at a depth of a few metres.

In 1884, the Moe Coal Mining Company excavated about 800 tons of coal. The Railways Commissioners visited the site in 1884. Subsequent trials of the coal in locomotives appeared satisfactory and by 1888 locos operating on the main Gippsland line and its branch lines were using this coal. The Moe-Narracan-Thorpdale branch line was in progress from 1886 and the first load of coal by this line to Moe and onwards to Melbourne took place in June 1887. A steep tramway connected the mine to a siding on the Moe-Thorpdale line. Output rose to its peak in 1890 at about 15,000 tons in that year, largely due to increased demand due to strikes reducing supplies from NSW to Victoria. The price received for the coal was largely determined by prices applicable to the Korumburra mines which were working in thicker seams. It was also being found that the Narracan Valley coal was more friable and tended to choke loco furnaces. The mine closed temporarily from 1892 to 1895 over a land boundary dispute preventing expansion of the mine. By 1896/7, sales from the mine had fallen to about 1,200 tons annually.

This mine closed in 1897 and the company was liquidated on 17 July 1897 after 15 years of significant activity. Over its lifetime this mine had produced over 100,000 tons, employing over 200 men at its peak but paying a dividend in only the peak year 1890.[134] This was the most successful and by far the largest mine in the Narracan Valley.[135] This mine was the major employer in the Coalville area, leading to the Coalville township being the second largest town after Walhalla in the

Drawing 4.1.1/2 Location of Coalville in Narracan Creek Valley (from Topo Map 8121-1-3 Yallourn). Copyright State of Victoria, Department of Sustainability and Environment.

Buln Buln County in the early 1890s but declining significantly from the mid 1890s.

In 1897, the Tipton Vale Co-operative Company commenced operation on the former Moe Coal Mining Company site. However the VR withdrew completely from purchase of Narracan Valley coal and the Tipton Vale Cooperative Company closed down in 1898.

4.1.3 Narracan Valley Company (Narracan Company)

(Approx. location: 345 662)

This company commenced operation in 1883 working a 76 centimetres seam at 36 metre depth. It operated intermittently, being renamed as the Narracan Company in the mid 1880s. One reference source states that this mine surrendered its lease in 1886 which was taken up by the Coalville Central Company[136]. The location of this mine was near the Coalville Station[137]. (John Wells states the location as 1.5 kilometres south of the Township.) See sub-Section 4.1.5.

4.1.4 Grange Colliery Company

(Approx. location: 355 684)

This mine was opened in 1887 at a location on the west of the Narracan Creek overlooking the Moe Coal Mining site. Some coal was sent to Melbourne and England for appraisal by potential investors. The mine did not prosper and ceased operation by 1890.

4.1.5 Coalville Central Company

(Approx. location: 345 662)

This mine which took over the workings of the Narracan Company in 1888 was located about 1.5 kilometres south of Coalville. It was stated to be better coal than the major producer, the Moe Coal Mining Company. The mine paid a dividend in 1891 but had closed by the mid 1890s.

4.1.6 Emmersley Park Company

(Approx. location: 353 673)

This mine commenced operation in 1890 as a shaft operation with its poppet head prominent at the township of Coalville[138]. The mine ceased in 1891.

4.1.7 North Coalville Mining Company and the New North Coalville Company

(Approx. location: 360 682)

This mine located on the east side of the Narracan Creek was opened in 1892. Several tunnels were used to intersect a 38 centimetre seam. At 1893, the mine output was 200–300 tons per week. However, from1893, the VR reduced its total intake from the Narracan Valley mines to 1,000 tons per week, one third its previous demand. In late 1894, the mine was unsuccessful in a tender to the VR for continuation of coal supply and the mine closed in early 1897. The New North Coalville Company was formed in 1897 for operation on this site but did not prosper and ceased operation in 1898.

[All black coal mining in the Narracan Creek Valley upstream as far as Thorpdale had ceased by 1898. The coal mining township of Coalville was not named until 1886 when a postal service was provided. In January 1887 the Narracan Valley Coal Mines State School Number 2822 was opened in a hall with about 100 pupils by 1890[139]. The VR rail line between Moe and Thorpdale was completed in 1888. At 1890 there was a population of 300–350 mainly scattered along the creek as squatters. It was not until 1893 that township housing blocks were surveyed and available for purchase and eviction of squatters from the creek banks occurred to allow road alignment. A rapid decrease in population occurred from 1897 as uncompetitive mines closed down. At least four new mines commenced operations in the Narracan Valley north of Narracan from 1904 to 1929. Each of these ventures had short unprofitable lives.]

4.1.8 Coalville Co-operative Black Coal Company

(Approx. location: 353 672)

This mine opened in 1904 but did not prosper and closed circa 1905. The location of the mine has not been ascertained in this study but is presumed to be near the Coalville township (353-672).

4.1.9 New Moe Company Dudley Colliery Company

(Approx. location: 351 674)

In 1908, the New Moe Company was formed and operated via shafts to a one metre thick seam on the west side of the Narracan Creek near the Coalville Railway Station. Coal was

delivered via a tramway from the mine over a bridge to the station. Coal supply was to private industry including the Australian Paper Mill, Geelong Woollen Mills, and to Sale Water Works. In 1909 this mine was renamed as the Dudley Colliery Company. The mine operated until 1911.

4.1.10 The Gladiolus Company

This mine operated in 1929–1930 but 'was only moderately successful' (John Wells, *So Tall the Trees*, p.101). 'All mining ceased in October 1930' (K. Bowden p. 82). The location of this mine is indicated by these two writers as in the Narracan River Valley but its more precise location has not been ascertained in this coal heritage study. [Another source (Waghorne (2005)) includes the Gladiolus Mine with the Korumburra area mines from 1926–1929 with a lifetime production of 5,408 tons. The differences between these information sources have not been resolved in this Coal Heritage study].

Assessment of Heritage Significance

Historical Significance

The discovery of black coal in the Narracan Creek Valley in 1862 was the first reported in the new colony of Victoria after the initial discovery of the Cape Paterson area coal seams. However it was some 17 years later before mining of black coal commenced in the Narracan Valley as a small scale operation with inadequate transport from the mine site to local customers. The construction of a VR branch line through the Narracan Valley in 1887 after a mine site visit in 1884 by the Victorian Railways Commissioners stimulated several mining ventures at the time of industrial disputation in NSW adversely affecting coal supplies to Victoria. However coal seams were thin and transport costs to the main market in Melbourne were high and not subsidised by the VR Commissioners. By 1893, coal supply to Victoria from NSW had returned to normal and black coal had become available from the Korumburra coal fields with rail access to Melbourne.

In the late 1880s, commercial prospects for black coal mines in the Narracan Valley appeared good. A rapid influx of mine workers took place leading to the establishment of the township of Coalville for about five years as the second largest town in Central Gippsland (after Walhalla). In 1889 the newly surveyed township had a population of about 350 with over 100 children going to school.[140] [This township no longer exists.]

The closure of nearly all the Narracan Valley mines by 1900 and their entire demise by 1930 was indicative of the likely economic fate of small scale mining ventures with a limited resource in competition in cost and reliability of supply and in quantity and quality.

Scientific Significance

No specific scientific significance was associated with the Narracan Valley black coal mining. The Narracan Valley black coal had been tested in laboratory and in usage as a black coal of average heating quality.

Economic Significance

The Narracan Valley mines attempted to compete with larger scale mines supplying well established industrial usage. These mines had no competitive economic advantage over the NSW coal supplies at the Victorian Fuel Depots and had no boutique niches in metropolitan or regional markets. Some competitive advantage in lower transport costs to Central and Eastern Gippsland markets was availed of but there were no significant industrial establishments in these areas at 1900, by which time the Korumburra mines were operating in thicker coal seams on a larger coal resource.

The local demand was later met by briquettes, brown coal and electricity from the Latrobe Valley large scale mining activities and subsequently by natural gas virtually eliminating prospects of revival of mining of the Narracan Valley remaining black coal resource.

Social Significance

The advent of coal mining in the Narracan Valley, in the 1880s, initially by tunnels into surface outcrops, presented paid work opportunities for the early settlers in the Narracan area who were mainly engaged in timber clearing on leased properties. The small mines could be readily worked by manual labour without the cost of extensive mechanisation and offered a bonus and an unexpected source of income to the timber and grazing workers in the area. The subsequent mechanisation of the mining activities for larger scale mines attracted mine workers in a time of high unemployment in the early 1890s,

eventually requiring replacement of unofficial 'tent' settlements along the Narracan Creek with establishment of the township of Coalville at the centre of the mining activities.

Coalville was a one industry township eventually with the Moe Coal Mining Company as the major mine, but with several (many?) small scale tunnels and shafts, some unmechanised and unreported, being worked along the hillsides and tributaries of the Narracan Creek.

Most of the paid mine workers and their families progressively transferred with their acquired mining skills to the new Korumburra, Jumbunna and Outtrim mines from the early 1890s and later to the State Coal Mine at Wonthaggi.

Mine Infrastructure Features

No specific remains of the Narracan Valley mines have been ascertained in this Coal Heritage Study.

The Coalville Rail Siding area is identifiable as a public reserve; a memento of the mining activity in the Narracan Creek Valley could be appropriately located at this site.

The Gippsland Heritage Park at Moe preserves some relics of the community of Coalville.

References

Adams, John, *So Tall the Trees*, 1986, pp.94–105

Daley, C, *The Story of Gippsland*, 1960, p.132

Hillbrick, G, *Memories of Coalville*, *Coach News*

Mineral Statistics, Mines Department, 1876, p.51

Ringin, Kath 'Bundilla and Coalville', *Coach News*, June 1983

Wells, John, Gippsland: *A People, a Place, and their Past*, 1986, pp.158–161

4.2 Morwell River Valley Black Coal Mines

Map Reference: **Jeeralang Mines 8121-2-N Yinnar North Vicinity 4480, 57555 approx.**

Boolarra Mines 8121-3-2 Mirboo Vicinity 4340, 57511approx.

Municipality: **City of LaTrobe**

Land Use/Status: **Mainly Private**

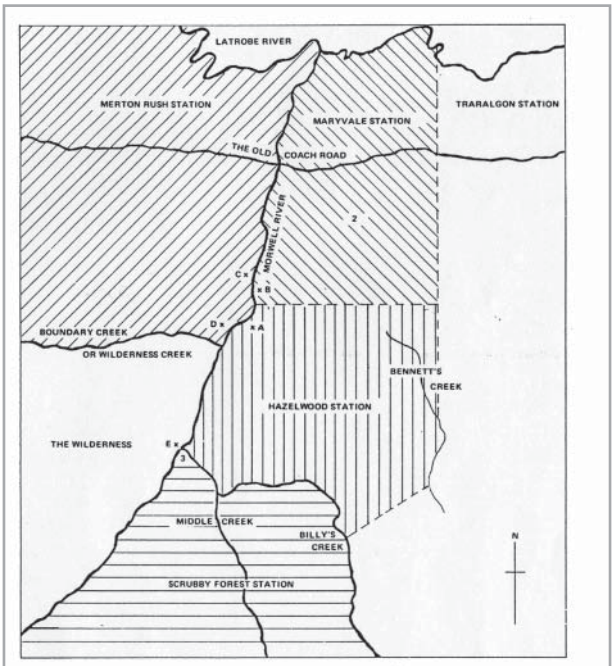
Site History

Black Coal seams in the Morwell River Valley occur at Jeeralang (Billy's Creek) and at West Boolarra at the southern border of the 'Known Area of Brown Coal' as depicted in Drawing 4.1.1/1. Other black coal seams found to the south west of Mirboo North and off the western border of the 'Known Area of Brown Coal' are outside the Morwell River catchment and are listed in Section 4.3 of this study.

4.2.1 The Excelsior Coal Mining Company

[Specific location not ascertained]

The existence of this mine on the Hazelwood Run is referred to in the *Mineral Statistics* for 1873. Reference to this mining operation has also been made by John Adams in *So Tall the Trees* p.94. The venture is also referred to by John Wells in *A People, a Place and their Past* p.158 as beginning mining operations on the Hazelwood Run in 1873/74. It is possible that this project may have been located on a brown coal deposit as was most (all?) of the Hazelwood Run. Alternatively it may have been the fore-runner of the Hazelwood Coal Mining Company which mined black coal. No record of the output from the Excelsior mine has been found in this Coal Heritage Study. Due to lack of transport from the area in the 1870s it is probable that usage of coal would have been restricted to the mine locality and less than 1,000 tons. It is reported that the company operating the mine failed 'shortly after 1874'.[141]



Drawing 4.2.2/1 Early Cattle Stations in the Morwell Area showing the Hazelwood Run (extracted from I.T. Maddern, *A Souvenir History of Morwell*). Copyright Ivan Maddern.

4.2.2 The Hazelwood Coal Mining Company and subsequent mines at Billy's Creek.

Map Reference: 8121-2-N Yinnar North Vicinity 4480, 57555 approx.

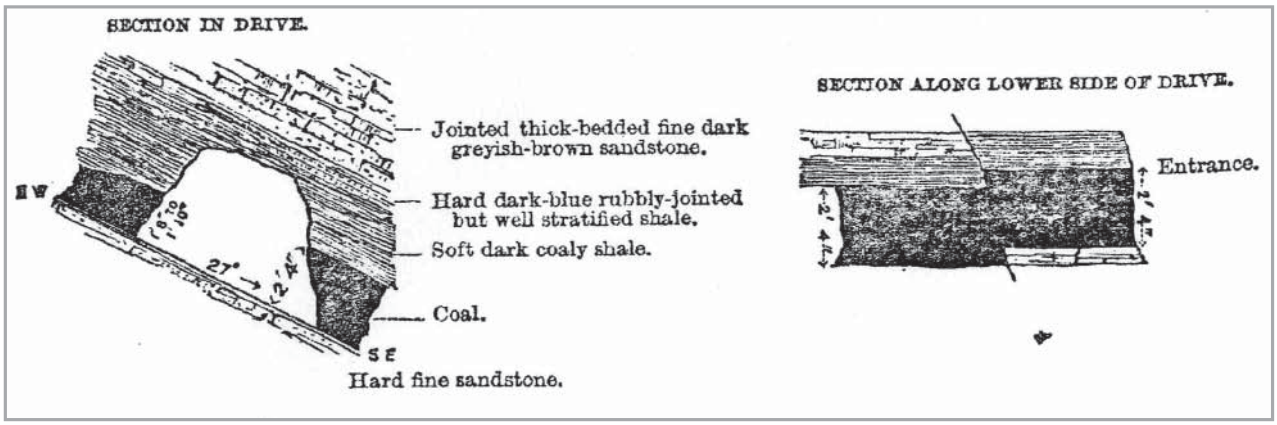
J P. L Kenny writing in 1947[142] states that the Hazelwood Coal Seams were first found as outcrops of black coal on a branch of Billy's Creek on Allotment 17 Section C Parish of Jeeralang. The Hazelwood Coal Mining Company was formed circa November 1874 to mine this seam.[143]

In 1876, the Mines Department depicted sections across a drive into a two feet four inch black coal seam named the Hazelwood Seam.[144] The site of this drive was 'on a branch of Billy's Creek, a tributary of the Morwell River, about three and a half miles south east of the 'Hazelwood Run' homestead' and at the southern border of this Run. (See Drawing 4.2.2/1). The location of the mine has been ascertained in this heritage study as that shown in Drawing 4.1.1/1 as a location of 'true' coal some 4.5 kilometres south from the present Churchill Town Centre. Smaller seams up to two feet thick outcropped at 60 yards and somewhat further down Billy's Creek. The quality of the coal was described as 'scarcely marketable as fuel although possibly suitable for gas making.' The feasibility of installing a tramway to the proposed VR Gippsland Rail line was suggested by RAF Murray to open up a market for this coal.[145] This suggestion was also pursued by the surveyor George Jones who had interests in the mining venture and through whose land the tramway route passed. The route remained as a reserve for a tramway but was not developed as such although Tramway Road between Morwell and the Billy's Creek area is a reminder of the original suggested route.

It was probably by about 1875/6 that the Hazelwood Coal Mining Company activities lapsed due largely due to lack of access to a market. A neighbouring venture on Billy's Creek also failed about this time without site activities having occurred.

In 1883, RAF Murray reported that 'the company continued working for some years.'[146] Presumably this comment conveyed that mining had ceased by 1883. It is also probable that Murray was referring to a company working the Hazelwood seam after the demise of the Hazelwood Coal Mining Company As detailed below, other companies appear to have operated the mine or adjacent workings from 1878/9.

JPL Kenny [147] presents a somewhat different summary of the coal mining of the Hazelwood Seam, stating that shortly after 1878 a mining lease was taken out by M Ehrenberg who formed a company to open the seam. Two shafts and several tunnels were installed. Coal in the main tunnel was up to four feet thick, averaging three feet.



Drawing 4.2.2/2 Sections showing Hazelwood Coal Seam at Jeeralang (from *Geological Survey Progress Report* Number. 3, 1876 by RAF Murray)

In June 1879 after completion of the VR Gippsland Railway through Morwell, the Prince of Wales Coal Mining Company was formed to rework the former Hazelwood Coal Mining Company mine but shortly after the shaft was flooded by Billy's Creek and this venture closed down without reaching production.[148] A VR branch line from Morwell through Boolarra to Mirboo North was built progressively from Morwell between 1883 to 1886 opening up possibilities for coal transport from the Hazelwood black coal seam.

In December 1884, the Lady Loch Mine was established but did not proceed to a commercial mining stage. The United Hazelwood Coal Mining Company, floated in 1886, apparently did not reach a commercial mining stage.

At January 1888 a syndicate, the Royal Standard United Coal Mine, Hazelwood, appraised diamond drilling in progress investigating the extent of the coal seam estimated by. RAF Murray as three feet thick. In March 1888, the syndicate, registered subsequently as the Hazelwood Coal Proprietary Company NL, took out leases 'to commence a mining operation' at the South West of the Hazelwood mine Tenders were called to mine 20 tons of coal and send this to Morwell[149] but this project also did not proceed.[150] No further information has been ascertained in this heritage study.

Although the Mines Department carried out widespread drilling around Hazelwood and Jeeralang in 1889, additional payable black coal seams were not discovered. Some minor black coal mining of the Hazelwood seams shaft continued to about 1890.

Drawing 4.2.2/3 Sketch of Coal Mine at Billy's Creek, Jeeralang (from *The Settling of Gippsland by Patrick Morgan*, 1997). Copyright Partick Morgan.

Some coal mining minor ventures were initiated in the flat land northwards towards Morwell but all were probably in brown coal deposits and none succeeded commercially. All these embryo mining activities had ceased by the mid 1890s as the Narracan Valley and the Korumburra area black coal mines and the Great Morwell Brown Coal mine had come into production in more economic ventures.

4.2.3 Black Coal Mines in the Boolarra Area.

Map Reference: 8121-3-2 Mirboo Vicinity 4340, 57511 approx.

About two kilometres west of the township of Boolarra, bores Number Two, Three and Four as depicted on Drawing 4.1.1/1 penetrated black coal seams delineating the boundary of the Known Areas of Brown Coal from bores Number One and Five.

Number Four bore passed through a black coal seam known subsequently as the Boolarra seam at three feet two inches thick at 696 feet with no other coal found to 1163 feet. Number Five bore north of Boolarra passed through brown coal in two layers the uppermost being 139 feet thick commencing at 71 feet with the bore terminating in basalt at 923 feet.[151]

At 1889, three black coal mines as listed below were in operation at Boolarra after the VR Rail line from Morwell through Boolarra to Mirboo North was opened on 31 December 1885.

Mirboo Collieries Number One
Map Reference 8121-3-2 Mirboo 4340, 57512 approx.

[In 1889, the Mirboo Collieries Company sank the Boolarra Shaft north east of the Boolarra township and extracted brown coal. See Section 6.4.4.]

This company also operated in the vicinity of the Number Three bore in the three feet five inch seam known as Batt's or the Boolarra seam of 'dense black coal' with a low ash content and 'good for gas, coke, and house or steam purposes'[152].

Boolarra Coal Mining Company
Map Reference 8121-3-2 Mirboo 4340, 57510 approx.

The mine was located in a three feet two inch seam near Number Four bore and was worked for several years.[153] This seam was found in 1890[154]. This mine closed in the early 1890s due to high costs.

Gippsland Railway Company

The operating location and history of this black coal mine have not been ascertained in this Heritage Study.

This mine reputedly closed by the early 1890s due to competition from the Korumburra area mines.

[The same company name was involved in brown coal exploration alongside the VR main Gippsland rail line between Moe and Morwell circa 1899.][155]

Assessment of Heritage Significance

Historical Significance

The mining operations of the Excelsior Coal Mining Company in 1874 at a black coal outcrop at Jeeralang in the Morwell River Valley was the first commercial mining of black coal in Central Gippsland preceding commercial mining in the Narracan Valley Creek where an outcrop of black coal had been found earlier in 1862. Although the Excelsior venture failed within about one year, mining of the same black coal seam in the immediate vicinity was subsequently taken up by a succession of companies until about 1890.

The commencement of black coal mining at the Jeeralang outcrop stimulated drilling activities by the Mines Department in the Morwell River Valley which disclosed the widespread existence of the brown coal deposits and the spasmodic occurrence of black coal seams. The commencement of black coal mining at Boolarra in 1890 in the Morwell River Valley resulted from this drilling activity.

The lack of commercial prospects for black coal mining in the Morwell River Valley was understood by the early 1890s. The advent of the VR branch line in the mid 1880s in the Morwell River Valley, provided partly for coal transport, proved insufficient cost advantages to compete with other coal supplies to the Melbourne area.

Scientific Significance

No specific scientific significance was associated with the mining and utilisation of the small black coal output from

the Morwell River black coal mines. The extensive drilling implemented to find additional black coal seams resulted in significantly increased geological knowledge of the brown coal deposits as a prime resource for development of the State.

Economic Significance

The initial black coal mining ventures at Jeeralang demonstrated that thin seams and high transport costs obviated commercial success of the Morwell River black coal mines other than for supply to local domestic use with insignificant local industrial activity.

The low and intermittent black coal output from the Jeeralang and Boolarra black coal mines had little economic significance other than to dissuade further investment in black coal mining in the Morwell River Valley.

Social Significance

In the 1870s when black coal mining commenced at Jeeralang, land clearing and grazing were the prime occupations in a sparsely settled community. The finding of black coal outcrops appeared to offer new opportunities. However the Morwell River Valley black coal seams proved to be thin and only of small extent. Unlike in the black coal mining in the Narracan Valley and later in the Korumburra area, the small size of the mine workforce and the intermittent activity in the Morwell River black coal mines did not induce an influx of mine workers or change the fabric of the local community.

However the advent of the VR branch line into the Morwell River Valley, partly justified by expectations of a coal industry accelerated closer settlement and economic growth in the area south of Morwell.

Mine Infrastructure Features

No physical remains of the coal mines at Jeeralang or at Boolarra have been ascertained during this coal heritage study.

The mine sites on Billy's Creek at Jeeralang could be identified approximately and linked with an existing small historical reserve in the area.

Recollections of the coal mine activities sites at Boolarra could be preserved by a memento in the existing public reserve at the former Boolarra Rail Station.

References

The Gippsland Times, 24 November 1874

Kenny, JPL 'The Hazelwood Coal Seam', *Mining and Geological Journal*, March 1947, pp.19–20

Knight, JL 'The Story of Black Coal in Victoria', *Mining and Geological Journal*, Vol. 4 No. 4, September 1951, p.41

Legg, Stephen M, *Heart of the Valley: A History of the Morwell Municipality*, 1992, pp.76–79

Annual Report, Mines Department, 1889, pp. 21–22 and 1890, p.9

'Borings in search of Coal and Lignite or Brown Coal', *Annual Report*, Mines Department, 1890, p.102

Progress Report, No. 10, Mines Department, 1899, pp.4– 5

Morgan, P, *The Settling of Gippsland*, 1997

The Morwell Advertiser, 3 March 1888

Murray, RAF 'Report on the Geology and Mineral Resources of South Western Gippsland', *Geological Survey Report*, No. 3, 1876, pp.158–159

Murray, RAF, *Geological Survey Report*, No. 7, 1883, p.74

Wells, John, *Gippsland: A People, a Place and their Past*, 1986, p.158

4.3 Thorpdale Area Black Coal Mines

Map Reference: **As listed below for individual mines**

Municipality: **Shire of Baw Baw**

Land Use/Status:

Site History

4.3.1 Ryan's Black Coal Mine

Map Reference: 8121-3-4 Allambee 210.618 (Approx)

This outcrop showing a black coal seam of 15 inch thickness was found circa 1875 on the upper reaches of a tributary of the Tarwin River [156] at about seven kilometres westerly from Thorpdale. Analysis of a sample showed fixed carbon of about 63 per cent and ash of 6 per cent. Another seam 14 inches thick was found by R. A. F Murray in 1875 about 100 feet lower some 200 yards southwards downstream. Murray stated 'These seams probably underlie a great area, and may be of more importance than can at present be attached to them. Communication with the railway by tramway would be difficult but by no means impracticable'.[157] It has not been definitively ascertained in this study whether these Ryan's seams were mined commercially, no record having been found in Mines Department reports.

The discoveries of these seams were the first in the upper Tarwin River area to the West of Thorpdale and stimulated expectations of further finds by drilling.

4.3.2 Whelan's Black Coal Mine

Map Reference: 8121-3-4 Allambee 207.604 (Approx)

This mine was based on a four feet thick coal seam. The initial discoveries in October 1888 found 'five or six outcropping seams ranging in thickness from 12 to 18 inches'[158]. The mine was located on Whelan's Creek at Childers about seven kilometres miles to the west of Thorpdale and two-three kilometres south of Ryan's mine beyond the western border of the 'known area' of brown coal in the Narracan Creek valley as depicted in the Mines Department *Annual Report* 1890. (see Drawing 4.1.1/1 of this heritage study.)

4.3.3 Unger's Black Coal Seam

Map Reference: 8121-3-4 Allambee vicinity 225 570

In 1891/2, about six kilometres west of Thorpdale, an outcrop of black coal about 10 to 18 inches thick and known as Unger's Seam was traced for about 30 chains along Watkins Creek[159]. This find increased the evidence for widespread black coal seams to the west and south of Thorpdale.

4.3.4 Rollo's 'Carpe Diem' Black Coal Mine,

Map Reference: Allambee vicinity 190.580

Discovery of a black coal outcrop at this site on a tributary of Watkins Creek and about three kilometres east of Allambee occurred in 1887. Analysis of a sample taken on 18 November 1889 showed fixed carbon of approximately 58 per cent and 8.6 per cent ash. Development was not forthcoming due largely of lack of access to rail transport as with other potential black coal mining prospects in the Childers-Allambee area to the west of Thorpdale. Continuing requests to Government to extend the VR Branch Line from the railhead at Thorpdale were made from 1888 through to 1909.

A tunnel was driven into the outcrop revealing a 10 to 14 inch seam. A bore was put down by John Rollo about 160 feet to the south east revealing a 15 inch seam. The name 'Carpe Diem' was evidently applied by Rollo by 1890. About three-quarters of a mile downstream another outcrop was driven into revealing an average seam thickness of 15 inches. The geological assessment was that 'this was probably a continuation of the Carpe Diem seam'[160]. Further details on the Carpe Diem nine have not been ascertained in this Coal Heritage Study. An analysis of the Carpe Diem seam is shown in Table A, p.22 of the Mines Department *Annual Report* 1889.

4.3.5 Scarlett's Black Coal Mine at Berry's Creek

Map Reference: 8121-3-2 Mirboo 221.485

On Berry's Creek, about 4.5 kilometres south west of Mirboo North, an outcrop of black coal was found in 1889 and was known as Scarlett's Seam. Eight deep bores were sunk by the Mines Department from 1888 to 1890. In bore Number Six, several thin black coal seams merged resulting in a four feet six inches thick seam.[161] The geological assessment was that the drilling 'clearly showed that Scarlett's Seam extends

over a considerable of ground, though evidently much faulted in places.'[162]

To 1930, about 2,000 tons of black coal was extracted from a shaft but the mine proved uneconomic compared to the Wonthaggi and Korumburra area mines, largely due to the comparative transport disadvantages.

In 1957, the mine was reactivated on Scarlett's Seam at Berry's Creek; the adjacent creek was bridged and mining recommenced by a new drive into the seam.[163] In 1958, an underground survey of the workings was carried out by the Mines Department. The mine was referred to as the Mirboo Coal Mine Berry Creek in the Mines Department *Annual Report* for 1958, but as Berry's Creek Coal Mine, Mirboo North in the Annual Reports for 1957 and 1959[164]. At 1959, this mine was the only black coal mine in operation in Central Gippsland.

In 1959, the Berry's Creek mine closed down. Annual production in the three years 1957 to 1959 was 582, 711 and 667 tons respectively. No definitive record of the total lifetime production of the Berry's Creek mine have been found during this study but total output probably did not exceed 5,000 tons.

Drawings

For locality Maps of the black coal mines in the Thorpdale area see:

- Drawing 4.1.1/1
- Drawing 6.3.8/3 from Topo Map 8121-3-4 Allambee
- Drawing 6.3.2/1 from Topo Map 8121-3-1 Thorpdale
- Drawing 6.3.1/2 from Topo Map 8121-3-2 Mirboo

Assessment of Heritage Significance

Historical Significance

The Ryan's Seam find in 1875, also promptly inspected in 1875 by the Mines Department, raised hopes of a widespread occurrence of black coal in the Thorpdale area extending to other recent black coal finds at Korumburra in 1873, at Jeeralang in 1874, and the worked seams at Cape Paterson and Kilcunda.

It appears that timber workers and land occupiers may have found other black outcrops in this extensive area but saw no opportunity for commercial ventures until VR branch lines were extended into proximity of the coal outcrops. Mining of these black coal seams did not occur until the late 1880s as VR rail access became available. However all the Thorpdale area mines, except that at Berry's Creek, closed down within a few years being unmechanised and uncompetitive with respect to the thicker seams at Korumburra.

Reactivation of the Berry's Creek mine for about three years from 1957 was in response to hard fuel shortages and delays in increased briquette production by the SECV when the small quantity of black coal output from the Berry's Creek mine provided a heating source in Gippsland milk factories and local hospitals.

Scientific Significance

No specific scientific significance is identified with respect to utilisation of the black coal from the Thorpdale area mines. The coal finds and subsequent drilling helped to diagnose the extent of the deposits and their geological origins in the wider Gippsland coal fields.

Economic Significance

The mining operations of the Thorpdale area thin black coal seams were too small in output to have any significant effect on the regional economy. The high local expectations of an extensive black coal resource in the Yarragon to Morwell River Valley were dissipated by the early 1890s with only a few mines surviving and catering only for local consumption.

Demise of the Yarragon black coal mines diverted attention to usage of the brown coal deposits in Gippsland the extent of which in Central Gippsland had been diagnosed by 1890 (see Drawing 4.1.1/1).

Social Significance

Most of the black coal finds in the Yarragon were by land occupiers discovering coal outcrops on their properties rather than by Mines Department geological investigations. Most of the area southwards about two miles southerly from Thorpdale consisted of heavily timbered ranges without road access other than the bullock tracks pushed into the forests for timber log extraction. The comments of RAF Murray (1890)[165] are pertinent: 'The rough country, the dense forests and high

jungle, the absence of roads, and the want of connexion with the railway system of the colony all cause the development of a coal mine to be truly pioneer work'. Prospects for coal mining were not realistic until the VR rail line reached Thorpdale in 1888. However the thin coal seams proved uneconomic. Most mines did not justify mechanisation, did not reach a commercial scale of operations and remained as intermittent operations using hand tunnelling and extraction for local consumption.

Thus, the working of the Yarragon area mines used local manpower rather than the importation of skilled miners and did not significantly alter the social groupings developed to meet the timber clearing and milling and the land settlement activities pre-1900.

Mine Infrastructure features

No specific at-site identification of the black coal mines in the Yarragon area has been undertaken in this Coal Heritage Study. No remnants of the mining activities have been elicited from discussions with residents in the Yarragon area.

References

From the Dawning: A History of Yarragon and District, Back to Yarragon Committee, March 1978

Annual Report, Mines Department, 1889, p.92

Annual Report, Mines Department, 1890, p.101

Annual Reports, Mines Department, 1957, 1958, 1959

Mining and Geological Journal, Vol. 6 No. 2, 1957

The Morwell Advocate, 6 October 1888, p.3

Murray, RAF, *Geological Survey Progress Report*, No. 3, Mines Department, 1876, p.159

Stirling, J, *Reports on the Victorian Coal Fields*, Report on the Yarragon District, 1892, p.16

5 Central Victoria Brown Coal Mines and Black Coal Seams

5.1 Lal Lal Lignite Mine

Map Reference: 7722-4-3 Lal Lal Open Cut Mine
7668, 58243

Lal Lal Shaft Area 7664, 58248

Municipality: District of Buninyong created
9 July 1858
Shire of Buninyong proclaimed
16 February 1864
City of Ballarat

Land Use/Status: Private

Site History

The existence of beds of lignite was reported for the first time in the Colony of Victoria in 1857[166] at Lal Lal, about 13 miles South-East of Ballarat in Central Victoria (see Drawing 5.1/1).[167] Prospecting for and mining of gold had burgeoned in the Ballarat area in the 1850s.

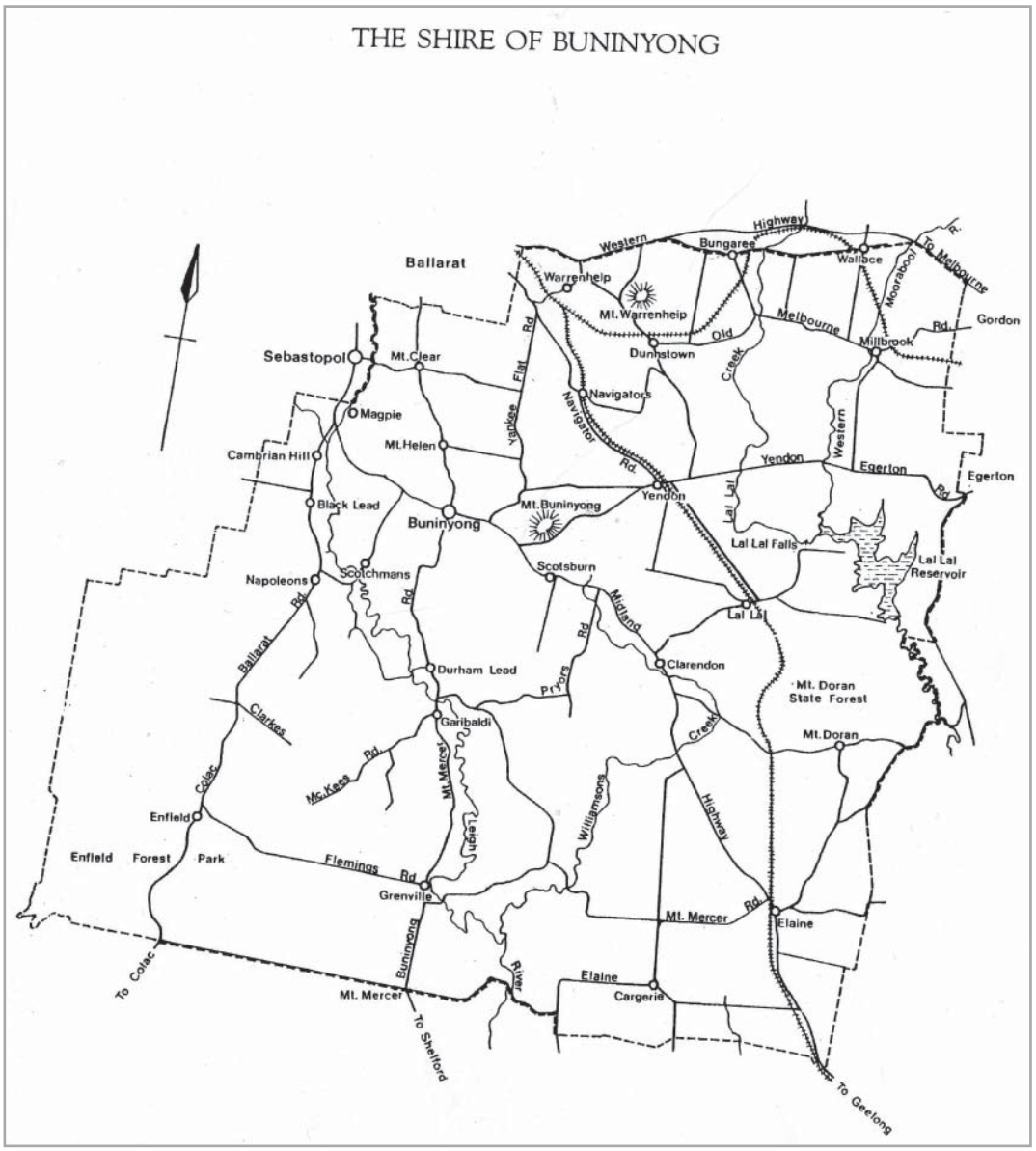
By the mid 1850s in the Lal Lal area, gold had been found in the creek gullies and some mining at surface had occurred. In 1857, a shaft sunk by a prospector, James Ralph, to a depth of 226 feet while searching for gold seams, intersected 'several layers of clay with occasional beds of lignite or as it was then thought to[168] be coal.'[169] The location of the shaft was about 70 chains south of the present road/rail crossing at Lal Lal and immediately adjacent to the western side of the Geelong/Ballarat railway reserve. James Ralph announced this discovery in the Ballarat Star resulting in a small syndicate being formed on 5 January 1859 to prospect specifically for coal beds. A second shaft was sunk about 300 feet to the North West of the initial shaft and intersected two layers of 'coal' each about 12 feet thick with about 12 feet of clay intervening, the top of 'coal' being at a depth of 60 feet.[170]

About 200 tons of 'coal' were raised[171] from this second shaft and 'distributed as samples amongst persons (and organisations) thought likely to have (or find) a commercial use for this 'coal"[172]. It was assessed by about 1860 that the deposits were more specifically classified as lignite, being softer, more friable, less dense, more woody and of significantly lower heating value than the normal range for black coal. Samples of the lignite were used in successful tests for gas making at the Ballarat Gas Works, for steam raising trials at engineering and manufacturing works in Ballarat, Geelong and Melbourne.

The Geelong-Ballarat Railway was opened in 1862 enhancing significantly commercial prospects for supply of lignite to metropolitan and provincial markets for fuel, gas manufacture, fertiliser and other processed by-products. A commercial company, the Victoria Lignite Company Ltd, was formed on 25 April 1863 with paid up capital of £1000 with James Ralph as manager[173]. This company obtained a lease on the East of the railway reserve immediately South East of the original discovery bore and sank a shaft which intersected a single bed of lignite 115 feet thick overlain by 64 feet of clay and gravel. Extraction of lignite via this shaft then proceeded by contract at seven shillings per tonne, forwarded to Geelong or Ballarat by rail at a cost of £1 per truck of rather more than six tons of lignite and sold for 20 shillings a ton at Ballarat.[174] Two hundred tons of lignite was mined from the 'Victoria' shaft in the calendar year 1864. This was the first quantity of lignite officially recorded as being mined in Victoria. 'This lignite was sold at prices varying from ten to fifteen shillings per ton.' [175]

By 1865, four companies held leases for mining lignite at the east of the railway at the south of Lal Lal covering an aggregate area of 669 acres. The Mines Department recorded that 'extensive deposits of lignite, some of great thicknesses' existed in the area.[176] At 1869, the Secretary stated 'At Lal Lal there is a bed of lignite more than 100 feet in thickness.'[177]

Mining was very intermittent through the 1860s as leases changed hands and the lignite was used in various tests including trials of drying and briquetting in Germany. Chemical



Drawing 5.1/1 The Shire of Buninyong with Lal Lal at centre right. Copyright Buninyong Historical Society.

analysis of the Lal Lal lignite undried was reported in 1869 as having properties averaging: 28 per cent fixed carbon, 22 per cent volatile matter, 48.7 per cent hygroscopic water and 1.3 per cent ash. Each tonne of lignite gave about 5,500 cubic feet of inflammable gas.[178]

Approximately 250 chains east of Lal Lal, iron ore was discovered in 1857 by gold miners working in the Moorabool Valley. An iron smelter was in service by 1875.[179]

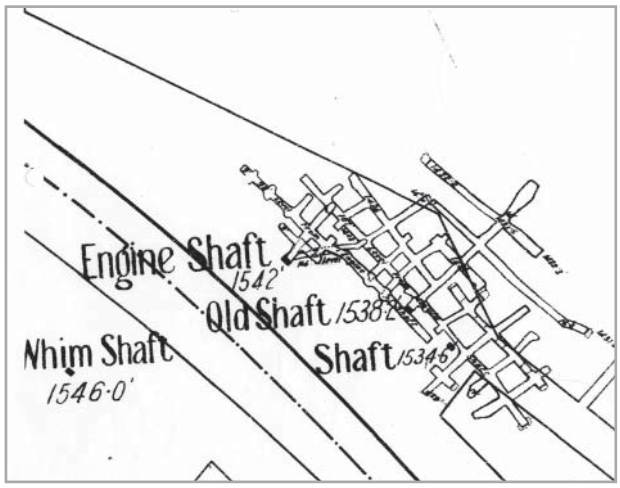
At 1870, although only 997 tons of lignite had been raised to date at Lal Lal, expectations of the Colonial Government and

private industries for successful commercial ventures for mining and utilisation of this lignite deposit were high. The favourable location for rail transport to potential markets offered commercial advantages compared with delivery costs of black coal from NSW or the relatively inefficiency of wood for industrial steam raising. The Mines Department reported that tests of this lignite 'in comparison with firewood and coal have in all instances turned out most satisfactorily and extensive preparations have been made at the mine for raising and storing large quantities of lignite in anticipation of large orders.'[180]

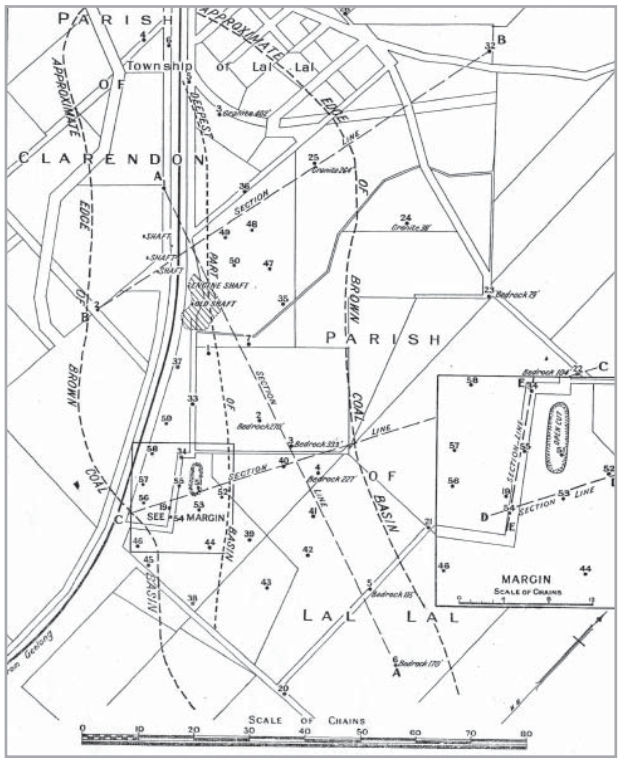
However at the end of 1871 all extraction of lignite had ceased. A new company, The Victorian Brown Coal Company, was formed by 1873 to take over the mining operation with better machinery and a means of artificial drying of the lignite before sale. By 1874, the average number of employees at the mine was sixteen. By the end of 1878, the total lignite production from the Lal Lal mine since the first commercial mining in 1864 had reached approximately 4,500 tons. Sale of lignite from storage at the mine was at five shillings per ton.[181]

By the late 1870s, numerous deposits of lignite (brown coal) had been found widely throughout the Colony. These finds were reported on and tested by Mines Department personnel. Until the late 1880s, Lal Lal was the only brown coal mine in commercial operation in Victoria. RAF Murray, Government Geologist, states in the Mines Department *Annual Report* for 1891 that 'with respect to the lignite or brown coal, public interest has been much excited during the past year, attention having been drawn and private enterprise directed towards it in consequence of the coal famine attendant on the recent strike of the coal miners in New South Wales. Although the material possesses undoubted qualities as a fuel for many purposes there are difficulties to be overcome before it can be extensively used'. Intermittent vagaries of black coal supplies from NSW over the next 50 years caused surges of interest in lignite indigenous to Victoria as an alternative source of fuel for the colony. A *Royal Commission on Coal*, initiated by the Victorian Government in 1889 led to a significantly greater measure of Government support for exploration and the technical analysis and commercial opportunities for coal and lignite resources in Victoria.

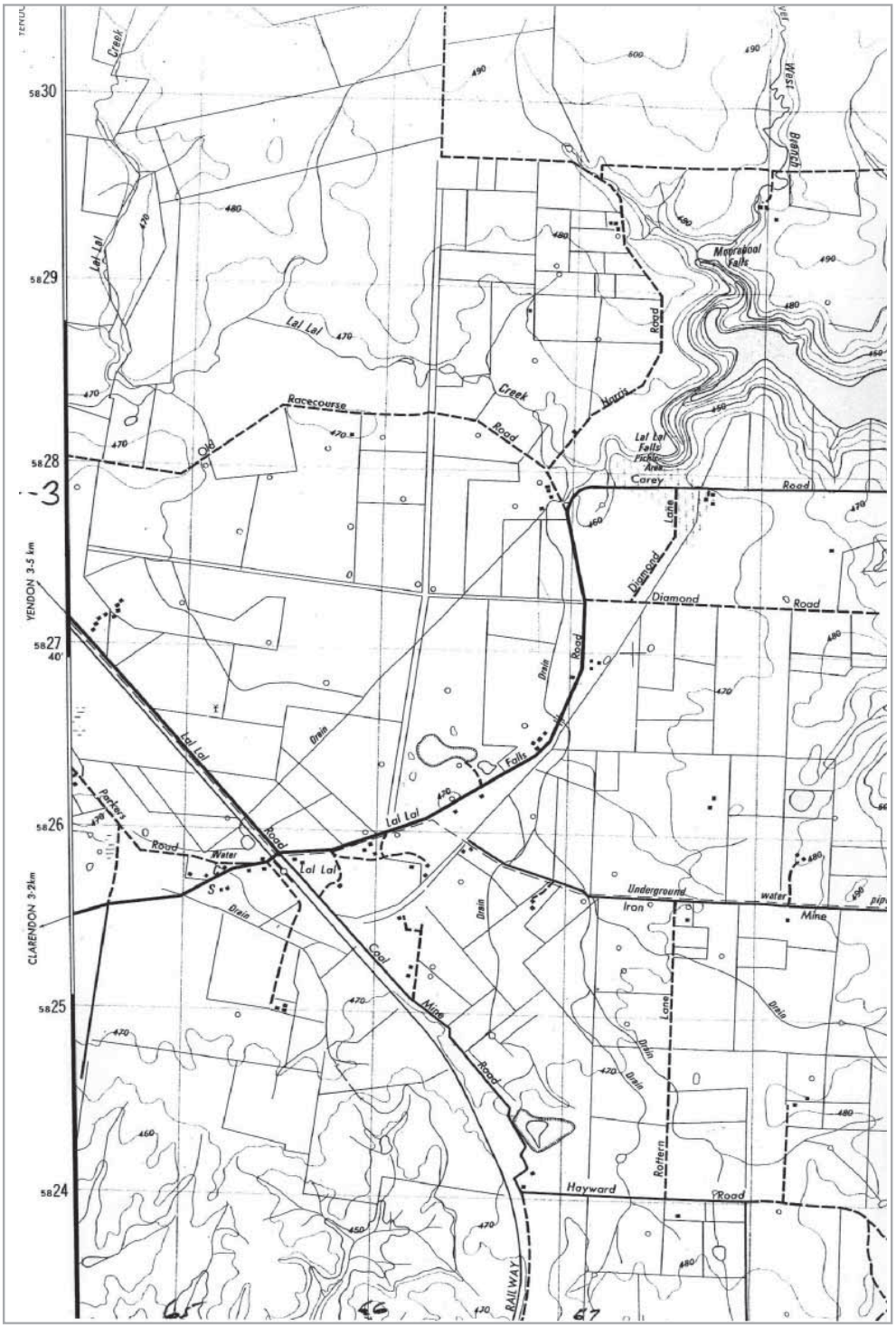
In 1891, after the Report of the *Royal Commission on Coal*, the Mines Department drilled seven bores at Lal Lal to the south east of the mining shaft extending knowledge of the extent of the Lal Lal deposit. But no definite structure of the basin was established.[182]



Drawing 5.1/2 Layout of underground workings at Lal Lal. (as depicted at 1921 by JPL Kenny, Mines Department.)



Drawing 5.1/3 Location of the open cut workings some 700 metres south of the engine shaft of the underground workings (from Thomas & Baragwanath, (1951), Part 4, p15).



Drawing 5.1/4 Locality of Lal Lal Brown Coal Mine (from topographical map 7722-43 Lal Lal). Copyright State of Victoria, Department of Sustainability and Environment.

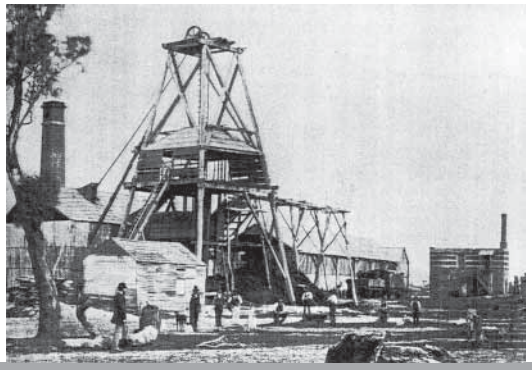
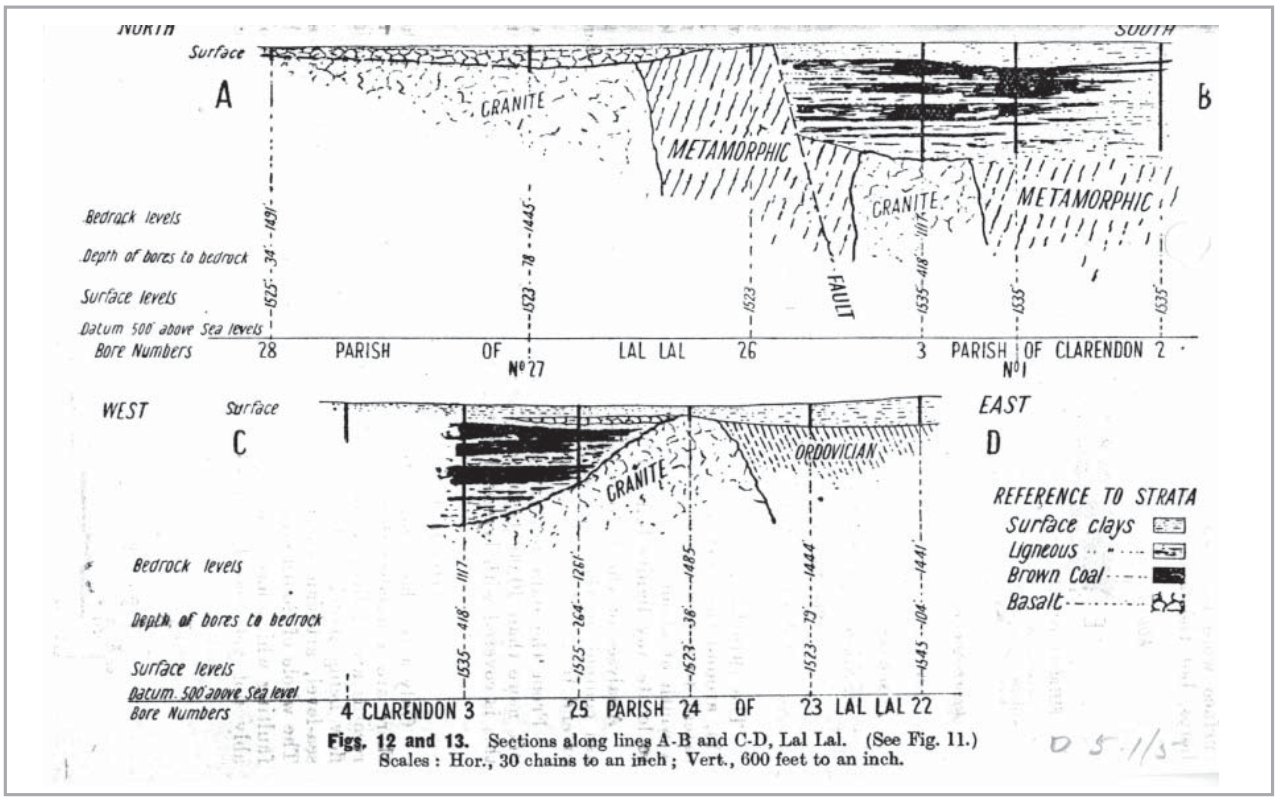


Photo 5.1/1 Poppet head for the underground workings, coal storage shed and drying house at the Lal Lal lignite mine. (Griffiths, Peter M (1988), p. 99 provides this photo). Copyright Buninyong Historical Society.

Peter M Griffiths (1988) states that the mine closed in 1892 after extraction to that time of 44,000 tons of lignite.[183] (This stated quantity is far in excess of quantities recorded in Mines Department statistics. Apparently it was not uncommon for mine output to be not fully notified to the Mines Department. The quantity of Brown Coal mined in Victoria to 1890 was quoted by H Herman (1922) at 9,326 tons[184].) The mine was reopened briefly in 1914 by the Victorian Central Coal and Iron Mining Company and again in 1919/20 when a new plant was installed in the post World War One fuel shortages in Melbourne.[185] At this time a rotary kiln for drying and pulverising the coal was installed, superseding storage and air drying techniques which had imposed a severe limitation on the throughput of the mine. About 4,000 to 5,000 tons of lignite from the underground workings was sold in 1921. However in late 1921, the new workings 'came in close proximity to a water filled tunnel of the former underground workings and flooded part of the new workings interfering considerably with extraction from the mine'. Drawing 5.1/2 shows a layout of the underground workings and adjacent bores and shafts at Lal Lal at 1921.[186]

In an endeavour to increase output and to mine the full depth of the brown coal deposit an open cut operation commenced in 1921 but was abandoned within one year. Other brown coal resources in several locations in Victoria and briquetting of brown coal from the Latrobe Valley had been developed or were under evaluation by the early 1920s such that continuing financial investment in the Lal Lal mine underground or open cut operations was withdrawn. Nevertheless at 1950, in the post World War II fuel shortages in Victoria, the *Courier* disclosed 'that the vast (Lal Lal) field is to be exploited by the open cut method this year or early next year. The coal is from 40 to 60 feet below the surface and the seams vary from 80 feet to 110 feet in thickness. It is possible that 50 men will be employed.' [187] Commercial interests based at Ballarat indicated conceptual support for re-activation of the open cut project and 'the then Premier, Henry Bolte, noted



Figs. 12 and 13. Sections along lines A-B and C-D, Lal Lal. (See Fig. 11.)
Scales: Hor., 30 chains to an inch; Vert., 600 feet to an inch.

Drawing 5.1/5 Section through Coal Deposit at Lal Lal (from Herman, H, *Brown Coal in Victoria*, 1922).

(conservatively) that a million tons of coal lay untouched at Lal Lal.'[188] A more technical assessment stated that in an area of 30 acres in the vicinity of the open cut, the estimated quantity of (brown) coal was 2.5 million tons.[189] However, realistic assessments were made that the cost of stripping the overburden and of continuous dewatering of the open cut rendered the redevelopment project uneconomical. Open cut operations were at a location about 35 chains south of the operating shaft of the underground operations (see Drawing 5.1/3).

In 1949, with severe fuel shortages in Victoria due to unavailability of black coal from NSW and the post-war lag in increasing power, gas, briquetting and brown coal output in Victoria, Lal Lal again came under consideration as a fuel source. Fresh boring in the open cut environs was initiated by the Mines Department with the concept of modernising the open cut operation via the post-war availability of mobile plant with increasing capacity.

In March 1952, a new open cut was commenced by HLW Green of Ballarat. The initial concept was to use modern dozers and scrapers as well as sluicing for overburden removal and disposal. However, difficulty was experienced in handling the variable overburden and the venture was suspended by September 1952.[190] Coal was not reached in this short term operation. Other brown coal mining initiatives at Yallourn North, at Bacchus Marsh, and at Wensleydale appeared to offer better investment opportunities and the Lal Lal mine was relegated to a site for potential future mining development.

Assessment of Heritage Significance

Historical Significance

The Government of the new Colony of Victoria, excised from the Colony of NSW in 1851, was intensely interested in ventures associated with the discovery and mining of coal in Victoria with the objective of becoming independent from coal supply and monopolistic pricing by NSW cartels. The 'coal' discovery at Lal Lal was of high significance with its favourable location adjacent to transport offering potential for economical coal supply to the gold mining areas and thriving provincial towns of Central Victoria. In an historical sense the disadvantages of high water content and friability of the coal, and the low total coal recovery from underground mining of the thick coal deposit, were technical aspects not understood by the initial private investors. However the attempts by various syndicates to achieve commercial success from the Lal Lal Lignite deposit lead to numerous investigations and trials by private firms and government agencies to utilise the recently found vast brown coal deposits of the Colony.

By 1890, the establishment of the *Royal Commission on Coal* fostered a wider understanding of the potential uses for brown coal in Victoria as the major fuel resource for industry and domestic purposes. The Lal Lal brown coal deposit continued to be a readily accessible source of brown coal for industrial, scientific and processing trials through to the 1950s.

Scientific Significance

The highly variable characteristics of the Lal Lal brown coal deposit and the wide variation of characteristics across the brown coal deposits on the world scene presented the need for much scientific evaluation to assess applicable procedures for effective and economical utilisation of each deposit. A successful process for utilisation within one deposit in many cases required significant modifications for comparative success within another deposit. By 1869, the Mines Department was undertaking scientific analyses from bores and shafts at Lal Lal and comparing results with similar testing of other brown coal deposits on the world scene and as they were found within Victoria.[191]

Scientific analysis as initially applied to the Lal Lal resource was subsequently extended in scope and intensity and was applied in decision making with respect to the selection of various brown coal mining projects within Victoria and the potential processes for commercial utilisation and conversion of the brown coal from individual mines.

Economic Significance

There was considerable euphoria in Victoria when the possibility of the occurrence of a large coal deposit at Lal Lal was made known in 1858. Potentially, further deposits under similar regional geological conditions were to be anticipated. In the 1860s, as the economy of the Colony was emerging from extreme dependence on gold discovery and mining, the need for a reliable and lower cost of coal supply grew in significance to support population growth. However, the high water content of the coal, its friability and its quality variations led to lack of commercial success in the early years of operation at the

mine, pending solutions being developed to achieve effective utilisation of the raw coal or its processed by-products. Apart from the long term economic benefits accruing to other brown coal mining operations from continuing investigations and trials of the Lal Lal coal resource, the economic significance of the Lal Lal mine did not live up to early hopes. The resource remains largely undeveloped perhaps in reserve for some boutique conversion process utilising special aspects of the chemical characteristics or the fabric of the coal.

Industrial Significance

Output from the Lal Lal Coal Mine had only minor beneficial significance on industry in the region or Colony/State of Victoria. Although an iron mine and smelter, a kaolin mine and brick works came into operation only a few miles to the east of Lal Lal in the 1870s, the Lal Lal coal proved unsuccessful as an industrial fuel in conventional coal burning grates of the time and the Lal Lal coal was not used in these local industries although a rail tramway was available for transport between the mine and these industries. Although trials of the unprocessed coal and as a mixture with black coal in Victorian Railways locomotives were pronounced as successful, the possibility of unreliability of supply from this single Lal Lal mine evidently obviated its pricing advantages. Somewhat similar conclusions were reached by gas companies regionally and in the metropolitan area. Industrially the Lal Lal mine output was significant during some of the coal supply shortages form NSW, i.e. for short periods in the late 1880s, in the early 1890s, in the early 1920s and in the early 1950s, the latter periods due to power and fuel shortages from other Victorian sources.

The use of the Lal Lal coal as fertiliser (soil conditioner) and as deodorant was a sales outlet, albeit of low quantity, from the mine although of doubtful commercial benefit to the mine operators.

Techniques for conversion of brown coal to gas and to a wide variety of liquid fuels had not been developed prior to about 1890. A surge in these industrial applications occurred throughout the world in the era to 1914, and were then curtailed somewhat during the war years 1914–1918. By this time other brown coal mines had been opened in Victoria, reducing the potential significance of the Lal Lal deposit. Nevertheless considerable technical investigations were carried out on Lal Lal and other Victorian brown coals by the Mines Department through to 1920. These investigations, reported in detail in Herman, H, *Brown Coals Of Victoria*, (1922), indicate the technical opportunities assessed at that time for industrial applications of the Lal Lal coal.

Social Significance

By 1860, much of the initial gold prospecting and mining boom in Victoria had either transferred from the Ballarat area or was moving to underground mining and boring for gold. Development of the Lal Lal mine in the 1860s offered opportunity to a resource of experienced mining personnel in the Ballarat area to transfer their skills to what appeared to be a more predictable underground mining operation. The availability of several coal mining leases at the not-fully explored leases at Lal Lal appeared to offer opportunity for individuals or small syndicates to transfer from being an employee or from owner/operator role of a single gold mining shaft. The possibilities at Lal Lal appeared socially attractive to those seemingly fortunate enough to gain a lease.

In the aftermath of the Eureka Uprising (1854), the Lal Lal coal resource presented more than a golden opportunity. Exploratory boring and mining at Lal Lal commenced as a man (or horse) powered operation without the immediate necessity of significant capital investment.

However, the vagaries and the quality disadvantages of the Lal Lal coal compared with black coal brought to Victorian markets from NSW, soon led to poor sales at the mine and several transfers of leases and intermittent cessations of mining. Ownership of leases progressively came into the hands of larger companies. As with many ventures in Australia, the ownership of the venture passed from entrepreneurial individuals to larger companies. The Australian social dream of self-employment achieved in the early stages of the Lal Lal mine passed away.

The social significance of the Lal Lal mine may well be its failure to succeed to this time (2005) and the adverse consequences of progressive transfer of ownership from individuals to larger corporations whose diversity of financial interests may survive temporary and intermittent suspension of operations.

Mine Infrastructure Features

Initial Bore Location.

Initial Shaft Location.

First Commercial Production Shaft Location.

Underground Workings Location.

Brown Coal Drying, Pulverising and Storage Facilities Location.

Open Pit Operations Location – water-filled open pit still visible.

References

Brough Smyth, R, *Goldfields and Mineral Districts*, Mines Department, 1869

Dickers Mining Record, June 1864

Griffiths, Peter M, *Three Times Blest: a History of Buninyong and District*, 1837–1901, The Buninyong and District Historical Society, 1988

Herman, H. *Brown Coals Of Victoria*, Bulletin No. 45, Geological Survey of Victoria, 1922

Jenkins, HC, *Brown Coal Mine Parish of Lal Lal*, Mines Department, 1920

Kenny, JPL, *Victorian Central Brown Coal Mine Lal Lal*, Mines Department, 1921

Mineral Statistics, Mines Department, 1864 and1878

Mining and Geological Journal, March 1952 and September 1952

Thomas, DE and Baragwanath, W, Geology of the *Brown Coals Of Victoria*, Parts 1 to 4, 1949 – 1951

5.2 Sebastopol and Daylesford

Map Reference:

Municipality: City Of Ballarat

Land Use / Status: Private

Site History

In 1864, the Mines Department reported that 'extensive deposits of lignite, some of great thicknesses, have been found at Lal Lal, at Dalesford (Daylesford) and in the Latrobe Valley.' This was the first of many official reports assembled of the locations of lignite or brown coal in the colony.

In 1865, as well as reporting on the Lal Lal mining operations, the Mines Department reported that the Victorian Patent Manure and Chemical Company had raised about 35 tons of lignite at a lease of some 19 acres at Sebastopol a mile or so south of Ballarat. This location was reported as being between the White Horse and Frenchman's Gold leads [192], less than 40 chains east of Sebastopol.[193]

Neither the Daylesford nor the Sebastopol deposits became significant mining operations. Similar disappointments occurred in several other locations throughout the colony. The lower calorific value of the brown coal compared with black coal proved the major deterrent to successful marketing of the brown coal as a fuel in competition with black coal. Some processing of the brown coal into chemicals and soil conditioners had some initial successes but the quantity of coal utilised was insufficient to support a long term mining operation.

Assessment of Heritage Significance

Historical Significance

The lignite find at Daylesford in 1864 initiated action by the Mines Department to record the discoveries of brown coal deposits as well as black coal seams during the extensive exploration for gold throughout the colony. By 1864, searching licences and mining licences were being issued by the Mines Department separately for black coal and for lignite. By 1876,

thirty two locations throughout the colony were listed by the Mines Department as having lignite (brown coal) deposits.[194]

Scientific Significance

Effective utilisation of lignite presented a challenge to the scientific community.

Economic Significance

No significant discoveries of black or brown coal had yet been found in the Colony of Victoria at the 1860s. Every new discovery offered hope that Victoria could become less dependant on coal supplies from NSW to meet growing demand from the burgeoning Victorian economy.

Social Significance

By the mid 1860s, prospecting for gold had spread throughout the colony. The identification of coal deposits was in many cases made as a by-product of the search for gold. Many of the visible coal outcrops were readily opened up by the shaft diggers of the gold miners.

Mine Infrastructure Features

No specific remains of brown coal mining at Sebastopol, at Daylesford or other Central Victorian sites other than at Lal Lal have been identified in this study.

References

Griffiths, Peter M, *Three Times Blest: a History of Buninyong and District, 1837–1901*, The Buninyong and District Historical Society, 1988

Minerals Statistics, Mines Department, 1864, 1865, 1866, 1867, 1872

Progress Report of Geological Survey, No. 111, Mines Department, 1876

5.3 Black Coal Occurences in Central and Northern Victoria in the Murray Basin.

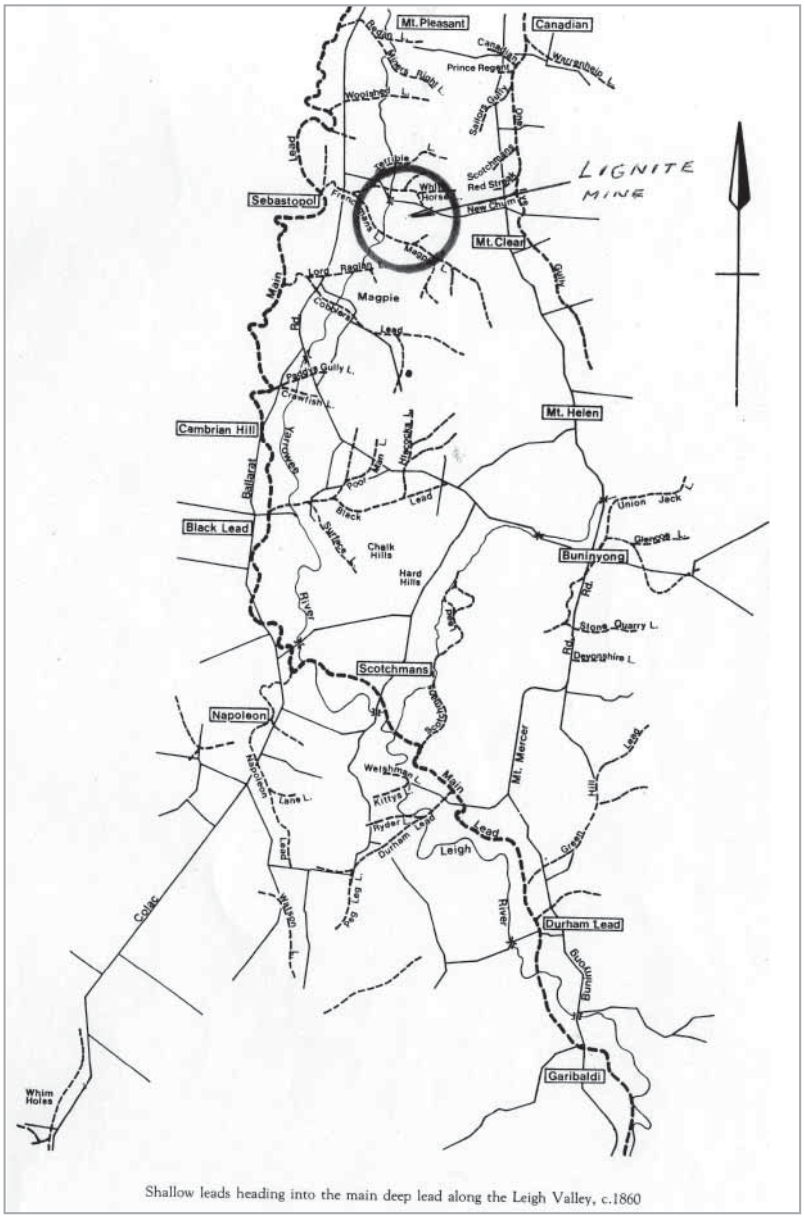
The occurrence of black coal measures in South Central NSW from Griffiths southwards to the Murray River had been known for decades before 1980. By 1980 a coal field at Oatlands in this wider area had received more detailed investigation showing up to 20 metres of coal. These coal measures were assessed as of Permian age underlying the tertiary deposits of the wider Murray Basin. No commercial mining of these coal fields had eventuated due to more economic black coal fields elsewhere in NSW.

Drilling investigations in Victoria by 1980 had identified the occurrence of coal measures as thin black coal seams at depth in the area from Rutherglen to Wangaratta considered by some as a southward extension of the NSW coal measures to Northern Victoria. No specific potential mining project appeared likely on these coal seams in Victoria although a proposal was developed by CRA for a (2000 MW ?) power station located in Northern Victoria fuelled from mining the coal resource at Oaklands in NSW. The coal measures in this part of the Murray Basin known as the Ovens Graben exist in NSW and Victoria over an area of approximately 4,000 square kilometres.

5.4 Brown Coal Occurences in Western and Northern Victoria in the Murray Basin

Six areas of brown coal deposits in the Murray Basin in Victoria were identified in the 1982 Victorian Brown Coal Resource Study (by Kinhill et al) accessing drilling information from exploration by CRA during the late 1970s. These areas included deposits at the south of the Murray River in central/north Victoria at Echuca, Cohuna to Kerang, and Torumbarry as well as areas at Wycheproof, at Warracknabeel, and at Willenbrina each in Western Victoria. Coal seam thicknesses vary from 5 metres to 20 metres in a total in situ quantity of brown coal in the Murray Basin of Victoria assessed in the Kinhill report as 19.6 Bt based on a depth from surface of 200 metres.

No commercial scale mining of the Victorian Murray Basin brown coal deposits has taken place or was being mooted at 2005.



Drawing 5.2.1 Sebastopol, Locality of Brown Coal Mine. Copyright Buninyong Historical Society.

6 Central Gippsland—Brown Coal mines

6.1 Warragul Area—Early Brown Coal Discoveries

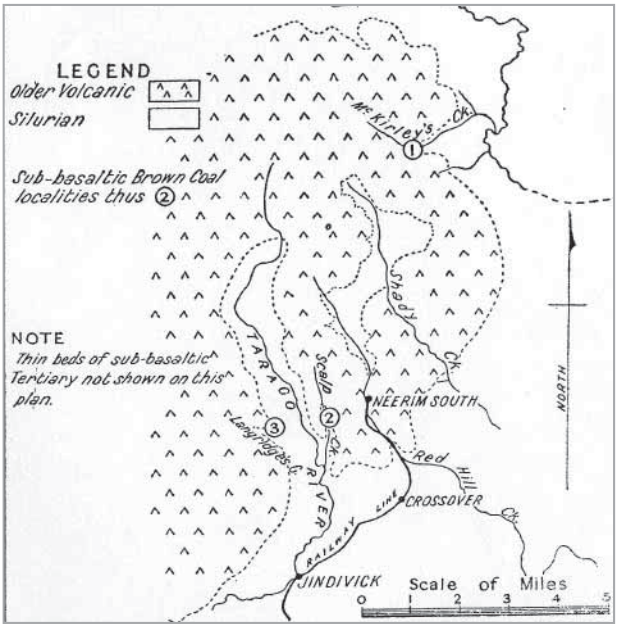
Map Reference: **McKirley's Creek Shaft**

Scalp Creek Shaft 8021-1-1
Tarago 4075, 57910 Approx

Langridge's Gully Shaft 8021-1-1
Tarago 4059, 57910 Approx

Municipality: **Shire of Baw Baw**

Land Use/Status: **Private**



Drawing 6.1/1 Brown Coal occurrences north of Warragul (from Thomas, DE & Baragawanath W. (1951), Part 4, p.4).

Site History

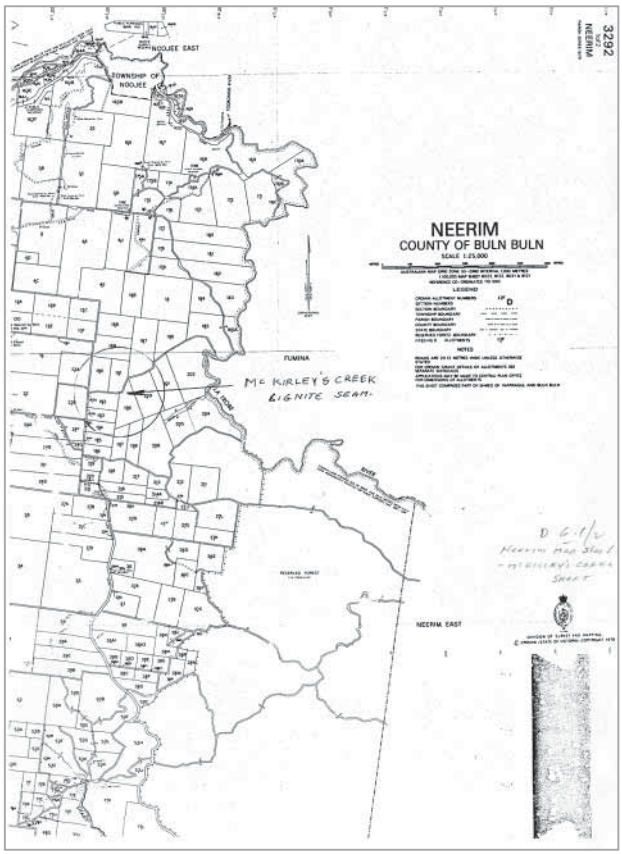
Lignite had been found in the Warragul area by 1873 as reported in the *Mineral Statistics* for 1873 and in *Geological Survey Report* No. 1 in 1873. Other lignite or brown coal discoveries were also been found eastwards to and beyond Traralgon by 1874[195] raising significant localised hopes of fuel supply to Melbourne and elsewhere in the colony via the increasing railways network.

At McKirley's Creek about 16 miles north of Warragul, adjacent to a lignite outcrop in the creek, at least three shafts were sunk, one revealing a lignite seam of 35 feet in thickness.[196] [In the early documentation on this lignite seam, the location was described as north of (the) Crossover or Crossover Creek] The lignite was reported to yield over 6,000 feet of gas per tonne.[197] At 1875, this lignite deposit was 'said to be in some places, fully 80 feet thick; it is a dense black lignite of first rate quality, contains less water than the Lal Lal (deposit) and is not so friable'.[198] Analyses of coal samples were undertaken by the Mines Department reporting ash content of 12.9 per cent in one sample[199] and 26.0 per cent in another.[200] Gloe, CS states that the seam at Mc Kirley's Creek was opened for mining in 1869[201] [confirmation of this has not been found in other references]. Analyses reported in 1875 stated ash content as 5.85 per cent. Later analyses reported by J Stirling in 1899 showed much lower ash at and below 4.1 per cent indicating perhaps that the initial samples may have been contaminated during extraction.

In 1874, lignite seams were found closer to Warragul. One of these at Scalp Creek about one mile west of the present township of Neerim South and on the east side of the Tarago (initially named Tarween) River a shaft sunk by gold prospectors showed impure lignite 25 feet thick under basalt, sand and clays.[202]

At Langridge's Gully, by 1876, on the west side of the Tarago (Tarween) River and about 1.2 miles west of the Scalp Creek lignite find, a shaft sunk by gold prospectors showed impure lignite 15 feet thick under basalt and clay.[203]

By 1876 it was assessed from geological interpretation of the area that this lignite seam is likely to underlie all the volcanic



Drawing 6.1/2 Location of McKirley's Creek Shaft (from Neerim Map Sheet). Copyright State of Victoria, Department of Sustainability and Environment.

country east ward.[204] However, by this time the extensive thick brown coal seams of the Latrobe Valley were being discovered close to the surface east and west of the Haunted Hills and adjacent to the planned main Gippsland Rail Line route.

No mining of the lignite deposits at the north of Warragul reached a commercial stage.

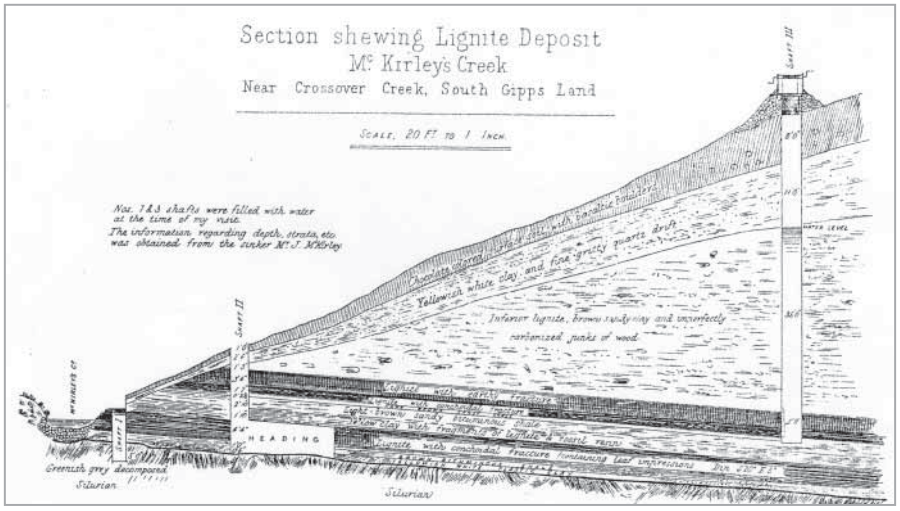
Assessment of Heritage Significance

Historic Significance

At 1873, the McKirley's Creek lignite deposit was the first recorded discovery of Lignite in Western Gippsland. The other two deposits noted above were recorded by 1874. Geological appraisal supplemented from other lignite discoveries to the east and south east suggested the existence of a very extensive area of brown coal deposits for say 60 miles at least as far east as Sale.

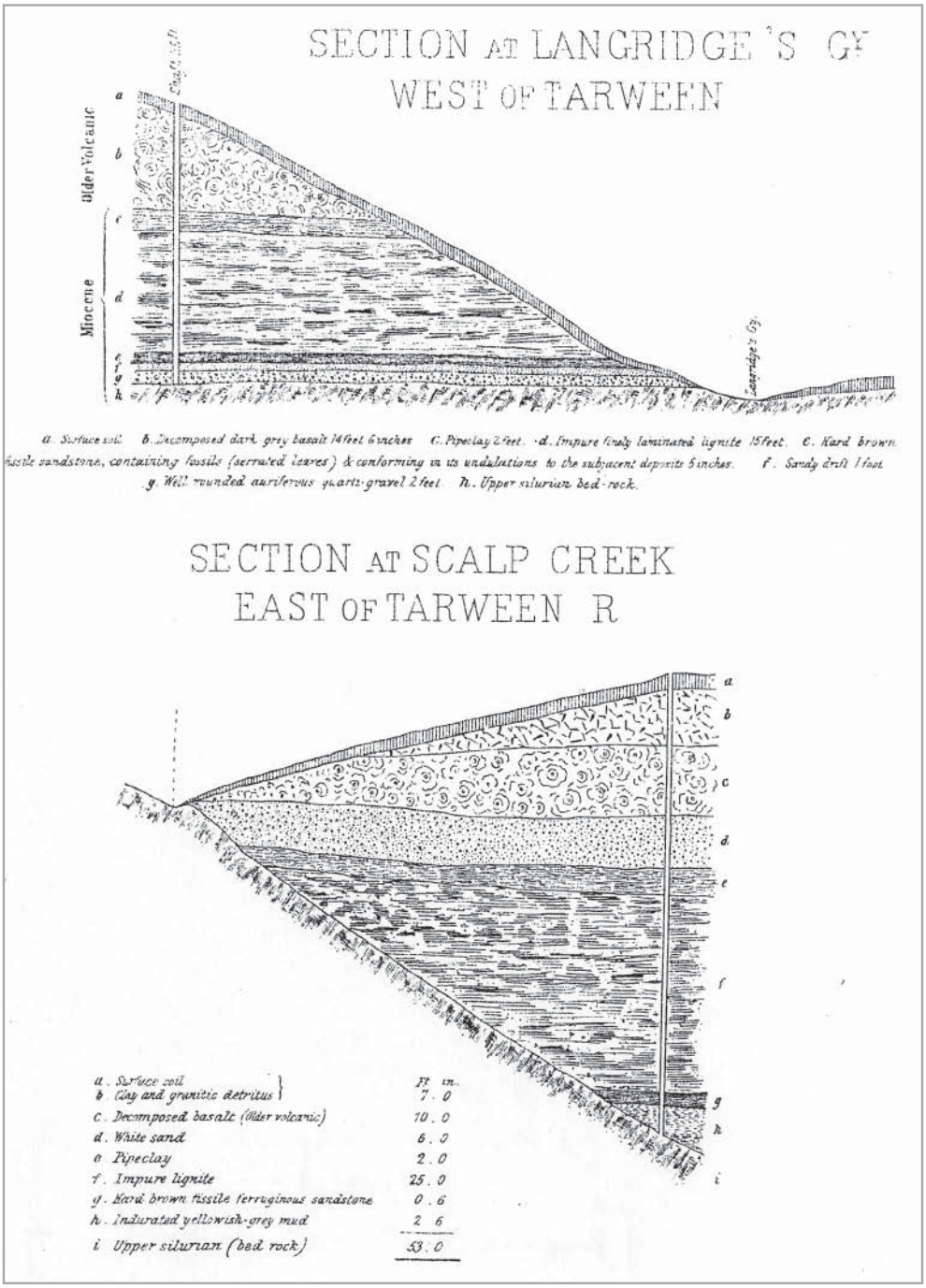
Scientific Significance

Initial tests indicated high ash with doubtful commercial prospects for economic utilisation. Within one year, further testing including suitability for conversion to gas indicated that proven conversion technology was available to utilise this brown coal. No specific scientific innovation appeared necessary for this basic conversion process.



Drawing 6.1/3 Lignite Seam at Mc Kirley's Creek (from Mines Department *Progress Report* No. 3, 1876).

Drawing 6.1/4 Locality of Scalp's Creek and Langridge's Gully Shafts [from topographical map 8021-1-1 Tarago]. Copyright State of Victoria, Department of Sustainability and Environment.



Drawing 6.1/5 Sections at Langridge's Gully and at Scalp's Creek (originally from *Geological Survey Progress Report* No. 3, Mines Department., 1876, p.150).

Economic Significance

Facilities for transport of this brown coal by rail from Warragul to metropolitan and regional markets were imminent. However there were many other brown and black coal deposits being discovered at about the mid 1870s throughout Gippsland, some vigorously supported by enthusiastic investors. The thinner coal seams and the capping of the Warragul deposits with a basaltic layer deterred development of the Warragul lignite deposits.

Social Significance

There was a suitable workforce skilled in manual mining activities readily available from a waning of gold prospecting in Victoria but basically no housing or infrastructure in the Warragul/Neerim area at the mid 1870s. Mining of lignite for gas manufacture or locomotive fuel was likely to be a longer term activity than mining of the scattered gold seams and offered opportunity of closer settlement in the Warragul area.

Mine Infrastructure Features

It is unlikely that any remnants of the exploration shafts sunk at the three 'lignite' sites north of Warragul still exist. The actual sites have probably not been covered by buildings or other infrastructure since their discoveries. However the two later sites are in close vicinity to the retaining wall of the Tarago River Dam at the West of Neerim South township.

References

Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No. 11, AusIMM, 1984, p.97

Mineral Statistics, Mines Department, 1873, 1874, 1875

Geological Survey Progress Report, Nos. 1, 2 and 3, Mines Department, 1873, 1874 and 1876

6.2 Yarragon Brown Coal Mine

Map Reference: 8121-4-3 Yarragon 4177, 57708

Municipality: Shire of Baw Baw

Land Use/Status: Private

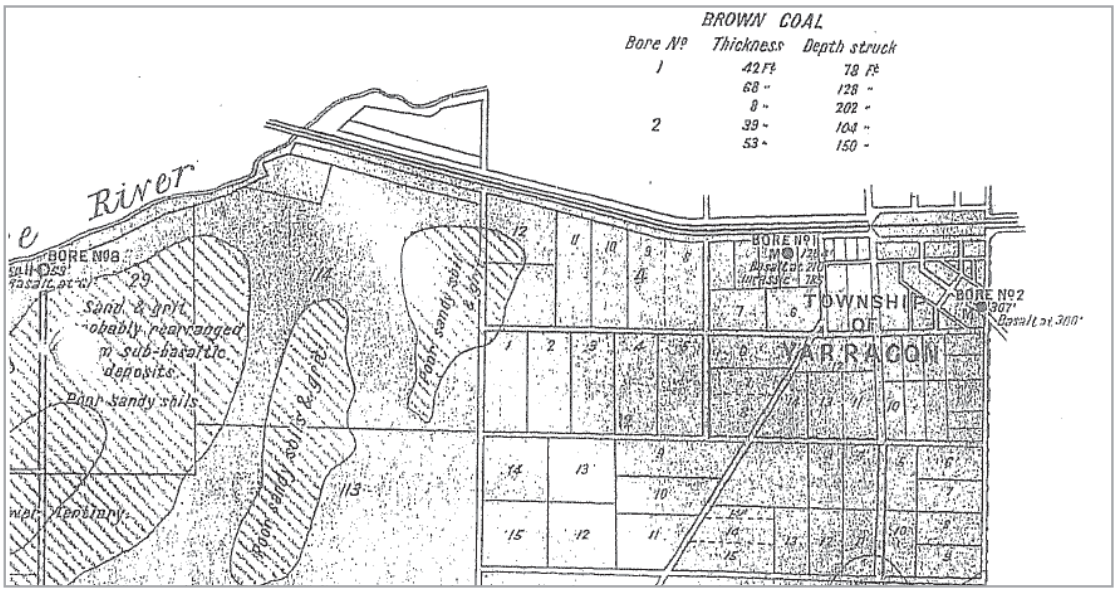
Site History

In 1888, brown coal was discovered by John Rollo, a land holder at Yarragon, while sinking a bore for water on the flat lands of Yarragon township (initially known as Waterloo) at the south of the Gippsland Rail Line. [205] 'After a number of bores had been put down near the Township of Yarragon by John Rollo, proving several seams of brown coal from 4 feet to 55 feet in thickness, a diamond drill bore was put down' by the Mines Department in 1889[206] (Drawing 6.2/1). Diamond drill bore results, as reported by Stirling in 1899, were as follows: Number One Bore in the township area and adjacent to the Gippsland Highway showed 110 feet of coal with a two foot parting with coal overlain by 78 feet of clays[207] (Drawing 6.2/2). Number Two bore showed brown coal 21 feet thick commencing at a depth of 81 feet.[208] [Another reference source shows Number Two bore with a 39 feet thick seam at 104 feet with a seven feet parting to a 53 feet thick seam].

Circa 1889, a small quantity of coal was reputedly 'sent to Melbourne where it was used to heat Parliament House'.[209]

In February 1890, with John Rollo actively involved, the Yarragon Brown Coal Mining Company was formed to mine the deposit immediately at the west of the Yarragon township and south of the main Gippsland Rail Line. In 1890, Rollo took a sample of the coal to Germany 'where experts there informed him that it was eminently suitable for manufacture of briquettes.[210] The initial shaft struck water and was flooded. A second shaft '141 feet deep, well timbered' installed in 1891 with pumping equipment was successful. The mine was connected to the VR rail line at Yarragon via a VR gauge branch line. Equipment installed included a poppet head with winding motor and gears, a stationary boiler and steam pumps.[211] The mine came on stream in 1891 at the time of restricted black coal supplies from NSW due to strike action in the mines and shipping activities. However the market for this high moisture brown coal was short lived and expired by about 1894.

Drawing 6.2/1 Yarragon township and environs (from topographical map 8121-4-3 Yarragon). Copyright State of Victoria, Department of Sustainability and Environment.



Drawing 6.2/2 Location of No.1 Bore in Yarragon Township. Copyright State of Victoria, Department of Primary Industries.

[The terminology Rollo's Mine was not applied by the Mines Department for this mine at the township of Yarragon but for another located in the ranges south east of the township referred to in Section 6.3.1. See also: Stirling, J (1892), p.15 and also p.17, map and geological section A-D.[212]]

James Stirling (1899) reported subsequently that 'some coal was extracted' from the Yarragon Brown Coal Mining Company's shaft. He also states that 'a sample of the coal was sent to Germany for testing for briquettability but the sample was lost in transit'. In a quarterly Mines Department report of 1891, J Stirling gave a somewhat adverse report on the Yarragon coal quality as containing high ash of about 13 per cent. Nevertheless in 1891 the London Coal Briquetting Company was formed. Reputedly this company 'supplied Parliament with briquettes.' from the Yarragon coal.[213] However, the briquetting company did not receive any Government support and did not achieve a commercially viable briquette product. Brown coals from other sources were tested for briquettability at about the same time as an outcome of the *Victorian Royal Commission on Coal* (1889–1891).

The mining operation at Yarragon did not achieve economic success after the return of reliable coal supply from NSW circa 1893/4 and the initial mining lease was forfeited in 1895 after low output in the previous few years[214].

By 1892, the brown coal deposit was found to be widespread from Darnum to the Haunted Hill east of Moe and on both sides of the Gippsland rail road transport corridor 'at a depth varying generally from 40 to 80 feet from the surface and up to 55 feet thick largely in lenticular form at the edges of the deposit'.[215]

[Some anecdotal hearsay has intimated that the 'Rollo' Brown Coal Mine at Yarragon was reactivated in the 1940s after its initial cessation in the early 1890s. However I cannot find reference in Mines Department publications or in the 1978 History of Yarragon of reactivation of the Yarragon Mine after the 1890s or especially in the 1940/50s. Alan Follet, the land occupier of the former mine site since 1954 and acquainted with the site since 1934, states that no mining on the site occurred from the 1930s. Some refilling of shallow mine depressions with his consent occurred in the 1960s by the Country Roads Board during widening of the Princes Highway. Recovery of a pump and water discharge piping together with refilling of the mine shaft has been undertaken progressively by Alan Follet over the years from 1954.]

In 1981–1983, investigation into the brown coal deposits from Trafalgar to Darnum was undertaken by Esso Australia Ltd. A report on these investigations included the following: 'Around the former coal shaft area [at Yarragon township] the coal deposit was estimated to comprise up to 500 million tonnes,

but less stringent coal reserve estimates were applied than in normal SECV practice and coal seams were shown to have extensive splitting.'[216] No proposals for further mining of these deposits had arisen at 2005.

Assessment of Heritage Significance

Historical Significance

Mining by the Yarragon Brown Coal Mining Company commenced in 1890 a year or so after the Great Morwell Coal Mining Company (at what is now Yallourn North) changed their mining operation from a shaft and tunnel procedure to an open cut. Although the Yarragon Company had the advantage of a short rail connection to the Main Gippsland VR line and a 15 mile shorter transport haul by VR trucks to Melbourne, the high ash coal and the higher cost of the underground operation at Thorpdale compared with the favourable open cut conditions at Yallourn North outweighed the transportation advantages.

The mining initiated by John Rollo, an enthusiastic entrepreneur in various developments at Yarragon, lead to wider exploration of the coal resource from Warragul to Traralgon and a wider understanding of its potential.

The technical and commercial failure of briquetting as well as the non-competitive use of the brown coal as a fuel demonstrated the need for improved technology in the use of brown coal and turned attention to technical developments in Germany through to the outbreak of World War One.

Scientific Significance

Several embryonic proposals for conversion to energy liquids and gas as well as boutique applications as fertilisers, soil conditioners, deodorants, lubricants and miscellaneous chemical by-products were advanced during hearings of the *Royal Commission on Coal*. The new mining endeavours at Thorpdale challenged the Government to invest in coal research rather than accepting that market forces would sponsor research as a consequence of the economic opportunities that this would provide.

Economic Significance

The Yarragon mine was not successful as an economic venture and had a short life of about five years. This lack of success was a factor leading to deferment of further investment in commercial scale brown coal mining throughout Victoria.

Social Significance

Community expectations for a local coal industry were high when the Yarragon mine was opened and when government drilling activities confirmed the wide extent of the brown coal deposit on the flat lands of Central Gippsland. Extractive industry in the Yarragon area was vigorously engaged in timber clearing with numerous timber mills delivering sawn timber and logs over private tramlines to the Main Gippsland rail line.

For the Yarragon Mine, an adaptable work force was locally available at the scale of operation the underground mining utilised. The location of the mine immediately adjacent to transport facilities imposed no special public infrastructure, domestic housing or service support requirements. The mine fitted well the community aspirations for diversity and growth.

Mine Infrastructure Features

No specific remnants of the Yarragon mine are visible at site.

The site of the mine is still identifiable on open fields at the West of Yarragon Township. The land occupier can identify the precise location of the mine shaft.

References

Adams, John, *So Tall the Trees*, 1978, p.105

From the Dawning: A History of Yarragon and District, Back to Yarragon Committee, March 1978

Fraser, N 'Exploration Licence 1800 Trafalgar', Final Report to the Mines Department, 1983, p. 8

Stirling, J 'Report on the Brown Coals and Lignites of Victoria', *Progress Report*, No. 10, Mines Department, 1899, p. 74

Stirling, J, *Report on the Victorian Coal Fields Report on the Yarragon District*, Mines Department, 1892, p.15

Thomas, DE and Baragwanath, W *Geology of the Brown Coals Of Victoria*, Part 1, Mines Department, 1949, p.11

Photo 6.3.1/1 View of Yarragon Escarpment.

6.3 Sub-Basaltic Brown Coal Mines in the Thorpdale Area

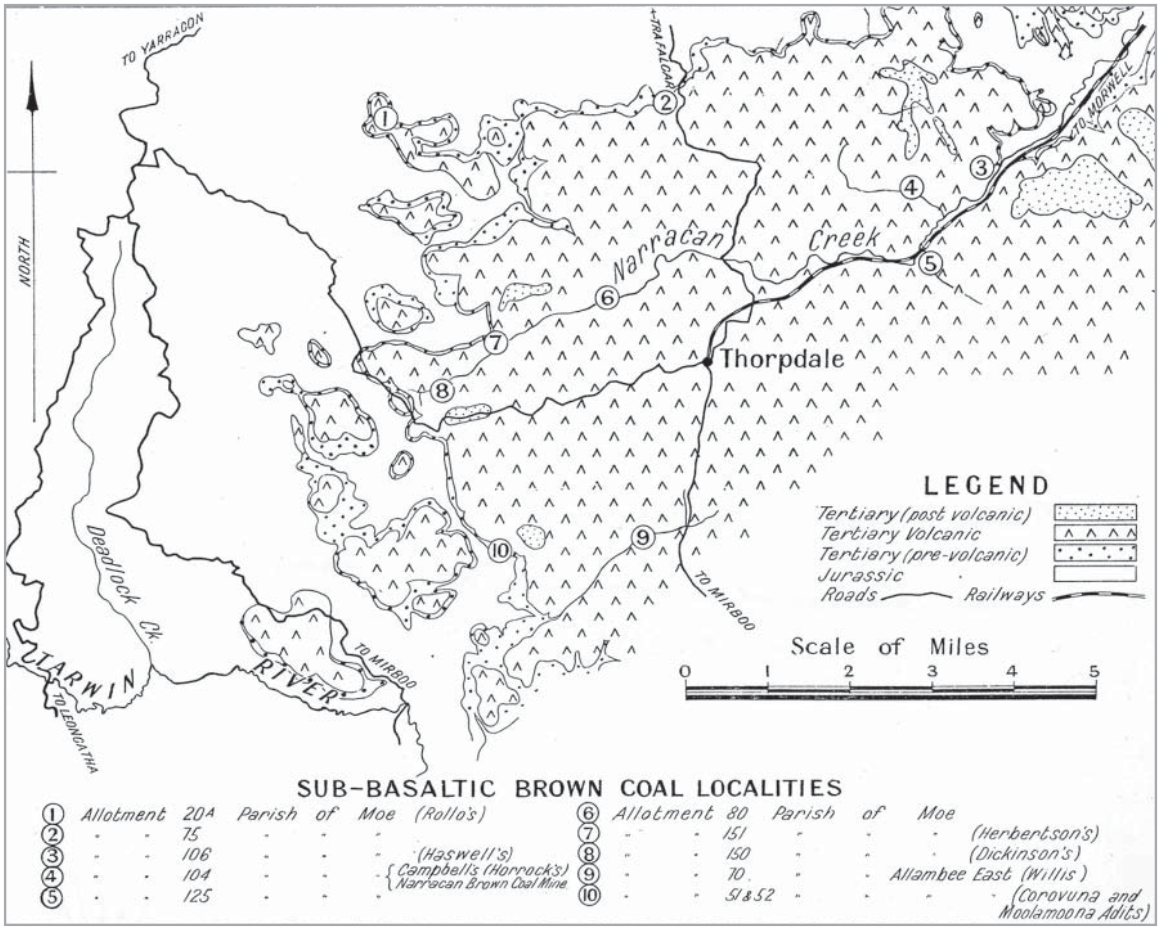
Map Reference: **(shown below for individual mines)**

Municipality: **Shire of Baw Baw**

Land Use/Status: **Private**

SITE HISTORIES

The coal deposits collated in this Section 6.3 were categorised by Thomas D.E. & Baragwanath (1949–51), pp.17–18, as being from the Narracan Group of Brown Coal deposits below basalt and older than the Morwell River Valley Brown Coal deposits. Drawing 4.1.1/1 delineates the known areas of black and brown coal in the County of Buln Buln depicted by the Mines Department at 1890 superimposed at 1999 on current topographic and infrastructure features. This drawing clearly distinguishes between the black and brown coal mine locations. Figure 54 in Thomas and Baragwanath Part 4 also shows locations.



Drawing 6.3.1/1 Sub-Basaltic brown coal localities near Thorpdale (from Thomas & Baragwanath, *The Geology of the Brown Coals Of Victoria*, Part 4, 1951, p9).

Photo 6.3.1/2 Giant tree near Yarragon – common in central Gippsland Forests (*From The Dawning*, (1978)). Copyright Back to Yarragon Committee.

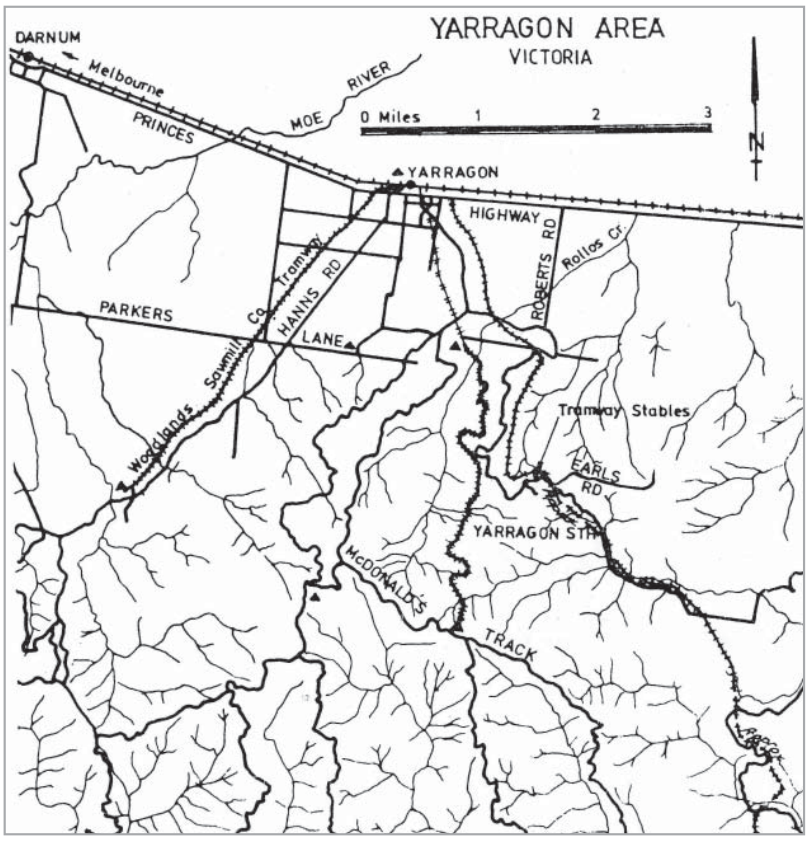
The VR rail line Moe to Thorpdale came into service in 1888, initially operating at two trains per day and providing new opportunities for coal transport to rail sidings throughout the colony. Strong efforts were made by the Thorpdale community to have the rail line extended to Childers but without success.

6.3.1 Rollo's Mines on the Yarragon Escarpment

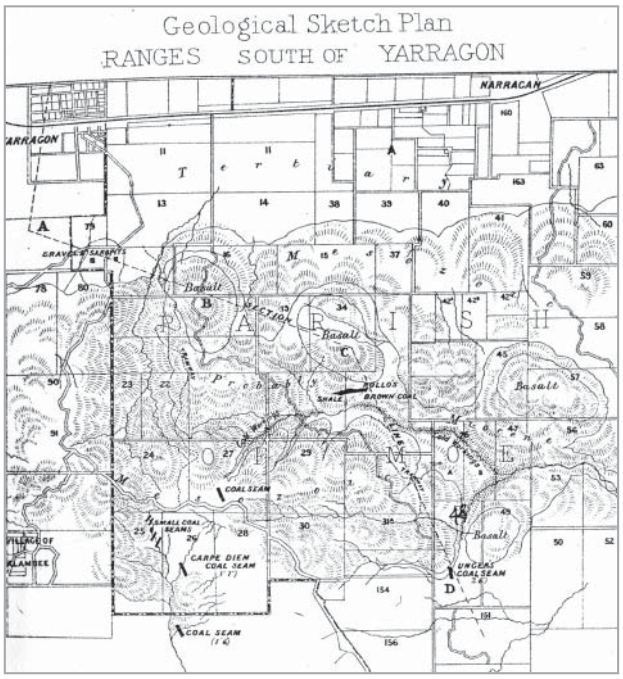
Map Reference: 8121-4-3 Yarragon approx. vicinity of 4203.57663; 8121-4-2 Trafalgar approx. vicinity of 4260 57680

John Rollo found two brown coal outcrops on the escarpment south of Trafalgar (Photo 6.3.1/1). One was about five kilometres south east of Yarragon, the other on the west side of the Thorpdale Road about three kilometres south of Trafalgar. These seams were each under basalt (Drawing 6.3.1/1).

At the more westerly location, in 1890, John Rollo opened a face in 20 feet of brown coal in a location where the generally overlying basalt had been eroded. [217] The coal quality was better than coal from the Yarragon township mine with ash content low, carbon content high at 48 per cent, and the coal described as dark brown lignite. Area maps at 1899 show a tramway heading northwards from the mine site but no evidence has been found in this study that this tramway was used for coal haulage. Drawing 6.3.1/2[218] shows the routes of two tramlines used for hauling timber from the hills at the south of Yarragon to the VR main Gippsland line at Yarragon. Coal was not listed among the materials transported on these tramlines. The mine evidently did not achieve commercial success and was closed by 1895. No further details have been ascertained in this *Coal Mining Heritage Study*.



Drawing 6.3.1/2 Map of tramlines in Yarragon district (*From The Dawning*, (1978)). Copyright Back to Yarragon Committee.



Drawing 6.3.1/3 Sections showing coal seams through the Yarragon escarpment and southwards (from Sitrling, J, *Reports on the Victorian Coal Fields*, 1892).

The more easterly outcrop was evidently not opened up.

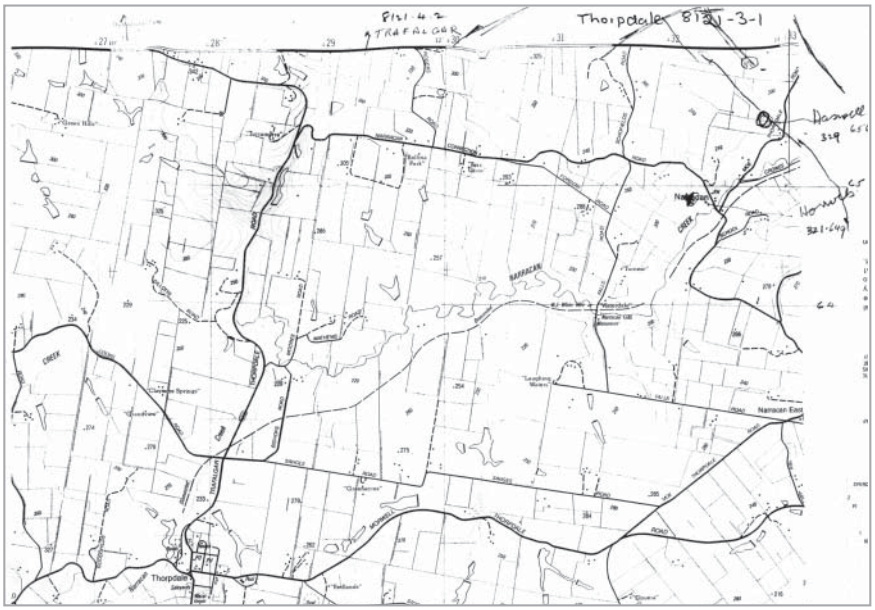
Stirling, J (1892), pp.17–18 presents a Geological Section and a Geological Sketch Plan from Yarragon to south of Thorpdale.[219] (Drawing 6.3.1/3)

6.3.2 Haswell's Mine

Map Reference: 8121-3-1 Thorpdale 4329, 57656 approx.

This deposit was in the banks of the Narracan Creek and at the north of the Morwell to Thorpdale rail line. It was about four miles north east of Thorpdale, about 1 1/2 miles from Narracan and half a mile from Coalville (Drawing 6.3.2/1). In 1889, the Haswell Coal Mining Company Company drove a tunnel into a brown coal seam 15 feet thick[220].

No definitive record has been found during this *Coal Mining Heritage Study* of the life of this mine. A local history relates that the mine worked on a three shift per day basis as did most of the Black Coal mines in the Narracan Creek valley during the early 1890s[221].



Drawing 6.3.2/1 Locality of Haswell's and Horrock's brown coal mines (from topographical map 8121-3-1-Thorpdale). Copyright State of Victoria, Department of Sustainability and Environment.

6.3.3 Horrock's Mine – Campbell's Mine – Narracan Brown Coal Mine

Map Reference: 8121-3-1 Thorpdale 4 322, 57649 approx.

Horrock's Co-operative Colliery was located to the north of the Narracan Creek and the Thorpdale rail line about a half mile south west of Haswell's mine. This mine is stated to have commenced in 1885[222]. A tunnel was driven about 40 feet into a brown coal seam 20 feet in thickness with branch tunnels about 300 feet in total length[223] (Drawing 6.3.3/1). Plate Number Five of Stirling (1899)[224] shows a cross section through the Horrock's brown coal seam under basalt and overlying a thin black coal seam. This was typical of the geological strata in the Narracan Creek valley and hillsides.

In the 1940s, the same seam was entered by a tunnel on Campbell's property in the close vicinity of Horrock's mine. The tunnel was known as Campbell's mine. The seam was 10 feet thick and was analysed as low in ash (4.5 per cent) and moisture. This mine did not reach commercial viability and ceased operation before 1950.[225]

6.3.4 Dickinson's Brown Coal Mine

Map Reference: 8121-3-4 Allambee 4220, 57608 approx.

This mine is depicted in the Mines Department *Annual Report* 1890 (see Drawing 4.1.1/1) as Dickenson's, located on the Narracan Creek about three miles to the west of Thorpdale being at the western border of the 'known area' of brown coal in the Narracan Creek valley.[226]

Mining appears to have commenced circa 1889 and to have ceased by 1894. Output apparently did not reach a commercial stage.

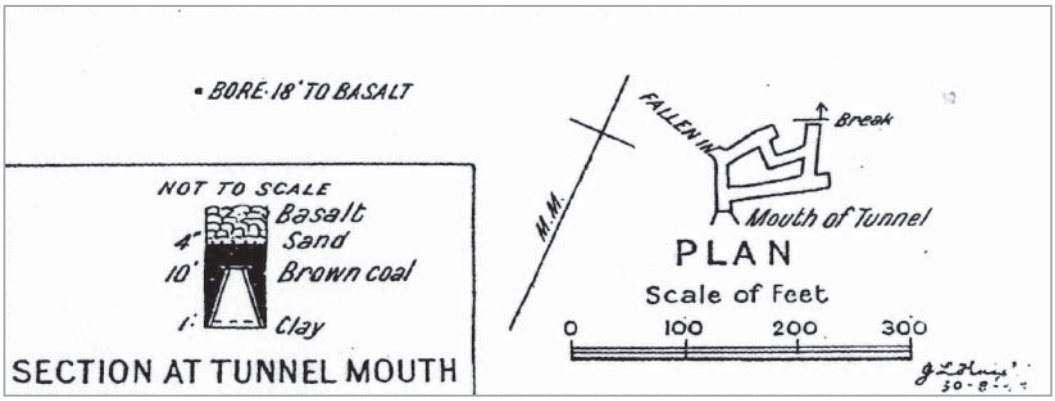
No further information on this mine has been ascertained in this study.

However I also identify a black coal mine in Section 4.3 as Dickinson's/ Whelan's adopting the description and location as stated in the *Morwell Advertiser* of 6 October 1888.

6.3.5 Herbertson's Mine

Map Reference: 8121-3-4 Allambee 4226, 57623 approx.

This mine was also located on the Narracan Creek about 2 ½ miles west of Thorpdale. No further details have been ascertained by me. This mine was also on the western border of the 'known area' of brown coal in the Narracan River valley. Mining appears to have commenced circa 1889 and to have ceased by 1894. Output apparently did not reach a commercial stage.



Drawing 6.3.3/1 Horrocks' Brown Coal Mine 1951, Section and Plan (from Knight, (1990)).

6.3.6 Willis's Mine

Map Reference: 8121-3-1 Thorpdale 4257, 57579 approx.

This mine was located about two and a quarter miles south of Thorpdale. Two seams existed, the main seam being eight to 14 feet thick[227] (see Drawing 6.3.6/1). This mine was also near the western border of the 'known area' of brown coal in the Narracan River valley. Mining appears to have commenced circa 1889 and to have ceased by 1894. Output apparently did not reach a commercial stage.

Further information on the nature and extent of mine operations has not been ascertained in this study.

6.3.7 Crisp's/Ferngrove Seams

Map Reference: 8121-3-1 Thorpdale 4232, 57581 approx.

The Ferngrove Seam on Crisp's selection [Stirling, J (1899), p. 75] was stated to be 40 feet thick[228]. (The location of this mine is shown named Crisp's on the 1890 Mines Department *Annual Report* Brown Coal Area map. See Drawing 4.1.1/1 of this heritage study.) The worked seam was separated by clays about five to ten feet thick from a younger seam of brown coal about six feet thick underlying basalt[229]. The coal quality as analysed was very similar to that of Rollo's Mine on the Yarragon escarpment leading to the geological assessment that all the mines in the area surrounding Thorpdale from south of the Yarragon Escarpment were based on the same seam(s)[230].

Mining appears to have commenced circa 1889 and to have ceased by 1894. Output apparently did not reach a commercial stage. As stated below, later development of the coal seam was undertaken from 1947 to 1956 as a commercial operation.

6.3.8 Moononook, Corovuna and Moolamoona Mines

Map Reference: Childers Township, 8121-3-4 Allambee,223, 604; Corovuna Mine Site 8121-3-1 Thorpdale, 240, 585 approx. (another version places the mine at 8121-3-3 Wooreen, 224, 580 approx.)

The definite location of these contiguous underground mines has not been ascertained during this study. It is probable that these mines followed on from the earlier working of the Crisp's/ Ferngrove seams. The site of the mines is variously recorded by the Mines Department as at Childers, at Thorpdale or at Thorpdale South. Childers township is about six kilometres south west of Thorpdale. The Moolamoona mine was also recorded at times in the 1960s as the Thorpdale mine, at that stage this mine being the only mine in operation in the Thorpdale area.

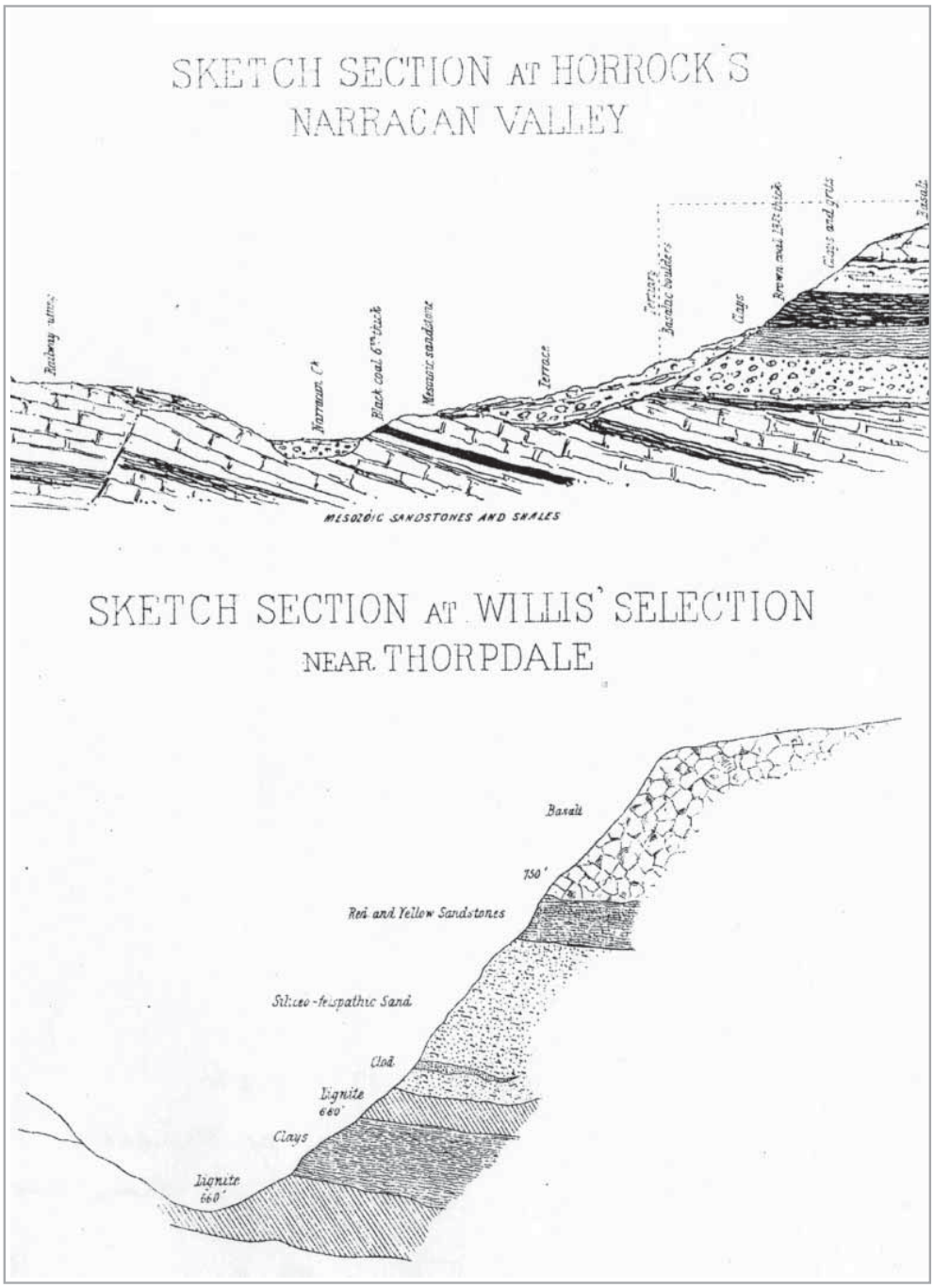
The initial mining operation had commenced in 1947 named the Moononook Mine.[231] This mine was taken over and renamed the Corovuna Mine in 1948. The *Mining and Geological Journal* of March 1948 reported that the Corovuna Brown Coal Mine at Childers was developing satisfactorily with two tunnels [and an air shaft] having been driven from the outcrop and an open cut excavation along the outcrop. Output for 1947 was 8,659 tons.[232] However the Corovuna operation was suspended in September 1948.[233]

From 1950, the mine continued under the name of the Moolamoona Brown Coal Mine. Outloading bins and two adits were installed by 1950 with an extensive network of side tunnels. Thomas & Baragwanath[234] (1949) refer to the brown coal in the Childers Formation at Childers: 'up to 40 feet of brown coal is exposed in creek sections. The results of boring have proved these to be neither extensive nor continuous'. At 1951 this was the only brown coal underground mine operating in Victoria, minor reactivation of the Horrocks mine in the late 1940s closing in 1950.[235] The Moolamoona mine used a bord and pillar operation engaging 3 mine workers producing about 80 tons weekly. In1951, the mine intentionally broke through to the former Corovuna mine to improve ventilation. A small open cut excavation was also commenced to mine along the outcrop.

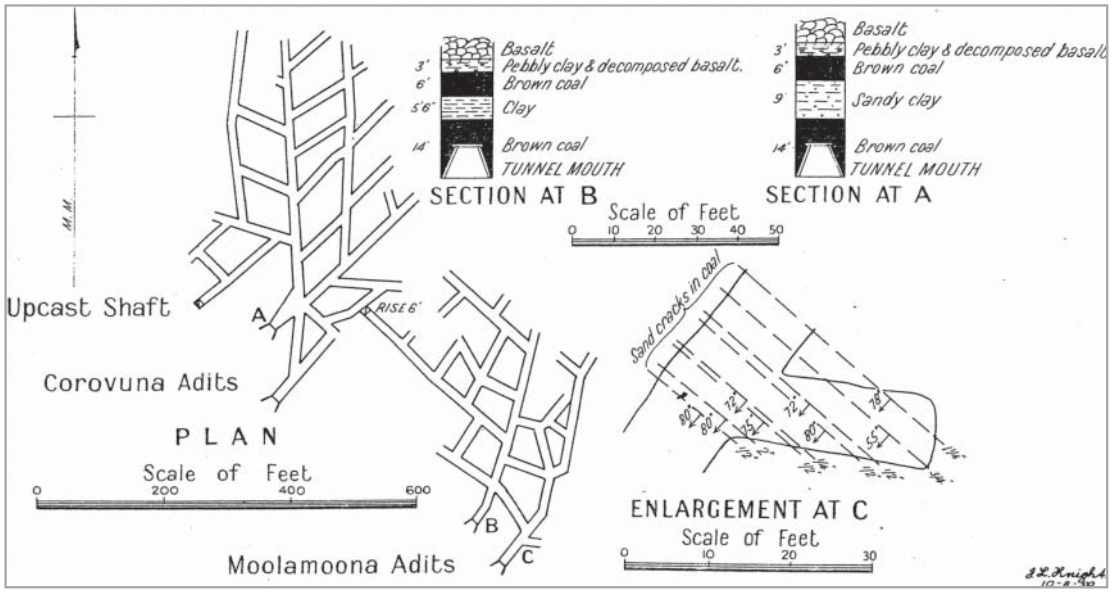
For 1953, output had grown to 4,852 tons for the year. Operations were suspended in May 1954 but were recommenced in September 1954 under new management [and ownership].[236] Two new tunnels were started from the outcrop. In 1959 another tunnel was installed. The coal output in 1959 was 5,521 tons. However by 1961 the annual coal output had fallen to 890 tons and by 1963 to 142 tons. The Mines Department *Annual Reports* show continuing decline with the Moolamoona Mine's last recorded output of 12 tons in 1965.

Between 1947 and 1950, 23,816 tons of coal was extracted from the Corovuna/Moolamoona mine. The lifetime total output for these mines until the last recorded operation of the Moolamoona mine in 1965 has not been definitively ascertained in this study but was probably of the order of 60,000 tons.

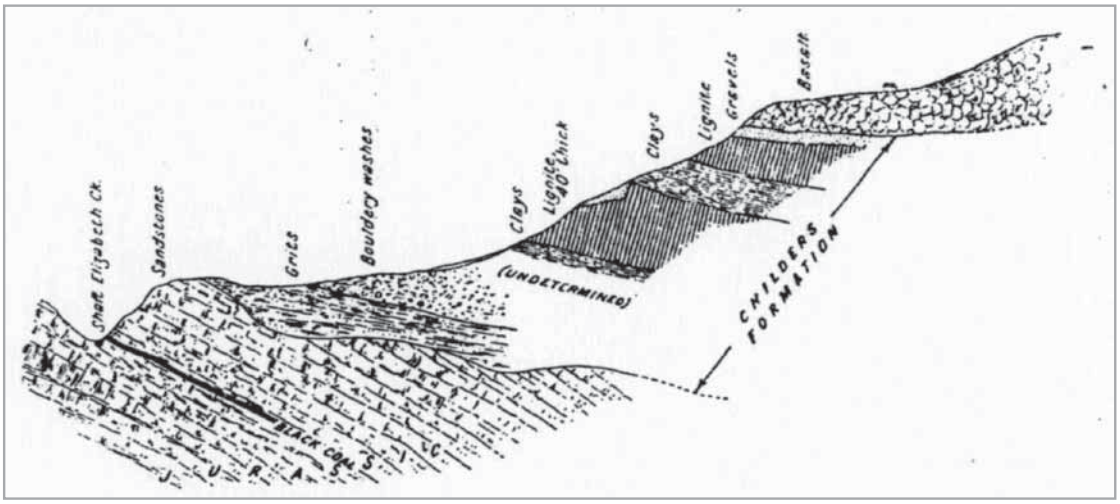
The precise location of these mines has not yet been visited or colloquially ascertained in this study.



Drawing 6.3.6/1 Sections of Horrock's and Willis's brown coal seams (from Stirling, J *Report on the Brown Coals and Lignites of Victoria*, 1899).

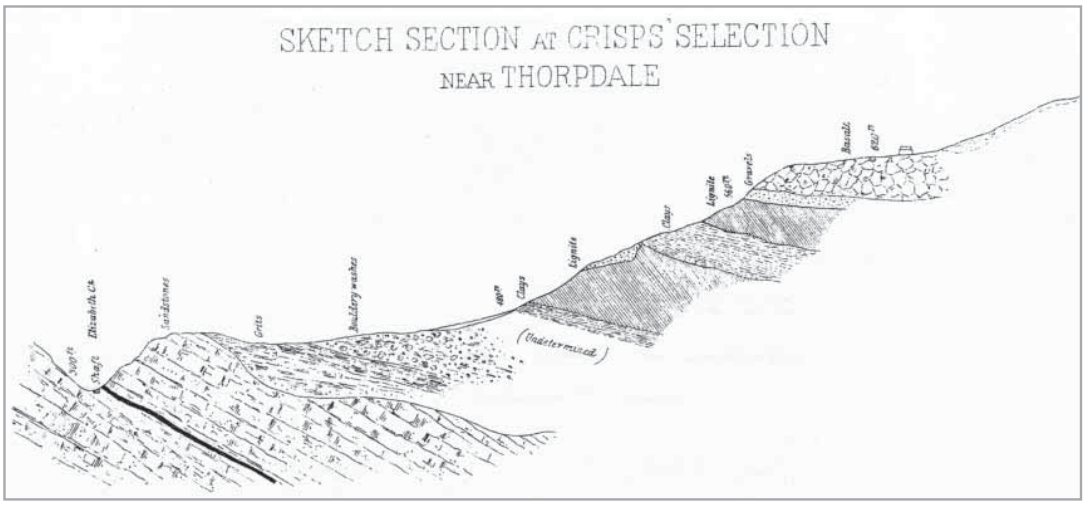


Drawing 6.3.8/1 Plans and sections of the Corovuna and Moolamoona mines (from Thomas & Baragwanath, Part 4, 1951).



Drawing 6.3.8/2 Section through the Childers formation showing lignite seams. (Stirling, J (1890), as presented by Thomas & Baragwanath, (1949), Part 1, Figure 11).

Drawing 6.3.8/3 Locality of Childers (from topographical map 8121-3-4 Allambee). Copyright State of Victoria, Department of Sustainability and Environment.



Drawing 6.3.8/4 Section through Crisp's Seam south of Thorpdale (from Stirling, J *Report on the Brown Coals and Lignites of Victoria*, 1899).

6.3.9 The Gan Mayen Mine at Thorpdale

Map Reference: not ascertained

The Gan Mayen Brown Coal Mine was referred to in the Mines Department *Annual Report* 1948 as being located at Thorpdale and having excavated 500 tons of coal employing four mine workers. No further reference to this mine has been found in researching this study.

Assessment of Heritage Significance

Historical Significance

The existence of widespread brown coal deposits in Central Gippsland had been gradually proven from the late 1870s. Mining of these deposits in the Thorpdale area occurred about a year or so later than the Great Morwell Coal Mine Company to the north of Morwell commenced operations. By 1890, six of the brown coal mines referred to above had commenced operations, although none had established a commercial scale customer base.

The *Victorian Royal Commission on Coal* (1889–1991) destroyed the hopes of the small brown coal mine operators in casting doubts on their economic viability without suitability of the coal for industrial usage having been established. The Commission recommended the need for research and observance of overseas successful practice. All the Thorpdale area brown coal mines had ceased production by about 1894 without having achieved market survival after the NSW coal and shipping industry strikes of the early 1890s had mitigated.

Scientific Significance

Utilisation of the extensive brown coal resource was a prime consideration of the *Royal Commission on Coal*. Their inquiry and final report fostered scientific research on brown coal quality and industrial processes for its economic use as a hard fuel with and without pre-drying and for conversion to gas, oil and various chemical products.

Economic Significance

The commercial failure of the several Thorpdale area brown coal mines after a brief life of less than five years demonstrated that mining of this low quality fuel by underground operations was unlikely to be competitive compared with similar mining of black coal. The Korumburra and Narracan Valley black coal mines which came into existence contemporaneously with the Thorpdale mines were in a much better competitive position. Hence, commercial investment in the Thorpdale mines was not forthcoming and the hopes of Thorpdale becoming a coal mining centre had faded by 1895.

As an exception, the Coravuna/Moolamoona mine was able to exist for some 18 years from 1947 at a low output from a conventional manual underground mining operation catering for local consumption with the competitive advantage of small transport distance from mine to customer.

Social Significance

The brown coal mining operations in the Thorpdale area were too small in scale and of too short a life to have a significant effect on the social fabric of the Thorpdale or wider community. Perhaps the prospects of a coal mining industry accelerated decisions to extend the VR branch line to Thorpdale. The mine workers in these intermittent and short-lived specific mining activities were predominantly drawn from the local land occupiers and local or itinerant timber workers. No mine was large enough to warrant the provision of mine site housing or infrastructure except that associated with haulage tracks to the embryo road system.

Mine Infrastructure Features

No specific mine sites have been inspected during this study.

The site of the Corovuna/Moolamoona mines 1947–1965 may still be identifiable.

References

Adams, John, *So Tall the Trees*, 1978

From the Dawning: A History of Yarragon and District, Back to Yarragon Committee, 1978, p.103

Mining and Geological Journal, March 1955

Annual Report, Mines Department, 1948

Stirling, J, *Report on the Yarragon District*, Mines Department, 1892, pp.15–16

Stirling, J 'Report on the Brown Coals and Lignites of Victoria', *Progress Report*, No. 10, Mines Department, 1899

Thomas, DE and Baragwanath, W *Geology of the Brown Coals Of Victoria*, Part 4, 1951, pp.8–10

6.4 Morwell River Valley Early Brown Coal Mines

Map Reference: As shown below for individual mines

Municipality: City of Latrobe

Land Use/Status: Private

Site Histories

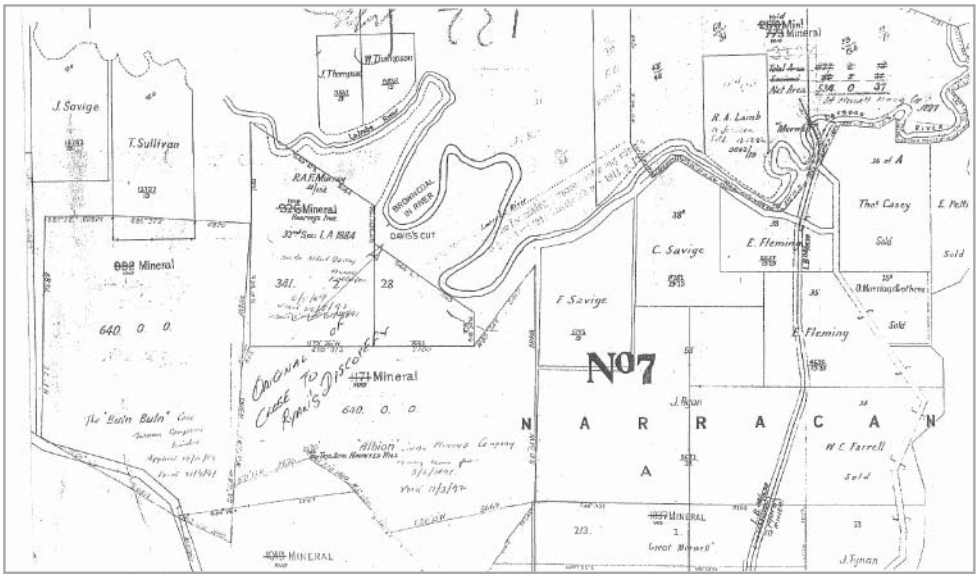
(The Site History of the Great Morwell Brown Coal Mine 1879–1924 is collated in Section 9.2).

6.4.1 Davis' Cut at Moe North

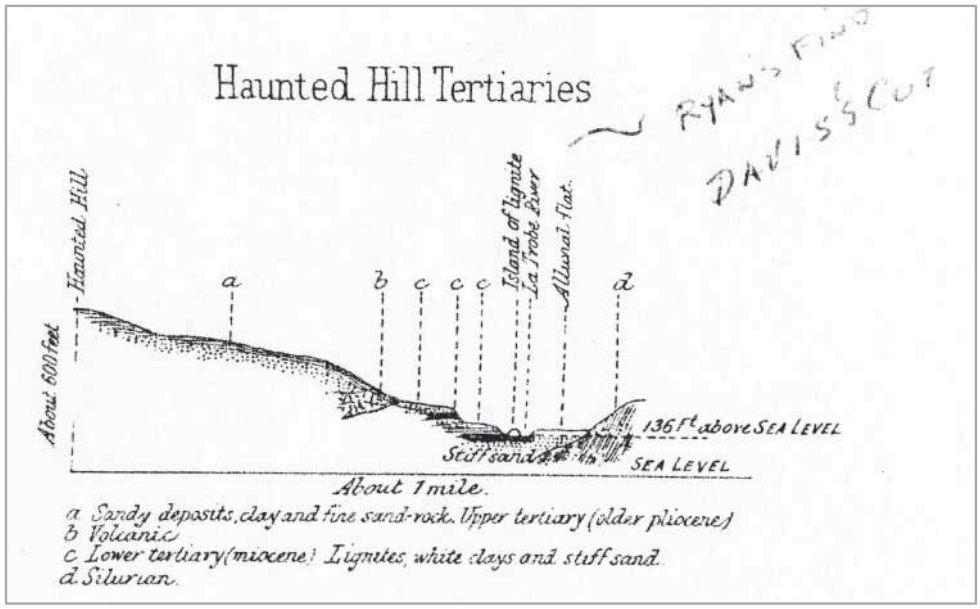
Map Reference: 8121-1-3 Yallourn 414, 748

In 1873, lignite was found by David Ryan near the southern bank of the Latrobe Valley about three miles north east of Moe and one mile north of the Haunted Hill trigonometrical station. A tunnel was driven about 20 feet into a nine feet thick seam with clay above and below the seam. The site was inspected by RAF Murray, geologist, who commented 'I believe the main deposit to be an extensive one'. Testing of a sample from this location revealed a low ash content of 4.10 per cent.[237] This seam, later co-related with the Morwell Number Two seam, was briefly mined in 1874 soon after its discovery and was referred to as the Haunted Hill or Davis' Seam[238] (Drawing 6.4.1/2). The quantity mined has not been ascertained in this study, but was not a commercial success and had closed before 1879 when further discoveries of a much larger deposit was found on the north bank of the Latrobe River in the same vicinity. Davis' Cut was the first mining of the Latrobe Valley Brown Coal deposits. The location of the shaft is now probably under the Yallourn W storage water in Halls Bay of the artificial Lake Narracan. Drawing 6.4.6/1 shows the location of Davis' Cut on a circa 1910 plan.

(At 1873 discovery of thin coal seams in scattered locations in the Latrobe Valley catchment were reported in the Mines Department *Mineral Statistics*, 1873, p. 52. These seams were classified as black coal at that time by the Mines Department although it is probable that all discoveries did not come under technical analysis at the time. The only coal mining activity



Drawing 6.4.1/1 Location of Davis's Cut at the North West of Yallourn. Copyright State of Victoria, Department of Sustainability and Environment. Note the nearby location of the Mining Lease to RAF Murray.



Drawing 6.4.1/2 Section through Ryan's Seam/Davis's Cut on the Latrobe River (originally from Stirling, J *Geological Survey Progress Report*, No. 3, 1876, p.149).

at that time was reported to be the Excelsior Coal Mining Companyon the 'Hazelwood Run' on a black coal seam[239]. Details of this venture or its location have not been ascertained in this study.

In 1873, lignite was found near the survey line for the proposed Gippsland Railway through the Haunted Hills. Testing of a sample from this location revealed a low ash content of 2.95 per cent. The lignite was described by the Mines Department analyst as 'compact lignite which burns readily with a bright flame'.[240]

Many additional findings of brown coal were subsequently made in the Morwell River valley, initially by private mining ventures supplemented from the late 1880s by Mines Department drilling. Some of the private companies which took out exploration or mining leases in the vicinity of Morwell are referred to in Section 9.1. At Boolarra, the southern border of the 'known area' of brown coal was immediately on the north and west of the Railway Station at Bore Numbers One and Five (the latter showing 139 feet of lignite from 71 feet deep) whereas bores Two, Three and Four immediately to the south showed only thin black seams of coal.[241] The Great Morwell Brown Coal Mining Company commenced an open cut operation in 1889 (see Section 9.2) at a site near the junction of the Morwell and Latrobe Rivers originally discovered in 1879. Much of the flat land in the Morwell River valley between Morwell and the Haunted Hills had been taken up by exploration or mining licences by 1890. Among these leases taken out was one by RAF Murray, geologist of the Mines Department.

6.4.2 Murdoch Brown Coal Syndicate at Morwell Maryvale Proprietary Coal Mining Company Morwell NL

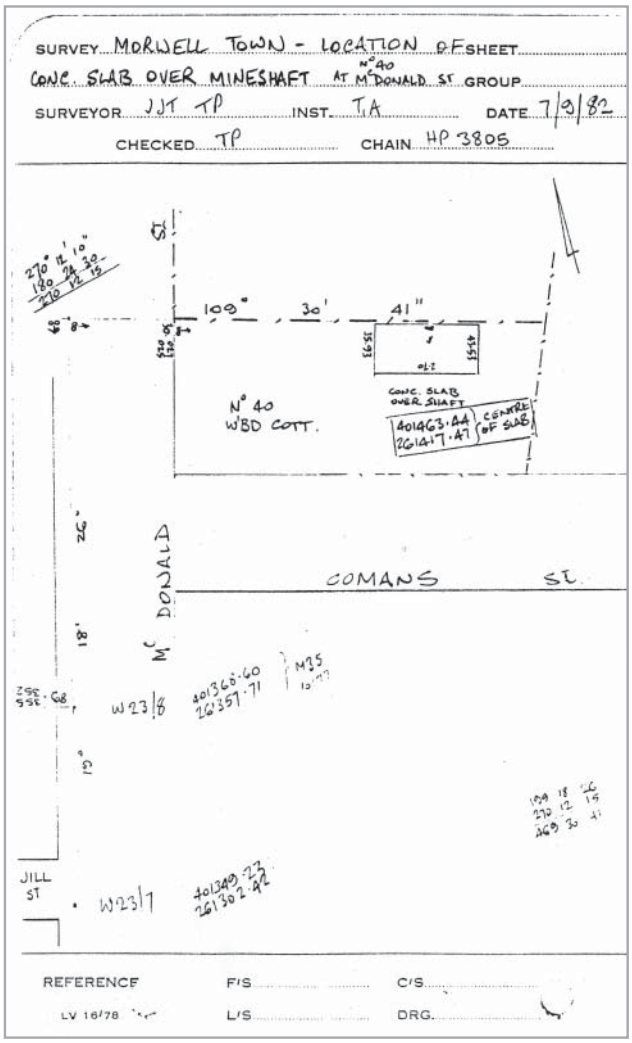
Map Reference: 8121-1-2 Morwell 479, 678; Maryvale Shaft 479, 681 Approx. location: of earlier bore and shaft in vicinity of Norman Brookes Park

On Buckley's land (private property Crown Allotment CA69 immediately at the north of Morwell township, the Murdoch Brown Coal Syndicate commenced a shaft at 700 metres north of the Gippsland Rail Line in December 1889 reaching 100 feet depth by 10 May 1890. At 10 June 1890, 200 tons of brown coal had been removed. By June 1890, drilling had commenced by the Mines Department at about 50 metres south east of the Murdoch shaft. This bore known as Maryvale Number One was sunk to 1,009 feet. It intersected seven seams of brown coal of which two seams each exceeded 200 feet in thickness, in a total brown coal thickness of over 800 feet. J Stirling of the Mines Department stated 'this is probably the greatest deposit of lignite, in point of thickness, yet discovered in the world.'[242] From 28 July 1890, a second shaft was sunk to a depth of 300 feet about 120 metres south of this deep bore, with coal continuous from 132 feet.

The Maryvale Proprietary Coal Mining Company Morwell NL was formed in December 1899 with JH. Buckley as one of the shareholders. This company took over ownership of two parcels of land from Buckley and subsequently took over the mining previously carried out by the Murdoch Syndicate[243] (Drawing 6.4.2/1). At 200 feet depth in the second shaft, a drive was excavated for 200 feet northwards and a cross cut of 50 feet. Average ash content from 32 samples of coal from the shaft was 2.79 per cent.[244] Although this mine had advantages of proximity to rail transport, the mining costs of the underground operation albeit in a thick coal seam were significantly higher than at the open cut mine at the Great Morwell Brown Coal Mine and the moisture content of the coal was higher. The mine did not find a continuing market for its coal and ceased commercial operation in early 1891.[245] It appears that some minor amounts of coal were subsequently extracted in the late 1920s for tests on conversion to liquid fuels.

The Minerals Lease was transferred to the Goldfields of Gippsland Syndicate Ltd. by 1899 and subsequently consecutively to three other mining companies to 1937 before the land returned to private ownership. One of these companies, the L&N Brown Coal Limited formed in England in June 1927 and an interlocked company, Australian Commonwealth Fuels and Oils Ltd., claimed success with a distillation process from the 'Maryvale' coal in a director's report dated 28 February 1930. This report also said: 'The London Fuel Conference of 1928 pronounced the Freehold Colliery Possessions at Morwell as the greatest of their kind in the world'. No commercial success eventuated and the L&N Company was compulsorily liquidated on 5 February 1934.

The poppet head of this second shaft was a feature of Morwell township (see Photo 6.4.2/1) until at least the late 1920s. See Drawing 6.4.2/1 for location of the shaft as identified by SECV Morwell survey section. (The locations of the Maryvale Number One bore and initial shaft as shown by H Herman, 1952, Fig. 33



Drawing 6.4.2/1 Precise location of Maryvale Proprietary Coal Mining Company shaft in Morwell township. Copyright State Electricity Commission of Victoria.

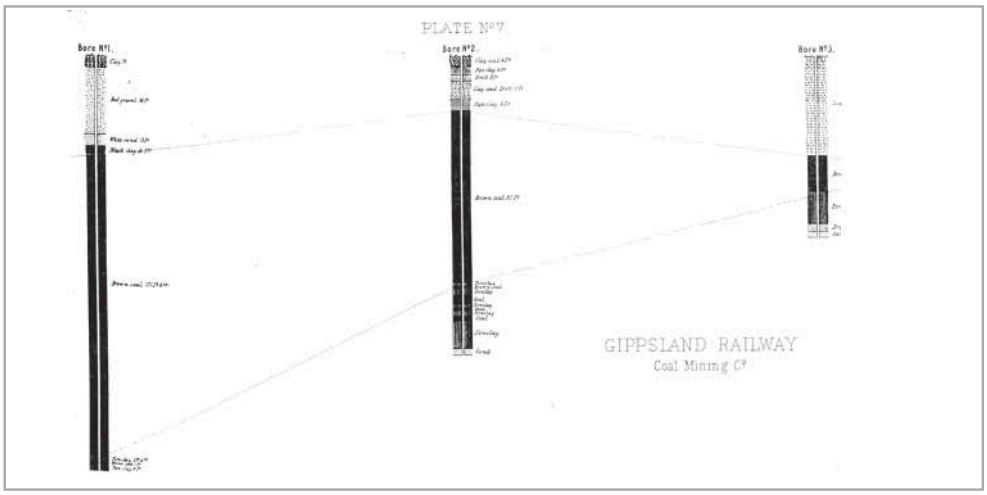
were plotted by this Survey Section as being: Number One bore about 150 metres west of the second shaft; initial shaft as being about 150 metres north of the second shaft.)

6.4.3 (Great) Gippsland Railway Coal Mining Companyat Herne's Oak

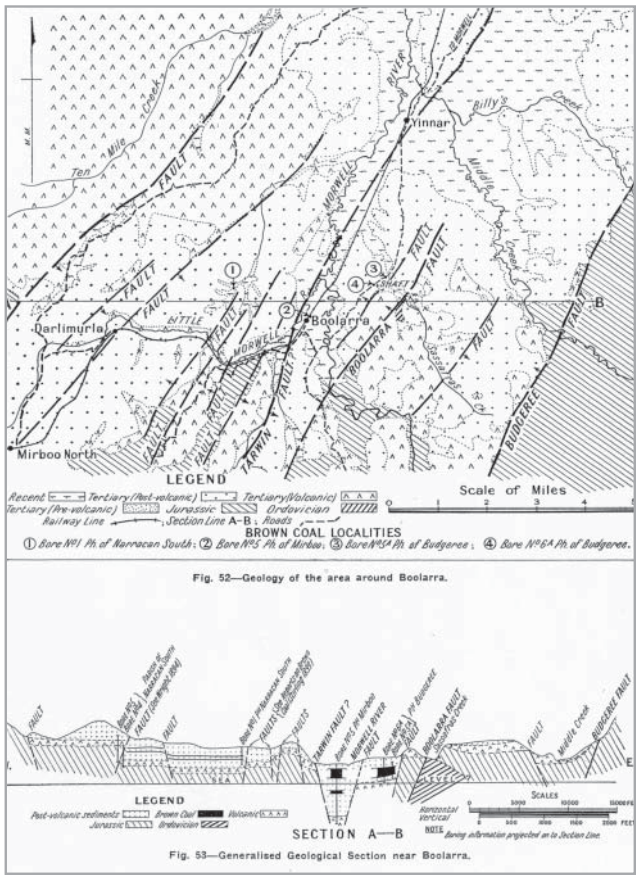
Map Reference: 8121-1-3 Yallourn 4425, 57700 approx.

In 1889, the (Great) Gippsland Railway Coal Mining Company, after sinking several bores between Moe and Morwell close to the VR Gippsland line,[246] opened a shaft on the North side of the Gippsland Railway on the eastern slopes of the Haunted Hills near the later hamlet of Hernes Oak and close to where brown coal had been found in 1873[247] (Drawing 6.4.3/1). These shaft workings were revealed as a shaft only (about 180 feet deep and timbered to a 14 by six feet cross section) when excavated during mining operations in Yallourn Open Cut in 1970,[248] during which the shaft required dewatering and dismantling before passage of excavators on each operating bench.

Photo 6.4.2/1 Poppet Head of Maryvale Proprietary Coal Mining Company in Morwell township.



Drawing 6.4.3/1 Sections through Gippsland Railway Coal Mining Company bores west of Morwell (from Stirling, J Report on the Brown Coals and Lignites of Victoria, 1899, Plate No.7).



Drawing 6.4.4/1 Geology and Brown Coal localities around Boolarra (from Thomas and Baragwanath, Part 4, Figs 52, 53).

6.4.4 Mirboo Collieries Proprietary Number One at Boolarra

Map Reference: not identified as yet in this study

In 1889, the Mirboo Collieries Proprietary Number One at Boolarra was located about 12 miles south of Morwell and two miles north east of Boolarra. Operations were through a shaft[249] which penetrated 162 feet of solid brown coal beneath a cover of 134 feet of clays (Drawing 6.4.4/1. See also Drawing 4.1.1/1.) The mine was connected to the Morwell/Mirboo North VR rail line. From these workings, 5,412 tons of brown coal were extracted in five months and sold in Melbourne during the maritime strikes of 1890.[250] (Other reports state 10,000 tons as the output from this mine before closure). High freight rates obviated further development from this shaft. It is also probable that the mining by open cut methods of the Great Morwell Brown Coal Mining Company (see Section 9.3) to the north of Morwell was more economical, also had access to the VR Rail system, and could potentially supply greater quantities of brown coal at short notice or by long term contract.

Another bore installed near the Morwell River about a quarter mile north east of the Boolarra township revealed brown coal 139 feet thick overlain by 71 feet of clays, boulders and sands with basalt not found until 922 feet depth.

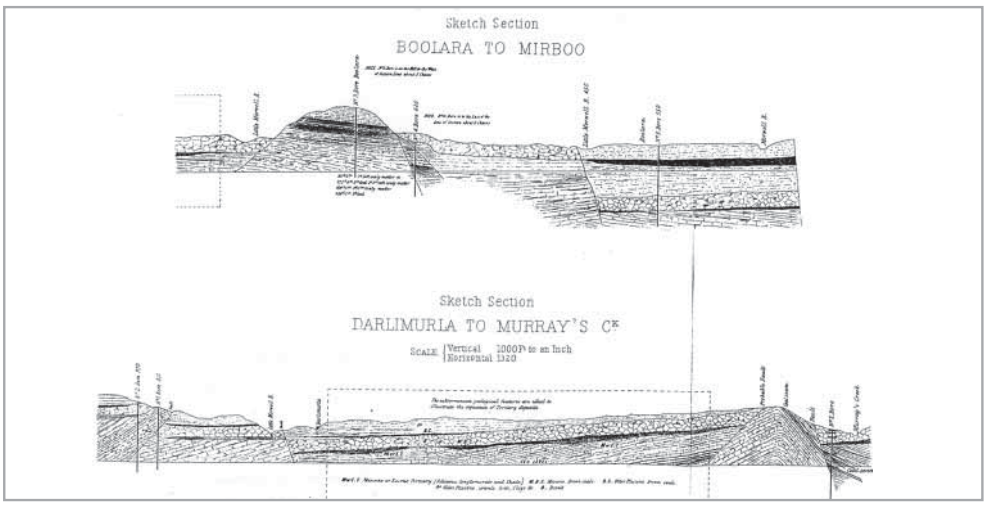
6.4.5 Darlimurla Brown Coal Mine

Map Reference: 8121-3-1 Thorpdale 4306, 57530 approx

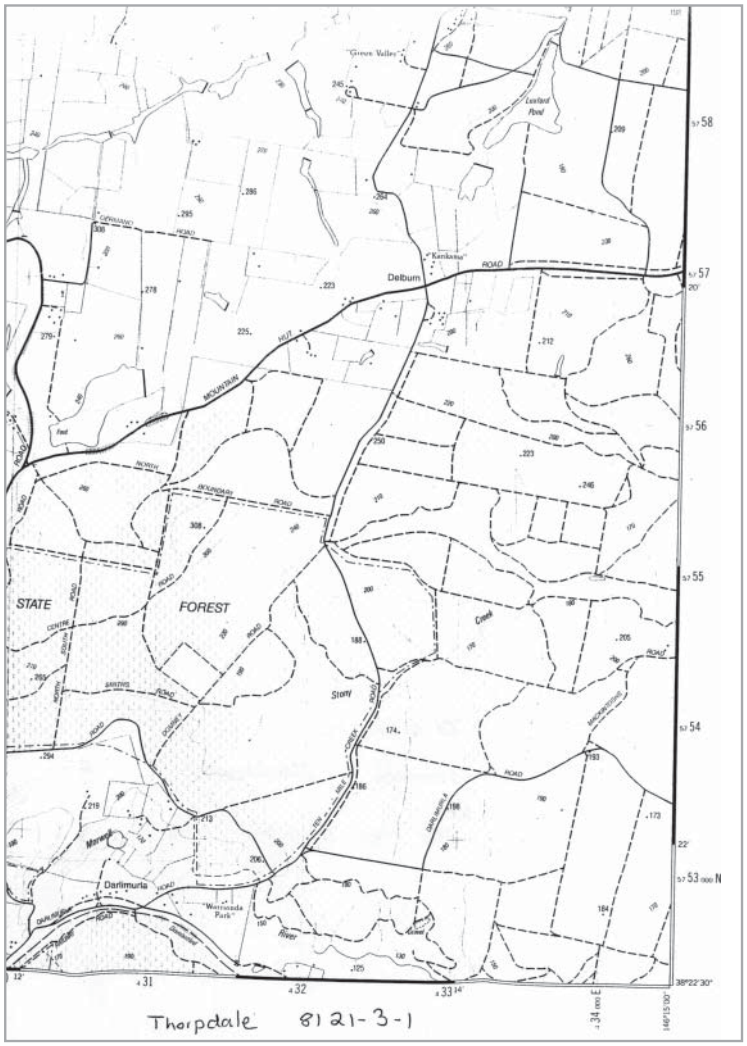
In the 1890s, brown coal was also found in the upper reaches of the Morwell River catchment along the Little Morwell River in the vicinity of Darlimurla. This coal was assessed to exist over an area of eight to ten square miles and was 30 feet thick at the Darlimurla rail siding. Tests on this coal showed it to be high in resinous matter with possible byproducts of varnish, pigments and paraffin. This coal deposit was assessed as being an older seam than those upper seams in the lower Morwell River valley.[251, 252] Some mining of this coal occurred but no longer-term utilisation eventuated.

The widespread discoveries of brown coal in Victoria stimulated analytical scientific appraisal of the vagaries of coal quality and the extrapolation to compile and modify geological understanding of the origins and interrelations of the various coal and lignite seams.

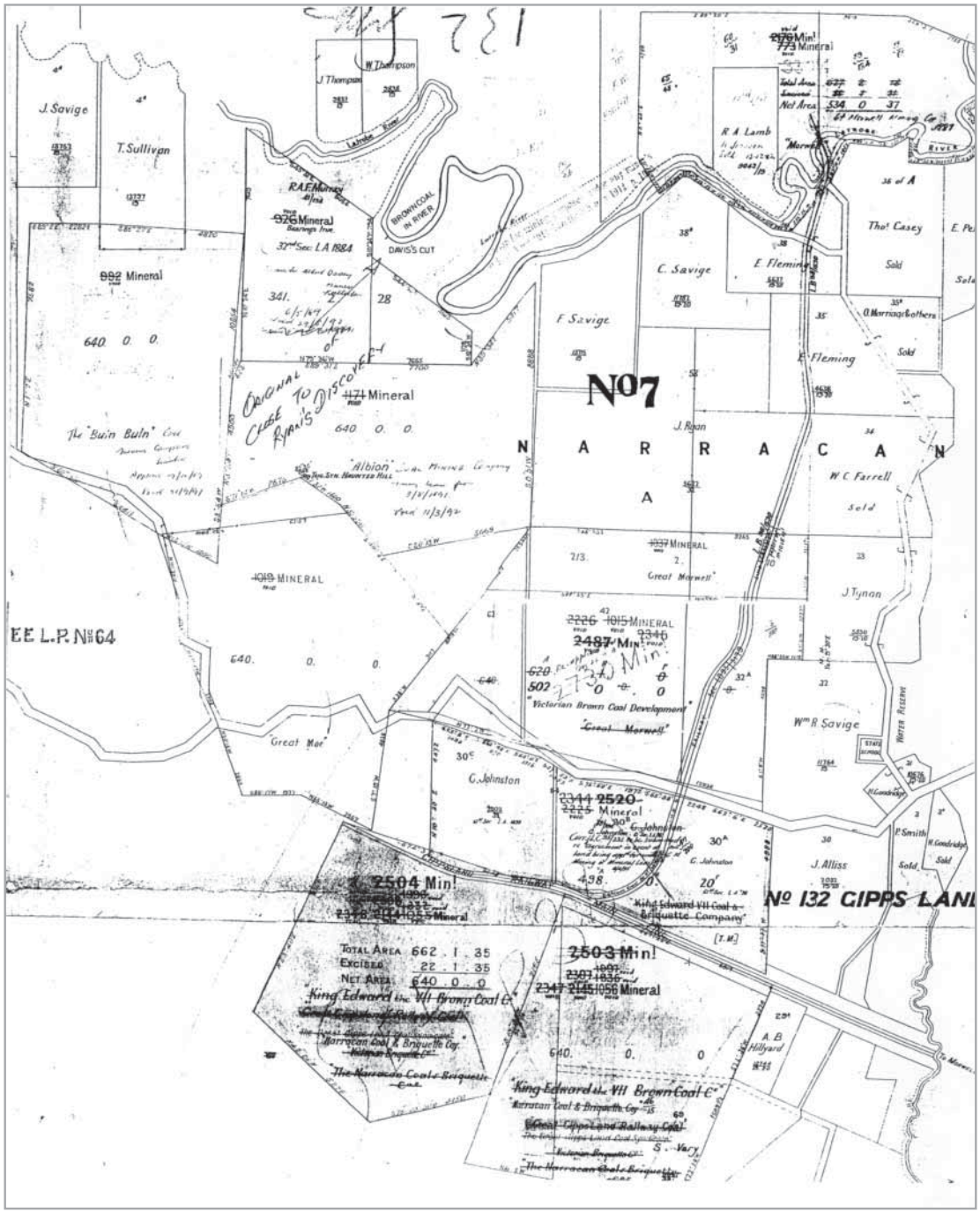
It was disappointing that a more strenuous support from Government prior to 1900 and again to 1920 was not forthcoming in scientific research to compare coal quality of the Latrobe Valley coal deposits with those being successfully utilised in Germany.



Drawing 6.4.5/1 Sections through Brown Coal at Darlimurla and Boolarra (from Stirling, J *Report on the Brown Coals and Lignites of Victoria*, 1899, Plate No.10).



Drawing 6.4.5/2 Locality of Darlimurla (from Topographical Map 8121-3-1 Thorpdale).
Copyright State of Victoria, Department of Sustainability and Environment.



Drawing 6.4.6/1 Plan showing mining leases west of Morwell River at Morwell circa 1910.

6.4.6 Other Coal Mining entrepreneurs in the Morwell Area 1880–1930

Map Reference: from one to four miles west of Morwell to the Haunted Hills south of the Latrobe River (see Drawing 6.4.6/1). Note: there may be some duplication of similarly named mines**.**

Albion Mining Company: Mineral Lease approved 28 April 1891 until 11 March 1892.

Australian Commonwealth Brown Coal Syndicate: Mineral Lease held December 1906 to June 1909.

Australian Commonwealth Fuels and Oils Ltd.: An English company, formed 1905.

Buln Buln Coal Mining Company: Mineral lease taken out 12 May 1891 until 21 September 1891.

Great Gippsland Coal Syndicate.

Great Gippsland Company:[253] circa 1892, inspired by the *Royal Commission on Coal* forecasts for brown coal utilisation, leased 2,000 acres in low lying land to the west of Morwell, commenced mining but found the soft wet overburden too difficult to handle and ceased operation by 1895.

Great Gippsland Railway Coal Mining Company: Formed 1889.

Great Moe Mining Company.

Great Morwell (Brown Coal) Mining Company: formed October 1888.

King Edward VII Coal and Briquette Company: Two mineral leases, held March 1904 to August 1905.

King Edward VII Brown Coal Company: Two Mineral Leases held October 1904 until August 1905.

L&N Brown Coal Ltd.: Formed 1927.

Maryvale Extended Coal Mining Company NL: Mineral lease held by C. Davey since 6 May 1889 transferredon 31 May 1910.

Narracan Coal and Briquette Company: Two mineral eases held June 1902 to February 1904

Victorian Briquette Company: Two mineral leases held November 1906 to May 1909

Victorian Brown Coal Development Company: Mineral lease held October 1906 to July 1907

Victorian Lignite Products.

Victorian Minerals Development Company NL: In 1901, 530 acre lease taken out via William Tulloch[254]. Lease transferred to VMDC in October 1910. Lease declared void June 1915.

Other leases to individuals: August Hoette (16/11/1911), P. G. Lansdown (5/7/1912), H. K. Hall (20/6/1901), C. Davey (5/3/1889).

Assessment of Heritage Significance

Historic Significance

The brown coal discoveries and mining outlined above were the first activities directly associated with the later extensive development of the Latrobe Valley brown coal resources.

Knowledge acquired from analyses of coal samples from numerous bores and shafts by 1890 led to public and government awareness that a vast resource existed in Gippsland available for use as a domestic and industrial fuel, for conversion to gas and electricity, and for many reprocessing applications.

The vast fuel resource within the colony of Victoria presented the opportunity for independence from one hundred years of vagaries of coal supply from NSW and offered prospects of better price regulation of black coal supplies from NSW.

Scientific Significance

To about 1890, resources for scientific appraisal of the coal and lignite samples from the numerous bores, tunnels and shafts had little exposure to overseas experience in scientific appraisal and utilisation of brown coal.

Economic Significance

By the late 1890s, the knowledge accumulated from the various brown coal discoveries in the Latrobe Valley watershed had spread to understanding by government and private enterprise of the economic potential of the vast deposits.

The *Royal Commission on Coal* in 1889–1891 was appointed to evaluate the economic potential of the coal fields and in

particular the interrelated roles of government and private enterprise to optimise this potential. Economic recession in the early 1890s delayed innovation and investment. Political interest was concentrated on Federation issues until 1900 and then on State/Commonwealth relations. It was not until about 1905 that private enterprise sought opportunities (and government subsidies in various forms) for brown coal utilisation for power generation with the technology for long distance electricity transmission now feasible and economical. Subsequently, by 1919, the Government decided to undertake large scale utilisation of the brown coal deposits in the Latrobe Valley for electricity generation and briquette manufacture as a public enterprise.

Social Significance

The Brown Coal discoveries in the Morwell River Valley were a significant factor supporting the provision by Government of a VR branch railway from Morwell through Boolarra to Mirboo North.

The occurrence of brown coal as outcrops or at shallow depths found during boring for minerals or water involved many individual discoverers on farms or leases. In many cases, tunnelling or shaft sinking into the known coal deposit was carried out by the landholder or lessee. There was no large influx of miners into the Morwell River Valley until development commenced at Yallourn from 1920.

The Morwell River Valley was occupied mainly by a farming/grazing community but with mining and exploration licences remaining for many years. The short lifetime of many of the mining ventures did not significantly destabilise the ongoing 'farming' use of the land through to the 1920s.

Mine Infrastructure Features

No specific tunnels or shafts have been identified.

No specific remains of mining machinery have been identified.

The site of the Maryvale Shaft has been identified.

The site of Davis' Cut could probably be identified although probably now under water.

The site of the Darlimurla Mine could probably be identified approximately.

The site of the Mirboo Collieries Brown Coal Mine could probably be identified approximately.

References

Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No. 11, AusIMM, 1984

Mineral Statistics, Mines Department, 1873

Borings in search of Coal and Lignite or Brown Coal, Mines Department, 1890

Stirling, J, *Geological Survey Progress Report*, No. 10, Mines Department, 1899

Thomas, DE, and Baragwanath W Geology of the *Brown Coals Of Victoria*, Part 1, Mines Department, 1949

Vines, JA, *Technical History of Yallourn Open Cut*, SECV, 1989

7 Coal Mines of the Otway Basin and Ranges

7.1 Point Castries/Aireys Inlet

Map Reference: **7721-3-3**

Aireys Inlet Coal Mine Creek 7422, 57377

Spout Creek-7412, 57372

Municipality: **Surf Coast Shire**

Land Use/Status: **Private**

Site History

The first land survey in the Aireys Inlet area in 1846 by Government Surveyor George Smyth[255] had identified 'veins of brown coal on the coast from thirty miles from the Port Phillip Heads to ten miles beyond Cape Otway.'[256] Smyth commented on the coal-bearing rocks cropping out at Aireys Inlet as being similar to those found at Western Port and the Barrabool area, and conjectured on the possibility of a vast coal basin underneath Port Phillip Bay[257]. (The existence of extensive beds of coal from Altona and Newport under Port Phillip Bay to the Mornington area was subsequently confirmed although the coal was generally under basalt in most of the area.[258]) This conjecture would have been of strong interest to commercial entrepreneurs in Melbourne seeking all avenues of independence from coal supply from Newcastle and the east coast of the colony (NSW).

In 1872, tenders were called by the Victorian Government for coal boring at Aireys Inlet.[259] Whether this boring eventuated has not been ascertained in this study.

The first official geological report of coal in the Otway Ranges area was by F.M. Krause in 1873 of a lignite deposit located about one mile south west of Aireys Inlet near Spout Creek, now called Coal Mine Creek (See Drawing 7.1/1.). Krause (1873) reported that 'there is a bed of considerable thickness. These lignite deposits are widely spread. They are undoubtedly of value, but they cannot be profitably wrought in localities far from a market, nor where the carriage of the fuel would be costly.'[260] Krause (1873) noted that a prospecting party which had discovered this deposit had sunk several shallow pits and a bore, followed by a shaft which had laid bare a 13 foot seam of brown coal. Although this site on the coast offered possibility of initiating sea transport for the lignite, at 1873 no further mining had occurred after the initial shaft.

In 1890 and again in 1919 reports on coal-bearing deposits in the vicinity of Aireys Inlet were noted in the Geelong Press.

The coal discoveries from the 1870s to 1920 scattered westwards from the Aireys Inlet/Point Castries area through the coastal fringes of the Otways led to some low scale mining ventures, all of which were restricted in economic success by remoteness of markets and inadequate haulage infrastructure. Drawings 7.1./2 to/5, copied from Stirling (1899), show the location and cross section of the coal seam at Point Castries, typical of the thin coal deposits found along the Otways coastline, as identified at that time. An update of the geological assessment of 'Brown Coal Prospects in the area of the Otways Ranges' was compiled for the Mines Department in 1974.[261]

Assessment of Heritage Significance

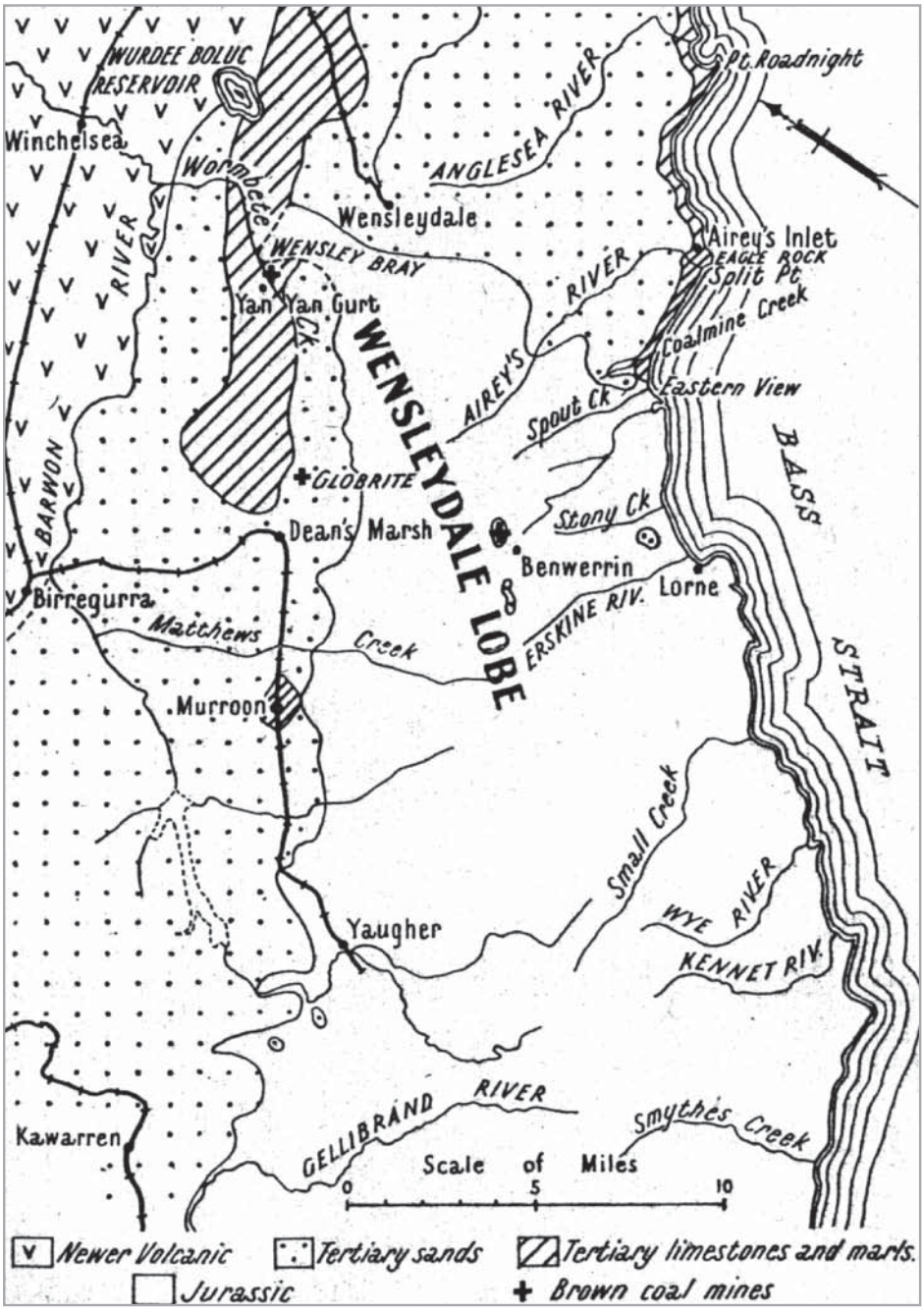
Historical Significance

The discovery and reporting of coal seams on the coast about 60 miles west of Melbourne in 1846 raised hopes of a coal source independent from the near monopoly of coal supply from the Sydney/Newcastle area.

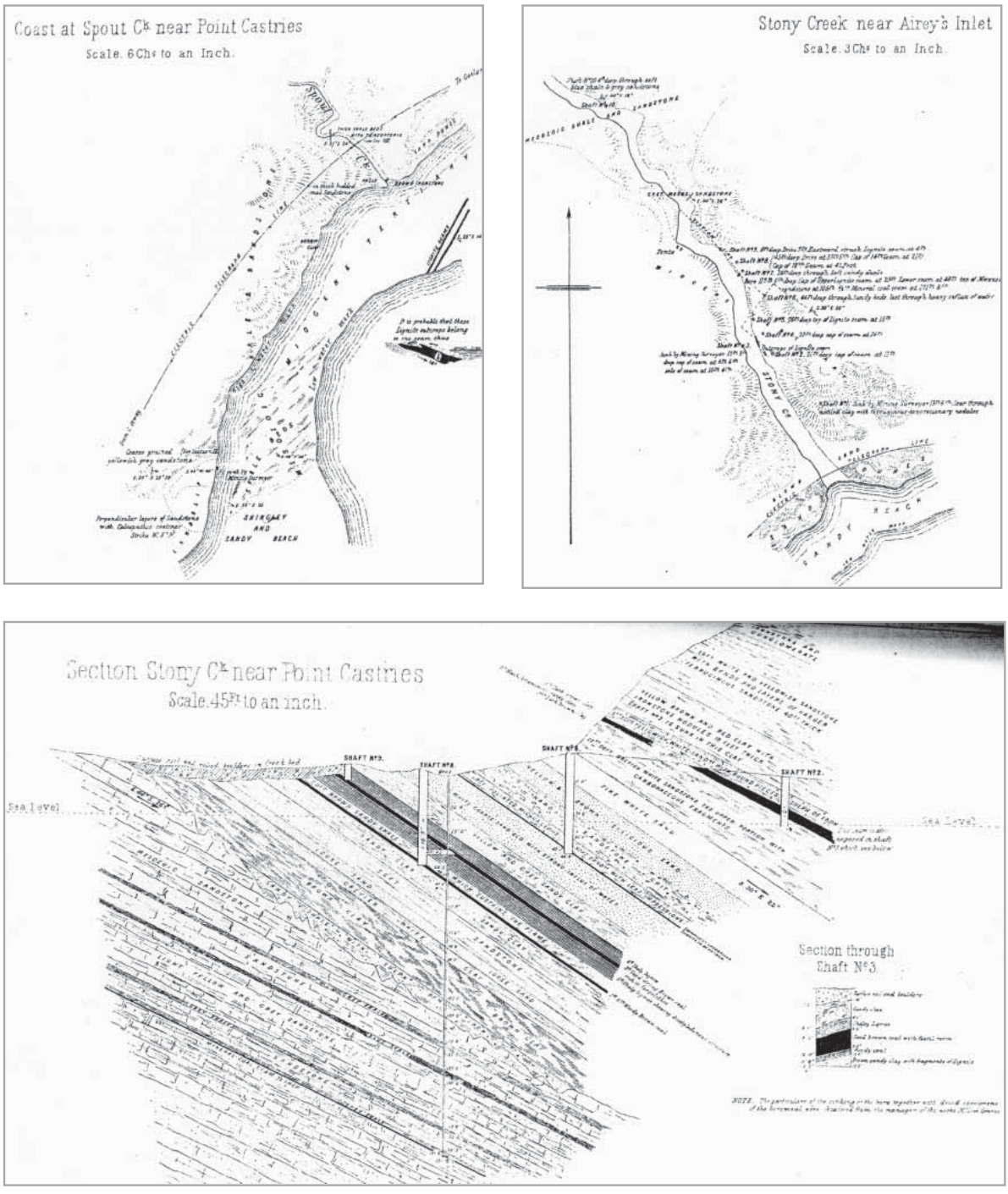
The geological reporting in 1873 (Krause 1873) of coal seams on the Otways shoreline raised hopes in the Colony of Victoria of an extensive coal deposit under and adjacent to Port Phillip Bay, close to the major towns and ports of Geelong and Melbourne.

Social Significance

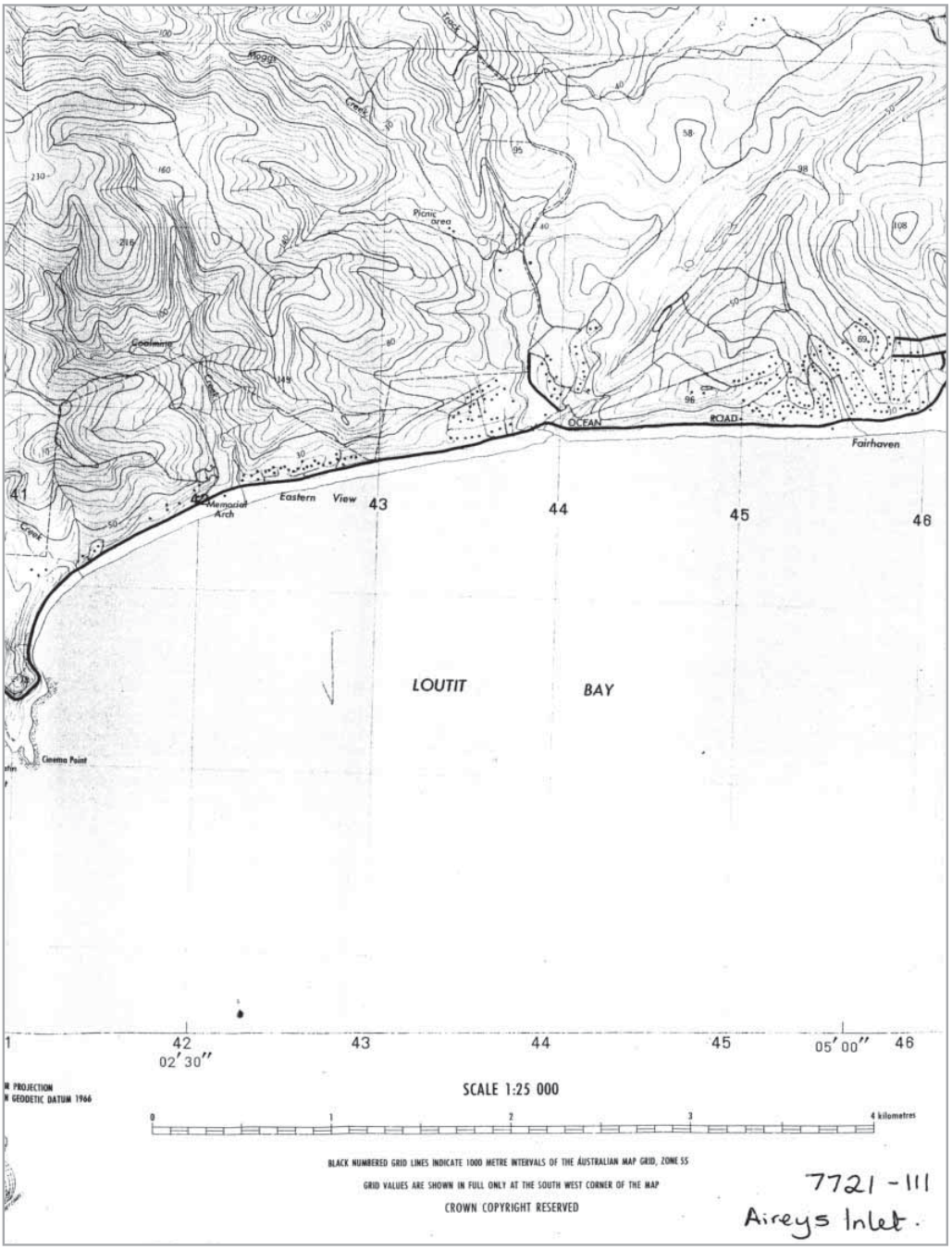
The coal discoveries to the west of Geelong and Melbourne offered prospects of self sufficiency in coal supplies within



Drawing. 7.1/1 Sketch Map of brown coal occurrences in the Otways, south from Wensleydale (from Thomas D. E and Baragwanath W (1950), Part 3, Fig. 43).



Drawings 7.1/2–4 Location and cross sections of coal seams at Point Castries/Aireys Inlet (from Stirling, J (1899), Plates 13–16).



Drawing 7.1/5 Location of mine sites west of Aireys Inlet (from Topographical Map 7721-111 SW Aireys Inlet). Copyright State of Victoria, Department of Sustainability and Environment.

Victoria. The possibility of an indigenous coal supply to shipping, railways and industry was of high social significance in maintaining prosperity in Victoria, as the surge of income from the gold discoveries progressively declined.

An indigenous coal industry would provide opportunity for new sources of employment directly in the mining operation but at least as significantly in fostering a more competitive industrial base in the Colony.

Mine Infrastructure Features

The locations of shafts have not been identified at site in this study.

References

Cecil, KL, *Along the Great Ocean Road: A Chronological List of Events at Anglesea and Aireys Inlet*, Anglesea and District Historical Society, 1988

Gregory, EB et al *Coast to Country: Winchelsea, A History of the Shire*, Shire of Winchelsea, 1985

Holdgate, GR, *Brown Coal Prospects in the Area of the Otway Ranges*, Mines Department, 1974

Krause, FM, *Progress Report*, No. 1, Mines Department, 1873

Stirling, J, *Report on the Brown Coals and Lignites of Victoria*, Mines Department, 1899

7.2 Wormbete

Map Reference: **7621-2-1 Bambra**
Wensleydale Mine at 7600, 57520

Municipality: **Surf Coast Shire**

Land Use/Status: **Private**

Site History

The locality of Wormbete is about 12 kilometres south of Winchelsea and about five kilometres east of Wensleydale. The name Wormbete was first used for the squatter's lease and later for the squatter's homestead.

A report in 1858 by James Bonwick, a Victorian historian and writer, informed of a coal deposit being mined at Wormbete on the north side of the Otway Ranges in 1857.[262] Perhaps the mining referred to by James Bonwick at Wormbete was some mining of the large brown coal deposit later (1921–1959) developed at Wensleydale, adjacent to and straddling the Wormbete Creek.

Herman, H (1922), p.12, refers to the coal deposit 'at the Wormbete Creek, near Wensleydale', as 'having been traced for about half a mile along the bed of the Wormbete Creek.'

Drawing 7.2/1 depicting localities of brown coal areas in Victoria, copied from Herman, H (1952), shows the locality of Wormbete but names the mine as Wensleydale.

No other information on the Wormbete mine as a separate mine from that developed as the Wensleydale mine has been ascertained in this study.

Assessment of Heritage Significance

The writing by James Bonwick in 1858 that some coal mining had occurred at Wormbete in 1857 has not been confirmed from other sources. If this had occurred, this mining operation would displace that at Lal Lal as the first mining of brown coal recorded in Victoria. However, the Wormbete operation was apparently not a commercial activity. There may well have

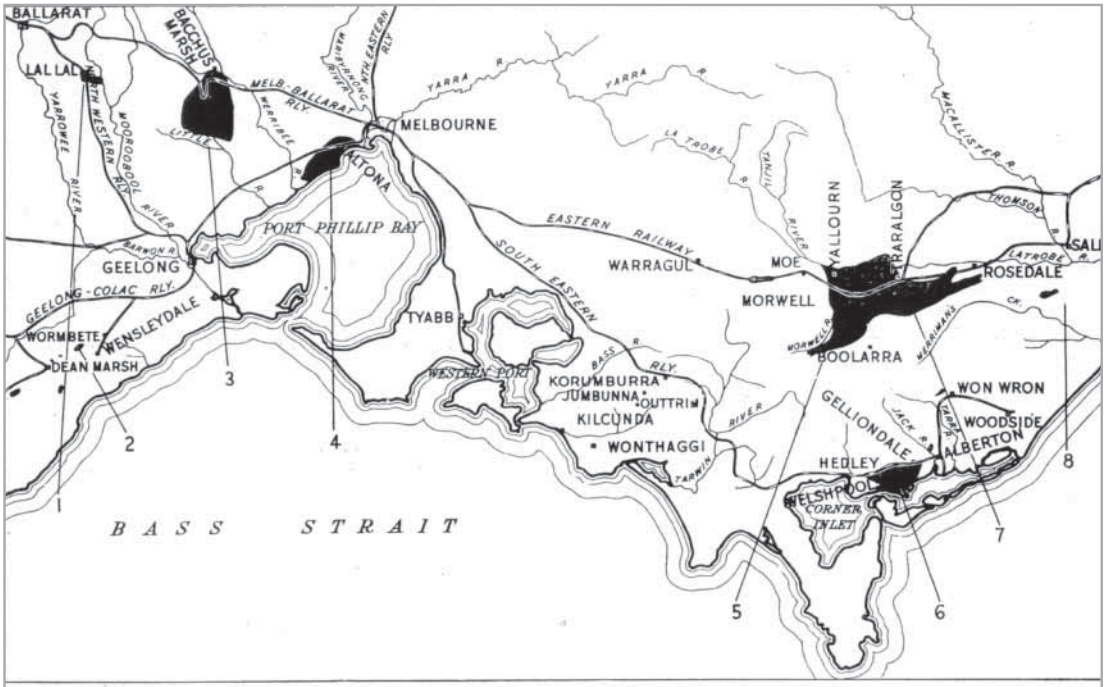


FIG. 48. Locality plan of brown coal areas in Victoria: 1, Lal Lal; 2, Wensleydale; 3, Bacchus Marsh; 4, Altona; 5, Yallourn-Morwell; 6, Welshpool-Alberton; 7, Loy Yang; 8, Coolungoolun. Scale: about 28½ miles to the inch.

Drawing 7.2/1 Locality plan of brown coal areas in Victoria (from Herman, H (1952), p.87).

been other mining from brown coal outcrops or from shafts into near-surface coal deposits found during the exploration for gold and the closer settlement throughout the colony by the 1850s. The domestic utilisation of brown coal as a standalone fuel did not offer significant advantages where firewood could be readily obtained, although brown coal combustion in conjunction with firewood offered minor benefits.

Mine Infrastructure Features

The actual site of the Wormbete mining operation mentioned by Bonwick has not been ascertained in this study. It is probable that this mining was at the Wormbete Creek area, subsequently mined as the Wensleydale mine.

7.3 Benwerrin

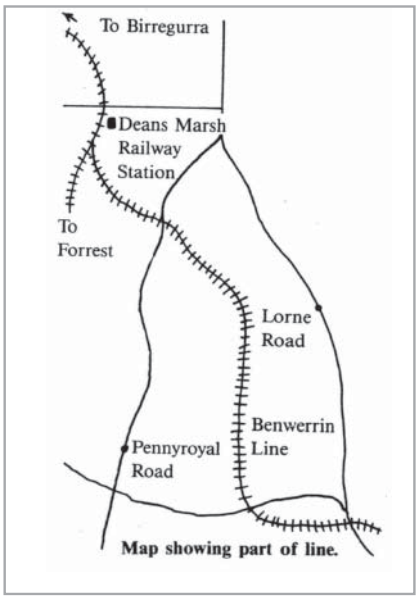
Map Reference: 7621-2-2 Boonah 7571, 57394

Municipality: Surf Coast Shire

Land Use/Status: Otways State Forest

Site History

The Benwerrin Brown Coal Mine was located about ten kilometres along the Deans Marsh to Lorne Road south east from the Deans Marsh Railway Station, and thence easterly about four kilometres by Seaview Road. It is about five miles east of the coal seams on the coast west of Airey's Inlet. Millard, R (1985) states that 'the mine was developed in 1895,



Drawing 7.3/1 Benwerrin to Deans Marsh Mine Railway Location (from Millard, R (1985), p. 57). Copyright Ron Millard

the coal at first being brought to the Deans Marsh Railway Station by horse and dray.'[263]

From 1899 to 1903, mining was carried out by The Great Western Colliery Company on a seam of brown coal which ranged up to eight feet in thickness. In 1901, a five foot thre inch gauge railway line from Benwerrin to the Deans Marsh Railway Station was built by the Great Western Colliery Company to speed up the transport of coal, but it remained in operation for only a little over 12 months when the company experienced financial difficulties (Drawing 7.3/1). Millard, R (1985), p.57, states that parts of the rail track can still be seen and a railway cutting is still visible about three miles from Benwerrin to Deans Marsh along the Lorne Road. Total output was 6,849 tons of brown coal in this period [264] (1899–1903). Documentation of output from 1895–1898 has not been sighted in this study but would probably have been less than 2,000 tons over the bullock drawn haulage to Deans Marsh Rail terminus.

Some ten years after the *Royal Commission on Coal in Victoria* (1889–1891) increased scientific investigations occurred into the composition and utilisation of brown coal. The high calorific value of the Benwerrin coal was assessed as being highly suitable for use in gas producers as a transport and industrial fuel.[265] On a dry basis, the calorific value of the coal was about 11,500 btu/lb with moisture content about 30 per cent and ash about 9 per cent.[266] 'In situ, the Benwerrin brown coal had a calorific value higher than any of the other Victorian brown coals.'[267] See Tables 7.3/1–2 below for coal quality comparisons.

The coal bearing area at Benwerrin had been identified in 1912 as existing over an area of 15–20 acres.[268] At 1947, the coal deposit was assessed as being minable over an area of about ten acres in a seam about six feet thick with a reserve of about 75,000 tons.[269]

Mining resumed at or shortly before 1947 as indicated in the 1947 *Annual Report* of the Mines Department. This operation was shortlived as the 1948 *Annual Report* states that output was small from the tunnelling operation at the Benwerrin Colliery and that the mine was experiencing problems with water ingress and shortage of manpower. No further reference to the Benwerrin Mine is made in subsequent *Annual Report*s. Other documentation of mining operations at Benwerrin subsequent to 1903 has been sighted in this study. Anecdotal information alleges that mining on a small scale occurred in the 1940s. Reference is made in Herman, H (1952), p. 5 and in Kenny, JP (1947), to mining being from a series of tunnels.

Herman, H (1952), p. 49, reports that the total output from the Benwerrin Mine to 1950 was 11,393 tons, with no output in the year 1950. Thus the recorded extraction from 1943 to 1949 was 4,544 tons. No record of subsequent output has been sighted. It is probable that not all output from this small and isolated mine was officially recorded. Thus the Benwerrin deposit of high quality brown coal remains largely unmined with winnable reserves probably of the order of 50,000 tonnes.

Assessment of Heritage Significance

Historical Significance

The mining operation commenced in 1895 in the aftermath of the *Royal Commission on Coal* (1889–1901), at which many options for utilisation of brown coal were advocated by various parties and following which a surge of brown coal mining occurred. The Benwerrin coal deposit had much lower water

	Yallourn open cut*	Morwell open cut*	YN Extn† open cut*	Loy Yang	Gormandale	Coolungoolun	Won Wron	Stradbroke	Alberton	Gelliondale
Moisture % a.r.	66.1	60.5	51.7	62.8	56.6	54.0	48.5	58.4	63.5	65.9
Ash (d.b.) %	1.8	3.7	4.4	1.4	2.6	2.9	2.0	3.9	3.1	6.3
Volatiles (d.b.) %	51.5	50.0	48.9	51.5	51.8	45.9	51.0	49.5	51.5	50.7
Fixed carbon (d.b.) %	46.7	46.3	46.7	47.1	45.6	51.2	47.0	46.6	45.5	43.0
Carbon (d.b.) %	66.7	67.8	66.7	68.4	66.1	68.2	66.7	68.0	65.3	64.8
Hydrogen (d.b.) %	4.7	4.8	4.7	4.9	4.9	4.8	4.7	5.0	4.7	4.5
Sulphur (d.b.) %	0.3	0.4	0.6	0.4	0.9	4.8	0.3	3.1	0.4	0.9
Chlorine (d.b.) %	0.1	0.1	0.1	0.1	0.1	0.1	n.d.	n.d.	0.1	n.d.
Specific Energy (MJ/kg)										
Gross dry	26.4	27.6	27.4	26.4	25.8	28.4	27.2	27.2	25.2	24.8
Gross wet	8.8	10.6	12.8	9.9	11.2	13.1	14.0	11.3	9.2	8.5
Net wet	6.8	8.6	10.9	7.9	9.3	11.3	12.3	9.6	7.4	6.6

* Values listed for Yallourn, Morwell, and Yallourn North Extension open cuts are weighted averages of shift dredger samples taken from 1959 to 1978. The remaining values are weighted averages of bore samples from selected areas.
† Yallourn North Extension.
n.d. Not determined.

Table 7.3/1 Analyses for Gippsland Basin Brown Coals (from Gloe, CS (1984), p.91). Copyright State Electricity Commission of Victoria.

	Altona	Maddingley	Wensleydale	Benwerrin	Anglesea	Basin
Moisture % a.r.	58.7	59.5	50.8	33.4	44.0	56.0
Ash (d.b.) %	12.6	5.2	3.3	2.4	4.0	10.8
Volatiles (d.b.) %	47.2	47.5	45.7	40.2	47.9	51.1
Fixed carbon (d.b.) %	40.2	47.3	51.0	57.4	48.1	38.1
Carbon (d.b.) %	68.6	64.4	66.3	70.3	66.6	61.0
Hydrogen (d.b.) %	4.9	4.4	4.6	4.6	4.7	4.9
Sulphur (d.b.) %	2.6	2.7	2.6	0.5	3.8	1.5
Specific energy (MJ/kg)						
Gross dry	22.5	25.2	25.8	29.1	26.5	24.6
Gross wet	9.2	10.2	12.7	19.4	14.8	10.7
Net wet	7.4	8.4	11.1	18.0	13.2	8.9

Table 7.3/2 Analyses for Otway and Murray Basin Brown Coals (from Gloe, CS (1984), p.91). Copyright State Electricity Commission of Victoria.

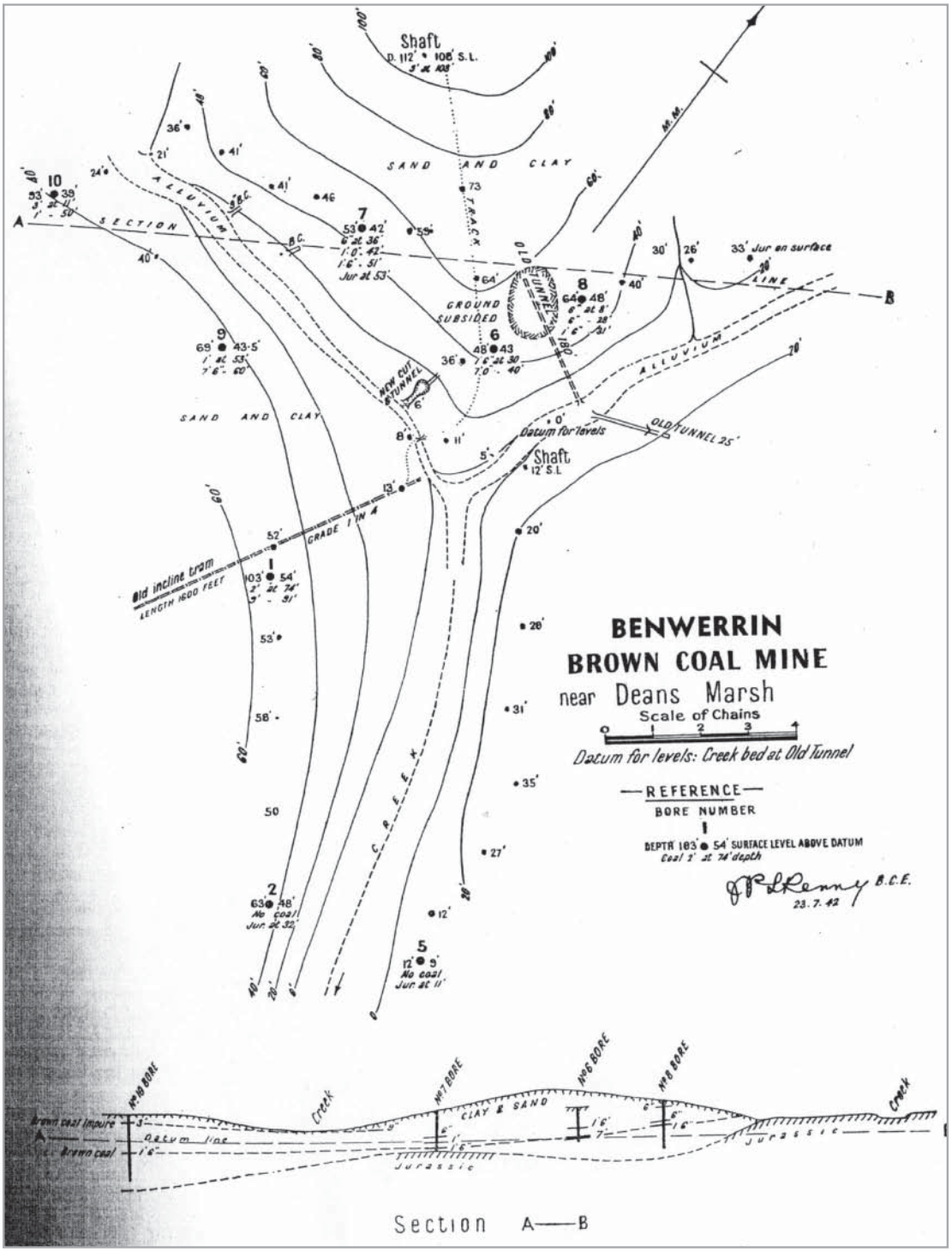
content than other brown coals in Victoria and potentially offered economic advantages in reprocessing as well as in steam raising.

Scientific Significance

No specific scientific significance was associated with potential usage of the low moisture Benwerrin brown coal. The remoteness of the coal deposit from Melbourne and regional centres such as Geelong and Ballarat and the smallness of the deposit were mitigating factors adverse to industrial conversion processing.

Economic Significance

The haul distance of about five miles to the VR rail-head at Deans Marsh offered economic opportunity for competition at rail head costs with other brown coal mines and with other



Drawing 7.3/2 Benwerrin Brown Coal Mine –Plan and Section of the mine at 1942 (from Kenny, JPL (1947)).

Drawing 7.3/3 Location of Benwerrin Mine on topographical map 7621-2-2 Boonah. Copyright State of Victoria, Department of Sustainability and Environment

fuels. However the low coal reserves of about 100,000 tons did not justify other than a low investment in mining plant. The resulting low level of output spread over more than 50 years of intermittent operation had no significant effect on employment or on the replacement of other fuels.

The mine was evidently not maintained in operational readiness to respond to the shortages in black coal supplies from NSW to Victoria in various times through to the 1950s.

Social Significance

The low and intermittent output from this mining operation had no significant long term social significance in the Otways region or further afield.

Mine Infrastructure Features

Anecdotal information suggests that the mine site is still identifiable in thick overgrowth at the end of a rough track, located on the Boonah Map co-ordinates stated above.

Railway line location is reputedly still identifiable in small cuttings.

Benwerrin to Deans Marsh rail terminal.

References

Kenny, JPL 'Benwerrin Brown Coal Mine', *Mining and Geological Journal*, March 1947

Stirling, J 'Report on the Brown Coals and Lignites of Victoria', *Progress Report*, No.10, Mines Department, 1899, p.83

Herman, H, *Brown Coal*, 1952, pp.5, 48, 49, 85

Whitelaw, OAL, *Progress Report*, No.12, Mines Department, 1900

Millard, R, *The Dean's Marsh Story*, 1985

Thomas, DE and Baragwanath, W *Geology of the Brown Coals Of Victoria*, Mines Department, 1949–1951

7.4 Deans Marsh Mine [Bambra: Globrite Colliery]

Map Reference: 7621-2-2 Boonah at 7540, 57460 approx

Municipality: Surf Coast Shire

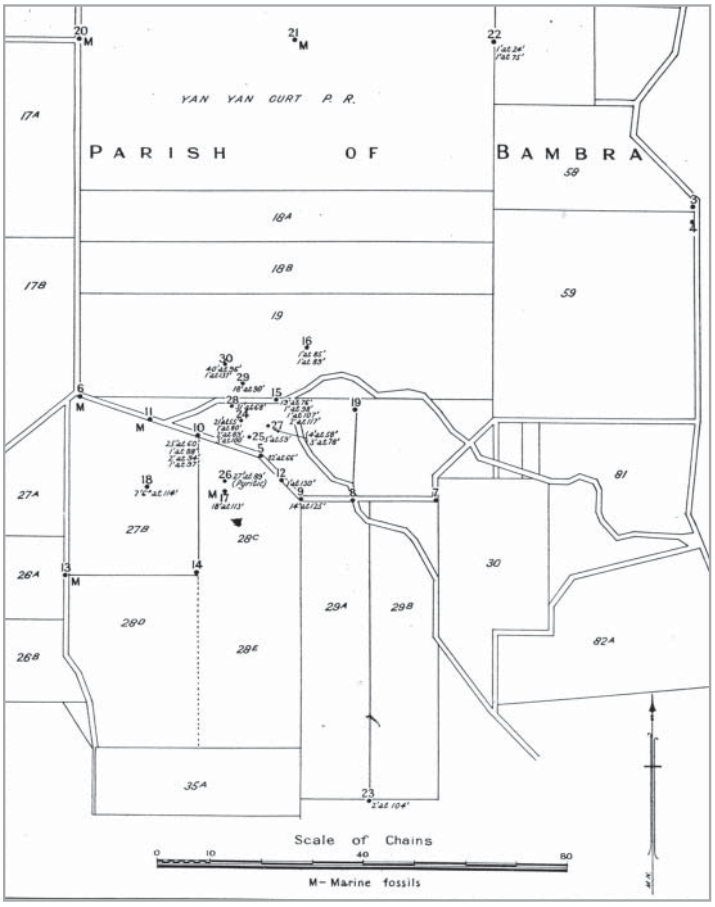
Land Use/Status: Private

Site History

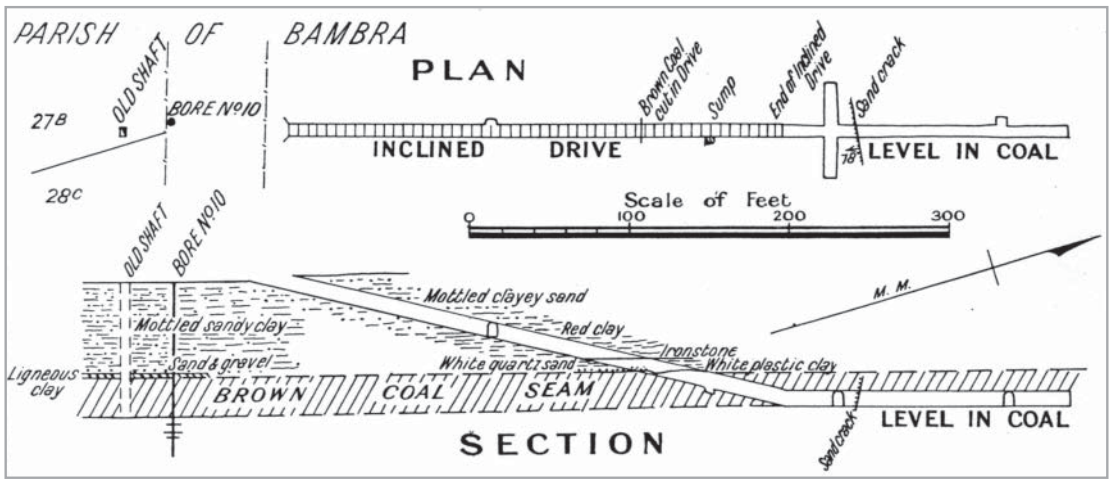
The Deans Marsh mine, in some references known as the Bambra Mine, was located about two miles north-easterly from the township of Deans Marsh in the Parish of Bambra, operating in a seam about 30 feet thick with coal surface about 60 feet below ground surface. The deposit was found during drilling by the Mines Department in 1922.[270] The mine site can be observed on the south side of Parkers Road by turning east at Mackey's Corner on the Deans Marsh-Winchelsea Road about 1.2 kilometres north east from the township of Deans Marsh.[271]

(It appears that there was another mine called the Bambra Coal Mine which was operated by B.G. Nicholls & Company in the 1920s, about which I have not ascertained further information.[272] Herman, H (1922), p.7, uses the nomenclature Deans Marsh for operations of the Great Western Colliery in 1901–1903. It appears that the location of this operation of the Great Western Colliery was at Benwerrin some ten kilometres south east of the Deans Marsh township, the Deans Marsh mine not commencing until decades later. (See Thomas and Baragwanath.)[273]

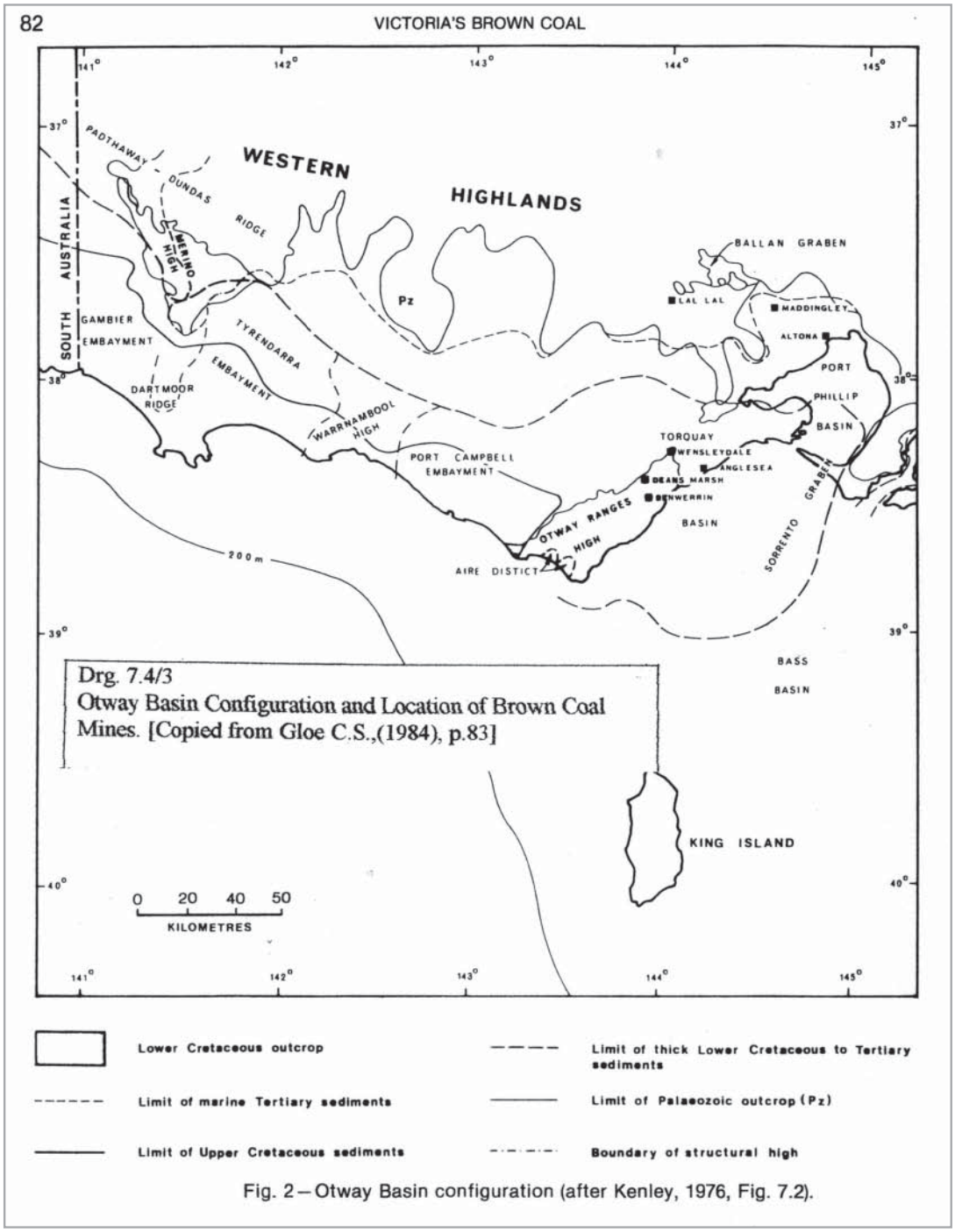
The first mining of the Deans Marsh deposit occurred in 1947 when coal and briquette supplies to private industry and households was in extremely short supply with no signs of relief in the near future. Initial mining was via a shaft about 100 feet deep just near bore Number 10. A few hundred tons were mined and sold to the Geelong woollen mills.[274] The Globrite Colliery Companytook over operation of the mine and installed a declined adit in 1950 to intersect the seam. The mine was then worked via a series of drives excavating 736 tons in 1950 and thence at a weekly output of 50 to 60 tons.[275] (See Drawings 7.4/1 and 7.4/2 for the location of bores, shaft, adit and tunnels and the mine location and cross section.)



Drawing 7.4/1 Deans Marsh Mine: location of bores and shaft (copied from Thomas and Baragwanath (1949–51), Part 3, p. 23).



Drawing 7.4/2 Deans Marsh mine plan and cross section of underground workings at 1950 (from Thomas and Baragwanath, (1949–51), Part 3, p.24).



Drawing 7.4/3 Otway Basin configuration and location of brown coal mines (after Kenny J (1976), Fig. 7.2, copied from Gloe, CS (1984), p.83). Copyright State Electricity Commission of Victoria.

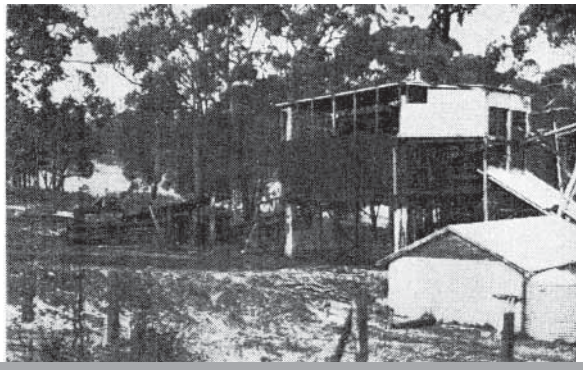


Photo 7.4/1 Globrite Colliery at Deans Marsh (Bambra) – outloading plant.

Drawing 7.4/4 Locality of Deans Marsh from topographical map 7621-2-2 Boonah. Copyright State of Victoria, Department of Sustainability and Environment.

The coal in-situ had a moisture content of about 55 per cent and a dry basis ash content of about 9.5 per cent.

Information on any further operations after 1950 has not been ascertained in this study. The mine probably shut down by the mid 1950s.

Assessment of Heritage Significance

Historical Significance

The discovery of coal in the Deans Marsh area was followed by at least 50 years the closer settlement of the area and the establishment of grazing, and timber milling as the major land utilisation features of the area.

Mining of the coal was deferred for 25 years after discovery of the deposit was well known. The small mining operation was initiated in 1947 by local entrepreneurs to take opportunity from the dire postwar fuel shortages that were restricting economic recovery in Victoria. No significant additions or amendments to local public infrastructure were required to facilitate the mining or coal transport operations. No specific innovation in the mining or transport operations or the utilisation of the coal was involved.

Social Significance

The mining and transport activity involved a short term increase in employment in general from the local population, but did not involve any significant population increase or influx of post-war migrants.

In effect the Deans Marsh mining operation had a small beneficial social impact on the local community in assisting to defer population movement to larger urban communities.

Mine Infrastructure Features

Site remains of shaft and adit.

References

Millard, R, *The Dean's Marsh Story*, 1985

Thomas, DE and Baragwanath, W *Geology of the Brown Coals Of Victoria*, Part 3, 1949–51

7.5 Wensleydale

Map Reference: **7621-2-1 Bambra 7600, 57520**

Municipality: **Surf Coast Shire**

Land Use/Status: **Private and State**

Site History

The brown coal mine at Wensleydale was located on the south side of Coal Mine Road about 1.5 kilometres east from the Winchelsea to Lorne Road from a turn-off about nine kilometres south of Winchelsea. The mine site was about 25 miles west of Geelong. (Between different references, the mine had varied names such as Winchelsea South, Wensleydale, Wensley Brae, Wensleybrae and Wensley Bray, the latter three variations being derived from the name of the mining company venture associated with the mine. The Mines Department documents in general adopted Wensley Bray, near Wensleydale, Parish of Yan Yan Gurt.)

The coal deposit had an in-situ moisture content of about 51 per cent with ash content on a dry basis of about 3.3 per cent and a net wet specific energy of about 11.1 MJ/kg.[276] As can be interpreted from Drawing 7.5/1, thickness of the coal deposit was up to 40 metres.

Scattered deposits of brown coal had been found and some mining thereof had occurred in the Otway Basin and Ranges in the 1800s. However, it was not 'until a year or two prior to 1920', (Houghton, N (1982), p.13, indicates the discovery at about 1913–1914), that two residents of the Winchelsea Shire found the coal deposit some five to six miles south of Winchelsea township.

The Wensleydale mine was opened in 1921 by the Western District Coal Mines Pty Ltd with the main activity being testing of the deposit. Boring indicated a minable coal reserve of about four million tons with an average of 15 feet of overburden. The Fyansford Cement Works at Geelong showed interest in a local coal supply to replace unreliable supplies from NSW. Shortly after, the Otway Coal Company Ltd. took over operation of the mine intending to mine as an open cut.[277]

(Herman, H (1952), p.49, Table 11, mentions the mine as consisting of both an open cut and small tunnel workings.

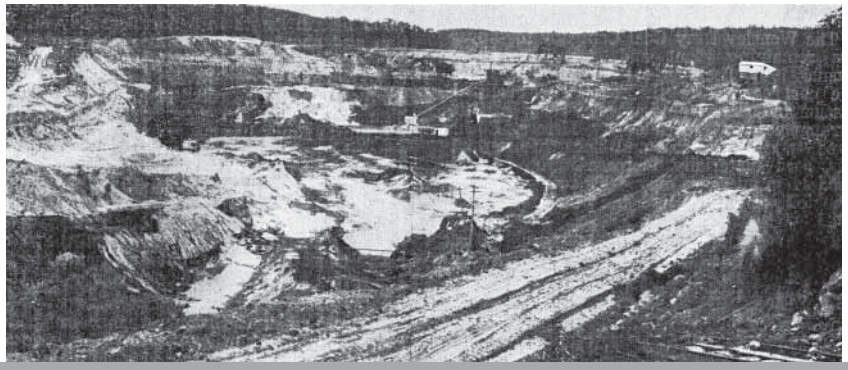
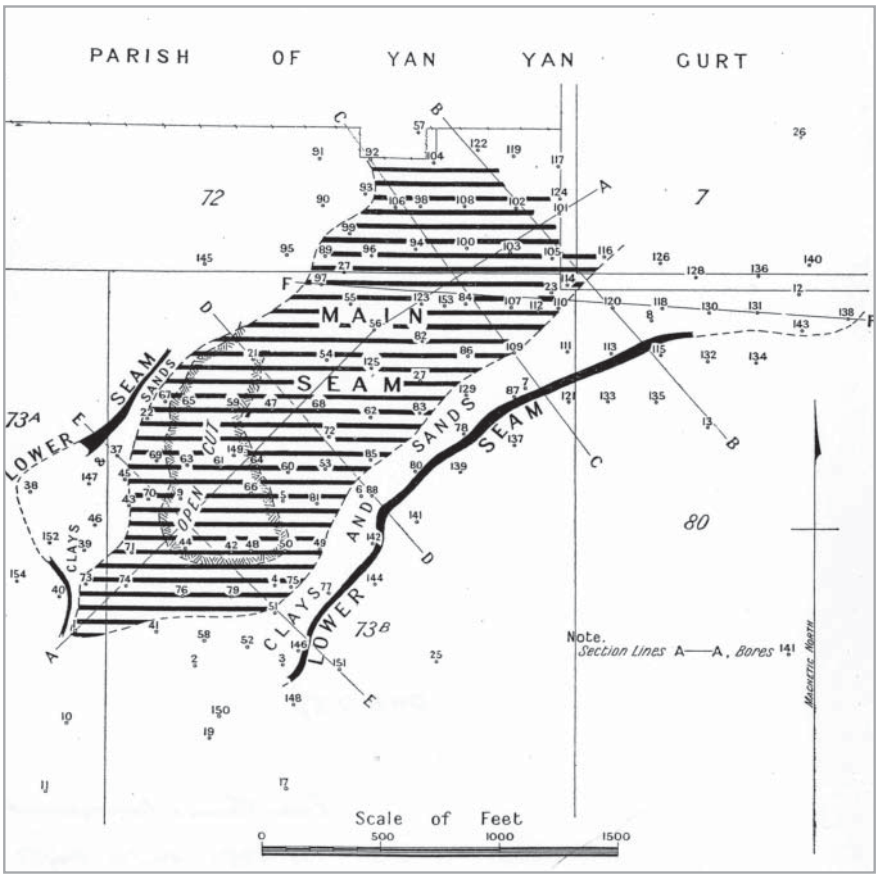


Photo 7.5/1 Wensleydale Open Cut (copy from Thomas and Baragwanath (1949–1951), Part 3, p.20).



Drawing 7.5/1 Wensleydale Mine Site: bores, and seam boundary in mine area (copy from Thomas and Baragwanath (1949–1951), Part 4, Fig. 57, p.13). This Drawing updates Fig. 45 from Thomas and Baragwanath. A second open cut was commenced in the north-eastern area of the coal deposit in 1952/3.

Photo 7.5/1 attached hereto shows an adit to the coal seam within the open cut, during early overburden removal. The coal was initially extracted by means of shafts and drives while overburden removal proceeded. One anecdotal source conjectured there was a smaller mine initially opened at the north of the open cut. Photos in the publication by Houghton, N (1982) do not show any other initial coal operations except from the initial adit.)

Overburden excavation was by a Ruston Proctor three and a half cubic yard shovel acquired from the Yallourn Open Cut, outloading via 30 inch haulage to an elevated pivoting discharge conveyor. Coal deliveries commenced in 1923, initially by road trucks mainly to Geelong industries.

Subsequently from 1925, coal was routed through a five storey screening plant to buckets on an aerial ropeway three and a half miles across country to coal hoppers at the Otway Coal Company siding, a special purpose siding about 400 hundred yards north of the Moriac to Wensleydale rail terminus at Wensleydale.[278] (The Moriac-Wensleydale rail line had been installed about 11 miles in length in 1890, mainly to carry timber and gravel to Geelong for further transfer on the VR rail system. It had a chequered history, with timber and gravel haulage deceasing over the years to closure of the branch line in 1948[279].)

Along the north west boundary of the open cut, the coal was 110 feet thick with 15 to 20 feet of overburden, with the coal

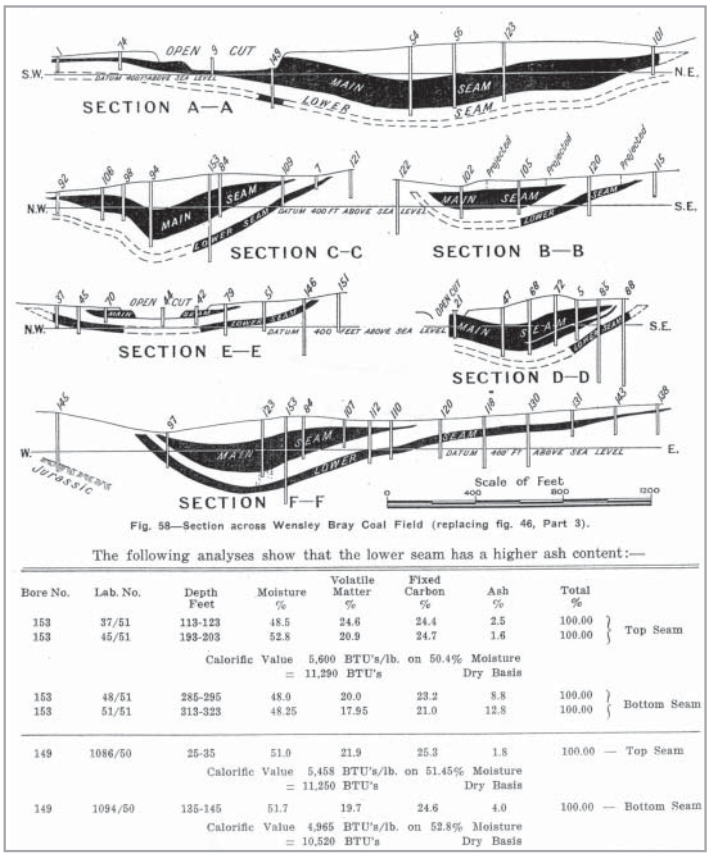


Fig. 58—Section across Wensley Bray Coal Field (replacing fig. 46, Part 3).

The following analyses show that the lower seam has a higher ash content:—

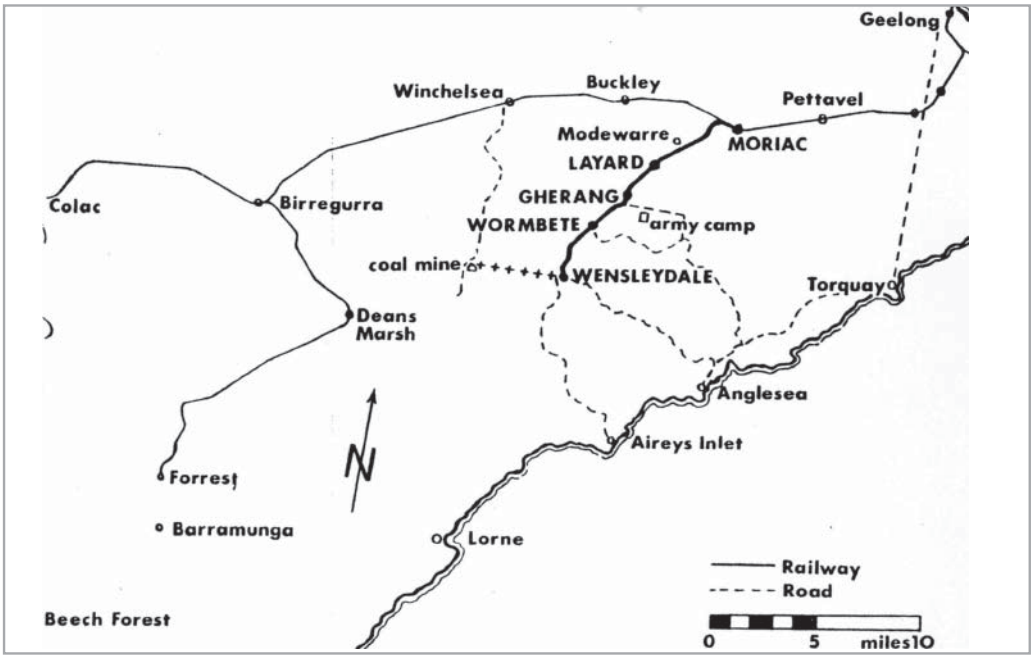
Bore No.	Lab. No.	Depth Feet	Moisture %	Volatile Matter %	Fixed Carbon %	Ash %	Total %	
153	37/51	113-123	48.5	24.6	24.4	2.5	100.00	Top Seam
153	45/51	193-203	52.8	20.9	24.7	1.6	100.00	
		Calorific Value = 11,290 BTU's	5,600 BTU's/lb. on 50.4% Moisture Dry Basis					
153	48/51	285-295	48.0	20.0	23.2	8.8	100.00	Bottom Seam
153	51/51	313-323	48.25	17.95	21.0	12.8	100.00	
149	1086/50	25-35	51.0	21.9	25.3	1.8	100.00	— Top Seam
		Calorific Value = 11,250 BTU's	5,458 BTU's/lb. on 51.45% Moisture Dry Basis					
149	1094/50	135-145	51.7	19.7	24.6	4.0	100.00	— Bottom Seam
		Calorific Value = 10,520 BTU's	4,965 BTU's/lb. on 52.8% Moisture Dry Basis					

Drawing 7.5/2 Cross sections through Wensleydale Open Cut (copy from Thomas and Baragwanath (1949–1951), Part 4, Fig. 58, p.22). This Drawing updates Figure 46 from Thomas and Baragwanath.

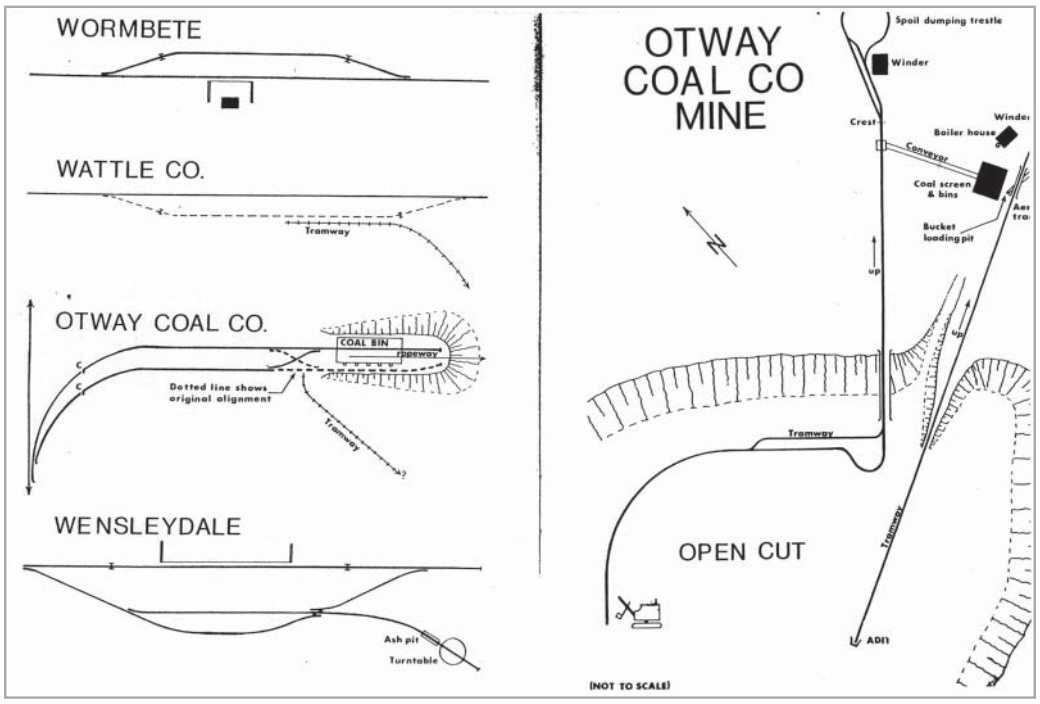
deposit thinning out to the south west[280]. About 8,000 tons of coal was mined between 1923 to 1927 and a further 8,000 tons from 1931 to 1932 when operations ceased due to marketing competition from NSW coal suppliers.[281] In 1935, the Otway Coal Company went into liquidation. In 1939 a fire destroyed some of the haulage and screening plant left at site. A new company, The Otway Coal Company Pty Ltd was formed about 1940 but did not recommence operation of the mine.

In August 1943, with fuel shortages severe throughout Victoria, a new company, the Wensley Brae Coal Company, acquired the mining right, commenced dewatering of the open cut and implemented coal deliveries by road trucks predominantly on a six mile haul to Winchelsea railway station on the Geelong-Colac main rail line. The rail line through Wensleydale siding had closed prior to renewal of the mine operation. Hence the aerial ropeway was no longer used. The Ruston shovel continued in use on overburden excavation which was hauled by road trucks to an external dump. 'Coal was blasted from the face, loaded by diesel shovel into three cubic yard tramway trucks hauled by horse and then winched up to a crushing and screening plant where road trucks were loaded.'[282] The Wensley Brae Coal Company managed and operated the open cut from 1943 until 1948, reaching annual output exceeding 35,000 tons.[283] Approximately 100,000 tons in total was excavated by this company with weekly output reaching 1,272 tons and averaging over 600 tons weekly in its last year of operation.[284] Coal

Photo 7.5/2 Wensley Bray brown coal mine at 1948 (from Swift (1948)).

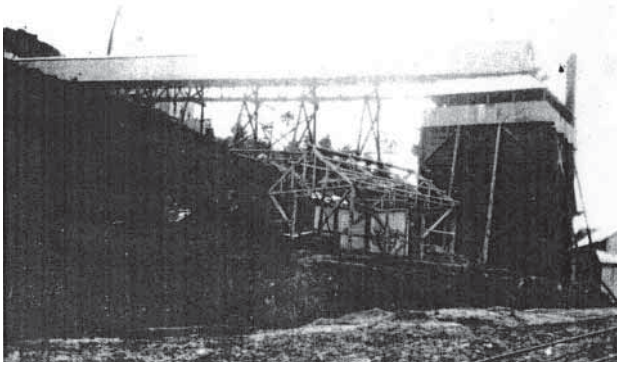


Drawing 7.5/3 Route of aerial ropeway from the mine to the Moriac to Wensleydale VR rail line (copy from Houghton (1985), p8). Copyright Norm Houghton.



Drawing 7.5/4 Rail sidings on Moriac to Wensleydale VR rail line and the Otway Coal Company Mine layout (copy from Houghton (1985), pp.18, 19). Copyright Norm Houghton.

Photo 7.5/3 Wensleydale Open Cut in 1950s, showing dragline loading haul truck (copy from Gregory, EB. et al. (1985), p.141). Copyright Surf Coast Shire.



Photos 7.5/4–5 (top to bottom) Wensleydale Mine – Open Cut outlet and Conveyors and Coal Storage Bins (copied from Houghton (1985)). Copyright Norm Houghton.

deliveries were by rail to Melbourne, by rail and road to Geelong and the Western District including Warrnambool.[285]

In 1948, Roche Brothers. Pty Ltd, a well established earth moving company, was contracted by the Wensley Brae Coal Company to upgrade the mining and haulage operation to a higher output level. Coal demand was high and Roche Brothers commenced their operation on 1 July 1948 introducing higher capacity excavation and haulage plant. In 1949, the open cut output was 124,846 tons per annum.[286] In 1950, output had reached 145,760 tons.[287]

'During the period that Roche Brothers were operating the mine, the Victorian Government purchased the mine and entered into an agreement with Roche Brothers to work the mine for a period of five years and in that time to produce a minimum quantity of one million tons, on which a royalty was to be paid (by Roche Brothers) to compensate the Government for its outlay.'[288]

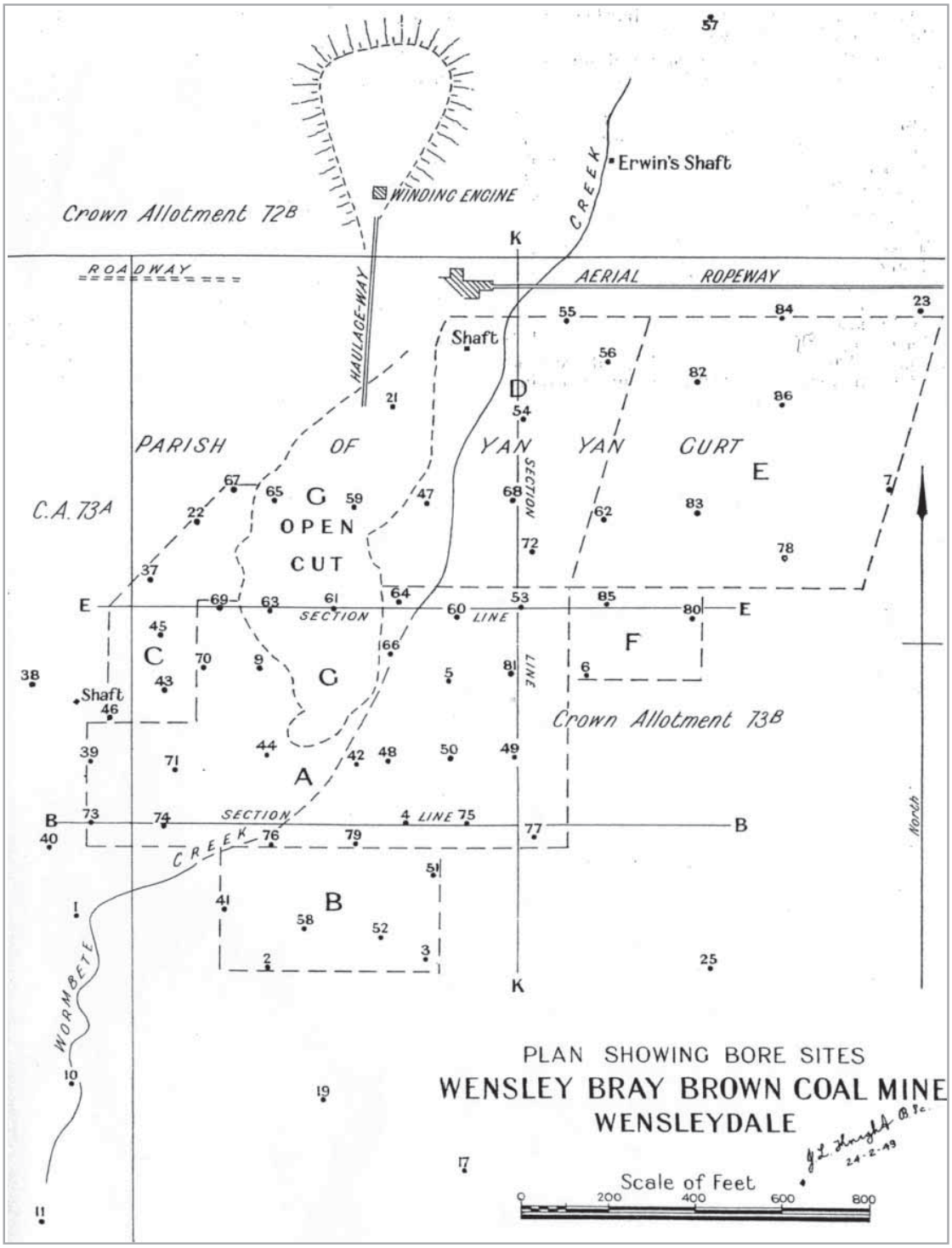
'Peak production reached just over 10,000 tons weekly and up to 200 men (in all roles) were employed. The road from the mine to Winchelsea had extensive upgrading, new bridges – the Karngun Bridges – had to be erected over the Barwon River and special train loading facilities were provided at Winchelsea rail station. Coal was railed to Geelong, Melbourne, Ballarat, Bendigo, and large Western District centres.'[289] Note that the peak production quoted by Gregory (1985) appears much higher than the average weekly production in the peak year of operation. At 1949, the (economically minable) coal reserves were estimated as about 3.75 million tons.[290] By March 1951, Roche Brothers had extensively mechanised the operations, which were exceeding 3,000 tons output per week.[291]

By March 1952, the mine was taken over by Winchelsea Coal Pty Ltd but continued with Roche Brothers as the operators. A new open cut was commenced to the north east of the existing operation. By March 1953, all operations had ceased in the old open cut and the new open cut was operating with a new crusher and conveyor system. From 1954 to 1957, output averaged over 370,000 tons per year before progressively decreasing to 1959 when the mine at Wensleydale closed down, with its customers and much of its equipment transferred to a new open cut at Anglesea, owned and operated by Roche Brothers.

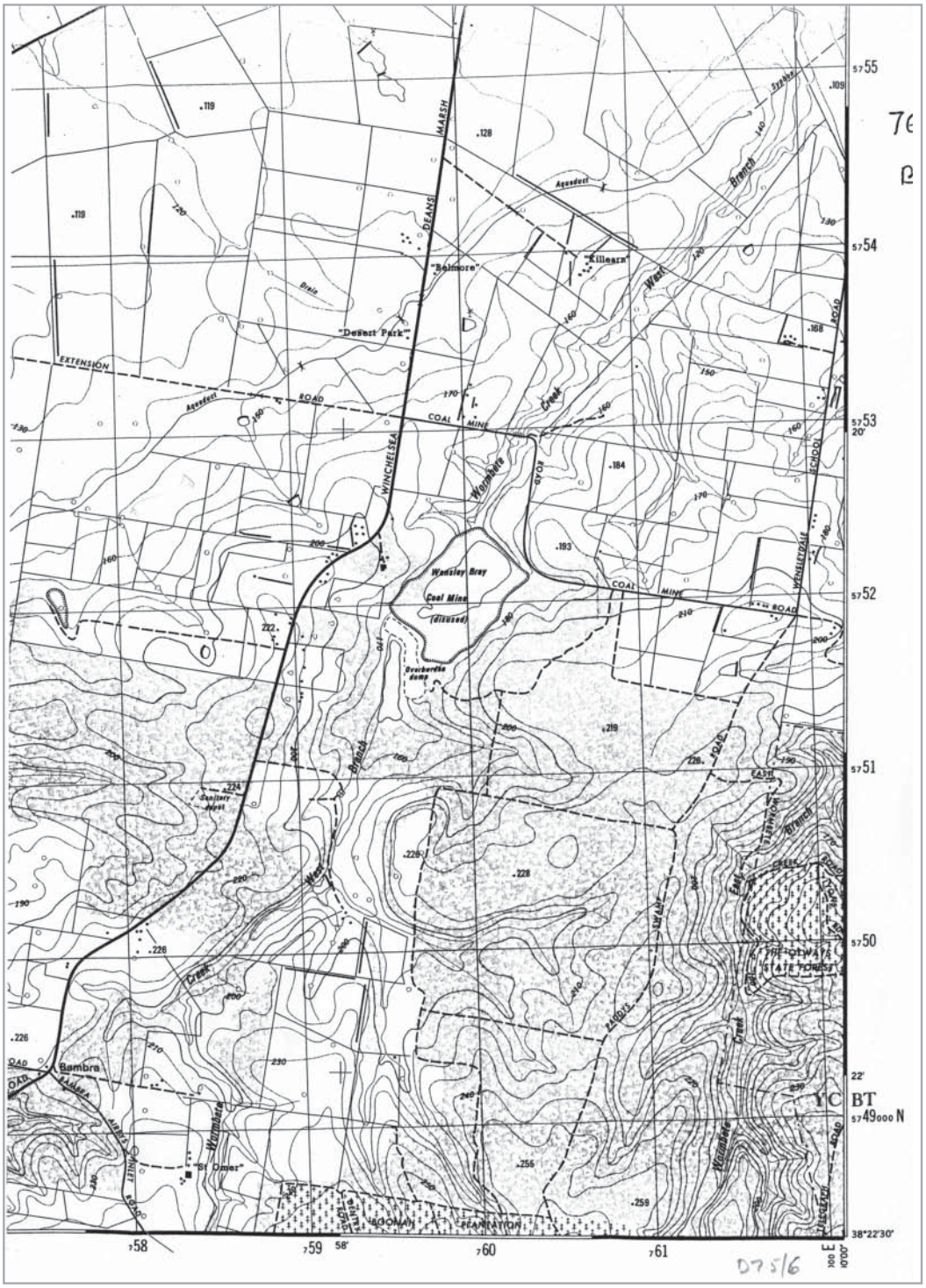
By 1959, when operations at the Wensleydale mine ceased, demand for raw brown coal from Wensleydale had fallen considerably as post war electricity generation expansion and increasing briquette supply moved towards satisfying industrial and domestic fuel requirements throughout the State. Additionally, coal reserves at the Wensleydale Mine were low. In the 1950s, extensive deposits of brown coal had been found at Anglesea which could be more efficiently mined than at the dwindling coal reserves at Wensleydale.

In 1958, Roche Brothers shifted their brown coal mining operations from Wensleydale to Anglesea, about 12 miles to the east, maintaining their coal supplies during the transition, their main market being the Geelong Power Station. (Geelong A Station 12 megawatts (1930–1966); B Station 35 megawatts (1954–1971)). Other customers in the late 1950s were spread from the Nestle factory at Dennington through Geelong and as far east as industry at Altona.

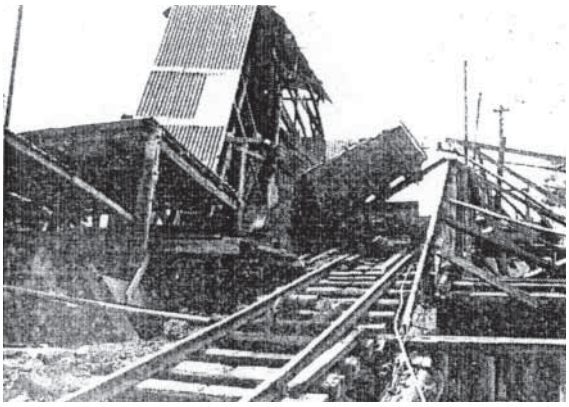
The Wensleydale Mine site still remains visible with little or no land restoration having been carried out and some remnants of mine infrastructure still evident at 2004.



Drawing 7.5/5 Wensley Bray Brown Coal Mine bore locations (from Knight (1949)).



Drawing 7.5/6 Locality of Wensley Bray Mine from Topographical Map 7621-2-1 Bambra. Copyright State of Victoria, Department of Sustainability and Environment.



Photos 7.5/6–9 (from top to bottom) Wensleydale Mine – plant and operations.

Assessment of Heritage Significance

Historical Significance

The Wensleydale coal deposit was probably that reported by James Bonwick in 1858 (see Section 7.2). The deposit was rediscovered in 1913 but was not mined until 1921, when post World War One industrial recovery was being hampered by shortages of coal while awaiting the introduction of briquettes from the embryo Yallourn project. From 1923 to 1935, the mine provided a vital source of hard fuel to industry in the Geelong area. By 1935, briquette pricing and availability from Yallourn offered advantages to industry throughout Victoria leading to closure of the Wensleydale mine.

The mine plant was decimated by fire and disposal in the late 1930s but was reactivated from 1943 to alleviate critical hard fuel shortages in Victoria during and after World War Two.

Output from the mine was increased significantly from 1948 with a change to contract operation and the post war availability of new plant and a revised open cut operation. Ownership of the mine was taken over by the State Government in the early 1950s to ensure continuity of supply and the contract operation.

The mine continued in operation until 1959 by which time increased electricity generation and briquette supply were available for industry throughout Victoria. At 1959, continuity of brown coal supply to existing customers of the Wensleysdale mine was transferred to supply from the larger coal deposit at Anglesea some 12 miles east of Wensleydale with the mine owned and operated privately.

The Wensleydale mine was of high significance in assisting with fuel supply to industry particularly during both World Wars and the industrial reconstruction therefrom.

Scientific Significance

The Wensleydale coal had slightly lower moisture and ash than coal from Yallourn North Open Cut (see Tables 7.3.1 and 7.3.2). Its utilisation from commencement of mining in 1921 did not suffer the problems emanating from the discovery at about the same time that the coal from new Yallourn Open Cut had significantly higher moisture content than from the well tested Yallourn North Open Cut.

Hence, potential users of the Wensleydale coal relied on the background of testing and evaluation carried out on the Yallourn area coals.

Economic Significance

Owners of the Wensleydale mine were generally price takers, retiring from competition except in periods of hard fuel shortages. Although longer term contracts were gained for supply to Geelong Power Station, and Nestle at Warnambool, the State Government found it expedient to purchase the mine to ensure continuity of supply.

In the 1920s and 1930s, the mine used contemporary plant including an in-pit crusher and aerial ropeway to a VR rail siding. Utilisation of the VR system presented opportunity for deliveries throughout the VR network and the retention of the branch line from Moriac for continued cartage of timber and gravel from the Otways.

From 1947, output progressively increased annually due to modernised plant and opening of a new open cut offering reduced mining costs.

The Wensleydale mine over its almost 40 years of somewhat intermittent operation provided significant alternative employment to that in the farming and timber industries in the Otways. Infrastructure improvement associated with road haulage of the coal to new outloading facilities to the VR main line at Winchelsea provided substantial benefit to the local community and the tourist industry.

Social Significance

The Wensleydale mine offered employment opportunities not only for former miners, but also for the local workforce who could rapidly convert their skills particularly to the road haulage and open cut operations.

The contractor operating the mine from 1948 was able to offer steady employment beyond the life of the Wensleydale mine through a well managed transition of continued coal supply from the new Anglesea mine.

Mine Infrastructure Features

Site of Open Cut.

Site of underground mine shaft.

Machinery remnants at mine site.

Route of overhead ropeway to Wensleydale siding.

Site of Wensleydale siding.

The Karngun Bridges.

The Winchelsea Station coal outloading site and facilities.

References

Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No.11, AusIMM, 1984

Gregory, EB et al Coast to Country: Winchelsea, *A History of the Shire*, Shire of Winchelsea, 1985

Herman, H, *Brown Coal*, SECV, 1952

Houghton, N, *The Saddle Line: A History of the Moriac to Wensleydale Railway*, 1982

Kenny, JPL 'Wensley Bray Brown Coal Mine, Wensleydale', *Mining and Geological Journal*, March 1947, p.10

Knight, JL 'Boring for Brown Coal near the Wensley Bray Brown Coal Mine', *Mining and Geological Journal*, Vol.3 No.5, 1949, pp.33–37

Mining and Geological Journal, March 1947 to September 1955

Annual Reports, Mines Department, 1947 to 1959

Swift, D 'The Wensley Bray Brown Coal Mine', *Mining and Geological Journal*, March 1948, pp.9–11

Thomas, DE and Baragwanath, W *Geology of the Brown Coals of Victoria*, *Mining and Geological Journal*, 1949–1951

7.6 Anglesea Open Cut

Map Reference: **7721-3-2: Anglesea 7530, 57465**

Municipality: **Surf Coast Shire**

Land Use/Status: private

Site History

In 1899, 'to the North West of the settlement (of Anglesea), the Wensleydale Prospecting Company was actively engaged in the search for coal with most favourable reports from geologists being supplied to the press.'[292]

'About the beginning of the century, four shafts were sunk on the foreshore between Devils Elbow and Coal Mine Creek in search for coal. Coal was found but deteriorated on exposure in air and was deemed not to be a commercial proposition.'[293] Coal mining had been commenced at this time at Benwerrin some ten miles from Anglesea in a brown coal deposit of high calorific value but the operation was struggling to survive due to remoteness from market centres. Numerous coal mining ventures commenced from the 1890s in various locations in Victoria as a result of unreliable black coal supplies from NSW and with optimism of Victorian Government support. Mining of the Anglesea coal deposit as known at 1950 did not appear to offer significant advantages over other brown coal mines already in operation.

As an outcome of the small and decreasing coal reserves at the Wensleydale and Deans Marsh mines in the early 1950s, the Mines Department began exploratory drilling initially to the south west of Deans Marsh but subsequently more intensively to the east where a large brown coal field was progressively delineated near the township of Anglesea. JL Knight [294] states that from 1955 'drilling was undertaken by Roche Brothers under the geological and technical guidance of the Mines Department progressively at Wensleydale, Breakfast Creek, Deans Marsh, Bambra, Murroon, Gum Flat and surrounding districts in areas known to have brown coal deposits and then at Anglesea.' Two hundred and seventy bores in a concentrated area of about two square miles (north west of Anglesea) identified a substantial brown coal deposit.[295] (See Drawing 7.6/1.)

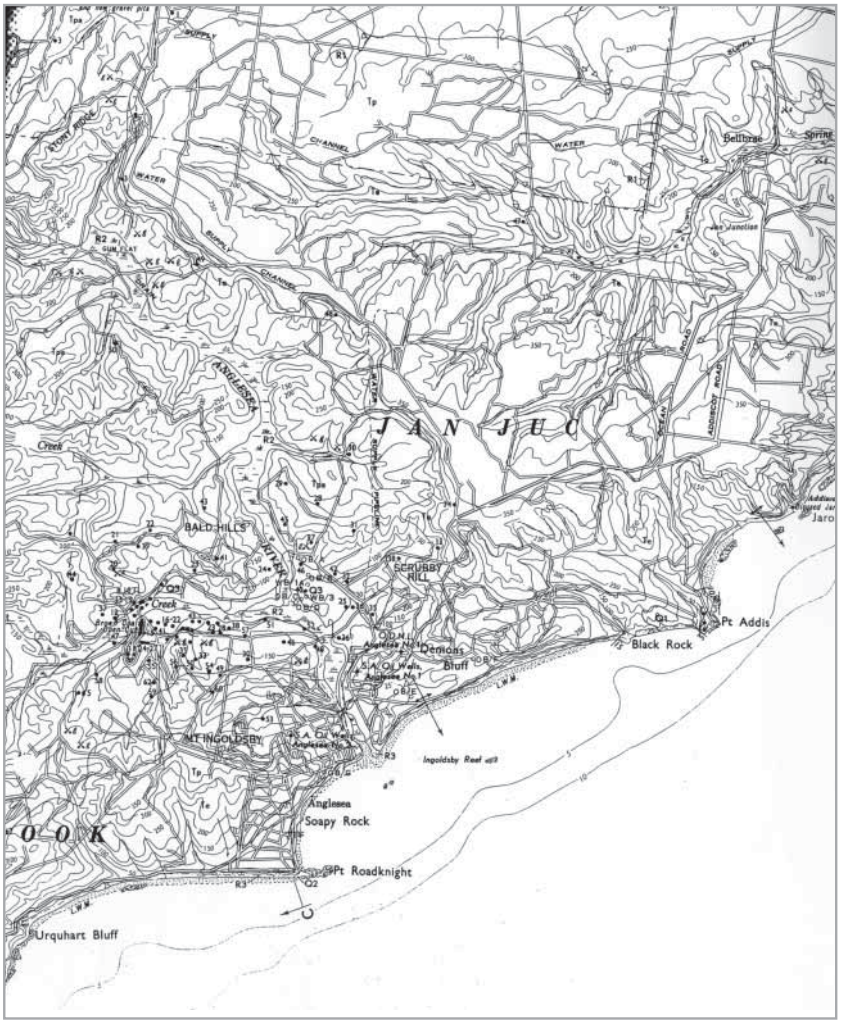
Gloe (1984) locates the Anglesea coalfield geologically as being in the north east corner of the Otway Basin. He states that the coalfield 'contains a number of coal seams in a coal measure sequence of about 140 metre thickness. The seams have been divided into an upper and a lower group. The upper group containing the main upper group seam of 24 to 36 metres thickness is overlain by 12 to 30 metres of overburden in the present area of open cut operations. Total brown coal reserves are estimated at 160 million tons of which 70 million tons belong to the main upper seam'[296] now being mined.

Roche Brothers commenced open cut mining operations on the Anglesea deposit in 1959. The mine location is about three kilometres north west of Anglesea township, which is about 40 kilometres south west of Geelong. Coal supply from their Anglesea operations took over from that previously supplied from the Wensleydale Mine. Customers for this raw brown coal included 'the small powerhouse at North Geelong to which they trucked coal', and 'a small paper factory operated by APPM at Ballarat'.[297] 'Roche Brothers also had hopes for supply to a proposed petrochemical plant or a chlorine plant using Geelong salt and brown coal. A German firm had also expressed interest in producing carbide from the Anglesea brown coal.'[298]

In the late 1950s, the Western Mining Corporation (WMC), at that time investigating extensive bauxite reserves in the Darling Ranges near Perth in Western Australia, developed a concept of an aluminium smelter at a deep water jetty at Point Henry, about three miles from Geelong, with feedstock alumina shipped from Western Australia. The concept envisaged the smelter would be supplied with base load electricity from a new generating station located at Anglesea and fuelled from the brown coal adjacent thereto.

In 1960, recent drilling undertaken for WMC in the Anglesea area had revealed a more economical mining area adjacent to that being operated by Roche Brothers. Assessments by WMC showed a coal deposit of about 200 million tons compared with that of about 30 million tons as assessed by Roche Brothers.[299] At 2004, Alcoa quotes that 'drilling surveys indicate proven reserves of approximately 120 million tonnes in two distinct seams north of the township'.[300]

In 1961, WMC bought out the mining rights and mining activity of Roche Brothers at Anglesea. In late 1961, Victorian Government legislation was passed which gave Alcoa of Australia Pty Ltd, of which WMC was a substantial shareholder



Drawing 7.6/1 Map of Anglesea area showing the extensive drilling undertaken to the north west of the Anglesea township. Copyright State of Victoria, Department of Primary Industries.

'among other things, a 50 year exclusive right to explore and mine over some 7,350 hectares of leasehold land to the north west of Anglesea'[301], including the area being mined by Roche Brothers. Agreement was reached on the terms of electricity interconnection between the power station at Anglesea and the SECV system. The smelter at Point Henry came on stream on 4 April 1963. The power station at Anglesea was officially opened on 20 March 1969,[302] the base load electricity for the smelter being supplied exclusively from the SECV network until that tine.

The enhanced drilling program for WMC had revealed that the original mining by Roche Brothers was in a lower seam to the west of the main upper seam. WMC developed a mine plan to mine 50 million tons of brown coal from a new open cut in the main seam and to cease mining of the lower seam.

Drawing 7.6/2 Locality of the Anglesea Mine from Topographical Map 7721-111 SE. Copyright State of Victoria, Department of Sustainability and Environment.

The second open cut at Anglesea was not distinguished in name from the first mine and retained the name of the Anglesea Open Cut. Colloquially, the first open cut appears to now be referred to as the 'Old Roche Brothers Open Cut'.

The new mine was opened adjacent to and expanding away from the power station site. Overburden removal was carried out by contractors until 1994, usually engaged on five year contracts. Backfilling of the old Roche Brothers open cut was used to minimise external dumps at ground surface

Photo 7.6/1 Air photo of Anglesea Open Cut and Power Station at 1967. Copyright Alcoa of Australia.

and to facilitate rehabilitation of the old open cut. In general, backfilling had power station ash placed in the bottom of the worked out mining areas, superimposed with the sand and clay overburden. Final landscaping used sandy topsoil and its buried seeds recovered from stockpiles. Dumping of the overburden was also used to build power station ash ponds and area levee banks. From 1979, backfilling of the new open cut became feasible as the coal mine expanded. Plant used by the contractors included conveyors (generally reconditioned plant from the SECV Latrobe Valley mines) and a range of conventional earth moving equipment including scrapers, bucket excavators and haul trucks. At the new open cut 'the overburden to coal ratio averages around 2.5:1 with an average coal thickness of 27 metres.'[303] The mine operation does not require the use of explosives.

From 1996, after cessation of overburden removal for about two years during a downturn in coal requirements from Anglesea Power Station with a world glut in aluminium supply, overburden removal has been carried out by Alcoa personnel as a 'just in time' operation to minimise coal exposure in endeavours for improved economy and environmental control balanced against security of coal supply to the power station. Plant engaged on overburden removal included two shovel excavators and three 60 tonne trucks. Overburden removal currently averages about 1.8 million cubic metres per year.

The coal mining operation has been undertaken by Alcoa personnel from 1961 using shovel excavators and trucks. For several years a small bucket-wheel excavator (O & K Sh 250) was used on coal excavation but was subsequently transferred to New Zealand. In the first part year of operation in 1959, coal output at Anglesea was 169,049 tons (at the Wensleydale Mine in 1959, its last part year of operation, output was 141,066 tons). However coal demand rapidly fell away: at 1961 to 57,747 tons; at 1968 to 14,361 tons. The Alcoa Power Station, a single unit station operating at about 160 megawatts, was officially opened in March 1969, having commenced testing and using coal from early 1961. Coal demand rapidly rose to over 1.1 million tons per year within two years. At 2004, the Anglesea mine continues to mine about 1.1 million tonnes per year of brown coal.

A long term coal stockpile of about 20,000 tonnes is kept undisturbed on site at the power station as a contingency against disruption in coal supply from the open cut. An operational coal stockpile of up to 4000 tonnes is used for daily variations in coal supply and usage. At 2004, coal delivery is exclusively to Anglesea Power Station. Expansion of the smelting facilities at Point Henry which occurred in the 1960s and 1970s was substantially higher than envisaged at 1961, such that from 1990 nearly 60 per cent of electricity used at Point Henry has been provided from the (previously SECV) Latrobe Valley base load power stations.[304] No additional generating plant was added by Alcoa to the initial Anglesea Power Station.

An extensive ongoing rehabilitation program of the site, under way since 1971, is outlined in Rolland, C (1992), pp.133–137.[305] Power station ash is settled and dried out in a twin cell arrangement. Settled ash is then placed in the overburden dump progressively being deposited in the worked out area of the open cut.

At 2004, an area of approximately 6,600 hectares (i.e. approximately 90 per cent of the mining lease area) has been declared under the National Estate with conservation co-managed by Alcoa and Victorian Government agencies to detailed strategies developed through consultation with a wide range of community groups. About 91 per cent of the land leased by Alcoa will not be disturbed by the mining and power station operations and is known as the 'Land for Conservation.' This land not now intended for mining operations by Alcoa is managed as the Anglesea Heath, a major objective being preservation of the native vegetation and habitat.[306]

An investigation and report by Holdgate (1974),[307] emanating from consideration of ground water drilling investigations in the Otways area in 1970–71, indicated the possibility of significant additional coal reserves at the south west of the Alcoa mineral lease. 'At least one bore penetrated coal seams of greater than 60 feet in thickness.' This same report indicated that 'drilling immediately to the west of the Deans Marsh–Wensleydale area did not reveal any economic coal deposits'.[308]

At 2004, the Anglesea Mine was the only brown or black coal mine in operation west of the Latrobe Valley in Victoria. Since the commencement of mining operations in 1959, approximately 37 million tonnes of coal and 67 million cubic metres of overburden have been excavated from the Anglesea mine.

Assessment of Heritage Significance

Historical Significance

The Anglesea Mine, opened in the late 1950s, is the latest of a number of mining ventures undertaken by private industry to utilise the scattered brown coal deposits in the Otways area at the west of Geelong and Melbourne. It was the only brown coal mine operating from the 1960s in the Otways area.

The mine was sited on the largest deposit of brown coal discovered to date in the Otways.

The mine was an integrated component of a large production complex which permitted the mining and processing within Australia of large scale bauxite deposits in Western Australia and the transport to Victoria of alumina for secondary processing. The mine provided the fuel source to a tied base load power station the low cost of a reliable supply of electricity from which was the prime reason for the siting of the aluminium plant in Victoria.

The availability of an adequate coal resource and the assessment of favourable mining costs facilitated development of the concept of the integrated aluminium complex by an Australian mining group and its adoption, leading to the formation of Alcoa of Australia as a significant aluminium supplier on the world scene. In the mid 1990s, further amalgamation occurred with the formation of a global alliance Alcoa World Alumina, the world's largest alumina producer, in which WMC, the initiator of the Anglesea mine and power station integrated development, was a 40 per cent stakeholder.

Scientific Significance

The Anglesea mine used conventional earth moving, excavation and transport equipment tailored to meet a very constant level of coal demand from 1969 onward.

Economic Significance

The Anglesea mine provided an economic opportunity for the establishment of a large scale aluminium production complex and associated aluminium by-products plants in competition with other proposals for the establishment globally of other plants with similar production objectives.

Social significance

The Anglesea Mine, located immediately adjacent to a pristine ocean-side holiday resort township of about 1,000 off-peak population, with its associated power station, has provided a stable source of employment for the Anglesea area for over 40 years to date. At 2004, the integrated mine and power station had 'a permanent work force of 109 people'[309] but is part of the wider workforce and service/supply industry tied to the Point Henry Smelter and the Geelong area community.

Effective restoration of mining areas has been a feature of the community liaison practised as a responsibility of the mine management and Alcoa corporate policy. A high level of community acceptance has been a commendable outcome of the environmentally sensitive operation of this mine in close proximity to the township of Anglesea.

Mine Infrastructure Features

Mining area progressive rehabilitation.

Ash pond twin cell installation.

References

Blainey, G, *White Gold, The Story of Alcoa of Australia*, Allen and Unwin, 1997

Cecil, KL and Carr, RV, *Anglesea: A History*, Vol. 1, Anglesea and District Historical Society, 1989

Cecil, KL and Carr, RV, *Aireys Inlet: A History*, Anglesea and District Historical Society, 1987

Foran, B, *Australia's Aluminium Since 1963*, Alcoa World Alumina Australia, 2004

Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No. 11, AusIMM, 1984

Holdgate, GR, *Brown Coal Prospects in the area of the Otway Ranges*, Mines Department, 1974

Knight, JL, *Preliminary Report on Structure of the Anglesea Coalfield*, Mines Department, July 1960

Rolland, C, *The Ongoing Rehabilitation of the Anglesea Brown Coal Mine*, Rehabilitate Victoria, Aus IMM, November 1992

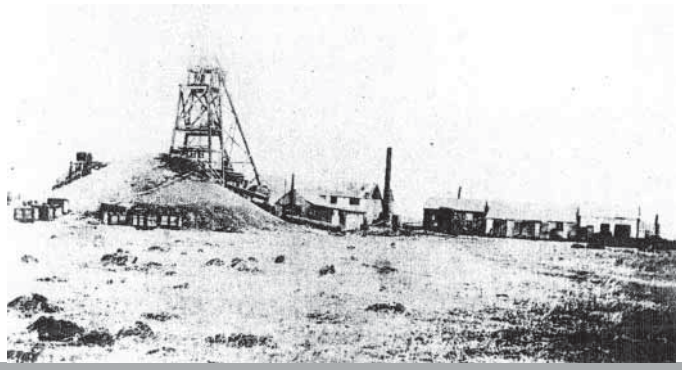


Photo 8.1/1 Altona Coal Mine near Harrington Square (from S.Priestly, (1988), p. 99). Copyright City of Hobson's Bay.

8 West of Melbourne—Brown Coal Mines

8.1 Altona/Werribee Mines

Map Reference: **7822-2-4 Sunshine Zone 55**

3076, 58066 (At south of Harrington Square)

3073, 58066 (Hosies Shaft approximately)

Municipality: **City of Hobsons Bay**

Land Use/Status: **Private**

Site History

'The Port Phillip Basin, the major portion of which covers the area from Melbourne to Bacchus Marsh and southwards to Geelong, contains an extensive deposit of brown coal mostly covered by thick flows of Newer Basalt.' In the Altona to Newport/ Williamstown area this deposit is known as the Altona Seam and is up to 25 metres thick.[310]

In 1881/1882, the Williamstown Coal Prospecting Company sank two bores on the South Newport estate finding water and seams of brown coal. This find apparently attracted little interest at the time. Brown Coal was found at Werribee in March 1889 and analysed by the Mines Department.[311]

The earliest recorded extraction of coal from the Altona Seam was from a shaft sunk by JS. Hosie in 1890 (S Priestly says 1892) at a location a few hundred metres west of the present VR rail terminus in Westonia. (Melway 54C10). Hosie had persuaded an Altona Syndicate to search for thicker brown coal seam(s) to the west of Kororoit Creek as a logical outcome of test drilling at the east of this creek[312] indicating thickening of seams to the west. An unrecorded amount of brown coal for 'marketing purposes' was extracted before the shaft was accidentally flooded with ingress of 'underlying artesian' water.[313]

In April 1894, the Mines Department sunk two bores to the base of the coal in the present Altona town area, revealing a thick coal seam under basalt. About 1894, The Trust and Agency Company of Australia took over the financing of Hosie's endeavours.[314]

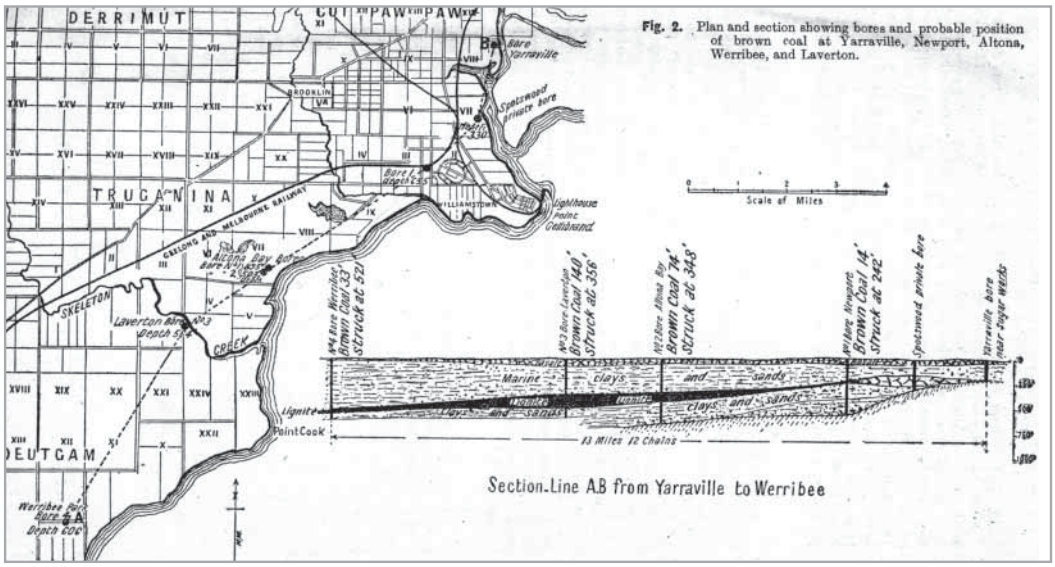
In 1894, (S Priestly says 1899) Hosie sank a second shaft ten feet by five feet to a seam 73 feet thick at 333 feet below surface.[315] This shaft (located in the vicinity of the present Harrington Square) was a few hundred metres east of the first shaft (Photo 8.1/1). The operators had a proposal to install boilers underground with electric generating plant at the surface. The mine remained inactive waiting on economic opportunities.

In 1905 the Victorian Electric Light Heat and Power Distribution Company took an option on the Altona mine. RAF Murray, formerly Mines Department geologist, was a director of this company which negotiated strongly with municipal councils for exclusive rights to supply electric power, intending to use the Altona mine as its power source.

In 1905, mining resumed from the shaft, with a renewed poppet head and larger pumping plant. Reputedly, mining was on a three-shifts-per-day basis, with a workforce of about one hundred men.[316] (Mines Department records or reports do not appear to refer to this operation or to include its output in Mines Department statistics.)

In 1906, an American firm, (Bewick, Moreing & Company), with Herbert Hoover intended as mining consultant, acquired the lease and sank another shaft somewhat south of the previous shaft. No production from this shaft has been ascertained in this study. At 1907, a proposal emanated from an Iron and Steel Company to use Altona coal at site with iron ore from Tasmania. This proposal did not proceed but was indicative of the interest shown by private groups in the potential of this coal resource close to the Melbourne metropolitan area.

In 1908, the Melbourne and Altona Collieries NL was formed and enlarged the previous shaft[317] to a nominal 15 feet diameter, actually a twelve-sided polygon, to a depth of 355 feet. The



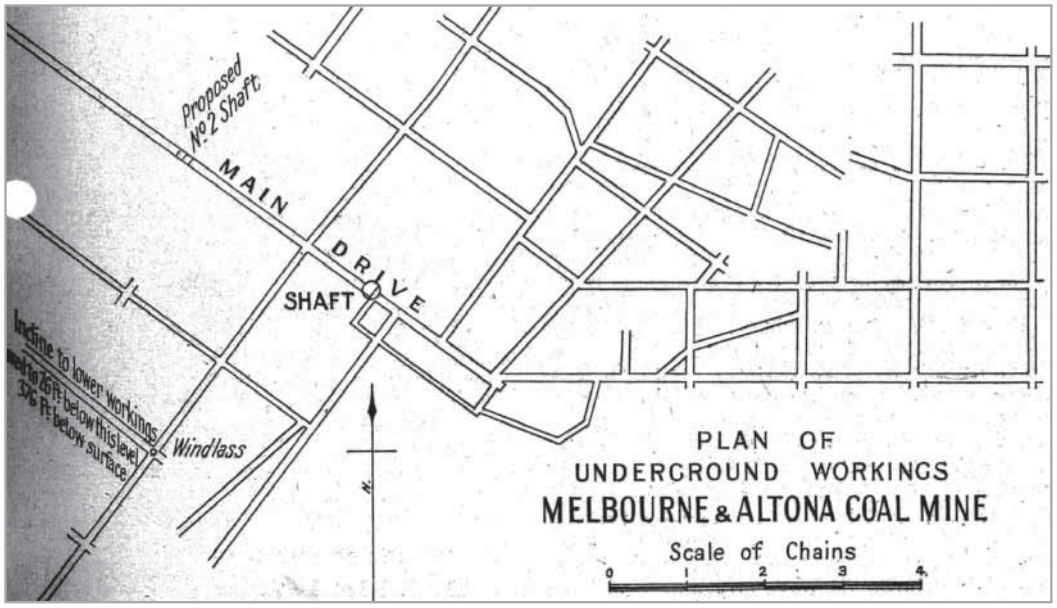
Drawing 8.1/1 Plan and Section of Altona area showing bores and shafts (from Herman, H *Brown Coals Of Victoria*, (1922), p.11).

VR rail line was extended about one and a half kilometres from Pier Street to the shaft site.[318]. This mine first produced coal in 1910 at about 600 tons in its first production year with considerable pumping involved.

In 1909, the establishment of the State Coal Mine on the Powlett River Coalfields was an indication of trends in Government thinking on the role of State Enterprises in the supply of essential services. In 1912, a British and American Syndicate proposed to build a power station at Altona involving takeover of the mine and the Altona coal resource and having a monopoly to provide electric power and lighting to all of Melbourne and its suburbs. CH Merz, a consultant to this syndicate, estimated that with the sinking of a second shaft an output of 3,000 tons per day could be achieved.[319] The State Government had divided opinions on the granting of a monopoly and in 1913 invited tenders from private companies to supply 5,000 to 25,000 kilowatts for railway electrification in order to release power for Melbourne consumers from Newport Power Station, then under construction.

However, Government decisions on State enterprise or private monopoly development of the Altona Coal resource had not been reached by the outbreak of World War One in August 1914 and was put on hold. For about five years, the Altona shaft operation limped along with the high cost of its underground operation being a disadvantage to gaining inroads to purchasing by established merchants with existing contracts for black coal supplies. Skeleton manning of the mine throughout the war permitted continued pumping but little production. At 1918, the Colliery Syndicate was confident that production would resume although it appeared that electric power generation would be reserved for public enterprise. Their concept at 1918 turned to utilisation of the Altona Coal for briquetting (and some other by products with only a low coal supply requirement).[320] However by 1919, the Altona briquetting opportunity dissipated with the Government intention to initiate a government briquetting operation in the Latrobe Valley.

Total recorded production from 1910 to 1919, when the mine ceased operation, was 31,160 tons. It is probable that the total production from the Altona shafts from the mid to late 1890s was significantly higher than this recorded figure if production pre-1910 is added, and taking into account the estimate stated by S Priestly of 75,000 tons from 1910 to 1919.



Drawing 8.1/2 Plan of underground workings at the Altona original production shaft (from Thomas and Baragwanath, (1950), Part 3, p.13)

In 1927, with the SECV struggling to meet growing demand for electricity and briquettes, the Altona Collieries Company revived proposals for utilising the Altona Coal for briquettes, for electricity generation at site with cooling water available from the adjacent bay, and for conversion to gas and oil.[321]

In 1928, the Altona Bay Estates Company, which in 1915 had taken over a large portion of land previously intended for coal mining and in 1920 took over further land holdings in the Altona Bay area, sank three bores within a few hundred metres of the second shaft, each bore intersecting a coal seam 62 to 77 feet thick and a overlying basalt deposit of 50 to 172 feet thick. A new shaft to the northwest of the previous production shaft was sunk by this company in 1928 to obtain coal for experimental purposes. However, all work ceased in 1931 after extraction of a minor undisclosed quantity of coal.[322] (The numbering of shafts and bores varies in different references. The depiction shown in Drawings 8.1/1 and 2 as copied from Thomas and Baragwanath (1950), Part 3, p.13 appears the most valid. This shows the 1928 shaft as the Number Two shaft approximately 200 feet northwest of the Number One shaft which was the production shaft sunk by Hosie in 1894 and enlarged in 1908.)

In early 1928, test bores by a new syndicate were drilled in the Galvin area about one mile west of the second shaft location, with the objective of mining in a new lease area to produce electricity at site and sell in bulk to the SECV. A thick coal seam was found in each bore. A shaft was sunk and some equipment utilised from the old Altona shafts. By May 1930, coal was being extracted. However the mine experienced difficulty and high costs in keeping the workings free from sub-artesian water and closed their operation in 1931 with a total production reported of 600 tons. The company offered their mining rights to the SECV in 1932 and again in 1940 but the offer was not taken up by the SECV.

Mines Department records as stated by H Herman assert: 'Nearly all the brown coal excavated in Victoria from 1911 to 1916 came from the Altona mine' which mined about 26,000 tons in that period. Approximately 5,000 tons were mined after 1916 until closure of the mine in 1919.[323]

Assessment of Heritage Significance

Historical Significance

Brown Coal at Altona was found in 1881/82 and mined in 1890/92. This mine was the nearest coal mine to the centre of Melbourne. The proximity to the metropolitan area presented opportunity for generation of electricity without long distance transmission, the techniques of which were not available until about 1905 –1910. The deposit attracted considerable interest from private consortia seeking to gain rights to the generation of electricity and its distribution throughout the Metropolitan area. This interest by private consortia was pursued vigorously in the State political arena through to the establishment of the SECV in 1920. Through to the 1940s, private interests continued to advocate utilisation of this coal instead of continued expansion of the SECV power and briquette production in the Latrobe Valley.

Scientific Significance

Extensive scientific analysis was undertaken by private interests from Great Britain and Germany, particularly between 1900 and 1915. An outcome of the Royal Commission on Brown Coal (1899–1901) was greater sponsorship by Government of scientific investigations in Britain and Germany into brown coal utilisation, with coal from Altona and from Gippsland being evaluated with priority.

Economic Significance

Utilisation of the Altona Coal Deposit extending to Werribee did not meet economic expectations. Although the underground mining of the seam was feasible and comparable in cost per tonne as mined with that for black coal from NSW and Wonthaggi, the lower calorific value resulted in much higher utilisation costs.

From the late 1940s when mobile excavating and haulage plant became available with ever increasing capacity, those brown coal deposits such as in the Latrobe Valley suitable for excavation by open cut gained significant mining cost advantages compared with underground brown coal mining.

Although the Altona deposit remains largely unexploited, its close proximity to the continually expanding suburban infrastructure appears to now be of significant disadvantage to its prospects for future mining.

Social Significance

The availability of this coal deposit close to the metropolitan area was of high social significance immediately after the formation of Victoria as a State of the Commonwealth. Failure of the strenuous endeavours of private industry to gain State Government support for utilisation of the deposit by private enterprise was to some extent reflected in State Government decisions to implement Public Authority management of its State Coal Mine, its electricity generation and transmission system, its tramways and many other public utilities.

The prospects of a mine underground the expanding outer suburban area appeared to raise as much concern as support, with misgivings of the local community tending to offset potential social benefits to the wider Melbourne area.

Mine Infrastructure Features

Harrington Square Area.

Galvin Rail Siding Area.

References

Australian Mining Standard, 15 August 1912

Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No.11, AusIMM, 1984

Herman, H, *Brown Coals Of Victoria*, Bulletin No.45, AusIMM, Geological Survey of Victoria, 1922

Herman, H, *Brown Coal*, SECV, 1952

Knight, JL, *Brown Coal in the Melbourne Area*, Mines Department (unpublished), March 1960

Annual Report, Mines Department,1889

Priestly, S, *Altona: A Long View*, City of Altona, 1988

Thomas, DE and Baragwanath, W Geology of the *Brown Coals Of Victoria*, Vols 1–4, 1949–1951

8.2 Williamstown to Mornington Brown Coal Discoveries

Map Reference: **7822-2-4 Sunshine 3129, 58086 Shaft of 1894**

7822-2-1 Maribynong 3154, 58121 Bore at Yarraville

7921-4-3 Frankston 3276, 57686 Outcrop at Schnapper Point

Municipality: **Various**

Land Use/Status: **Private & Public**

Site History

In 1881/1882, the Williamstown Coal Prospecting Company sank two bores on the South Newport estate finding water and seams of brown coal.[324] This find apparently attracted little interest at the time.

In 1894, the Williamstown and Newport Coal Prospecting Company sank a shaft 225 feet deep and then bored to 311.5 feet. Five seams of brown coal from two to eight feet thick were found from 200 feet to 311.5 feet depth with interseam sediments. The location of this shaft was (approx. 3129-58086) just west of Newport Railway Workshops and just south of the Altona rail line.[325] A bore named Number One Bore Newport located 65 feet to the north east of the shaft also found five seams of brown coal from two to fourteen feet from 198 to 293 feet depth with interseam sediments.[326]

At Yarraville about three miles north easterly from Number One Bore Newport, a bed of brown coal eight feeet thick at 221 feet depth was found. Details of these boreholes were published by the Mines Department in Progress Report Number 10, 1899.[327]

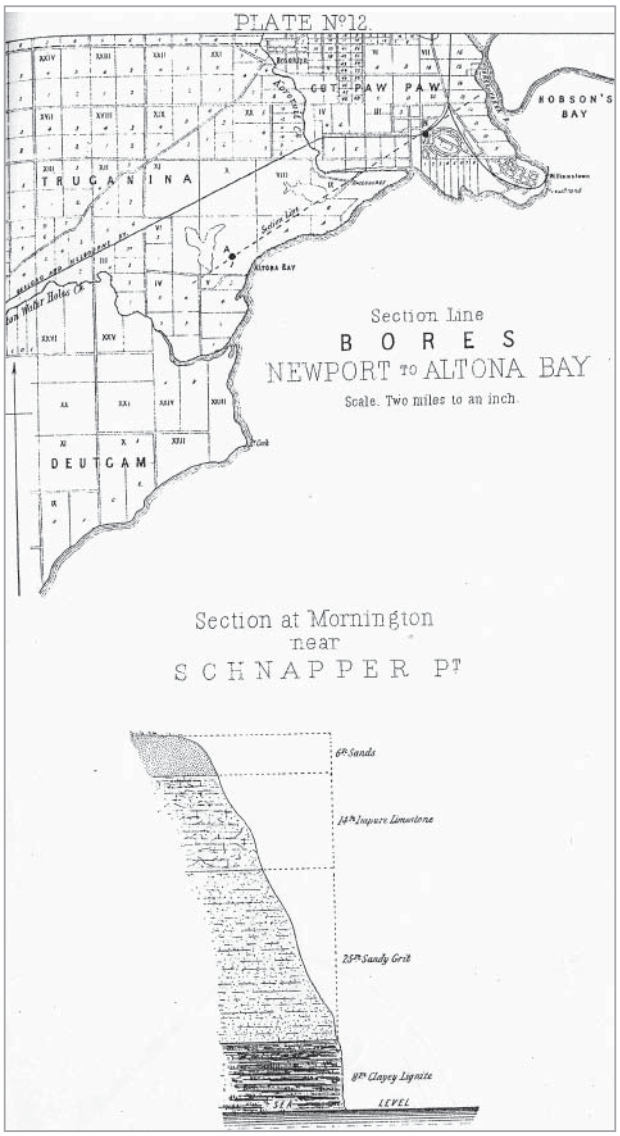
On the Eastern shore of Port Phillip Bay, a lignite seam outcropping at eight feet thick from sea level underlying 45 feet of sands, grits, and limestone had been found at Schnapper Point, Mornington, and analysed by 1899.

By 1910, the existence of brown coal beds under basalt in the Port Phillip Sunkland was well known. H Herman in 1922 summarised as follows: 'In the Altona area, brown coal is known to extend for a length of about 13 miles from Yarraville to Werribee. Brown Coal may continue along the western shore of Port Phillip Bay for ten or 15 miles south westerly from the mouth of the Werribee River – it may extend also for many miles to the north west – and it may also occupy a large area under Port Phillip Bay itself'.[328] By 1910, entrepreneurs investigated and advocated mining these deposits for electricity generation, gas conversion and briquetting with perceived economic advantages of closeness to Melbourne, availability of transport and access to abundant cooling water. To 1919 various lobbies sought government support and/or monopoly to mine coal in the western fringes of the metropolitan area either to supply coal or to provide the finished byproduct of electricity, gas, briquettes or liquid fuel as a monopoly to designated markets. Through at least ten years of debate to 1919, the government finally opted for a State Enterprise to develop the brown coal resource in the Latrobe Valley to meet base load electricity demand and briquetting needs as well as to continue its operation of the State Black Coal Mine at Wonthaggi.

The geological assessment of the brown coal seams east of Altona had revealed that the coal deposit was much thinner and in split seams compared to the deposit characteristics at Altona. By 1910, the lack of commercial success in mining the thick coal seam at Altona had dissipated interest in expenditure on the thin and split seams from Williamstown northwards to Yarraville. Coal discoveries on the east shore of Port Phillip Bay created community interest but little public support for any mining of the deposit, and no commercial venture was initiated.

Thus, commercial interest in mining the brown coal deposit in the Melbourne suburban area east of Altona had dissipated by 1920. Intermittent ventures at Altona continued after 1920 as outlined in Section 8.1 of this Heritage Study.

At 1951, the eminent geologists DE Thomas and W Baragwanath suggested areas of Victoria as worthy of further drilling investigations specifically for brown coal. The nominated areas included the Port Phillip Sunkland from Bacchus Marsh and Werribee at the west to the eastern shores of Port Phillip Bay at the east.[329] No significant drilling program eventuated except in the Bacchus Marsh area.



Drawing 8.2/1 Coal seam at Schnapper Point, Mornington (from Stirling (1899), *Progress Report No.10*, Plate 12).

Assessment of Heritage Significance

Historical Significance

By the late 1890s, it was known that brown coal seams existed in much of the area from the eastern shores of Port Phillip Bay and west to Werribee. However most of the discoveries revealed seams less than eight feet thick, generally under basalt or limestone.

Scientific Significance

No specific scientific investigations on these metropolitan deposits, other than at Altona, were undertaken except for geological analysis for contribution to regional geology appraisal.

Economic Significance

None of the investigation bores and shafts, other than at Altona, reached a commercial mining stage. Advocacy by Thomas and Baragwanath for more extensive drilling from the 1950s was to prove regional geology rather than to pursue economic mining possibilities.

Social Significance

Considerable local interest was evident (see Frankston Library collection on Brown Coal) as coal discoveries accumulated from the 1880s, and vague proposals for utilisation were mooted. By 1920, the endeavours by private industry to gain Government sponsorship for development of mining and processing at Altona had not succeeded. From that time, the existence of brown coal seams in the expanding Metropolitan area had little social significance or little influence on suburban development.

Mine Infrastructure Features

No remains of boreholes have been ascertained.

Precise location of Schnapper Point Outcrop has not been ascertained at site.

References

Herman, H, *Brown Coals Of Victoria*, Bulletin No.45, Mines Department, 1922

Priestly, S, *Altona: A Long View*, City of Altona, 1988

Stirling, J 'Report on the Brown Coals and Lignites of Victoria', *Progress Report*, No.10, Mines Department,1899

Thomas, DE and Baragwanath, W *Geology of the Brown Coals Of Victoria*, Parts 1–4, 1949–51

8.3 The Parwan Brown Coal Mine
The Bacchus Marsh Coal Mine Ltd.

Map Reference: **7722-2-1 Balliang Creek, 2774, 57457 (approx. – precise location not determined)**

Municipality: **Shire of Moorabool**

Land Use/Status: **Private**

Site History

Area Coal Discoveries

The existence of Brown Coal in the Bacchus Marsh area 50 kilometres west of Melbourne was first recorded in 1884 as occurring in a railway crossing of the Werribee River at the east of Bacchus Marsh. Two seams were discovered, one 24 feet thick covered by soft clays and sands 44 feet thick, the second coal seam being 20 feet thick below interseam clays of 25 feet thickness. Spasmodic discoveries followed, mainly from boring for water by landholders until a specific drilling program of six bores about 1.5 miles west of Bacchus Marsh was undertaken by the Parwan Park Estate Company during 1923–24. Each of the six bores proved a thick coal seam varying from 29 to 96 feet thick and with top of coal varying from 271 feet to 389 feet, with coal quality of about 50 per cent water and 5 to 10 per cent ash.[330] However, no coal mining occurred in these areas until the 1940s.

The Parwan Mine

In 1923, at Balliang, several miles south of Parwan Rail Siding, a 96 feet thick seam of brown coal was found at 328 metres depth.[331] No mining at this location occurred.

In 1927, at a location about five miles south of the Parwan Rail Siding and about two miles east of the main Bacchus Marsh to Geelong road, a brown coal seam was located by accident during boring for water by a Government drilling crew. A local land owner, MD Cock, took some coal samples for analysis which showed brown coal of good quality with a moisture content of 48 per cent and ash of 3.6 per cent to 5.4 per cent.[332] He purchased 700 acres surrounding the bore site.

In 1929/30, a shaft eight feet six inches by four feet was sunk at this location by a private group, Messrs. Broome, Cock and Edgar. This shaft encountered hard basalt for about 200 feet, followed by hard clays and an upper coal seam 11 feet thick at 357 feet. This seam was followed by thin layers of sand and coal to 4 05 feet, below which was the main coal seam 103 feet thick to the bottom of the shaft at 510 feet. A drive was installed initially at the 465 feet level for 200 feet northeasterly into the bottom seam.[333] This operation became known as the Parwan Mine (Drawing 8.3/1), but registered as the Parwan Colliery Pty Ltd.

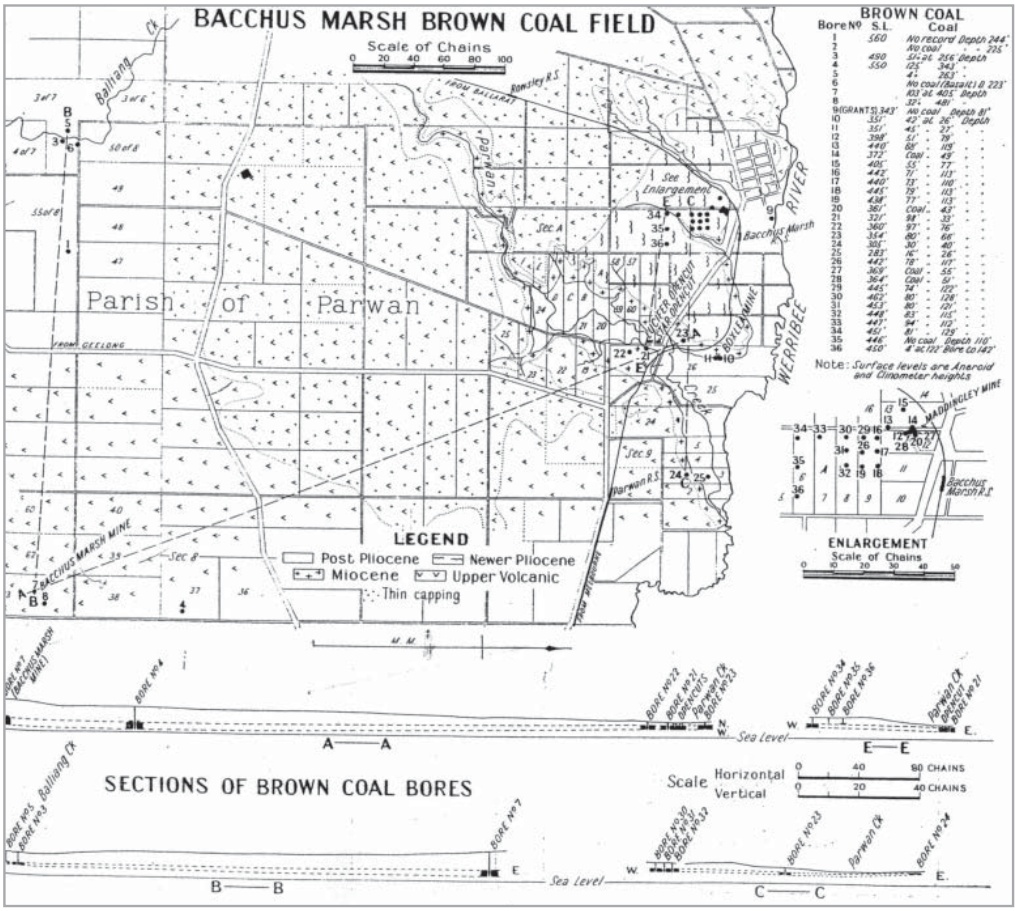
The mine was not a commercial success and closed in 1930. Output from the mine has not been ascertained but would have been less than 1,000 tons from the shaft and drive. In 1930, the initial plant was sold and removed.[334]

In 1931, after voluntary liquidation of the company following the death of MD Cock, the mine was reactivated as The Parwan Colliery Ltd. This company sought more capital to renew the operation and to provide a tramline about six miles long from the shaft to the Parwan VR rail siding. This tramline did not progress but an official reopening of the former mine took place on 11 June 1932. An enthusiastic report by GH Broome, General Manager of the State Coal Mine, assessed that the deposit at the Parwan Mine over an area of 1,250 acres contained 190 million tons from the 125 feet to 130 feet thick deposit of which 90 million tons was above ground water level. The mine was 'worked steadily for a few weeks' but again had a pause in development while the company tried to obtain government action for the SECV to be prevented from selling second quality briquettes at below-cost price to the Melbourne fuel merchants.[335]

In 1936, an attempt was made by AW Bretherton to reactivate the Parwan Mine but the venture did not reach the production stage and the plant was sold.

In 1940, Messrs. Chalmers & Jenkins reopened the mine, found only about three feet depth of water in the shaft and commenced mining on two levels, at 446 feet and 485 feet. In 1940, about 1,800 tons of coal was produced but the coal could not compete successfully with sales of briquettes from the SECV briquetting plant at Yallourn.[336]

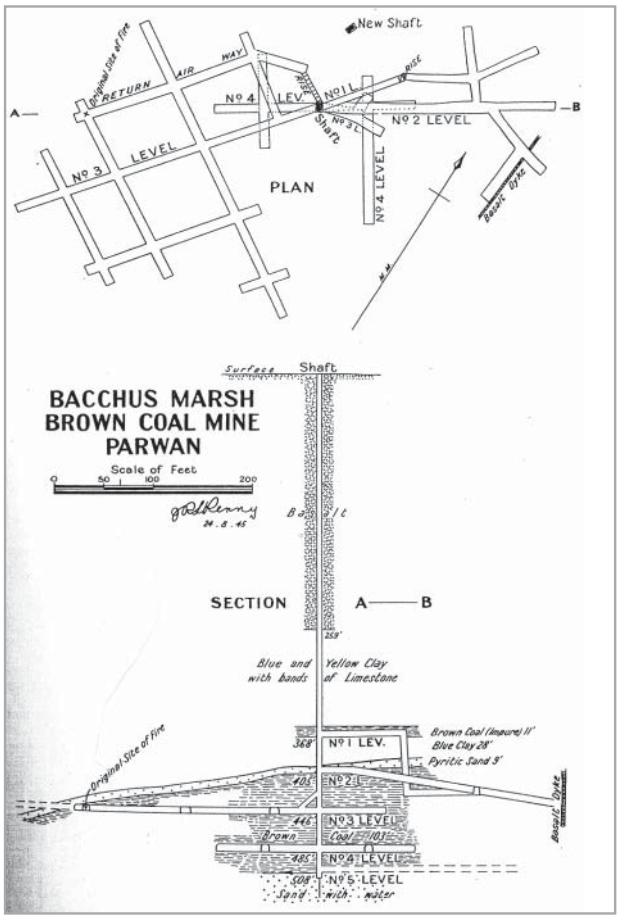
In 1941, the mine and its installed plant were taken over by the Bacchus Marsh Coal Mine Company which continued operation on the two previous levels from 1942. Colloquially,



Drawing 8.3/1 Bacchus Marsh Brown Coal Field showing location of the Parwan Shaft (from Thomas, Brown 'Coal Deposits at Bacchus Marsh', *Mining and Geological Journa*l, September 1947, p.18).

the mine thence became known as the Bacchus Marsh Coal Mine. Under wartime coal shortages from NSW, a market niche had opened for this new company. At early 1944, mining was continuing in the lower seam only, with six faces opened up. However, on 23 March 1944, fire broke out in pyrite-bearing coal exposed to air in the underground operation. Mining then ceased while the shaft was sealed to cut off air supply. There was only one shaft from surface level used for access, haulage and ventilation. An attempt to recommence operation was aborted initially in May 1944, when it was found that the fire was still burning or had reoccurred on re-opening. From 30 May 1944, a further attempt at reactivation was initiated by driving an incline from above the blocking of the shaft to intersect the 405 feet level operation.[337, 338] Drawing 8.3/2 shows plan and sections of the mine at August 1945.

Over 2,000 tons of coal were excavated before fire again lead to sealing off the operation. No further production occurred before the shaft was resealed on 8 November 1945. Several attempts to re-open the mine took place to 1947 but it was found that fires reactivated and that some shaft timbers had collapsed. Reworking was hampered by the need for effective ventilation without that leading to fire outbreak in the smouldering coal debris.[339]



Drawing 8.3/2 Bacchus Marsh Coal Mine, Parwan: Plan and Sections of underground workings at August 1945 (from Kenny, *Mining and Geological Journal*, Vol. 3 No.1, March 1947, p.15).

Total production from the Parwan Mine varies in separate references. Production as stated by Thomas and Baragwanath (1950) from 1940 to 1944 totalled 12,882 tons.[340] With the production which also occurred in the 1930s and the quantities stated by Kenny (1947) included, the total production may have been about 15,000 tons of brown coal. (Output stated by DE Thomas (1947) as 9,536 tons[341] appears to be too low.)

Assessment of Heritage Significance

Historical Significance

The Parwan Shaft at 1930 was the first commercial mining of the extensive brown coal deposits in the Bacchus Marsh area. Although the deposit was thick enough to be worked on several levels, mining of only a low percentage of the thickness was likely, due to the associated need for roof support. It was found that underground mining costs were similar to that of NSW black coal underground mines, resulting in the Parwan venture being unable to compete on a calorific basis for sale on the open market.

The several failed attempts to obtain commercial success from the Parwan venture with its advantages of a thick unbroken coal seam and low water inflow deterred other ventures for underground mining of the widespread deposits. This occurred particularly from the 1950s when large capacity mobile excavation and haulage plant became available after World War Two to mine selected areas by open cut methods at much lower costs than by underground mining.

Scientific Significance

The quality of the Parwan Shaft coal was similar to that of other brown coals in Victoria which had been extensively appraised from the 1890s. No specific characteristics of the Parwan Shaft coal merited specific study unless a niche market was in prospect.

Economic Significance

The Parwan Shaft came into operation about the time when briquettes from Yallourn were becoming more available to general industry and the public. Coal fines from the State Coal Mine at Wonthaggi and brown coal from the Yallourn North Open Cut and from the Wensley Dale Open Cut were also in the market as competitors to the Parwan prospects. The brown coal deposit at Altona was being promoted as feedstock for briquette manufacture near the centre of consumption in Melbourne.

No niche market offering sole or specific advantage to the Parwan Shaft operation was unearthed. Any such prospects were overrun with the development of open cut mines on the Bacchus Marsh brown coal fields and elsewhere in Victoria.

Social Significance

The Parwan Shaft was located on open grazing land some sixmiles from the village of Bacchus Marsh. The mining activities had no significant community interaction. Employment in this mining operation was intermittent over the twenty years of its activity and would not have exceeded about ten individuals at any time.

Lack of commercial success of this mine indicated similar poor prospects at other potential mine sites widely available in the Parwan valley.

Mine Infrastructure Features

The sealed shaft may still be identifiable.

References

Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, Vol. 3 No. 4, September 1948

Kenny, JPL 'The Bacchus Marsh Brown Coal Mine, Parwan', *Mining and Geological Journal*, Vol.3 No. 1, March 1947

'Brown Coal at Bacchus Marsh', *Mining and Geological Journal*, Vol. 3 No.2, 1947, pp.14–16

'The Parwan Coal Field', *The Bacchus Marsh Express*, 15 July 1933

Thomas, DE 'Brown Coal Deposits at Bacchus Marsh', *Mining and Geological Journal*, September 1947, p.17

Thomas, DE and Baragwanath, W, Geology of the *Brown Coals Of Victoria*, Part 3, Mines Department, September 1950

8.4 Maddingley Brown Coal Mine Number One at Bacchus Marsh

Map Reference: **7722-1-2 Lerderderg 2734, 58255**

Municipality: **Shire of Moorabool**

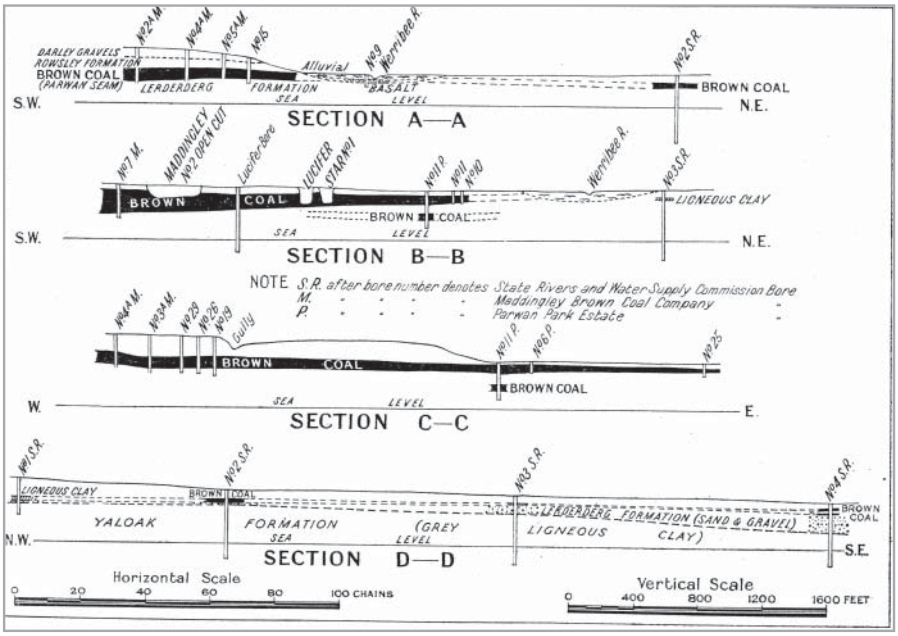
Land Use/Status: Private

Site History

The early coal discoveries in the Bacchus Marsh area have been outlined in Section 8.3.

Between 1942 and 1944, 28 bores were sunk in the Bacchus Marsh area[342] to ascertain the nature and extent of the brown coal deposit at that time of war time fuel shortages being

Drawing 8.4/1 Plan showing distribution of bores and open cuts at Bacchus Marsh (from Thomas and Baragwanath, Part 3, September 1950, p. 6).



Drawing 8.4/2 Geological Sections across Bacchus Marsh Area (from Thomas and Baragwanath, Part 3, September 1950, p. 7).

worked as an underground mining operation at the Parwan Shaft. The drilling information was immediately utilised. In March 1944, the Maddingley Brown Coal Pty Ltd in an operation known as the Maddingley Brown Coal Mine, commenced mining via a tunnel[343] into the Maddingley Hill at a location on the south side of the VR rail line about 400 metres west of the Bacchus Marsh Railway Station. At the location of the mine, the coal seam was about 70 feet thick overlain by up to about 80 feet of gravels and sands.[344] (Both the overburden and coal decreased in thickness northwards of the VR rail line.)

At March 1945, the tunnel was 450 feet long, levelling out at 130 feet below surface. The tunnel was well timbered and opened out to a 13 foot chamber for marshalling of underground skips.

At 1946, the mine was producing a few hundred tons of coal per week; 250 tons per week was reached in 1945.[345] In the mine the coal was loaded into skips which were hauled up the inclined tunnel and loaded into VR trucks at a siding[346] for delivery to Melbourne and Ballarat or into road trucks for deliveries locally or to Geelong.

In 1946, the Australian Paper Manufactures Ltd, (APM), purchased an interest in the Maddingley Mine. The APM had been experiencing a serious shortage of suitable fuel for their boiler plant at their Melbourne, Fairfield and Broadford Mills.[347]

The newly strengthened mining oversight from APM had noted the disastrous continuing spontaneous combustion underground in the coal seam of the Parwan Shaft several miles south east of Bacchus Marsh. At the Maddingley Mine, the improving post war availability of larger capacity mobile excavation and haulage plant had opened the option of an open cut mining operation. In 1946, shortly after the APM involvement commenced, an open cut operation was initiated immediately south of the underground entrance. Underground mining ceased at the Maddingley Mine at the end of 1946. By January 1947, coal excavation from this open cut had fully replaced the underground mining operation. From the open cut, coal output had risen to about 1,000 tons per week with demand increasing.

Drawing 8.4/3 Bacchus Marsh Area (part of Topographical Map 7722-1-2 Leederderg). Copyright State of Victoria, Department of Sustainability and Environment.

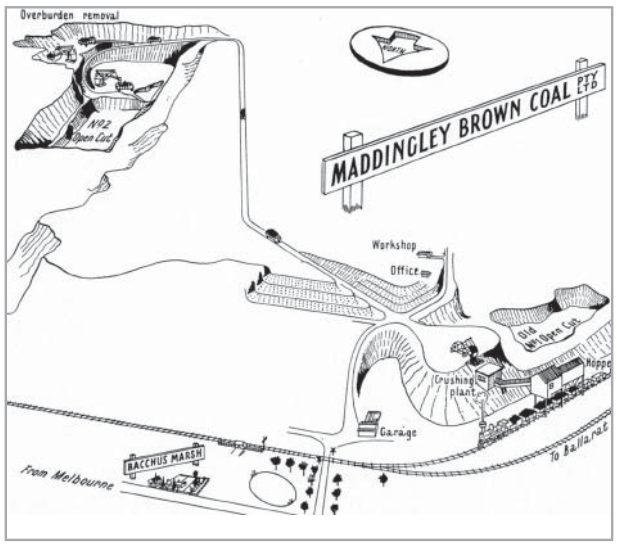
In 1947, Maddingley Brown Coal Pty Ltd decided to open a second open cut about 1.5 miles to the southeast where the coal deposit had a more favourable coal to overburden ratio. The original open cut was then named the Maddingley Open Cut Number One with the new mine named as Open Cut Number Two. The Number One Open Cut continued in operation after Number Two was opened in March 1948 using the same receiving, crushing and out-loading plant. Output from the Number One Open Cut in 1947 had risen to 1,600 tons per week with total output for the year at 67,641 tons.[348]

By 1949, the Maddingley Open Cut Number One had almost ceased coal winning. The Number Two mine was more economic and could be readily expanded to meet continuing growth in demand. In the 1951 year, the combined production from both open cuts was 284,326 tons with 85 men employed[349] but production from the Niumber One mine had virtually ceased.

Total output for the Maddingley Open Cut Number One was stated to be 120,000 tons,[350] having reached about 2,000 tons per week.[351] A reserve of coal was left at the Number One Open Cut to provide a contingency in case of problems such as earth movement, flood or fire in the Number Two Open Cut.

The Number One Open Cut was used as the overburden dumping area from Open Cut Number Two such that by the 1960s the former mine area was fully filled, with terracing of higher refill areas and reclamation effectively restoring the landscape.

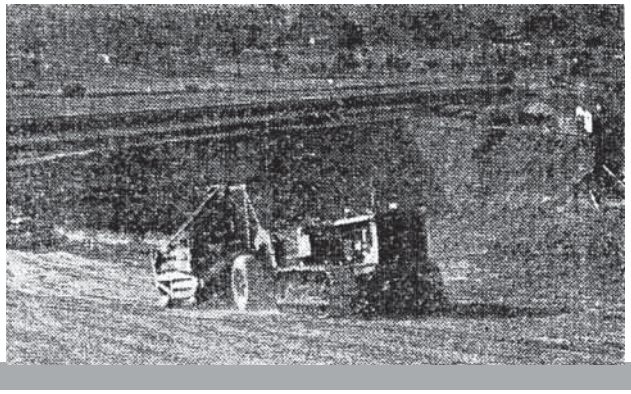
At 2005, the site of the former Maddingley underground mine and the Number One Open Cut , as shown in Photo 8.4/1, is utilised as a storage area for a fertiliser and soil conditioner mixing and bagging plant using some fine crushed brown coal from Maddingley Number Two Open Cut in some of its product mixes.



Drawing 8.4/4 Sketch Plan of Maddingley Open Cuts Number One and Number Two Operational Areas (from *Mining and Geological Journal,* March 1954, p. 6).

Photo 8.4/1 Maddingley Underground Mine Site at 1951.

Photo 8.4/2 Maddingley Open Cut Number One at about 1948 (from G. Brown, *Mining and Geological Journal*, September 1948, p. 9).



Assessment of Heritage Significance

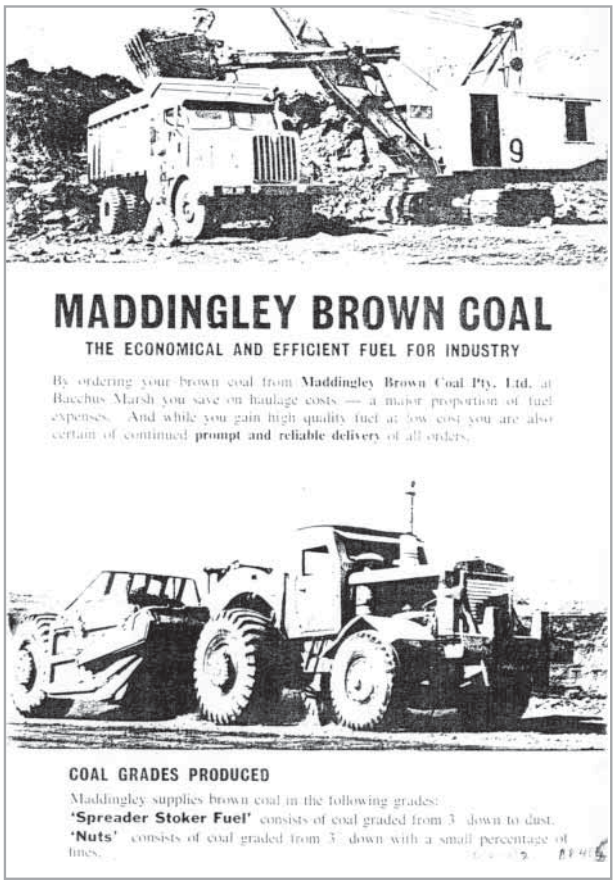
Historical Significance

The commencement of brown coal mining at the Maddingley mine in 1944 was the first commercial utilisation of the Bacchus Marsh brown coal deposit. Being immediately adjacent to the main VR rail-line offered economic and social advantages for a rail loading point somewhat remote from the village of Bacchus Marsh.

Although opened economically as an underground mine via an adit into a hillside, subsequent drilling had revealed absence of overlying basalt resulting in the mine management recognising greater economy in converting to an open cut operation. Planning and plant procurement moved rapidly to achieve implementation of the change to open cut operation within two years of opening of the underground mine. Three other mining ventures followed as open cut operations within the area.

Scientific Significance

No specific endeavours were initiated to further investigations already carried out by others into the brown coal qualities and utilisation of the Bacchus Marsh coal. The mine sought to supply run of mine coal into the fuel market rather than investing in research into specific processing.



Drawing. 8.4/5 Type of excavating and transport equipment used at Maddingley Number One Open Cut.

Economic Significance

The Number One Maddingley Mine commenced operation in 1944 as the first commercial venture to utilise the brown coal deposit at Bacchus Marsh. Its operation was in an area discerned by drilling about two years previously as having a thick coal seam close to surface.

There was a serious long term shortage of fuel in Victoria (and in NSW) in the war time economy which fostered the birth of coal mines as well as the attempted reactivation of earlier mines. The early transition of Maddingley Number One mine from an underground to an open cut mine demonstrated that the Bacchus Marsh deposit could be mined economically with conventional earth moving and haulage plant and with much less risk than in small underground mines.

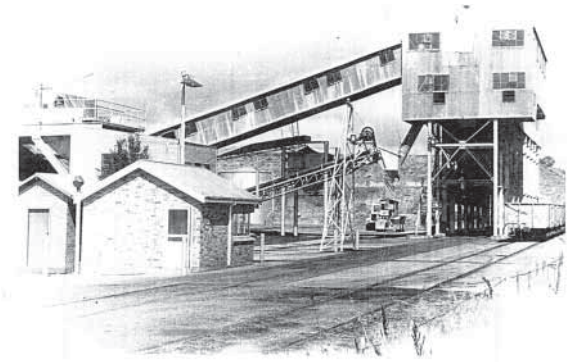


Photo 8.5/1 New Crushing and outloading plant for Maddingley Open Cut Number Two, 1952.

Social Significance

The success of the Maddingley Number One mine in gaining access to the Melbourne and regional hard fuel markets lead to the almost immediate establishment of other mines on the Bacchus Marsh Coal Field. Open cut operations and maintenance skills were readily acquired from within the local quarrying and farming community, thus offering ready availability of a suitable work force with post war employment priority. The coal mining industry at Bacchus Marsh, initiated by the Maddingley Number One Mine, added significantly to the post war economic and social stability of the Bacchus Marsh area.

Mine Infrastructure Features

The underground mining site is discernible.

The outloading station is still in existence.

The Maddingley Number One open cut area is identifiable as a backfilled and restored natural regrowth site.

References

Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948

Mining and Geological Journal, March 1947, September 1947, March 1948 and September 1948

'Brown Coal at Bacchus Marsh', *Mining and Geological Journal*, Vol. 3 No.2, 1947, pp.14–16

Moffat, G 'New Coal handling Plant at the Maddingley Open Cut, Bacchus Marsh', *Mining and Geological Journal*, September 1952

Moffat, G 'The Maddingley Brown Coal Open Cut, Bacchus Marsh', *Mining and Geological Journal*, March 1954

Thomas, DE 'Brown Coal Deposits at Bacchus Marsh', *Mining and Geological Journal*, Vol. 3 No.2, September 1947, pp.17–18

Thomas, DE and Baragwanath, W *Geology of the Brown Coals Of Victoria*, Part 3, Mines Department, September 1950

8.5 Maddingley Brown Coal Mine Number Two Bacchus Marsh

Map Reference: **7722 1-2 Lerderderg 2740, 58236**

Municipality: **Shire of Moorabool**

Land Use/Status: **Private**

Site History

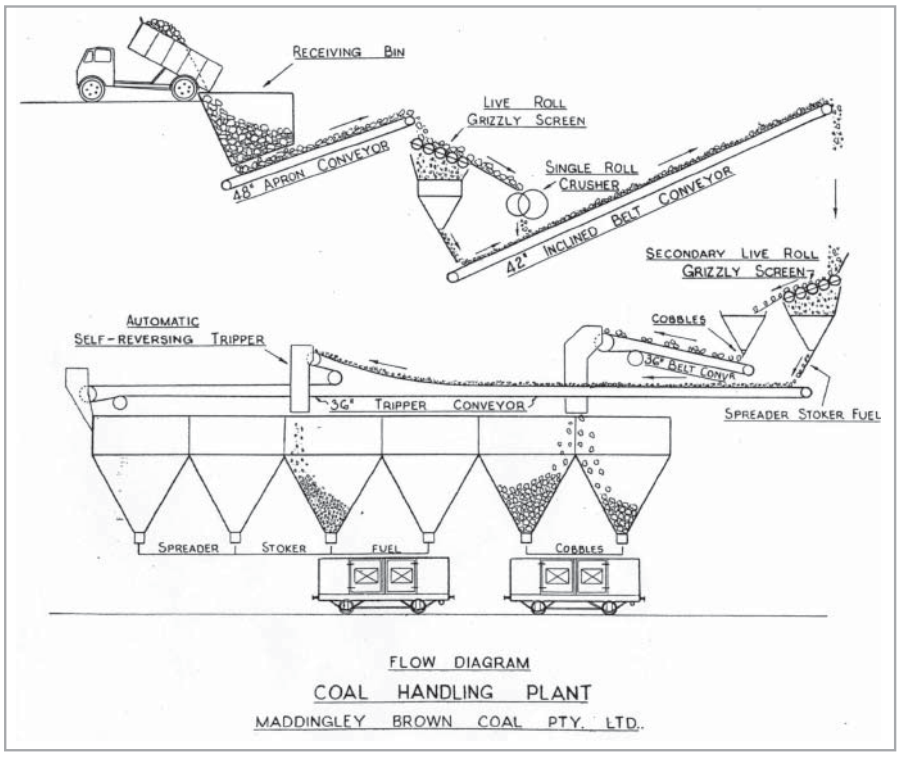
The Maddingley Open Cut Number Two was commenced in March 1948. It was located about 1.5 miles south east of the Number One mine and 1.5 miles south easterly from the Bacchus Marsh Railway Station. (See Drawing 8.4/1). The operating company was Maddingley Brown Coal Pty Ltd largely (or totally) owned by APM.[352] The Number Two mine was opened where a single coal seam about 125 feet thick was overlain by 20 to 30 feet of soft overburden without basalt.[353] It was a more favourable site for open cut mining of the coal deposit than the Number One site.

By 1950, the Number Two mine had reached an output of over 4,000 tons per week,[354] with uncrushed coal being delivered 1.5 miles over a dedicated haul road to the Maddingley Mine rail siding, where the crushing, screening and outloading plant was in place as originally commissioned for the Number One mine.

In early 1952 an upgraded crushing, screening and loading plant was installed at the siding with outloading to either of two rail tracks. A receiving bin, crushing and grinding plant was installed allowing for tipping of ten tonne capacity trucks and delivery to rail or road trucks in either lump form above three inches (cobbles) or as fines below three inches. See Drawing 8.5/1 and Photo 8.5/1.

At the end of 1952, the operation from the two mines had produced over one million tons of coal at an output reaching 7,000 tons per week.[355] At 1953, Maddingley Brown Coal Pty Ltd was anticipating that it could win a market for some 4,000 tons of coal per week to the new SECV Power Station at Ballarat.[356] (These hopes were not realised. Maddingley coal, after an initial contract for 1,000 tons per week, was used at Ballarat P.S. only at times of SECV briquette availability shortages. Subsequently in July 1955, the Ballarat P. S.

Photo 8.5/2 View of Maddingley Open Cut Number Two and outloading plant. Copyright Bacchus Marsh & District Historical Society Inc.



Drawing 8.5/1 Flow Diagram of coal handling and crushing plant, Maddingley Open Cut Number One (from *Mining and Geological Journal*, September 1852, p.10).

changed from coal/briquettes to oil, having used 114,000 tons of Maddingley coal over a two year period.)

From 1951 to 1955, the nomenclature Number Three Open Cut was used in reports referring to future expansion. At 1955, this name was no longer used, the future development being considered as an extension of the Number Two Open Cut. Maximum yearly production from the Number Two Open Cut occurred in 1954 at 504,767 tons.[357] Output stayed above 400,000 tons through to 1967 but then fell away as natural gas made inroads to brown coal usage. By 1972 output was below 200,000 tonnes and at 1979 about 100,000 tonnes.

From the early '70s , the mine was operated by APM Minerals Pty Ltd. Mining plant in use included 30 tonne twin power scrapers on upper overburden removal, 2.5 cubic metre electric and diesel powered shovels and a fleet of 24 road trucks each of 12 tonne capacity on overburden removal and coal transport. The coal seam averaged 100 feet thick. A series of six working benches arranged in steps about 16 feet high were used to remove all coal from top to bottom of the seam. This height of bench was the optimum for the excavators to load direct to the road trucks.[358]

In the 1969 year, Maddingley Number Two output was steady at 313,319 tons for the year.[359] For the 1954 year, output from Maddingley Number Two was 504,467 tons. This was the peak year. Output stayed above 400,000 tons through to 1967. However, by 1971, demand had fallen considerably as the availability of natural gas made inroads into brown coal and briquette usage. In 1973, APM Minerals Pty Ltd took over the operations with output at 194,715 tonnes in that year and falling further by 1975 to 147,154 tonnes and at 1979 to about 100,000 tonnes.[360]

In 1989, ownership of the Maddingley Open Cut operation was taken over by Melbourne Quarries. At 1992, the operation was taken over by Calleja Nominees which have continued

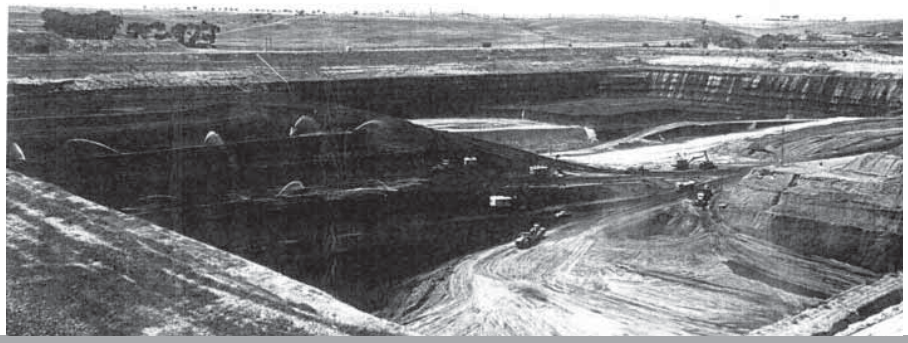


Photo 8.5/3 View of Maddingley Open Cut Number Two (from *Bacchus Marsh: a Pictorial Chronicle*). Copyright Bacchus Marsh & District Historical Society Inc.

Photo 8.5/4 General View of Maddingley Open Cut Number Two (from *Mining and Geological Journal*, March 1954, p.5).

producing small coal quantities for the local CSR hardwood factory, for a local soil conditioning production firm, and minute quantities for product colouring in brick manufacture.[361] The Calleja Group have financial interests in development at Loy Yang of a coal drying and power generation plant with the mooted objective of a power plant operating on Maddingley Coal. At 2005, a significant operation is continuing by Calleja Nominees utilising the worked out area of the Maddingley Open Cut Number Two as a waste disposal area for industry and the community.

At 2004, there was a brief activity to mine and deliver a small tonnage of less than 100 tonnes for coal conversion trials by a private consortium. Ample coal reserves were available for a continuation or expansion of these trials.

Maddingley Open Cut Number Two was a successful operation, mainly supplying coal by rail direct to the APM at Fairfield in the Melbourne metropolitan area. Excavation at the mine continues as a minor operation to the present time, 2005, although, from late 1993, a local firm, CSR Wood Panels, were the only significant customer, demand falling away as customers in general converted to natural gas.

The *Bacchus Marsh Heritage Guide*, 2003, produced by the Bacchus Marsh & District Historical Society Inc, states that the Maddingley Coal Mine is classified to be of Local Significance (GSA Heritage, Rosengren 1986, Mitchell 2000.)

Assessment of Heritage Significance

Historical Significance

The Maddingley Open Cut Number Two which commenced operation in 1948 as a transition from the Number One Open Cut was the largest and longest surviving brown coal mine in the Bacchus Marsh district. It eventually absorbed three other adjacent and smaller open cuts, utilising these for overburden disposal sites.

Supply of coal from this mine was vital to several industrial plants west of Melbourne and for about two years to the Ballarat Power Station, but particularly to the Paper Mills at Fairfield and Broadford. Ownership of the mine by the Australian Paper Mills and successors facilitated supply to the Fairfield Mill for a forty year period until natural gas supplanted brown coal as their process energy source.

A large brown coal resource still remains unmined in the Bacchus Marsh region although mostly covered by basalt and/or limestone and with overburden depth exceeding 100 feet.

Scientific Significance

As the Maddingley Open Cut Number Two was owned by its major customer, there was no specific endeavour to undertake scientific research other than to optimise quality control of its deliveries. In general there was some use of briquettes at the APM mills, from the SECV Briquette works in the Latrobe Valley, to blend with the Maddingley coal for enhanced furnace purpose, the extent of blending with this more costly fuel being determined by continuing scientific testing of the coal quality.

Economic Significance

The success of APM over a 40 year period in utilising this coal rather than other fuels demonstrated that this high moisture coal was suitable for industrial use as a fuel without a high scientific input. This had also been demonstrated by the small industrial complexes using brown coal deliveries from the Yallourn North and the Wensley Dale/Anglesea Open Cuts.

The other open cuts on the Bacchus Marsh Coal Fields were marginally successful in selling all the coal accessible within their boundaries in the era before pricing (and convenience) with long term surety of supply of natural gas offered advantages over brown coal supply costs.

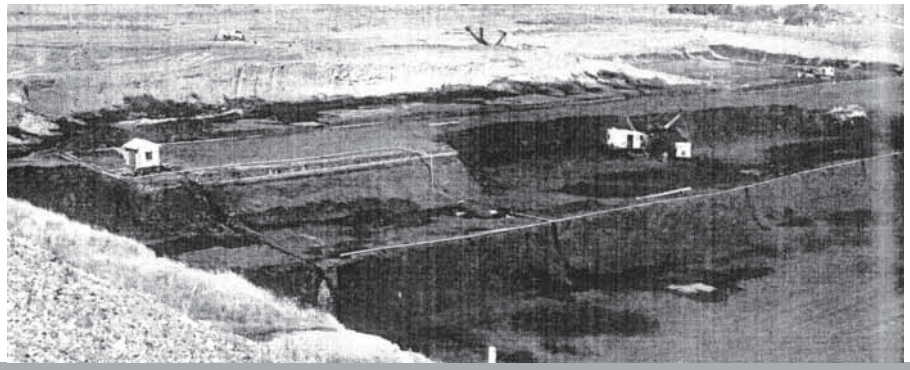


Photo 8.5/5 Operational Faces at Maddingley Open Cut Number Two (from *Mining and Geological Journal*, March 1954, p.4).

Photo 8.5/6 Shovel and truck at Maddingley Open Cut Number Two (from *Mining and Geological Journa*l, March 1954, p.9).

The technical success of this open cut demonstrated that the brown coal deposits of Victoria remain as a major industrial resource, with high potential economic significance where development becomes cost competitive.

Social Significance

This open cut and its coal delivery process presented diversification of and additions to employment in the Bacchus Marsh area for nearly 50 years. The location of the mine was sufficiently remote from the township such that the mining, haulage and rail outloading operations had no adverse effect on the township area.

The continuing use of the open cut as a managed waste recycling and disposal location is of continuing social benefit to the regional area.

Mine Infrastructure Features

The coal outloading station at the Bacchus Marsh rail siding is still in existence.

The rehabilitated overburden dumps in the adjacent worked out open cuts remain as unobtrusive relics of the mine operations.

The panoramas over the existing waste disposal operations are of potential tourist and heritage interest.

Mobile Plant currently involved in the waste disposal and restoration works are representative of that used for many years in the mining operation.

References

Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948

Mining and Geological Journal, March 1948, September 1948, March 1949 and March 1950

Moffat, G 'New Coal Handling Plant at the Maddingley Open Cut, Bacchus Marsh', *Mining and Geological Journal*, September 1952

Moffat, G 'The Maddingley Brown Coal Open Cut, Bacchus Marsh', *Mining and Geological Journal*, March 1954, pp.5–6.

Thomas, DE and Baragwanath, W Geology of the *Brown Coals Of Victoria*, Parts 1–4, 1949–1951

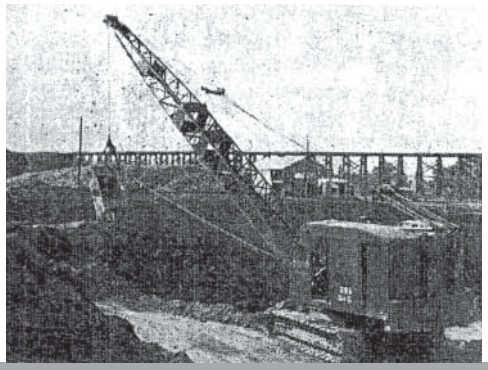


Photo 8.6/1 Dragline in operation on overburden removal at Star Colliery Number One (from *Mining and Geological Journal*, Vol. 3 No.2, 1947, p.15).

8.6 The Star Collieries Bacchus Marsh

Map Reference: **7722-1-2 Lerderderg**

Number 1 Colliery 2750, 58245

Number 2 Colliery 2747, 58229

Municipality: **Shire of Moorabool**

Land Use/Status: **Private**

Site History

These two collieries were among a group of mines which commenced operation in the 1940s in areas one to two miles to the south east of Bacchus Marsh Railway Station. Extensive drilling of about 30 bores had been carried out by the Mines Department in the early to mid 1940s which delineated a brown coal seam at depths of from 26 feet to 129 feet with overburden free of hard limestone and/or basalt. Coal seam thickness varied from about 30 feet to 98 feet. One bore revealed 98 feet of coal under 33 feet of overburden.

An open cut operation known as the Star Colliery Number One commenced site activities in mid 1946 at a location about 1.5 miles southeast of the Bacchus Marsh Railway Station and immediately south of the VR line to Melbourne. At this location about 100 feet of coal was covered by about 30 to 35 feet of soft overburden.[362] At March 1947, the mine was excavating coal from a bed 67 feet below surface with overburden of 33 feet.[363]

For 1947, average production was approximately 1,000 tons weekly with a peak production of 1,960 tons for one week during May 1947.[364] Coal output for the 1947 year was 48,895 tons.[365] At September 1948, production had averaged 1,450 tons weekly over the last three months.[366] However the mine site was hemmed in by two other mines, and by the Parwan Creek and the Bacchus Marsh to Geelong Road. It had little room for expansion. Coal was excavated by mechanical shovels, loaded into road trucks and crushed, screened and stored in bins for delivery to customers. Proposals to haul the in-pit coal by conveyors to out-loading bins did not eventuate due to the short life ahead. Overburden was removed predominantly by dragline loading road trucks.

In 1949, overburden removal at a new open cut known as the Star Colliery Number Two commenced at a location one mile south of the Number One Colliery and on the southern side of the Parwan creek which separated the Number Two Colliery from the operational area of Maddingley Number Two Open Cut. See Drawing 8.4/1. The Star Colliery Number Two operated with a similar advantageous coal to overburden ratio as the Maddingley Number Two mine, both mining operations having been relocated southwards from their original mine. Coal production from Star Colliery Number Two commenced circa May 1950, with the Number One Colliery still producing at an average of 1,230 tons weekly (1,487 tons weekly during a coal strike in NSW).[367]

At June 1950 the combined output from the two collieries averaged about 1500 tons per week and production to that date was stated as 209,243 tons.[368] By September 1951, the Star Collieries Number One closed and appropriate plant was transferred to the Number 2 Colliery.[369]

In July 1952, the Star Colliery sold their Number One worked out open cut to Maddingley Brown Coal Pty Ltd, who then gradually, from about 1957, filled this space fully to natural surface level with overburden from Maddingley Open Cut. At 2005, the existence of the earlier Star Collieries Number One Open Cut can not be readily distinguished due to the restoration of natural flora in conformity with natural flat lands of the Parwan Creek.

For the 1954 year, production was 83,244 tons and was continuing at about that level. In early 1957, a fire destroyed crushing plant and mine power station and buildings but output was resumed.

In August 1960, the Bacchus Marsh Briquetting Company Ltd took over Star Collieries with the intent to briquette crushed coal before sale. This concept evidently did not progress.

At the 1969 year, coal output had fallen somewhat to 60,071 tons with reduced demand, with a dramatic fall to 18,480 tons in the 1970 year. From 1973 when output was 1,433 tonnes, mining continued at a very low output of about 1,000 tonness annually to 1978.[370] The Star Collieries Number Two Open Cut evidently ceased in 1979 from whence no output is shown in the Mines Department Annual reports.

A record of the total coal output fro Star Collieries Number One and Number Two has not been discovered in this study

but was probably of the order of 1.5 million tonnes from 1946 to 1976.

At 2005, the former Star Collieries Number Two Open Cut remains filled with water on the south side of the Parwan Creek and south of the Maddingley Number Two Open Cut.

Assessment of Heritage Significance

Historical Significance

The Star Collieries Number One commenced as an open cut operation in 1946 at about the same time as Maddingley Number One mine changed over from underground to open cut operation. It was a pioneer in post war management of small open cut mining activities.

This venture initiated their operation quickly after World War Two terminated. It was restricted somewhat in the availability of excavating and haulage plant. However the mine site was restricted and within three years, the venture commenced a second site about one mile to the south with greater coal reserves.

The mining operation was representative of optimum plant selection for small open cut operations at the time and achieved its move to the second site with continued use of the on-site equipment.

Scientific Significance

No specific achievements or endeavours were involved with the Star Collieries Number One and Number Two mines. A concept to manufacture briquettes was not proceeded with.

Economic Significance

The mining operation at the Star Collieries sites continued for a 30 year period providing employment at the mine sites as well as at service suppliers. With the Maddingley Number Two Open Cut progressively directing most of its output to the APM mills, the Star Collieries customer base was mainly the small industrial plants still raising steam as their power input.

Star Colliery Number Two had high economic significance in the late 1940s and in the 1950s when all other fuel sources were in short supply and before the advent of natural gas supplies.

Social Significance

The Star Collieries in combination with the other Bacchus Marsh open cut mines established a supplementary employment mode consolidating a multi-skilled workforce in the Bacchus Marsh region.

The surge in coal output in the 1940s was a significant social benefit to the Bacchus Marsh community offering employment in the era of industrial restoration after World War Two. The slow decline in coal output from the Star Colliery Number Two from the late 1960s allowed a progressive rather than instant downsizing of the workforce without major adverse social effects.

Mine Infrastructure Features

The Number One Colliery Open Cut was filled with overburden from Maddingley Number Two operations. The site has been restored to local grazing use. No mining plant remains at site. All workable plant had been reused at the Star Number Two Colliery or sold for scrap.

The Number Two Colliery Open Cut remains identifiable in its present state as partly water-filled up to the level of the adjacent Parwan Creek. No mining plant remains at site. Reusable plant had been sold progressively to the local quarrying companies or to earth moving contractors. A feature of the plant selection for this Colliery was the reusability of the excavation and haulage plant.

References

Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948

Mining and Geological Journal, March 1947, March 1948, September 1948, September 1949, March 1950 and September 1951

Thomas, DE 'Brown Coal at Bacchus Marsh', *Mining and Geological Journal*, Vol. 3 No.2, September 1947

Thomas, DE and Baragwanath, W 'Geology of the *Brown Coals Of Victoria*', Part 3, *Mining and Geological Journal*, September 1950

Photo 8.7/1 Lucifer Open Cut (Copy received from Bacchus Marsh & District Historical Society Inc, extracted from 'Industry File'). Copyright Bacchus Marsh & District Historical Society Inc.

8.7 The Lucifer Colliery, Bacchus Marsh

Map Reference: **7722-1-2 Lerderderg 2750, 58243**

Municipality: **Shire of Moorabool**

Land Use/Status:

Site History

The Lucifer Colliery was located about 200 yards south of the Star Number One Colliery and about one mile south east of the Bacchus Marsh Railway Station. See Drawing 8.3/1. At the mine site about 30 to 35 feet of soft overburden covered about 100 feet of brown coal in a single seam. The mine was opened by the Lignite Company NL in mid 1946[371] at about the same time as the adjoining Star Colliery Number One mine.

By mid 1947, coal output was averaging 850 tons per week with a peak of 1,143 tons achieved in one week in August 1947. In the 1947 year, annual production was 36,300 tons.[372] The coal excavation bench was at 62 feet below surface with overburden of 30 feet.[373] Coal was excavated by mechanical shovel, loaded into road trucks then crushed, screened, and stored in bins at ground surface. Coal analysis showed a moisture content of about 57.5 per cent and ash content of about 5.85 per cent.[374] This quality was similar to the other mines south and east of Bacchus Marsh. It was readily acceptable for steam raising in those plants converted to usage of brown coal in the continuing post war shortages of other fuels.

From March 1948 to March 1950, coal output varied from about 580 tons to 1,000 tons weekly.[375]

By June 1950 output was averaging about 1,000 tons of coal per week with total production to that date stated as 135,583 tons.[376]

By June 1950, the Lucifer Colliery (Lignite NL) was considering sale to the Maddingley Brown Coal Pty Ltd. As collated in Sections 8.4 and 5, this latter company was at that tine operating Maddingley Number Two Open Cut and was in the process of phasing out the operation of Maddingley Number One Open Cut. By March 1951, Maddingley Brown Coal Pty Ltd took over the Lucifer Colliery from the Lignite NL Company[377] Coal output in the 1951 year was 55,459 tons.[378] However on 14 June 1952 the mining operation ceased,[379] there being no feasibility to obtain more coal within the confined boundary of the mine. Maddingley Brown Coal then used the former Lucifer Open Cut to take about two thirds of Maddingley Number Two Open Cut overburden disposal over the next several years.

Total brown coal output from the lifetime of the Lucifer Open Cut was approximately 230,000 tons.

At 2005, the former Lucifer Colliery has been re-blended into the natural landscape of the area.

Assessment of Heritage Significance

Historical Significance

The Lucifer Colliery had a short but active and commercially successful operational life of about six years during most of which it averaged at or above 1,000 tons of coal per week from 1947. During the early post-World War Two years of industrial regrowth, this mine significantly contributed to the supply of hard fuel in Victoria, while larger mines took longer to respond to demand.

This mine was completely worked out in six years within the small area of its operation hemmed in by adjoining mines and roads, railway and the Parwan Creek. This mine shared a short term fate with other adjacent small mines each of which left unmined coal, (in their batter systems and access roads), which could have been mined effectively in a single larger open cut mine.

The inefficiency of establishing a number of small mines on the same coal seam within a discrete confined area reduced the potential economies of scale for mining of the total resource. The concept of a single mine for effective development of a confined deposit was successful at the contemporary mines at Wensleydale, at Anglesea, at Yallourn North and at the State Coal Mine at Wonthaggi.

Scientific Significance

No specific scientific investigations were undertaken with respect to the coal mined at the Lucifer Colliery. The mine was activated quickly with a knowledge of the coal characteristics from earlier drilling and associated coal analysis of the coal resource. The mining concept appears to have been to deliver run-of-mine coal, the average quality of which was known by its customers.

Photo 8.7/2 At Lucifer Open Cut 1946 – Initial Coal excavator (extracted from *Bacchus Marsh: A Pictorial Chronicle*). Copyright Bacchus Marsh & District Historical Society Inc.

Economic Significance

This mine was a small but timely contributor to the fuel needs of Victoria in the late 1940s and early 1950s. The availability of coal delivered from this mine slotted in well with the output growth of the adjacent major Maddingley Number Two Open Cut.

Social Significance

The inception of this mine coincided with the establishment of adjacent mines, each of which adopted similar mining and haulage plant for their separate operations. This similarity in development concepts resulted in a pool of mining and maintenance personnel available for transfer as the smaller mines phased out of operation with the growth of the Maddingley Number Two mine.

Effective restoration of the Lucifer site was undertaken by the Maddingley Mine after it took over the worked-out Lucifer Colliery site, and used the former open cut for overburden disposal from the Maddingley operations.

Mine Infrastructure Features

The Lucifer Colliery mine site has been restored to its former grazing use.

No mining plant remains on the former mine site.

References

Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948

'Brown Coal at Bacchus Marsh', *Mining and Geological Journal*, Vol. 3 No.2, 1947, pp.14–16

Annual Report, Mines Department, 1951

Mining and Geological Journal, March 1947, September 1947, March 1948, September 1948, March 1949, March 1950, September 1950, March 1951, March 1952 and September 1952

Thomas, DE and Baragwanath, W 'Geology of the Brown Coals Of Victoria', Part 3, *Mining and Geological Journal*, September 1950

8.8 The Boxlea Colliery, Bacchus Marsh

Map Reference: **7722-1-2 Lerderderg 2751, 58243**

Municipality: **Shire of Moorabool**

Land Use/Status:

Site History

The Boxlea Colliery had commenced an underground mining operation circa 1945 via an adit driven southward from a location about 0.9 miles east of Bacchus Marsh Railway Station.[380] (See Drawing 8.3/1.)

In 1947,[381] the operating company, Fuel and Chemical Industries Ltd., abandoned the underground activity and commenced overburden removal for an open cut operation on a narrow strip of land immediately opposite the Star Number One and Lucifer Collieries[382] at about 1.2 miles south east of Bacchus Marsh Railway Station. The success of open cut operations by other companies mining the Bacchus Marsh coal deposit, the improved availability and capacity of mobile excavating and road haulage plant, and the avoidance of inherent fire danger from pyritic sands in the underground operation, were all factors favouring the concept of open cut operation at the Boxlea Colliery. Overburden removal was by carryall scrapers with dumping at the east beyond the crest of a steep hill.

In July 1949, coal excavation from the open cut commenced[383] under the same mining and coal seam characteristics as being mined at the two adjacent mines, the Star Colliery Number One and the Lucifer Colliery. Output was below 50 tons per week. For the first half year of 1950, output totalled 463 tons.

By September 1950, the operation was taken over by the Sunshine Fuel and Brown Coal Company which continued to work the constricted area immediately south of the junction of the Geelong Road and Cummings Road. Mines Department records state that loading bins and a small crushing plant were installed by March 1952 but that no coal mining was continuing at September 1952.[384] No further reference to this small mining operation has been found.

Mines Department statistics of output quantities for the underground and/or the open cut operations at the Boxlea

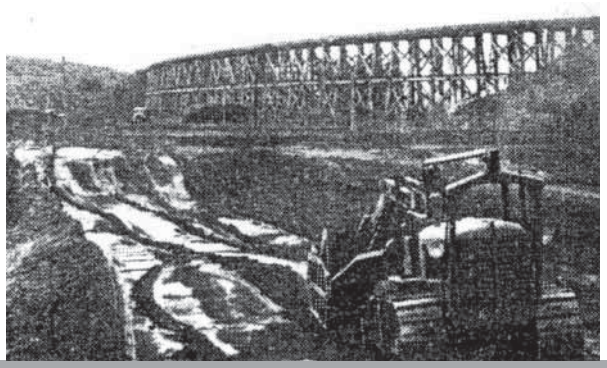


Photo 8.8/1 Boxlea Open Cut – overburden Stripping (from *Mining and Geological Journal*, September 1947, p.16).

mine have not been ascertained in this heritage study. One colloquial report states output at 1948 was 30 tons per day for use in chemical byproducts, briquettes and producer gas fuel. But these features may have been concepts rather than reality. It appears that the full depth of the coal deposit was not reached within the confined area of the Boxlea Open Cut and that the total coal output was probably of the order of 20,000 to 40,000 tons.

At 2005, the former Boxlea Open cut site remains as a water-filled hole with minimal rehabilitation having been carried out.

Assessment of Heritage Significance

Historical Significance

The initiation of the Boxlea Colliery as an adit into the coal seam followed by about one year similar action by the Maddingley Number One mine. As with the Maddingley mine, the underground venture was replaced by an open cut in 1949 as soon as mobile excavating and haulage plant became more readily available after World War Two. The Boxlea underground mine was the last of the brown coal mines in Victoria to initiate a commercial underground mine.

The open cut operations of the Boxlea mine were not a commercial success. The small site available to the mine involved a higher proportion of overburden removal to coal mined, resulting in higher costs per ton of coal extracted than was available from the Maddingley Number Two mine and the other Bacchus Mines. The commercial failure of this low output mine also illustrated the relative economies of scale in a larger mining operation.

Scientific Significance

No specific scientific endeavour was applied to the Boxlea mining operation.

Economic Significance

The Boxlea mining operation was the smallest of the mines in the Bacchus Marsh area. The commercial failure of the mine illustrated the cost disadvantages arising from a small and restricted mining site.

Social Significance

The demise of the underground operations resulted in the termination of employment opportunities as underground miners in the Bacchus Marsh area. The adverse impact of this was however offset by the adaptability of the mine workforce to the skills required in open cut activities.

Mine Infrastructure Features

The open cut site of the Boxlea Colliery remains as a water-filled hole.

No mining plant remains on site.

The location of the adit entrance has not been identified in this Coal Heritage Study.

References

Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948

'Brown Coal at Bacchus Marsh', *Mining and Geological Journal*, Vol. 3 No.2, 1947, pp.14–16

Mining and Geological Journal, September 1947, March 1948 and September 1949

Thomas, DE 'Brown Coal Deposits at Bacchus Marsh', *Mining and Geological Journal*, Vol. 3 No. 2, September 1947, pp.14–16

Thomas, DE and Baragwanath, W'Geology of the Brown Coals Of Victoria', Part 3, *Mining and Geological Journal*, September 1950

9 Latrobe Valley—Brown Coal Mines

9.1 The Great Morwell Brown Coal Mine

Map Reference: **5121-1-3 Yallourn – Zone 55 – GMBCM Entrance – 4440, 57750**

Davis' Cut 4413, 57748

Municipality: **City of Latrobe**

Land Use/Status: **Public since circa 1916**

Site History

In 1873, the Mines Department recorded the discovery of lignite, by David Ryan a gold prospector, on the south side of the Latrobe River at a location about seven miles northwest of Morwell township.[385] Some years later a small amount of coal was extracted by a miner named Davis at this location.[386] This was probably the small and brief mining operation referred to in Mines Department records as being at the edge of the Haunted Hills and east of Moe. This coal was evidently utilised locally as no economical transport was available to send this coal outside the locality.

In 1879, *The Gippsland Times* printed a letter from H Godridge which stated that he had found lignite in the north bank of the Latrobe River at a location 'near the foot of the Morwell River. This location was about 1.7 miles east of David Ryan's find. In his letter, Godridge sought financial investment from private enterprise to develop this deposit at which he had already inserted a tunnel proving a thick lignite deposit.

It was not until some seven years later that Henry Playford, a stockbroker, joined with Godridge to apply for a mining lease on the north side of the Latrobe River including the site of Godridge's initial find. Lease 773 Mining District of Gippsland, County of Tanjil, over about 537 acres of crown land was granted to this syndicate on 8 August 1887.

Mining of this deposit with H Godridge as manager commenced in late 1887 at the initial site discovered by Godridge. In September 1888, it was reported that prospecting in the lease area had found the coal deposit to be up to 60 feet thick with overburden in places only 15 feet deep.[387] On 6 October 1888, a report on a visit to the mine site was printed in The *Morwell Advertiser and Weekly Chronicle* describing the mining operation via tunnels up to 100 feet long into the coal face on two levels. Three shafts had been sunk into the coal from surface level but were prevented from excavation below the river level due to ingress of water and lack of pumping. This report designated the deposit as brown coal rather than lignite on the basis of a low content of woody material. The report stated that the coal was 'especially good for glass works, iron foundries or any industry requiring great heat and was excellent for gas producing. It has been tried by the Victorian Railways and has given every satisfaction'. The report advocated that a rail line approximately three and a half miles long 'could be connected to the Main Gippsland VR Line at about three miles west of Morwell at about 85 miles from Melbourne.'[388]

On 26 October 1888, the Great Morwell Coal Mining Company (GMCMC) No Liability was registered with Henry Playford as Manager of the Company. There were no Gippsland directors or shareholders.

On 11 February 1889, Lease 773 was transferred to the GMCMC with John Lang the first mine manager for this company. H Godridge was no longer involved in this mining operation although in 1891 he transferred to the GMCMC the Mining Lease 1015 about one mile south of the Latrobe River, which later became part of Yallourn Open Cut. The quantity of brown coal mined before transfer of the lease to the GMCMC has not been ascertained but was probably several hundred tons all used locally, except for small quantities for testing. The first half-yearly report of the GMCMC predicted an annual output from the mine of 250,000 tons of coal with enough coal available for 100 years at this output rate.

In June 1889, an agreement was reached with the Government for construction and financing of a spur rail line to the Great Morwell Mine from the main Gippsland line, partly financed by a loan from the National Bank.[389] The spur rail line came into service in September 1890 connecting to a mine entrance some 150 yards downstream from the initial mining operation. The coal deposit was thicker at this new location,

Photo 9.1/1 Great Morwell Brown Coal Mine 1894: Coal Excavation and Transport.

Photo 9.1/2 Great Morwell Brown Coal Mine 1894: Briquetting Plant.

which was to remain as the mine entrance for the lifetime of the mine. By December 1889, a bridge over the Latrobe River at the mine entrance was also constructed specifically for rail track entry to the mine.

A report by Geological Surveyor, James Stirling, at December 1889 described the mining operation. At the first site a tunnel about 65 feet long had been driven into the coal just above river level. At the second site some 150 yards northeast of the first site, an open cut had been commenced with overburden 15 feet deep to the top of coal. By December 1889 about 600 tons of coal had been excavated with the floor level of the coal bench 30 feet above river level.[390] Stirling estimated that the coal deposit extended under the Latrobe River and alluvial flat land to the south. (This assumption was not disproved until about 1921 when the coal seam excavated in Yallourn Open Cut at the south of the Latrobe River was found to be of a higher moisture content and from a different seam than that mined at the Great Morwell Mine.)

Overburden removal at the new mine location was transported via horse-drawn skips on a light rail system and dumped at the west of the open cut. Coal was excavated by hand and loaded into horse drawn trucks until the spur line came into service permitting loading into VR rail trucks for transport out of the mine.

It was found that run-of-mine coal crumbled significantly during delivery, storage and burning, resulting in blockages in conventional industrial grates. Some of the combustion tests carried out on air dried coal showed combustion efficiency performance nearly equivalent to NSW black coal. Both of these factors allied with deliberations of the Royal Commission on Brown Coal 1889–1991 lead to proposals by the GMCMC to undertake briquette manufacture. The Royal Commission had concluded that 'the future of the infant brown coal industry appeared to rest on the briquetting processes. Testing in England and in Germany had demonstrated that coal from the Great Morwell Mine was highly suitable for briquetting'.[391] In December 1891, it was stated that the Victorian Government offered a bonus of £5000 for the first 100,000 tons of briquettes manufactured in the colony and/or a bonus of £1000 for the first plant to produce 1,000 tons of briquettes monthly over a six month period.[392]

A briquetting plant 'capable of manufacturing 30 tons of briquettes a day'[393] was installed at the mine in 1894 predominantly following a German design but manufactured in Victoria (Photo 9.1/2). The drying performance of the installed plant proved inadequate requiring additional expenditure for capacity augmentation. In August 1894, JW Corbett was granted a contract to operate the mine. He continued to have an interest in the mine through to about 1912. In 1894, the delivery point in Melbourne was a storage shed at Princes Bridge Station.[394]

A bushfire on 2 March 1895 destroyed the briquetting plant and adjacent buildings. A second plant was then installed by early 1896 but the plant continued to have production inefficiencies although the briquette quality was good.

Due mainly to inefficiencies and delayed production of the briquette plant, the Great Morwell Coal Mining Company ran into financial difficulties. The price available for brown coal as delivered to Melbourne was below expectations by May 1894. This was due to economic depression and a price war between NSW and Victorian black coal suppliers. Additionally, NSW black coal deliveries became more available with a reduction in industrial disputes in the shipping and coal mining industries. Refund from the Victorian Railways of construction costs of the spur line was delayed due to deliveries from the mine being below guarantee. Pressure from the National Bank was exerted for repayment of the loan now swollen by accumulated interest. Lack of income to meet mortgage repayments resulted in liquidation of the Company on 21 March 1899.

Coal deliveries from the mine by GMCMC from 1891 to 1898 totalled 26,091 tons and briquette production was 1549 tons.[395] (McKay (1950), states briquette production as about 4,000 tons). See Table 9.1/1.

In August 1899, the National Bank was given title to Lease 773. This lease subsequently passed through two companies before being declared void in March 1901. In May 2001, Lease 2176 was granted to W Tulloch over the same area as the previous Lease 773. The Lease 2176 then passed through the Goldfields of Gippsland Syndicate, then to the Victorian Minerals Development Company NL, and then to the Victorian Lignite Products Company NL. Lease 2176 was declared void on 4 September 1915.[396]

(Other Mineral leases south of the Latrobe River and north of the Gippsland Railway were also taken out by the GMCMC. One of these leases, on Lot 42, was transferred to the

Photo 9.1/3 'Old Brown Coal Mine' 1920: looking south towards mine entrance.

COAL TONNAGES PRODUCED AND IMPORTED: 1887—1898

YEAR	GREAT MORWELL COMPANY (BROWN COAL)	BLACK COAL: TOTAL IMPORTS (FROM NSW)	BLACK COAL FROM VICTORIA
1887		554 300	3 357
1888		623 594	8 573
1889		758 315	14 596
1890	1 000	696 701	14 601
1891	3 169	848 171	22 834
1892	3 933	739 703	23 363
1893	4 206	602 191	91 726
1894	3 184	542 637	171 660
1895	1 804	544 629	194 227
1896	4 531 + 134 Briquettes	502 972	226 562
1897	2 925 + 726 Briquettes	527 374	236 277
1898	2 338 + 323 Briquettes	562 329	242 860

Table 9.1/1 Great Morwell Brown Coal Mine Coal Output 1887 to 1898 (taken from Herman 1922).

Victorian Brown Coal Development Company by 1906 with the concept of mining for electricity generation on this site.)

No briquettes were produced after 1898. Only about 2,000 tons of coal was excavated from 1899 to 1915 when the mining lease was cancelled. Total coal excavation from the Great Morwell Mine from its inception until 1915 was about 43,000 tons including that used for briquetting.[397]

Mining of the Great Morwell Mine by private enterprise terminated in 1915.

In 1916, during an extensive industrial strike on the NSW coal fields, the Victorian Government instructed the Mines Department to reopen the Great Morwell mine. However the strike terminated about one week after this instruction and before mining recommenced. In June 1917, with wartime shipping shortages reducing NSW coal supplies to Victoria, the mine was again reactivated by the Mines Department on Government orders.[398]

Initial transport of coal from the mine through 1917 was by 'horse haulage to the main Gippsland line until the former spur line was reconditioned for loco haulage'. From 1918 coal excavation procedures were upgraded via hand excavation into one-ton skips on 24 inch gauge tracks manually hauled over trestles and tipped into VR trucks hauled singly by a horse to VR marshalling yards on the south side of the Latrobe River[399]. See Photos 9.1/3 and 4.

At 1920, coal output had reached about 163,000 tons in that year, supplies being to the Newport Power Station as well as to a wide variety of industrial plants. Extensive testing of the Greater Morwell brown coal had occurred from 1909 as detailed investigations were made for its use for electricity production[400]. Additionally, tests with the Great Morwell brown coal in pulverised form and in gas producers were also carried out by various groups[401]. A small 'Cornish' Boiler, consuming about seven tons per hour of raw brown coal was installed at the Great Morwell Mine in 1919 'to run electric lighting and plant' within the mine.[402]

From May 1921, the Great Morwell Mine commenced coal supply to a temporary power station located south of the mine, with the function to supply electricity to the construction activities of the SECV in building the Yallourn Power Station, Briquette Works and for operation of the new Yallourn open cut mine on the south of the Latrobe River. On 1 April 1924, operation of the Great Morwell Mine was transferred to the SECV as commercial operation of the Yallourn Power Station became imminent. This transition of management of the Greater Morwell Mine from the Mines Department to the SECV occurred without reduction of brown coal supplies to the Melbourne area. The terminology 'Old Brown Coal Mine' was used for several years until it was officially named the Yallourn North Open Cut. Aspects of the continued operation of the Yallourn North Open Cut from 1 April 1924 are collated in Section 9.3 of this study.

Photo 9.1/4 'Old Brown Coal Mine' 1920: hand excavation to horse drawn skips.

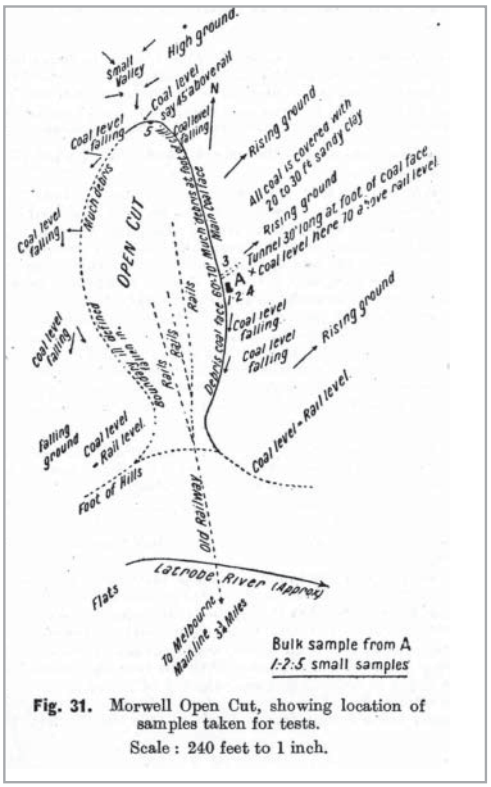


Fig. 31. Morwell Open Cut, showing location of samples taken for tests.
Scale : 240 feet to 1 inch.

Drawing. 9.1/1 Great Morwell Brown Coal Mine Extent of Open Cut 1917 (Taken from Herman (1922)).

Total coal output from 1915 until the mine operation was taken over by the SECV on 1 April 1924 was about 0.45 million tons.

Assessment of Heritage Significance

Historic Significance

The discovery of this visible thick brown coal deposit lead to a surge in coal exploration in Victoria coinciding with the extension of the Victorian Railways network rendering coal transport economically feasible to Melbourne and provincial centres throughout the State.

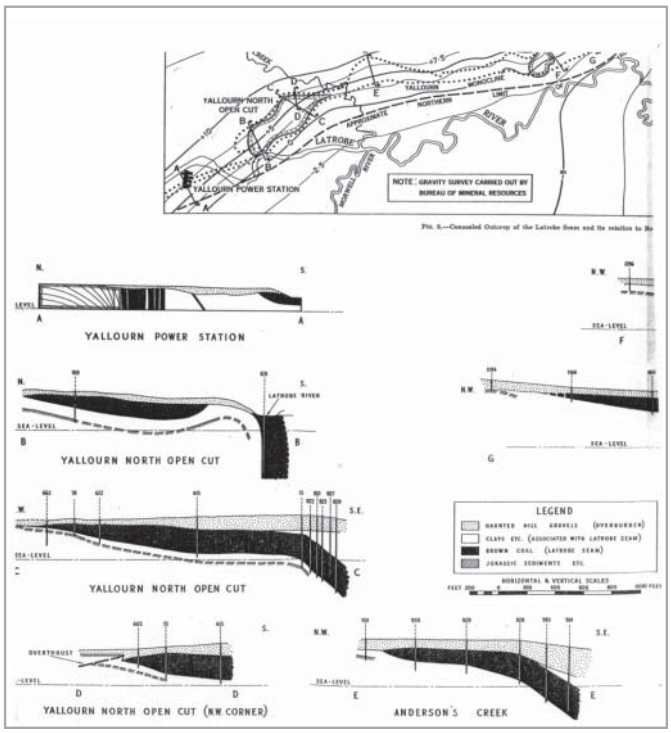
This mine was the second brown coal mine of high significance opened in Victoria. It was the first significant brown coal mine opened in the Latrobe Valley. At the time of commencement of mining operations by the Great Morwell Coal Mining Company, the vast extent of the tertiary coal deposits in the Latrobe Valley had been geologically interpreted, leading to a surge of applications for mining leases throughout Gippsland.

The appointment by the Government of the *Victorian Royal Commission on Coal* in 1889 was strongly influenced by the potential of brown coal to supplant the dependence of Victoria on black coal imports. The findings of this Commission lead to government sponsorship of research into brown coal utilisation as the major energy and fuel resource of the State.

Scientific Significance

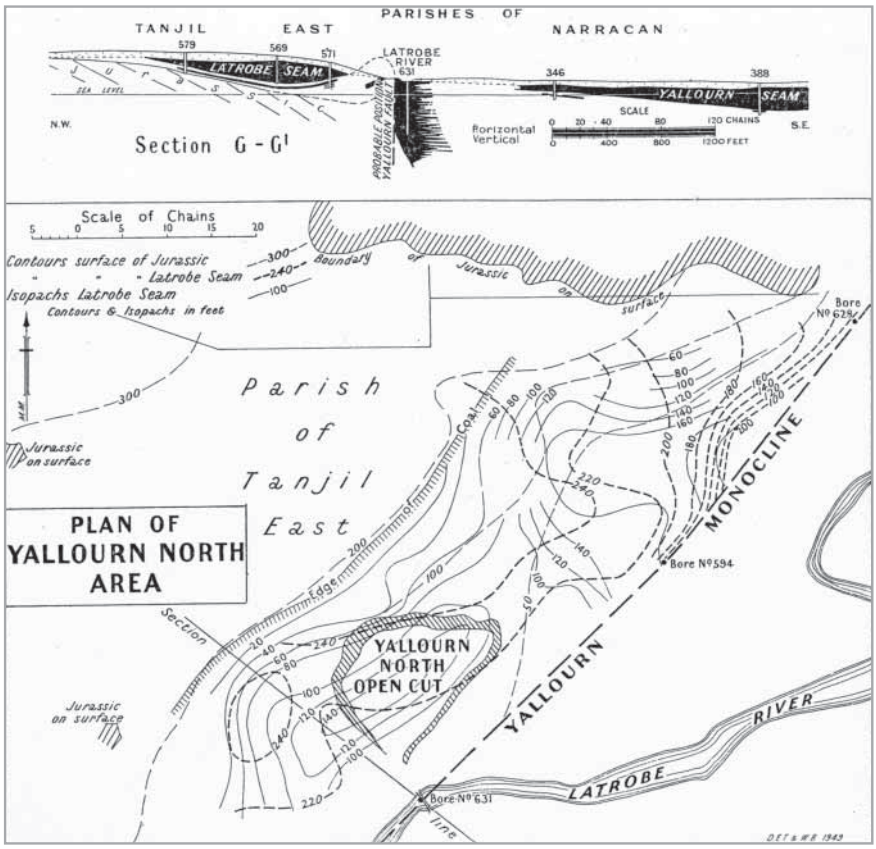
The development of techniques for effective combustion of this relatively high moisture coal was an ongoing feature of the scientific analysis of this coal compared with other coals including the German and British coals.

The high potential of the GMBCM resource was widely recognised as gas and electricity generation demand grew



Drawing. 9.1/2 Sections of Latrobe Brown Coal Seam at Yallourn North (Taken from Gloe, C(1960), part of Figs 9 and 10). Copyright State Electricity Commission of Victoria.

Photo 9.1/5 'Old Brown Coal Mine' 1921: huts and tents at north of open cut.



Drawing 9.1/3 Plan and section of Yallourn North Area circa 1949 (Taken from Thomas and Baragwanath, Part 1, Fig. 13).

rapidly from the late 1890s and the resource was open for supply. In effect, the coal was a potential feedstock for testing in a variety of conversion processes. Some of these processes and byproducts took many years of testing and research, often without commercial success at the time. Nevertheless, when the time arrived in the early 1900s for large scale utilization of brown coal in the electricity, gas and briquetting industries, the accumulated scientific knowledge was of prime benefit to the achievement of efficiency in these and associated enterprises.

No scientific innovation was applied in the mining operation of this mine. The failure of the briquetting plant to meet output objectives and consistent quality demonstrated the necessity to utilize the experience and scientific knowledge of the German brown coal industry, and to recognize that vast differences occurred in the detailed composition of and within coal seams.

Economic Significance

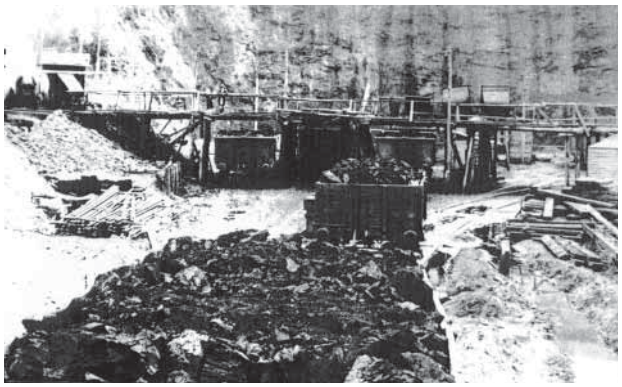
Utilization and testing of the run of mine coal from this mine showed that the brown coal resource of the State had the potential to substitute for black coal supplies.

Although this mine could be considered a commercial failure, its output as applied to testing for future applications was highly important. To a considerable extent, the commercial failure was due to the decision to negotiate the contract for supply and installation of the briquetting plant with Australian resources rather than accept expensive offers for plant

Photo 9.1/6 'Old Brown Coal Mine' 1922: Yallourn Open Cut commencement in distance.

Photo 9.1/7 'Old Brown Coal Mine' 1922: looking east to coalface.

Photo 9.1/8 'Old Brown Coal Mine' 1923: coal outloading station.



designed and commissioned from German resources of proven capability.

The mine received little Government support, particularly from lack of influence on the Railways Department to adapt their locomotive fleet to use this coal for the overall benefit of the State economy. The Government did, however, facilitate testing and scientific investigation of the brown coal from this source expected to be representative of the recently known extensive deposits throughout Gippsland. In effect this private mining operation provided at their cost the feedstock for laboratory and pilot plant investigations, which led to the Government decision to institute the State Electricity Commission to develop the brown coal resources of the State as a public enterprise.

Operation of the mine by the Mines Department from 1917 to 1924 was of significant economic benefit to the State. Shortages of other fuels were supplemented through this period. The availability of the Great Morwell Mine with its exposed coal resource adjacent to the temporary power station at Yallourn permitted that station to have a reliable fuel supply as soon as it was constructed. The supply from the Great Morwell Mine also permitted time for adequate overburden stripping and coal face exposure at Yallourn Open Cut prior to the main Yallourn Power Station coming into service in mid-1924.

Social Significance

The 35 year period of private mining of the brown coal from the Great Morwell Mine did not achieve expected coal and briquette output. Technology for effective utilization of the coal did not exist in Australia and access to overseas practical applications was restricted by distance and international relations.

Government support to private mining enterprise was low, due partly from economic depression and partly from opposition from established coal suppliers. By 1910, private mining and energy entrepreneurs were vigorously seeking subsidies or monopolies for development of coal resources in the State for power generation. In the evaluations and debate on the philosophy of private versus government control of coal mining, the ineffectiveness of the Great Morwell Coal Mining Company and its descendants to develop their lease influenced the Government of the day to adopt a State Enterprise model for 'Essential Services'. The State Coal Mine at Wonthaggi and the Newport Power Station were prime examples of the socialization of State resources.

On the Gippsland scene, the Great Morwell Mine with its rail access provided by the Victorian Railways influenced the establishment by the VR of branch rail lines to other coal bearing areas such as the Morwell River valley and the Narracan Creek valley. The Great Morwell spur line carried clay and timber as well as coal and briquettes; the other lines carried timber, general goods and passengers as well as coal.

A separate township, initially in the form of a conglomeration of tents, was established immediately adjacent to the Great Morwell Mine when the Mines Department took over operation of the mine in 1916. The population in the tent town and surrounding scrubby bush was less than 200 at 1918. The first store was built in 1917, a school established in a marquee in 1918 and a progress association formed in 1922. This small settlement later was called Yallourn North with a population at its peak of about 3000, the home of many migrants forming a significant part of the workforce for the SECV works and supporting service facilities.

Photo 9.2/1 YNOC 1923: Latrobe River in flood (from Vines, (1989), Photo 1.2/11).

Mine Infrastructure Features

Entry to the former Great Morwell Mine.

Foundation remains of small power plant at the Great Morwell Mine.

Location of Davis' Cut.

References

Australian Mining Standard, 24 November 1889, p.11

'Victorian Lignite', *Australian Mining Standard*, 8 April 1890

Herman, H, *Brown Coals Of Victoria*, Department of Mines, 1922

The Gippsland Times, 24 March 1879

McKay, RJ, *History of Development pf the Brown Coal Workings at Yallourn*, SECV, 1950, p.4

Mineral Statistics, Mines Department, 1873, p.52

Morwell Advertiser and Weekly Chronicle, 15 September 1888 and 6 October 1888

Morley, WJ, *The Great Morwell Coal Mining Company No Liability 1888–1899*, M. A. Preliminary Thesis, Monash University, 1983

Mining Lease 2176, Registry of Applications

Stirling, J 'Preliminary Report on the Brown Coal Deposit at the Great Morwell Coal Mining Company's Mine', *Quarterly Report*, Mines Department, 31 December 1889, Appendix F

Half Yearly Report, The Great Morwell Coal Mining Company NL, May 1894

Final Report, Victorian Royal Commission on Coal Mining Industry, December 1891

Vines, JA, *Train Systems: Yallourn and Morwell Open Cuts*, Generation Victoria, 1994, Notes to Table 9.7, p.247

9.2 Yallourn North Open Cut

Map Reference: **5121-1-3 Yallourn Zone 55 Mine entrance 4440, 57750**

Municipality: **City of Latrobe**

Land Use/Status: **Public**

Site History

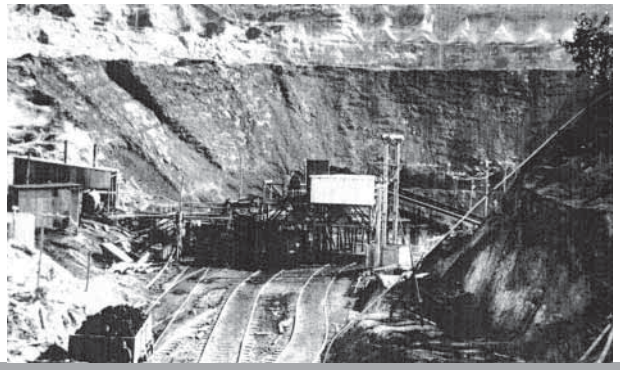
The original mine at Yallourn North situated about five miles northwest of Morwell was opened in 1887 by a private consortium. It was known as the Great Morwell Brown Coal Mine from 1888/89 and was operated consecutively by several private companies until 1915, when the mining lease was surrendered. This mine was reopened in 1916 and operated by the Mines Department until 31 March 1924, when the operation was handed over to the SECV. The mine was then known as the 'Old Brown Coal Mine' until about 1930 when it became known as Yallourn North Open Cut (YNOC).

Coal supply was continuous in the transition of the mine management from the Mines Department to the SECV. The history of the mine from 1 April 1924 is collated under the nomenclature of the YNOC.

Coal supply from the YNOC was initially to the temporary Yallourn Power Station until this plant was taken out of service on 1 September 1924.[403] The new Yallourn Power Station came into service on 15 June 1924.

For the new power station, coal excavation from the YNOC was on a three shift, seven day a week basis, also supplying other industry via the VR system and by road trucks. 'Although deliveries of Yallourn Open Cut Coal to the new Power Station commenced in August 1924, it was found necessary to burn a certain amount of Yallourn North coal in the boiler furnaces to obtain the required output.'[404] This quotation understates the problems which the SECV faced when it was found in about 1921 that the coal intended to be mined from the Yallourn Open Cut for the Yallourn Power Station was of a different seam with significantly higher moisture content than that at Yallourn North, on which design of the power and briquetting plant had been based. It was realised by the SECV that plant on order for the Power Station, the Briquetting Works and the

Photo 9.2/2 YNOC 1926 Mine Entrance (from Vines, (1989), Photo 1.2/12).



Open Cut would require supplementation and modification to reach required outputs using Yallourn Coal.[405] The seam at Yallourn North was later described as the Latrobe Seam.

Expanding and continuing coal demand from YNOC required increased overburden removal. In 1924, horse drawn scoops were used to straighten the Latrobe River and divert it over a 1,000 feet length to provide space for overburden dumping outside the YNOC. In 1925, coal excavation on the south side of the YNOC was exhausted, and coal and overburden excavation was transferred to the west side. A new bridge over the Latrobe River was constructed at the Yallourn North Open Cut entrance. This permitted the transfer from Yallourn Open Cut of a 150B excavating shovel to replace hand excavation of overburden. Transport of overburden was now by steam locomotives hauling three cubic yard trucks to a sluice dump at the south outside the YNOC (Photo 9.2/3). Overburden removal was suspended in January 1928, with sufficient coal exposed to meet decreasing coal demand as Yallourn Power Station moved towards complete reliance on coal supply from its dedicated Yallourn Open Cut. The 150B shovel and overburden rolling stock were transferred to Yallourn Open Cut in 1928.[406]

Coal supply including about 50–60 per cent to Yallourn Power Station up to 1926, was by hand excavation into one cubic yard dobbins which tipped through a crusher into 20 ton VR trucks. In 1927, the mining procedure was changed with coal excavated by hand dropping through chinaman chutes to trucks on a single floor level. Coal output exceeded 300,000 tons in each year 1927 and 1928, before declining as Yallourn Power Station moved progressively to full dependence on Yallourn Coal. Coal supply from Yallourn North to industry was also declining as briquettes from the Yallourn Briquetting Works became in greater supply to the public. On 24 August 1930, coal supply from Yallourn North to the Yallourn Power Station was suspended. On 20 September 1930, the Yallourn North Open Cut was closed down, as coal demand from industry was considered insufficient to continue the mining operation at that time.

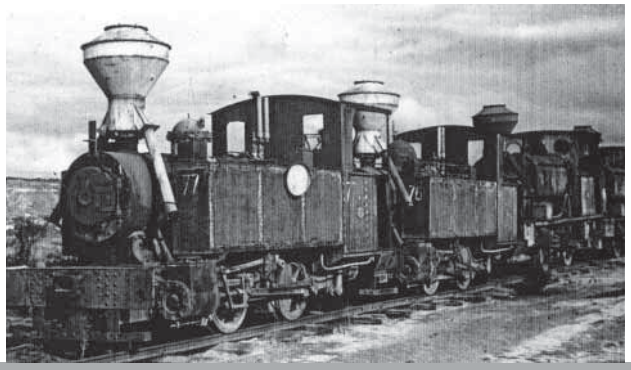
On 26 December 1934, the YNOC was reopened in an emergency to supply coal to the Yallourn Power Station and Briquetting Works following a serious flood in the YOC. Five steam locomotives and 42 three and five cubic yard trucks were used on overburden transport with a dragline and two shovels as excavators. Coal was excavated by hand into dobbins and then tipped into 20 ton SECV coal trucks and

TO 30/6	BY HAND	20B SHOVEL	No 1 MARION	100RBI SHOVEL	100RB2 SHOVEL	55RB SHOVEL	175B SHOVEL	490RR D'LINE				OTHER MACHINES	TOTAL EXCAVATION
1924	34 882												34 882
1925	170 996												170 996
1926	175 009												175 009
1927	307 601												307 601
1928	319 656												319 656
1929	41 072												41 072
1930	43 361												43 361
1931	1 092 577	TOTAL											
1932												9 494	9 494
1933													
1934													
1935													
1936												252 924	252 924
1937													
1938													
1939													
1940													
1941												1 217	1 217
1942		8 074	20 873									4 435	33 382
1943			39 130									483	39 613
1944			34 857	51 262								606	86 725
1945		10 027	36 531									505	47 063
1946		4 802	44 153									282	49 237
1947		3 224	6 918	120 483	2 575								133 198
1948		25 949		168 532	3 148								197 629
1949		38 540		96 114	333 643	170	2 431					2 431	471 873
1950	No 5	13 626		313 392	342 795	46 318		48 000	120B1	120B2	120 B3		764 131
1951	DREDGER	16 800		307 766	177 360	188 469		30	SHOVEL	SHOVEL	SHOVEL/ D'LINE		690 425
1952		22 600		472 029	429 693	78 246		3 796				849	1 007 213
1953	137 952	27 467		403 316	312 418	97 259	200 367	2 583				288	1 181 650
1954	395 821			48 044	210 956	2 408	10 300	17 701	568 827			8 038	1 262 095
1955	434 213				233 937				714 504			8 378	1 391 032
1956	659 610			456	176 762				710 258			2 860	1 549 946
1957	601 170			17 092	79 859				493 943	272 243		2 641	1 466 948
1958	483 918								664 139	113 362	12 335		1 273 754
1959	462 595								163 455	172 291	197 776		996 177
1960	495 690							1 507	190 162	132 856	135 683	42	955 940
1961	222 743								112 013	353 733			688 489
1962	220 677								102 789	160 602			484 068
1963	36 055								62 673	131 793	1 318		231 839

Coal Winning Ceased Yallourn North — 3 May 1963

Table 9.2/1 YNOC Coal Excavation Quantities 1924–1963 (from Rusden, 1968, Appendix 10, and Vines, 1989, Table 1.1/3). Copyright TRUenergy.

Photo 9.2/3 YNOC Steam Loco 1926 (from Vines, (1994), Photo 1.23/3).



Drawing. 9.2/1 YNOC Development at June 1960 (from Rusden (1968) Plan Number Six). Copyright TRUenergy.

hauled by SECV electric locos to supply Yallourn Power Station and the Briquette Factory. A large workforce was recruited rapidly for flood recovery activities in both the YNOC and YOC. Coal output from YNOC on a three shift basis reached 3,444 tons as a daily maximum. The YNOC was again closed on 31 May 1935 after supplying 252,924 tons of coal in the five month emergency.[407]

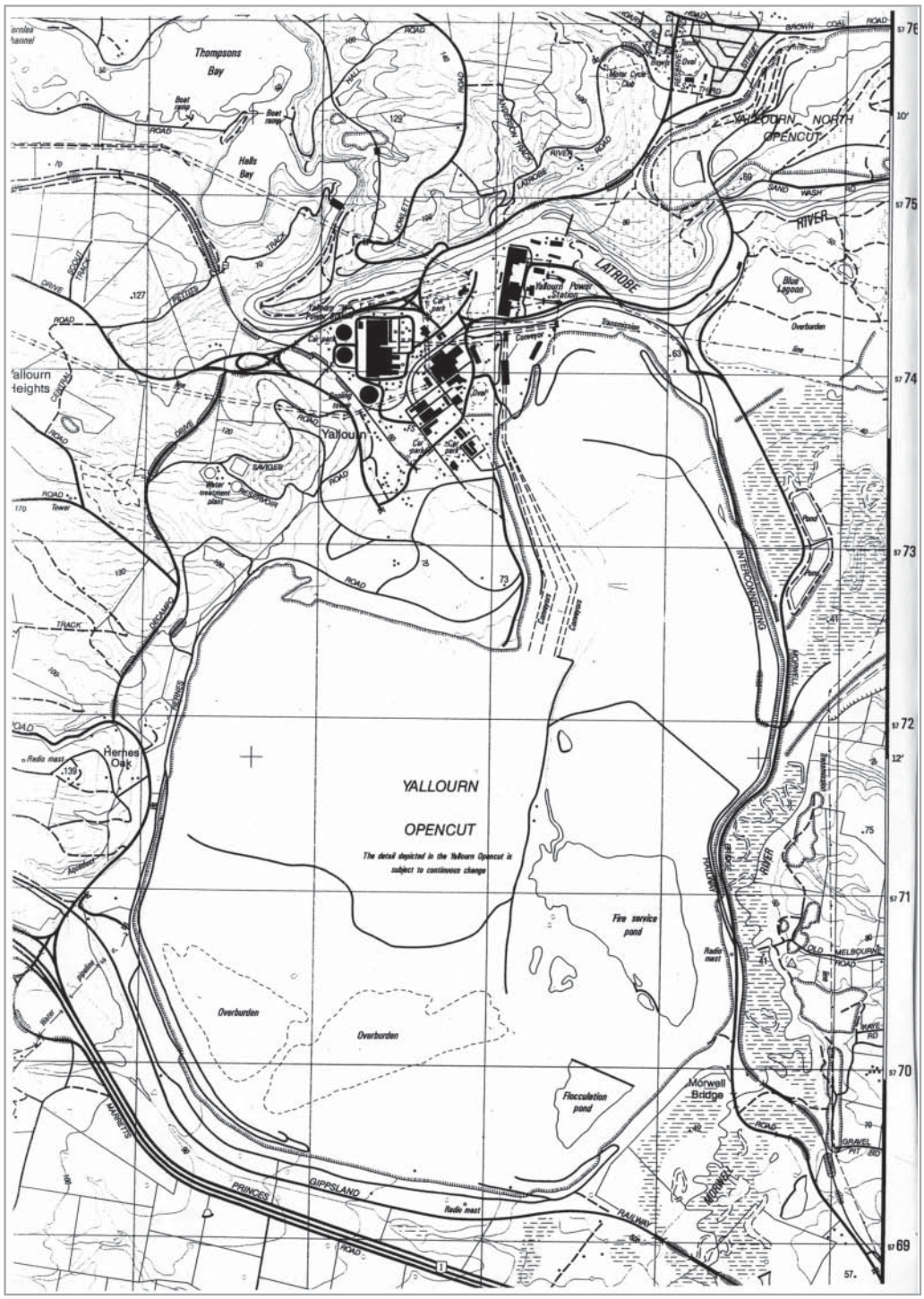
On 26 March 1941, the YNOC was reopened by the SECV under Government orders in wartime conditions to prepare the mine for an output of 2,000 tons of coal per day in case of emergency. The mining operation was completely modified to meet this contingency. Overburden operation used a three and a half cubic yard coal burning shovel, with four steam locos hauling trucks to a sludge dump. Overburden excavation was suspended from May 1942 until July 1946 as exposed coal reserves wee considered adequate.

The VR line was extended from the Yallourn Power Station into YNOC and a new crushing station and delivery station completed in September 1941. Coal deliveries were recommenced to public buyers and to Newport Power Station experiencing black coal shortages during the wartime conditions. Within YNOC, coal excavation was mainly by a three cubic yard shovel transferred from YOC loading to a fleet of 17 eight cubic yard Mack road trucks delivering through a crusher to the rail outloading station.

Due to difficulties in recruiting labour for the YNOC, the SECV arranged with the Country Roads Board to take over operation of YNOC from 6 January 1947. This arrangement continued until 4 April 1949 for coal winning and progressively to 11 November 1949 for overburden removal.

From 1946, plant used on overburden removal included steam and electric shovels and draglines, tractors, scoops

Photo 9.2/4A YNOC Coal Face 1935 (from Vines, (1989), Photo 1.2/33).



Drawing 9.2/2 Locality of YNOC (from Topographical Map 8121-1-3, Yallourn). Copyright State of Victoria, Department of Sustainability and Environment.

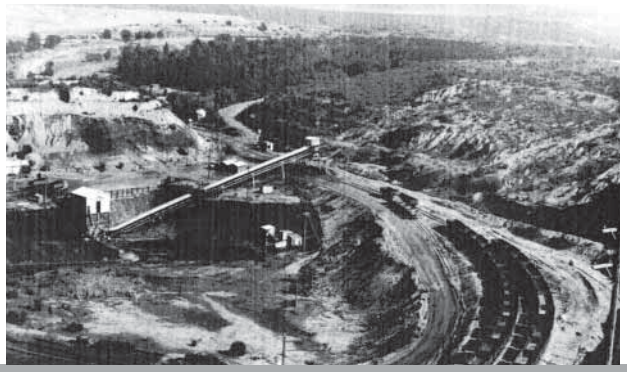
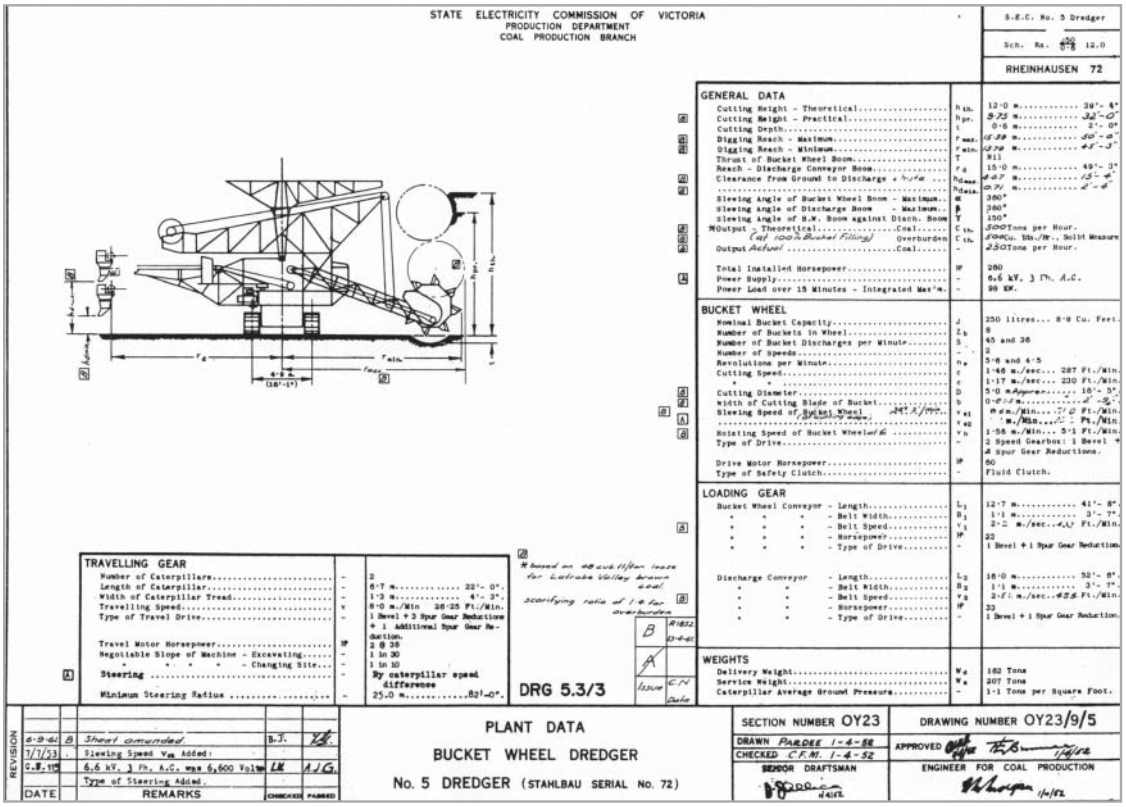


Photo 9.2/4B YNOC Coal Face 1941 (from Vines, (1994), Photo 1.31/3).

Photo 9.2/5A&B YNOC Open Cut Entrance and Overburden face 1948 (from Vines, (1989), Photos 1.2/44 and 1.2/45).

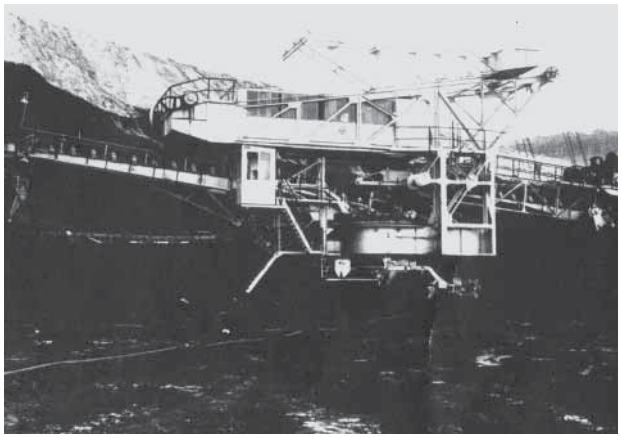


Drawing 9.2/3 Number Five Bucket Wheel Dredger Plant Data (from Vines, (1989), Drawing 5.3/3).

Photo 9.2/6 YNOC Electric Shovels excavating overburden 1948 (from Vines, (1989), Photo 1.2/49).

Photo 9.2/7 YNOC Access Bridge 1949 (from Vines, (1989), Photo 1.2/49).

Photo 9.2/8A YNOC Number Five Dredger (from Vines, (1989), Photo 5.3/2).



and tournapulls with scrapers and trailers (Photo 9.2/6). Overburden excavation was from two levels on the north face of the mine. In 1949, a second straightening of the Latrobe River was made to provide more space for overburden dumping. In August 1949, Euclid wagons were introduced for overburden haulage. In 1952, removal of overburden by contract was introduced on a new western development of the mine, taking over most of the overburden removal requirements. New annual overburden removal contracts were placed in most years through to 1960.

At 1949, coal excavation was from several levels in the mine with face heights varying from 25 to 30 feet. Use of explosives to break up coal in the face was abandoned with the cessation of hand excavation and replacement by machine excavation.

From 1951, conveyor systems were progressively installed to give greater reliability of coal transportation in wet weather and winter conditions, when road truck haulage on coal surfaces had proved unsatisfactory. Road haulage was retained for various smaller mining areas and also for transport during conveyor relocations and maintenance. Conveyors could be track-shifted to new locations on each level by a track-shifting head mounted on a tractor. A mobile crusher/loader was used with each coal excavator loading to a conveyor. A track mounted mobile truss conveyor with assembly options at 80, 160, or 240 feet in length was available to extend the reach of the excavators in special or developmental operations.[408]

In January 1953, a small electric-powered bucket wheel excavator with an output capacity of about 300 tons of coal per hour, originally intended for YOC but constructed at YNOC by the SECV, was brought into service. This machine was modified for the harder coal at YNOC and did not require use of a crusher to achieve a small enough coal lump size for loading to conveyors. At 1956, four electric shovels and a dragline each of about 300 tons per hour capacity were also available at YNOC for overburden or coal excavation.[409] Table 9.2/1 shows the annual outputs of the various excavators at YNOC from 1924 to 1963.[410]

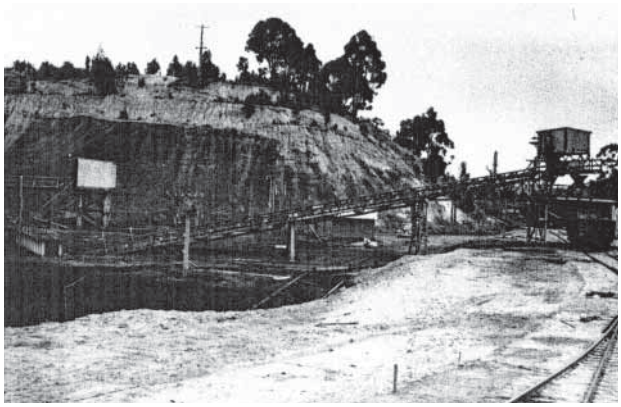
A major batter slip occurred on the north face of YNOC after a period of heavy rain on 29 June 1950. Investigation of a cracked area at surface level and precautionary measures had been underway for about three weeks before the slip. ‘An approximate estimate of the volume of earth and coal involved in the movement is 300,000 cubic yards; the overall length of the slip is about 600 feet, the horizontal movement

Photo 9.2/8B YNOC Operating Plant circa 1960 (from Rusden, (1968)). Copyright TRUenergy.

Photo 9.2/8C YNOC Coalfaces circa 1960 (from Rusden, (1968)). Copyright TRUenergy.

Photo 9.2/8D YNOC VR loading arrangements circa 1960 (from Rusden, (1968)). Copyright TRUenergy.

Photo 9.2/9 YNOC Yallourn North township at 1988 (from Vines, (1989), Photo 2/6).



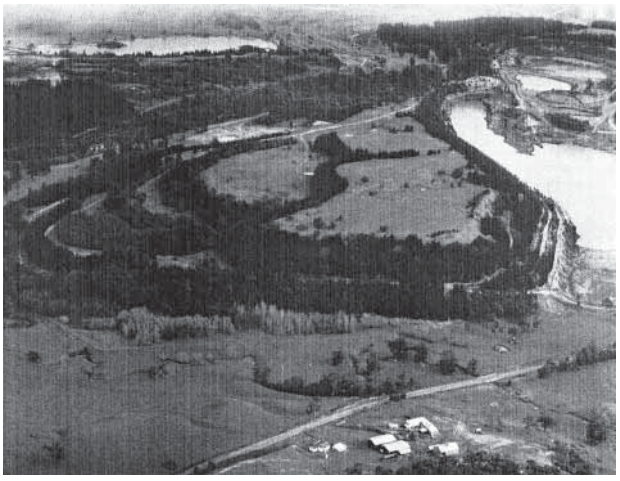
of the coal surface at about the centre of the slip was about 210 feet, and the drop in level of the top of the slipped coal was about 27 feet.'[411] This slip area was trimmed and consolidated at its toe but continued to experience minor movement over several years.

By the early 1950s, the SECV, aware of the probable exhaustion of coal reserves at YNOC by the mid 1960s, initiated investigations on the optimum means of continuation of coal supply to public buyers and in emergencies to SECV power stations and briquette factories. Although the Morwell Open Cut was also in progress by the early 1950s and could replace coal supplies from YNOC with various inefficiencies due mainly to higher moisture content of the MOC coal, the SECV gained Government approval to open a further open cut on the same seam of coal as at YNOC at a location about three miles to the east of YNOC.

'The yearly output of coal from YNOC exceeded one million tons in each of the seven years from 1951/52 to 1957/58, with the peak output of over one and a half million tons in 1955/56'. This latter year saw the commencement of coal winning from Yallourn North Extension Open Cut (YNEOC), which progressively took over the role and coal output of

Photo 9.2/10 YNOC Revegetation of Western Pond circa 1973 (from Vines, (1989), Photo 2/3).

Photo 9.2/11 YNOC Restoration of overburden dumps at September 1973 (from Vines, (1989), Photo 2/4).



YNOC until the coal reserves at YNOC were worked out. Coal winning at YNOC terminated on 3 May 1963.[412] Overburden removal at YNOC ceased on 26 August 1960.[413]

As YNXOC took over from YNOC most of the excavating, conveying and mobile plant at YNOC was transferred progressively to the YNEOC. Until 1965, some coal deliveries continued from YNEOC to the outloading station at YNOC.

For fifteen years or so after the cessation of coal excavation at YNOC, extensive rehabilitation of the worked out batter systems with terracing of some batters and revegetation with commercial pine plantations was undertaken. Pondages were maintained in the east and west of the open cut, partly to achieve fire protection and partly for aesthetic value. The central area in the open cut was used as a Yallourn Works Area hard rubbish dump. In the mid 1980s, a twin pondage arrangement was established in the central area of the YNOC to receive ash hydraulically from the Yallourn W Power Station. Each pond was operated alternatively for air drying of the ash before its excavation for disposal in the western area of the worked out open cut. This ash disposal activity was still in operation in 2005.

Assessment of Heritage Significance

Historical Significance

The YNOC was operated as a public mining enterprise from 1916 to 1963 and continued an operational activity thereafter as a public enterprise during restoration and ash disposal. It was a vital source of fuel supply to power stations and other industries when their normal coal feedstock was in short supply.

The YNOC was the initial source of fuel supply for the Yallourn Power Station when it was found that the Yallourn Open Cut coal had higher moisture content than expected, and that the power production plant under construction required extensive modification to contend with the Yallourn Seam coal. It was not until 1928, four years later than expected, that the Yallourn Power Station became independent of coal supply from YNOC. It would have been a disastrous power supply situation for Victoria if the YNOC coal had not been available as a reliable

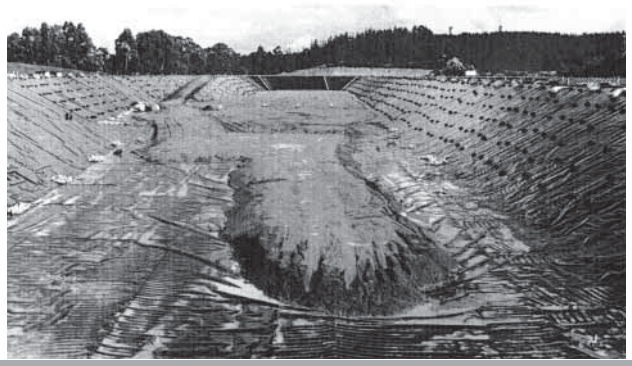
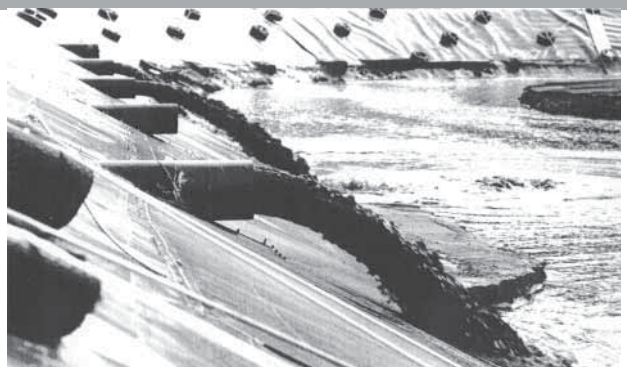


Photo 9.2/12 YNOC Ash pond lining at 1987 (from Vines, (1989), Photo 3/1).

Photo 9.2/13 YNOC Ash discharge into pondages at 1987 (from Vines, (1989, Photo 3/2).

Photo 9.2/14 YNOC 1993 Panorama (from Vines, (1994), Photo 1.31/5).



supply in sufficient quantity to meet the initial demand, and subsequently to blend with Yallourn seam coal as the Power Station modifications achieved their objectives.

Scientific Significance

A significant amount of analytic and combustion testing was carried out on the YNOC coal source prior to the approval by Government that the essential major post World War One electricity generation project would be via a State Authority, and be based on the brown coal resources of the State.

Economic Significance

From the 1920s to the 1960s, coal output from the YNOC was the source of energy supply to many small industrial plants in the metropolitan area, as well as more scattered plants including country hospitals and the Maryvale Paper Mill.

From 1941, at Government direction, mechanisation of the mining process at YNOC provided a strategic reserve of coal ready for immediate increase in output and suitable for use in power stations to replace or supplement other fuels. Through the 1950s, when its coal output exceeded one million tons annually for several years, it was a prime source of energy to the established power stations as newer stations had been delayed by financial restrictions and constraints.

Social Significance

The township immediately adjacent to the YNOC emerged from a tent town of the late 1910s. For the first 40 years or so of its existence, it was a dormitory town consisting of low cost housing with a large proportion of residents deriving their incomes as employees of the adjacent mine and subsequently of the Yallourn Works complex. The name of the township changed from 'the Brown Coal Mine', to the 'Old Brown Coal Mine' and by the 1940s to 'Yallourn North'.

Many of the early mine employees were of Maltese origin. As British English-speaking citizens, sponsorship by relatives in Australia overcame barriers to migration. From the mid-1930s, significant numbers of new employees for the Yallourn Works complex, mainly from the unemployed workforce of the 1930s Depression, were housed in an SECV camp at Yallourn North. By the early 1950s, a large number of public authority houses were erected at Yallourn North to provide housing for a large migrant intake. The advantage of this site was that employees at the Yallourn North Open Cut and the Yallourn Works area could walk to work. For many of these migrants this was their first home and first workplace in Australia. The township remains a closely knit dormitory township mainly for the employees of the mining and power generation companies in the Latrobe Valley. Former migrant employees at the YNOC formed the core of this township population, and many second and third generation employees of the mining and power industry in the Latrobe Valley trace their work and housing origins to the YNOC and its township. The success story of multiculturalism at the Yallourn North township preceded that of the Snowy Mountains townships. The Yallourn North Township originating from the workforce needs of the YNOC remains a vibrant community to this day.

Mine Infrastructure Features

Rehabilitation of the mine site.

The YNOC bridge – the fourth at this site.

The mine entry.

The remaining foundations of the YNOC power station.

The area of the major batter slip of 1950.

References

McKay, RJ, *History of the Development of the Brown Coal Open Cut Workings at Yallourn*, SECV, 1950

Rusden, GF, *History of Yallourn, Yallourn North, and Yallourn North Extension Open Cuts*, July 1947 to June 1965, SECV, 1968

Annual Report, SECV, 1925, p. 27

Three Decades: The Story of the State Electricity Commission of Victoria from its inception to December 1948, SECV, 1949, pp.44–46

Vines, JA, *A Technical History of Yallourn North and Yallourn North Extension Open Cuts 1965–1988*, SECV, 1989

9.3 Yallourn Open Cut

Map Reference: **8121-1-3 Yallourn Zone 55**

Open Cut entrance 4430, 57740

East Field entrance 4442, 57737

Municipality: **City of Latrobe**

Land Use/Status: **Private since 1996**

Site History

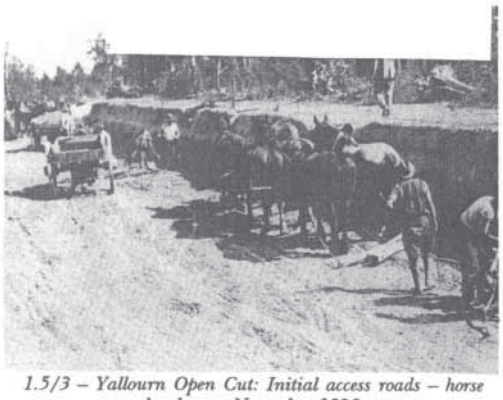
In the 1880s and early 1890s, with the discovery and development of the brown coal deposit called the Great Morwell Brown Coal Mine, mining leases were taken out by various private individuals and syndicates on about 30 square miles of the land south of the Latrobe River and east-west between Morwell to the Haunted Hills at the east of Moe. This area had been proven to contain thick brown coal deposits close to ground surface, and had been traversed by the main Gippsland Railway from 1878.

Difficulties experienced by the Great Morwell Coal Mine Company in marketing its product in Victoria, in competition against entrenched black coal supplies, suspended development of several other brown coal mining ventures by 1900.

However the potential of the extensive deposit in the wider Latrobe Valley had been recognised by Government, resulting in the establishment of a Royal Commission (1889–1891). Recommendations from this Commission prompted Government to sponsor and undertake increased testing and research into the extent, properties, and potential utilisation of this low grade coal. The Royal Commission also recommended a greater role for Government in the control and development of the resource.

In 1909, the Government established the State Coal Mine on the Powlett River black coal seams in south west Gippsland to provide an alternative or supplementary black coal supply to the Newport Power Station, operated by the Railways Commissioners.

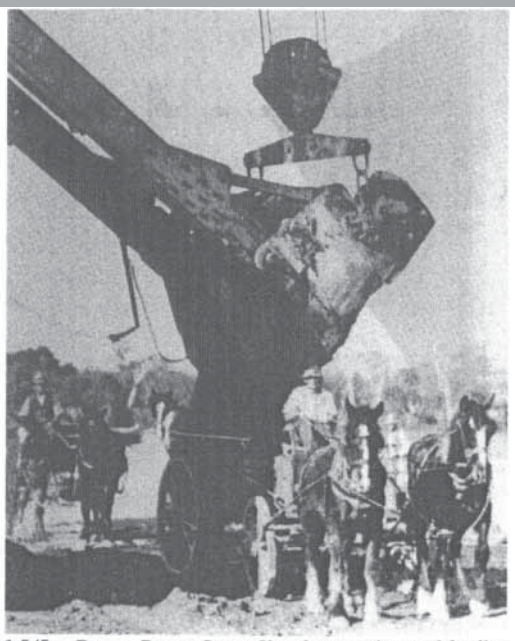
In 1912, a report by C Merz commissioned by Government recommended, among other projects, a base load power



1.5/3 – Yallourn Open Cut: Initial access roads – horse haulage – November 1920.

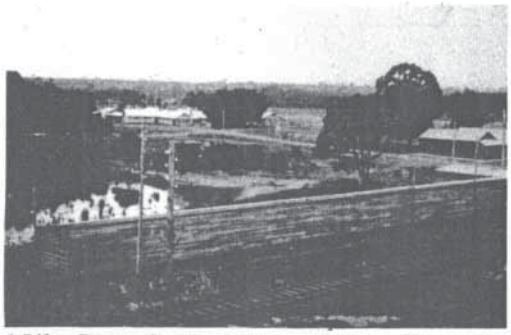
1.5/4 – Crawler mounted Ruston Proctor Steam Shovel in early overburden stripping – February 1921.

1.5/5 – Horse drawn scoops on overburden removal and transport. Ruston Proctor Steam Shovel in background – February 1921.



1.5/5 – Ruston Proctor Steam Shovel excavating and loading overburden to horse drawn drays – November 1920.

1.5/7 – Yallourn Temporary Power Station during erection – late 1920.



1.5/8 – Eastern Camp and offices at Yallourn. Horse stables in foreground – December 1921.

Photo 9.3/1 YOC early activities (from Vines, (1994), p. 5).

Photo 9.3/2 YOC First Dredger Number 208. Ladder dredger excavating overburden to rail tracks (from SECV *Three Decades*, 1949, p. 39). Copyright State Electricity Commission of Victoria.

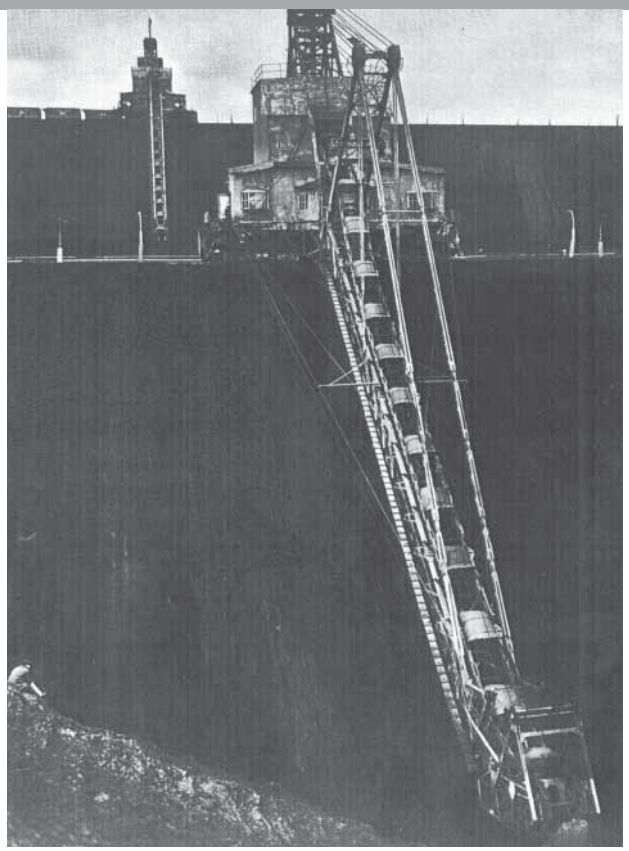


Photo 9.3/3 YOC Development at 1931: Nos 1 and 2 Ladder Dredgers on coal faces (from SECV *Three Decades*, 1949, p. 41). Copyright State Electricity Commission of Victoria.

station on the brown coal deposits near Morwell to provide for the expected electricity growth throughout the State. Government action on this recommendation was deferred while other options, such as a private development of the Altona brown coal deposit and/or hydro power from the Kiewa and other rivers, were given further consideration. In September 1917, a Brown Coal Advisory Committee with H.Herman as Chairman appointed by Government, strongly recommended the Morwell project.[414]

In late 1918, the Minister for Public Works requested Lindsay Clark, a consultant mining engineer, to report on suitable methods of mining and resultant costs of development in a specifically nominated one square mile area on the south of the Latrobe River opposite the entrance to the Great Morwell Mine. Lindesay Clark visited this site over a two day period. In a letter to the Minister dated 6 December 1918, Clark acknowledged the drilling and geological information supplied to him by Mines Department staff and proposed a mining scheme and costs of development of the mine.[415]

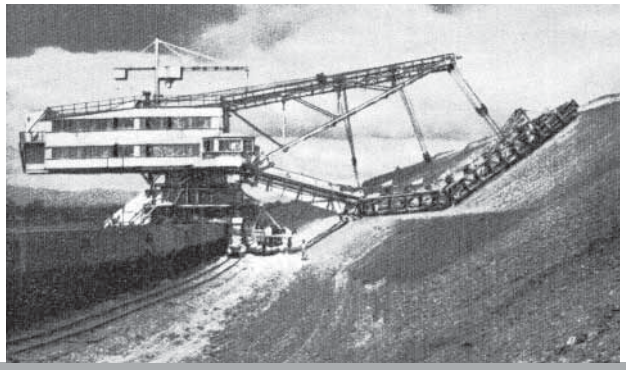
In January 1919, the Government appointed three Electricity Commissioners with duties including 'the preparation of a scheme of coal mining and electric supply at Morwell'. In November 1919, the Commissioners submitted their report recommending a State owned power and briquetting development at Morwell including the mining proposal as prepared by Lindsay Clark. The Government authorised the Morwell project (to be known as the Yallourn Project from 1920) in December 1919. The Commissioners recruited key staff to prepare detailed proposals. From September 1920 the Commissioners called tenders for power plant, transmission lines and open cut equipment. Under a new act, the State Electricity Commission of Victoria was established to commence this project within a wide range of other powers for the management of electricity supply throughout the State.[416] Sir John Monash was appointed the first Chairman of the SECV, as from 1 January 1921. He had previously been appointed on 1 October 1920 as General Manager under the Electricity Commissioners with the understanding that he would be appointed chairman as soon as the necessary legislation could be enacted. Lindesay Clark was appointed by the Commissioners on 28 May 1920 as Consulting Engineer for Coal Winning. The mining plan by Lindesay Clark was approved by the Commissioners on 1 October 1920, the same day as their appointment of Monash as General Manager.

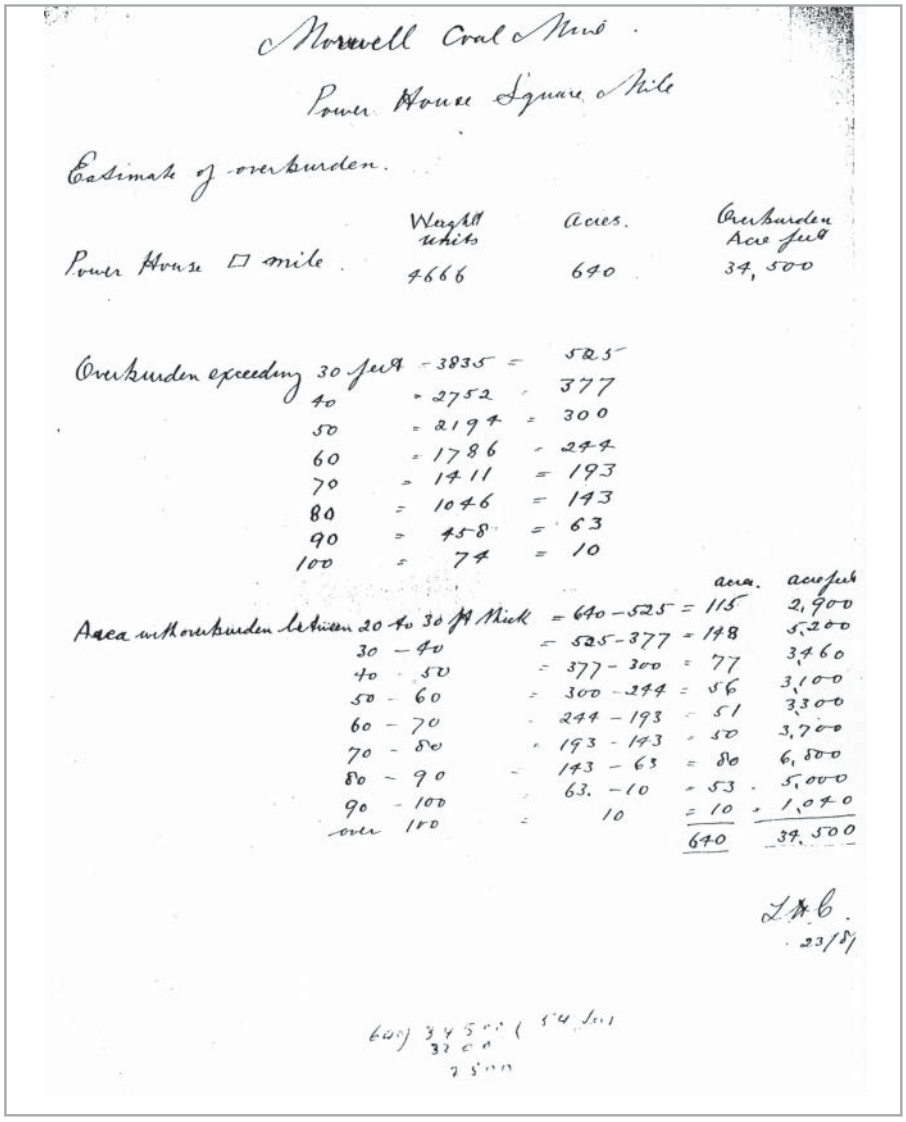
The mine plan was based on American/Australian mining plant as being the only excavation plant available, Germany not having restored manufacturing at this time of post-war recovery.

Mining commenced in October 1920 using horse drawn scoops to build protective levee banks. In October 1920, an order was placed for two mechanical shovels of two and a half and three and a half bucket capacity respectively. A small steam shovel commenced in February 1921 with output of about 450 cubic yards per day. In February 1921, orders were placed for overburden conveying and stacking plant and tenders called for endless ropeway haulage systems for coal transport. In May 1921, arrangements were made with Victorian Railways for rail access and provision of sidings.[417] Later this rail connection was extended to YNOC.

Horse-drawn three cubic yard side tipping trucks were used initially on overburden transport until a conveyor/stacker system came into service in May 1922. In November 1922,

Photo 9.3/4 YOC Number 4 Ladder Dredger (from Rodgers). Copyright State Electricity Commission of Victoria.





Morwell Coal Mine.

Power House Square Mile

Estimate of overburden.

	Weight units	Acres.	Overburden Acre feet
Power House □ mile.	4666	640	34,500

Overburden exceeding 30 feet - 3835 = 525
40 = 2752 = 377
50 = 2194 = 300
60 = 1786 = 244
70 = 1411 = 193
80 = 1046 = 143
90 = 458 = 63
100 = 74 = 10

		area.	acre feet
Area with overburden between 20 to 30 ft thick	= 640 − 525 =	115	2,900
30 − 40	= 525 − 377 =	148	5,200
40 − 50	= 377 − 300 =	77	3,460
50 − 60	= 300 − 244 =	56	3,100
60 − 70	= 244 − 193 =	51	3,300
70 − 80	= 193 − 143 =	50	3,700
80 − 90	= 143 − 63 =	80	6,800
90 − 100	= 63 − 10 =	53	5,000
over 100	= 10	= 10	1,040
		640	34,500

L.A.C.
23/8/

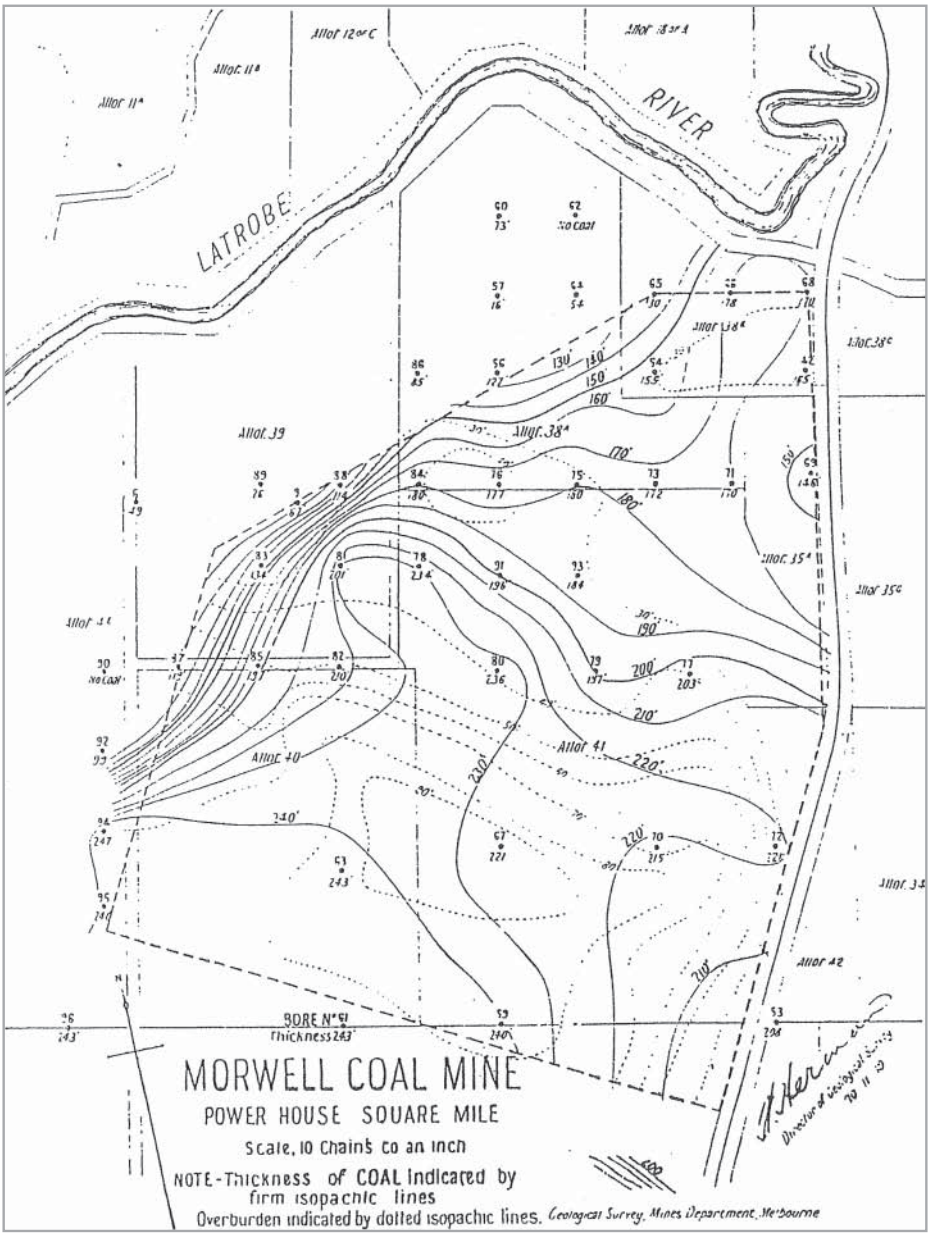
Drawing 9.3/1 YOC Initial Calculation by L Clark of overburden in designated area, August 1919.

work commenced on a 'deep drainage scheme' via shafts and tunnels in attempts to lower the moisture content in the coal before excavation. After several years of pumping, this scheme was abandoned as being ineffective and not cost justified.

Coal deliveries to the Yallourn power station commenced on 21 August 1924 and to the briquette factory in October 1924. Until 1927, coal from YNOC was also used in Yallourn Power Station, these deliveries progressively decreasing as combustion problems with the high moisture YOC coal were successfully contended with.

In 1924, mobile crusher/loaders were introduced to load crushed coal to the six cubic yard capacity rope haulage coal trucks. In January 1925, a three foot six inch gauge rail system was installed on the coal benches for use with steam locos

Photo 9.3/5A YOC Numbers One and Two Overburden Spreaders (from Vines, (1994), p.67).



Drawing 9.3/2 YOC Depiction of coal resource for 'Morwell Project' by H Herman, November 1919.

and five cubic yard side tipping trucks. Drawing 9.3/3 shows the layout of the YOC in February 1925. In June 1925, a larger shovel with a ten cubic yard bucket came into service. A two cubic yard dragline, three steam locomotives and 40 five cubic yard trucks came into service up to July 1926.

In December 1925, taking into consideration longer term plans to increase electricity generation from a proposed expansion of Yallourn Power Station, the SECV decided 'to abandon the original methods of open cut operation and to introduce plant and methods which had proved successful in German brown

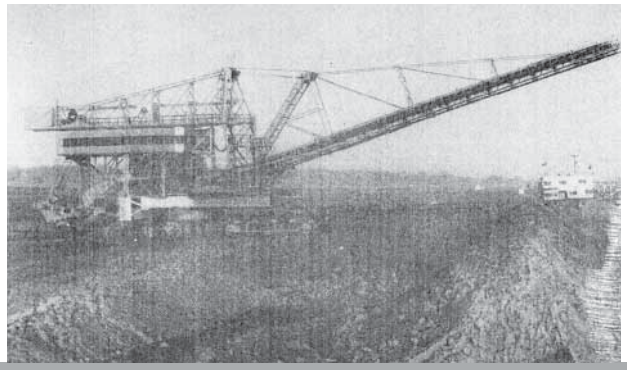
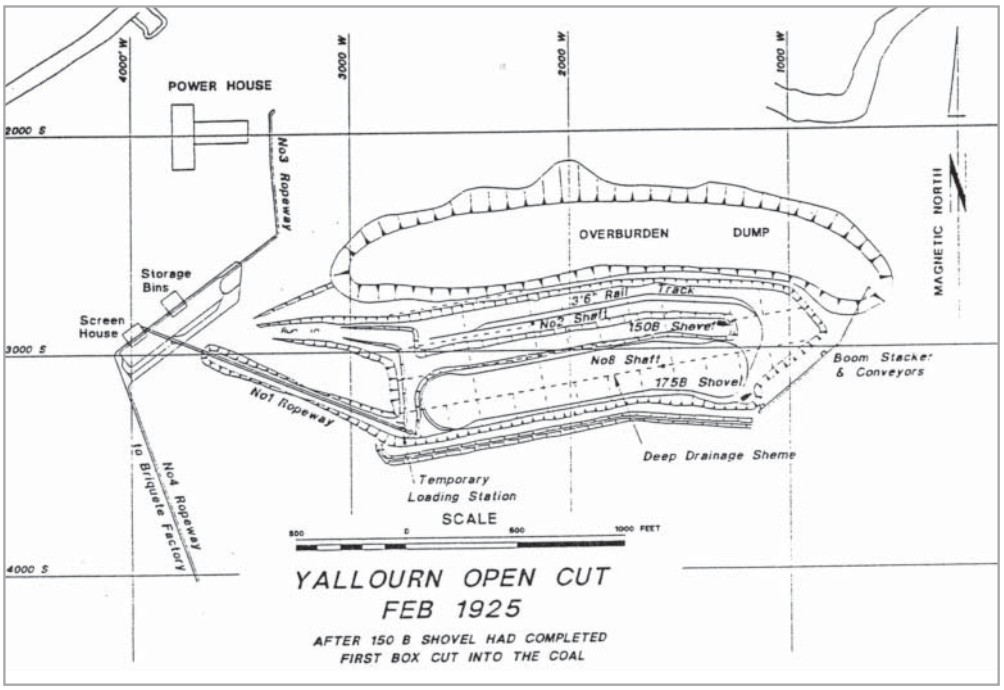


Photo 9.3/5B YOC Numbers One and Two Overburden Spreaders (from Vines, (1994), p. 67).



Drawing 9.3/3 YOC at 1925 as developed to plans by L Clark (from McKay, (1950), Plan Number Two).

coal open cut workings'.[418] The role of Lindesay Clark as consultant mining engineer had been terminated in June 1924. Advice on the changeover to German procedures and plant was now provided to the SECV Board by visitation of staff to Germany and visitation of German experts to Victoria.[419]

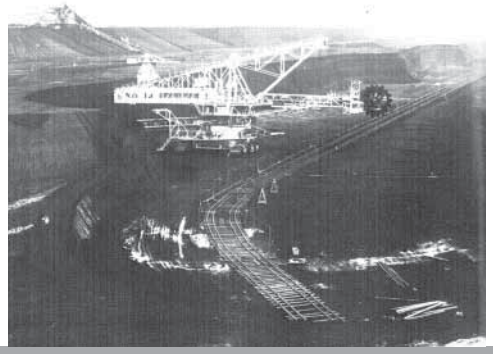
A 90 centimetre 1100 Volt DC electric rail system was progressively installed for transport of coal and overburden, replacing the rope haulages and the steam loco rail system. This 90 centimetre rail system came into service on coal transport in September 1927 and on overburden transport in February 1928. An electric powered single portal revolving bucket dredge (Dredger 208) also came into service on overburden excavation in February 1928. Overburden was out-loaded from the 90 centimetre rail system to a movable track hopper loading a movable conveyor discharging to the Boomstacker, the first overburden spreader in YOC. Dumping of overburden was also available via a 90 centimetre rail electric dump plough.[420]

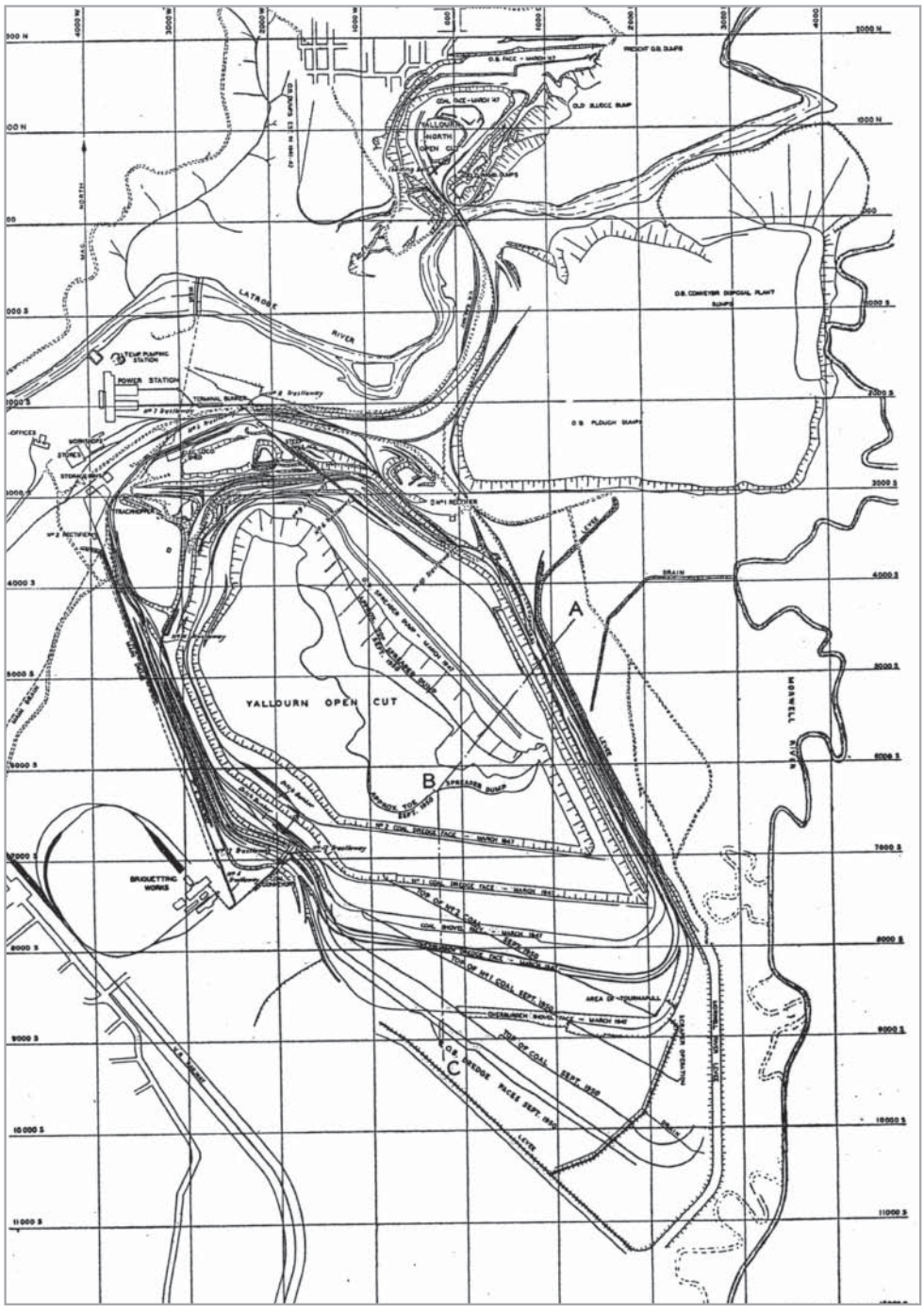
Two rail mounted Dredgers (SECV Dredgers Number One and Number Two) came into service on coal excavation, the first in July 1929 and the second in March 1931. A fleet of eighty 20 tonne gable bottom coal trucks was progressively introduced as coal demand grew from 1927 through to 1951.[421] The capacity of coal haulage was increased in 1954–58 by the addition of ninety two 33 ton capacity gable bottom coal trucks and in 1961–64 by the conversion of 85 of the early coal and overburden trucks to 26 ton gable bottom coal trucks. Coal output from the first two coal dredgers was supplemented from six different shovels until bucket wheel dredgers were introduced post-World War Two: Number 3 Dredger in October 1950, Number 6 Dredger in May 1956 and Number 7 Dredger in October 1956. Transport of YOC coal to the Yallourn Briquette factory converted from rope haulage to conveyors progressively through 1942–1947.[422]

In 1940, dumping of overburden into the base of YOC commenced by dragline and dump plough. Number One Spreader, converted from the early Boomstacker, came into service in 1943 and Number Two Spreader in 1953. In 1951, Number Four dredger, a bucket chain dredger, came into service to replace Number 208 dredger on Overburden

Photo 9.3/6 YOC/MOC Loco on ICR Bridge over Morwell River (from Vines, (1994), p.175).

Photo 9.3/7 YOC Numbers 6 and 8 Dredgers on coalfaces (from Vines, (1989), p.107).





Drawing 9.3/4 YOC at 1947 (from Herman, (1952), Fig.180).

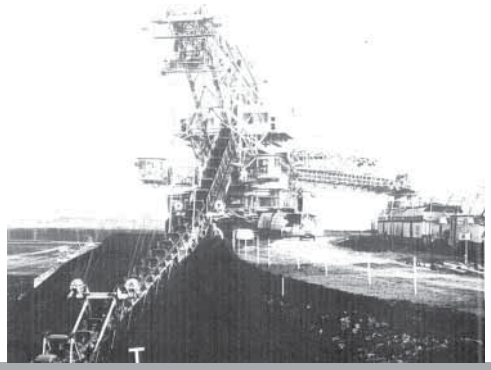
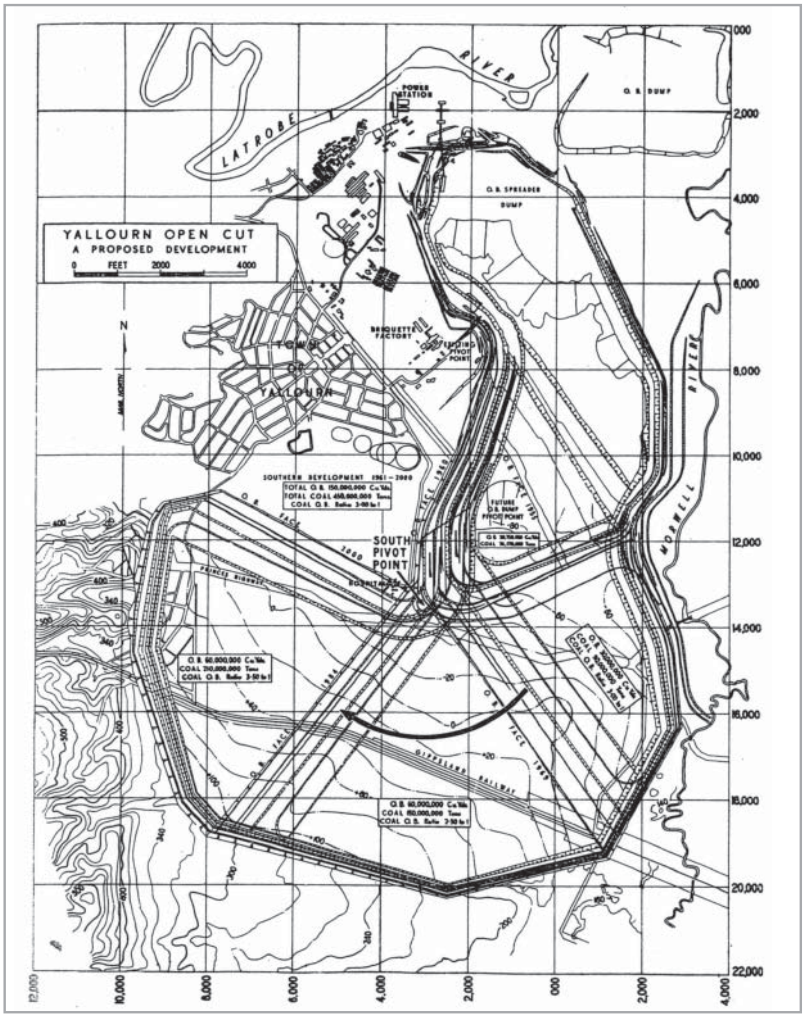


Photo 9.3/8 YOC Number 8 Dredger on coalface (from Vines, (1989), p.104).



Drawing 9.3/5 YOC Proposed development from 1955 into the South Field (from Stewart, (1960), p. 45).

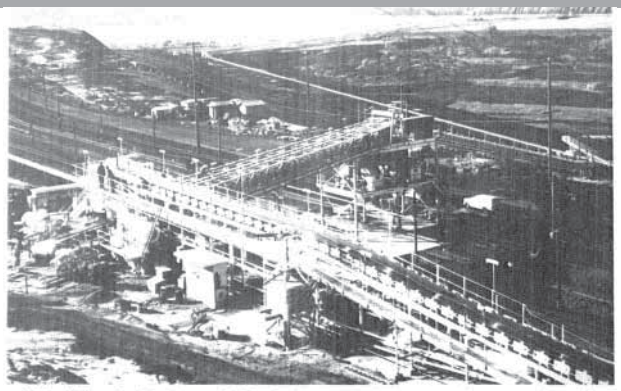
removal.[423] Seventy 32 cubic yard side tipping overburden trucks were introduced between 1952–54 to replace ninety 20 cubic yard side tipping trucks purchased from 1927. The electric locomotive fleet comprised 24 46-ton locos (1927–1953), 13 60-ton locos (1950–1954) and five 62-ton locos (1963–1967).[424]

By 1956, annual coal output from YOC had reached eight million tons with deliveries of coal from Morwell Open Cut to YPS commencing as the new open cut excavated its first coal to open up a coalface to prepare for supply to the Morwell Power Station, then under construction.[425] In 1956, an interconnecting SECV rail line of 90 centimetre gauge came into service between the two open cuts, initially with the purpose of disposing of the early overburden output from Morwell into the base of the Yallourn Open Cut but with the longer term objective of achieving greater reliability of coal supplies being available from both open cuts.[426]

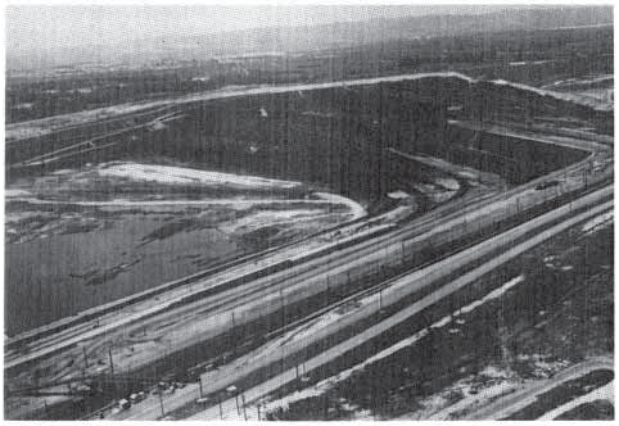
Additional excavators, all of German design to detailed specification by the SECV, were brought into service to meet increasing coal demand from additional units at Yallourn Power

Photo 9.3/9 YOC views 1962/63 (from Vines, (1989), p.112).

Photo 9.3/10 YOC Open Cut and Yallourn township, 1973 (from Vines, (1994), p.131).



5.14/1 – Yallourn Overburden Conveyors. Coal Transfer Station to trains. Overburden disposal by conveyors to dump. 1962.



5.14/2 – Yallourn Open Cut – about 1963. No. 7 Dredger on overburden conveyor system – coal outloading station from overburden conveyor system in left foreground. No. 4 Dredger on No. 1 cut, No. 8 Dredger on No. 2 cut, No. 6 Dredger on No. 3 cut, Nos. 1 and 2 Dredgers on No. 4 cut.

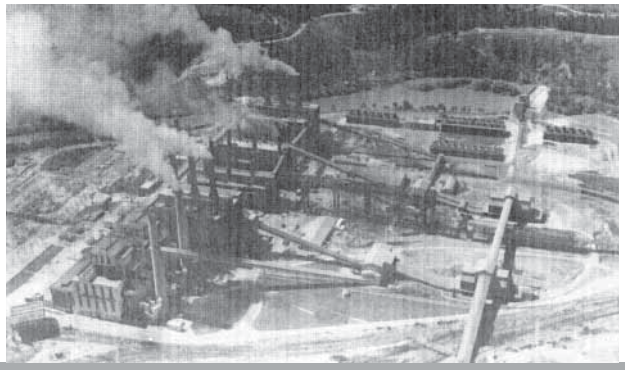
Station – Number Eight bucket chain Dredger in 1960,[427,428] Number 12 bucket wheel Dredger in 1974, Number 13 bucket wheel Dredger in 1977, Number 24 compact bucket wheel Dredger in 1984. Numbers One, Two and Four dredgers were retired between 1970 and 1974. Number Three Dredger was transferred to Morwell Open Cut from 1959 to 1983 and was retired in 1984 after retransfer to YOC. Number 24 Dredger was transferred to Morwell Open Cut in June 1987. The coal rail haulage systems were progressively phased out from 1974, with all replaced by higher capacity conveyor systems by 1984. Train systems on overburden excavation and disposal operations had been converted to conveyors in 1962/63.[429] Coal output from YOC peaked at 22.275 million tonnes in the 1981–82 year.[430] From 1960, YOC coal deliveries to the Morwell Briquette Factory had averaged over three million tons per year.

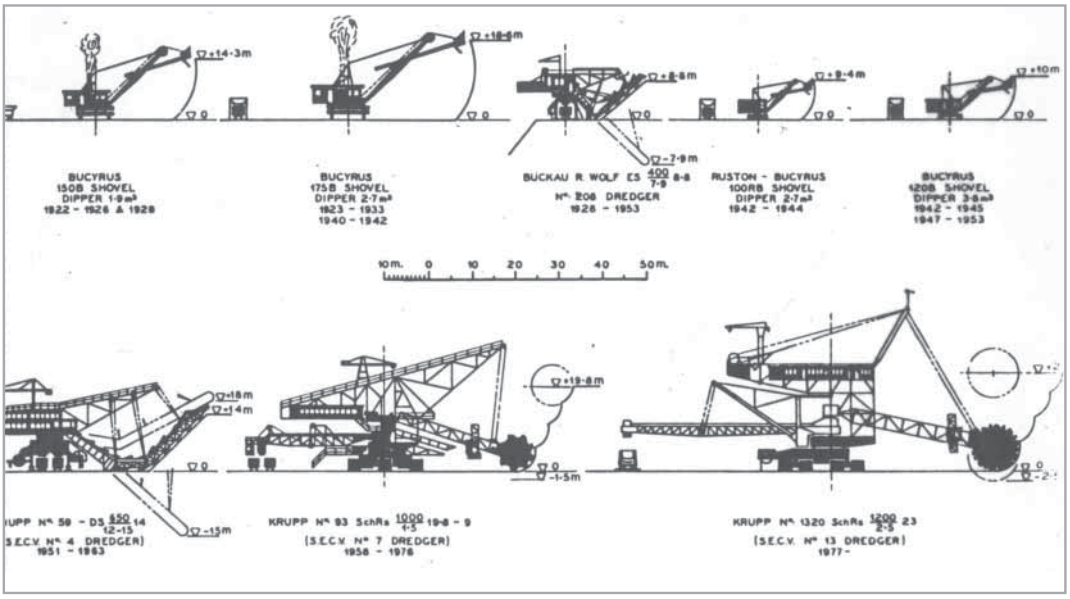
Yallourn Open Cut had expanded its operational area via a series of pivot points in a clockwise rotation from the early 1920s[431] until excavating through the former Yallourn Township area from 1981. On 1 May 1992, overburden excavation in the East Field commenced with Dredger Number 13 loading conveyors. A diversion of the Morwell River and of the Interconnecting Railway had been undertaken to gain access to the coal reserves in the East Field.[432]

On 8 April 1982, the Labour Party came to Government after 34 years as the opposition party and continued in Government until replaced by a Liberal-National Party Coalition Government in October 1992. The SECV was disaggregated in January 1994, with Generation Victoria allocated management of the coal mines, power stations and associated activities. On 1 April 1996, the former SECV coal mining assets and activities at Yallourn were privatised via sale to Yallourn Energy. At 2005, this company remained in this role with one shareholder, China Light and Power (CLP).

In September 1993, transport of briquetting coal from YOC to MOC on the Interconnecting Railway was contracted to a private contractor who used diesel locos and ex-SEC coal trucks on the ICR, eliminating the 1100 volt DC traction

Photo 9.3/11 Yallourn Power Station showing coal delivery system circa 1962 (from Vines, (1994), p.133).



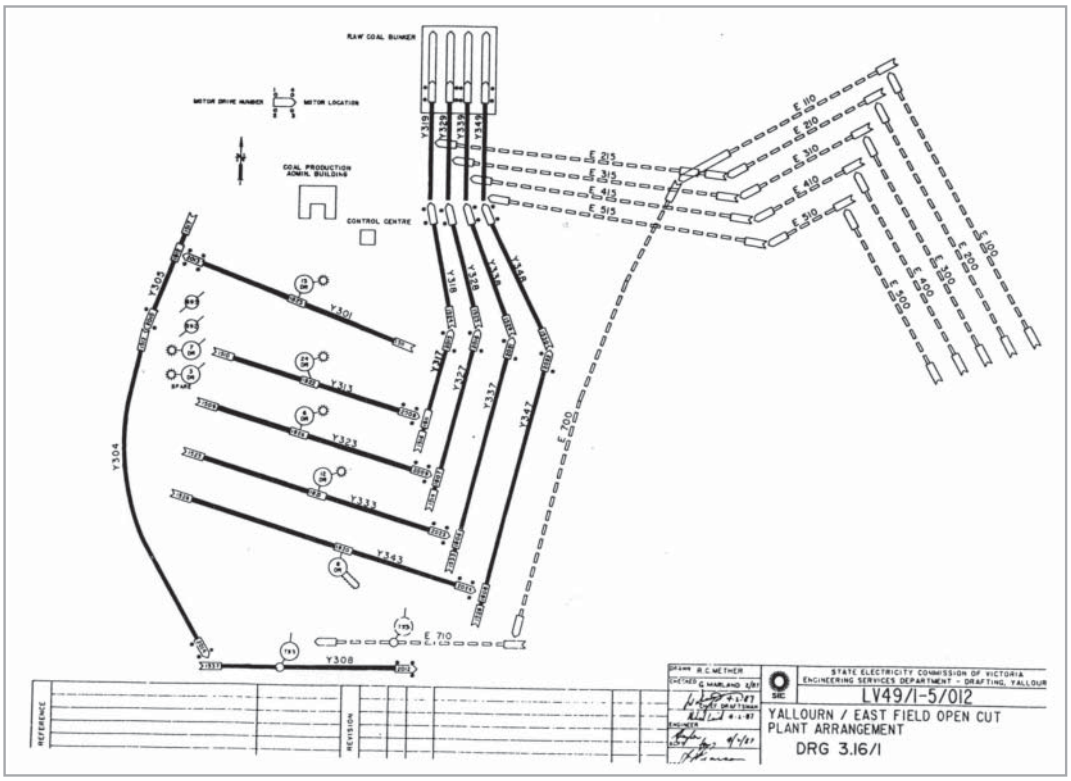


Drawing 9.3/6 YOC Excavators allocated for overburden removal, 1922 to post-1977 (from Vines, (1989), p. 84, as copied from Rodgers (1960)).

Drawing 9.3/7 YOC proposal as adopted for extension into the East Field, 1981 (from Vines, (1989), p. 203).

Photo 9.3/12 Yallourn town centre, 1973. Copyright State Electricity Commission of Victoria.

Photo 9.3/13 Yallourn township view, 1975 (from Vines, (1994) p.151). Copyright State Electricity Commission of Victoria.



Drawing 9.3/8 YOC conveyor systems and disposition of excavators to East Field from 1987 (from Vines, (1989), p. 94).

system. The annual usage of briquetting coal had fallen to 1.264 million tonnes by 1992/93, before this contract was placed. In August 1994, the Interconnecting Railway and its loading points, marshalling yards and conveyors to the Morwell Briquette Factory raw coal bunker were sold to Energy Brix, a private company which had bought the Morwell Briquette and Power Station assets.[433]

In February 2002, major earthworks for a Morwell River diversion 3.5 kilometres long and up to 140 metres wide from levee top to top, commenced by contract 'with nine 85 tonne and thirteen 50 tonne dump trucks and three excavators excavating 26,000 cubic metres per day of earth' from the eastern end of the East Field.[434] The Morwell River confluence with the Latrobe River was relocated about four kilometres upstream from its previous location in the Latrobe River.[435] This river diversion to the western side of the East Field 'allowed substantial new coal reserves to be accessed [in the East and Maryvale Fields], extending the mine's life by about 25 years to 2032'.[436] Water flow through these river diversion works took place on 27 May 2005. In 2004, four tunnels for overburden and coal transport under the river diversion had been completed and handed over for installation of conveyors.

In February 2002, trials were proceeding for utilisation of a 120 tonne D11R bulldozer loading coal down a decline into a feeder-breaker for delivery to a coal face conveyor. The tests were considered successful and intended to avoid high expenditure on maintenance or replacement of ageing dredgers for the coal excavation in the prolonged east field extension and the Maryvale Field.[437]

At January 2003, it was expected that all coal mining in the YOC would be converted to slope mining by June 2003.

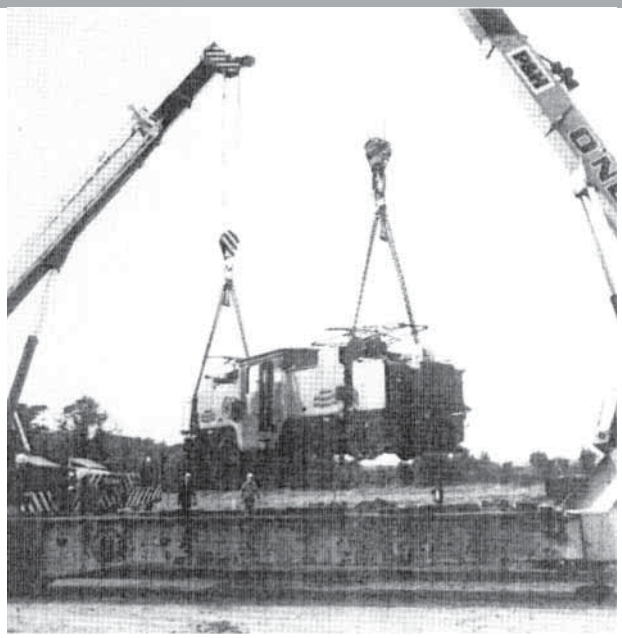


Photo 9.3/14 Electric loco being out-loaded to the Railways Museum at North Williamstown, 1985 (from Vines, (1994), p.151).

Photo 9.3/15 YOC Air photo 1992, including the East Field (from Vines, (1994), p.181).

The slope mining operation was in progress by contract to Yallourn Energy with the dozing plant anticipated to have a five year operating life.[438] Two or possibly three slope mining systems were expected to meet coal demand from Yallourn W Power Station. Briquetting coal supplies from YOC to the Morwell Briquette Works had ceased with supply transferred to Loy Yang Open Cut. This cessation eliminated the practice in YOC of identifying, selecting, storing and delivering coal for briquetting as sand free, of light lithotype and with low woody or fibrous content. This cessation permitted the slope mining operation to produce 'run-of-mine' excavation albeit with selective storage areas in the raw coal bunker.

At 2003, Dredgers Number Six and Number Seven, each with over 45 years of operation, were retired and made available for sale or demolition. Dredger Number Eight with over 40 years of operation was parked and not being used. Dredger Number 12 was on standby available to take over from Dredger Number 13 on overburden removal or to be used for development or emergency operation on coal winning. Annual coal demand of about 17.5 million tonnes was being met with over 99.9 per cent reliability.

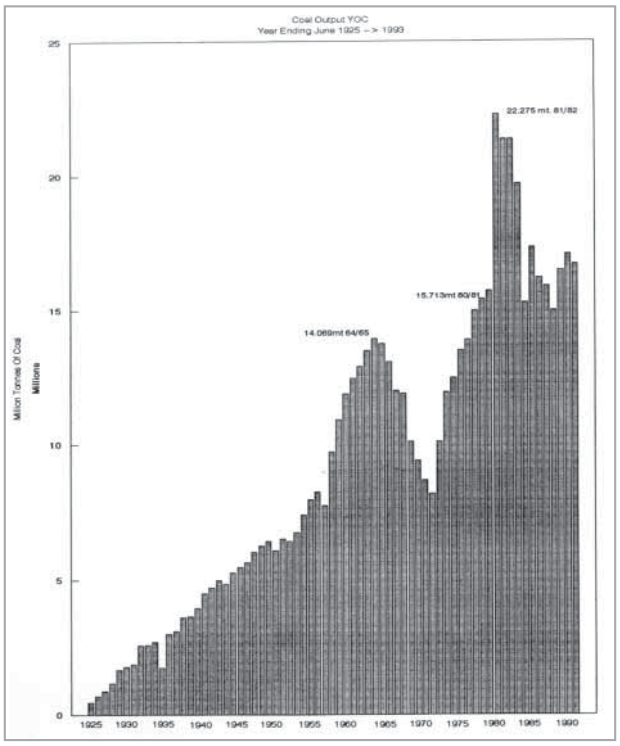
Thus, at 2005, Yallourn Open Cut had been in continuous operation for 83 years, now supplying coal exclusively to Yallourn W Power station which was generating about 22 per cent of Victoria's electricity consumption. As from 1 July 2005 the owners of Yallourn Energy changed its name to TRU Energy in a consolidation with its other energy interests in Australia.

Assessment of Heritage Significance

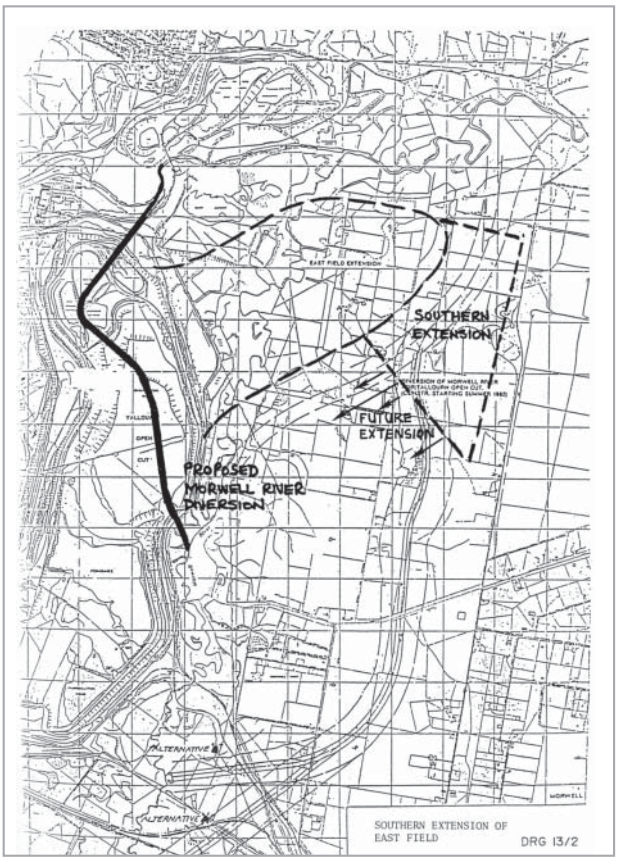
Historical Significance

The Yallourn Open Cut was the first large-scale project to attain effective commercial utilisation of the vast brown coal energy resource of the Latrobe Valley.

The success of the Yallourn Power Station and Briquette Works fuelled from YOC led to further utilisation of the brown coal resource in power stations, gas manufacture, briquettes, hard char, pulverised fuel and conversion to liquid fuels.



Drawing 9.3/9 YOC annual coal output, 1924 to 1993 (from Vines, (1994), p.143).



Drawing 9.3/10 YOC proposal for extension to south of East Field, 1986, including westward deviation of Morwell River (from Vines, (1989), p. 207).

Scientific Significance

The techniques of combusting the friable high moisture coal from YOC were developed under extreme public and government criticism as the initial drying and boiler plant required modification and supplementation. Post World War One access to the applied scientific experience in the German brown coal industry had not been sufficiently available at the time of ordering vital plant.

Misinterpretation of the geology of the Yallourn seam of brown coal with its significantly different qualities from the Latrobe seam as mined at Yallourn North led to recognition that much more scientific investigation of coal quality was necessary in each new brown coal utilisation development.

Economic Significance

The Yallourn Project, as with the State Coal Mine at Wonthaggi, was a successful State Government initiative to challenge the dependence on the NSW black coal industry.

Base load generation using the YOC coal lead to more economic utilisation of the hydro power opportunities in Victoria.

Briquette manufacture with availability to industry substituted for unreliable supplies of other hard fuels at competitive costs.

Social Significance

The Yallourn Project was the first large scale non-farming industry in Gippsland. As well as establishing the Yallourn township immediately adjacent to the Yallourn Works,

significant population growth in the townships of Moe, Newborough, Yallourn North and Morwell also took place. Closer settlement of the farming community largely from SECV workers also occurred.

Recruitment of personnel in the 1920s to 1940s was predominantly from the unemployed. From the 1950s, recruitment at the Yallourn Works was predominantly from migrants and second generation SECV employees. Successful integration of migrants into the wider Latrobe Valley community was a commendable feature of the SECV management of the Yallourn Project.

Mine Infrastructure Features

Small bucket wheel dredger on display at Visitors Centre, Morwell.

Coal loco and trucks on display at Visitors Centre Morwell.

Coal locos on display at Railways Museum, Spotswood.

Interconnecting Railway bridges at Morwell.

Visitors viewing area of Yallourn Open Cut, DeCampo Drive, Yallourn.

Visitors viewing area, Yallourn Power Station.

Photographic display and news clippings, Yallourn North Historical Society.

Display and records, Moe Historical Society.

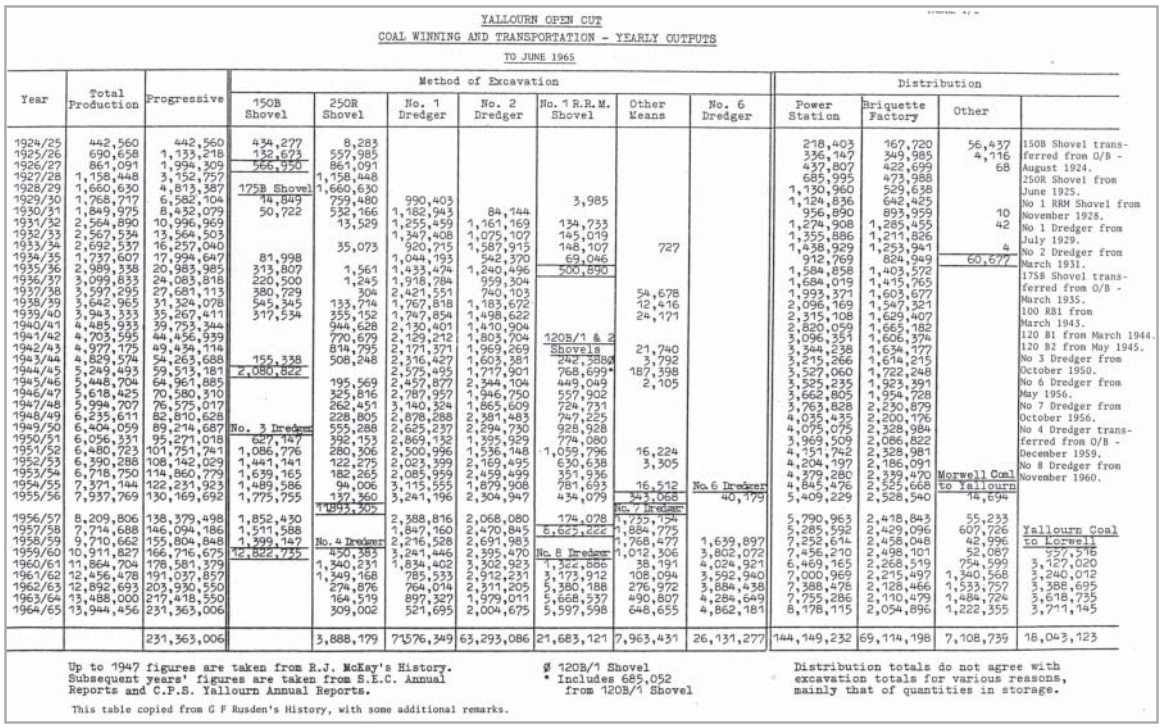
Analyses for Gippsland Basin brown coals

	Yallourn open cut*	Morwell open cut*	YN Extn† open cut*	Loy Yang	Gormandale	Coolungoolun	Won Wron	Stradbroke	Alberton	Gelliondale
Moisture % a.r.	66.1	60.5	51.7	62.8	56.6	54.0	48.5	58.4	63.5	65.9
Ash (d.b.) %	1.8	3.7	4.4	1.4	2.6	2.9	2.0	3.9	3.1	6.3
Volatiles (d.b.) %	51.5	50.0	48.9	51.5	51.8	45.9	51.0	49.5	51.5	50.7
Fixed carbon (d.b.) %	46.7	46.3	46.7	47.1	45.6	51.2	47.0	46.6	45.5	43.0
Carbon (d.b.) %	66.7	67.8	66.7	68.4	66.1	68.2	66.7	68.0	65.3	64.8
Hydrogen (d.b.) %	4.7	4.8	4.7	4.9	4.9	4.8	4.7	5.0	4.7	4.5
Sulphur (d.b.) %	0.3	0.4	0.6	0.4	0.9	4.8	0.3	3.1	0.4	0.9
Chlorine (d.b.) %	0.1	0.1	0.1	0.1	0.1	0.1	n.d.	n.d.	0.1	n.d.
Specific Energy (MJ/kg)										
Gross dry	26.4	27.6	27.4	26.4	25.8	28.4	27.2	27.2	25.2	24.8
Gross wet	8.8	10.6	12.8	9.9	11.2	13.1	14.0	11.3	9.2	8.5
Net wet	6.8	8.6	10.9	7.9	9.3	11.3	12.3	9.6	7.4	6.6

* Values listed for Yallourn, Morwell, and Yallourn North Extension open cuts are weighted averages of shift dredger samples taken from 1959 to 1978. The remaining values are weighted averages of bore samples from selected areas.
† Yallourn North Extension.
n.d. Not determined.

T93/

Table 9.3/1 Comparison of Gippsland brown coals (from Gloe, (1984), p. 91). Copyright State Electricity Commission of Victoria.



YALLOURN OPEN CUT
COAL WINNING AND TRANSPORTATION - YEARLY OUTPUTS
TO JUNE 1965

Year	Total Production	Progressive	Method of Excavation: 150B Shovel	250R Shovel	No. 1 Dredger	No. 2 Dredger	No. 1 R.R.M. Shovel	Other Means	No. 6 Dredger	Distribution: Power Station	Briquette Factory	Other	
1924/25	442,560	442,560	434,277	8,283						218,403	167,720	56,437	150B Shovel transferred from O/B - August 1924.
1925/26	690,658	1,133,218	132,673	557,985						336,147	349,985	4,116	
1926/27	861,091	1,994,309	566,950	861,091						437,807	422,699	68	
1927/28	1,158,448	3,152,757		1,158,448						685,995	472,988		250R Shovel from June 1925.
1928/29	1,660,630	4,813,387	175B Shovel	1,660,630						1,130,960	529,638		
1929/30	1,768,717	6,582,104	14,849	759,480	990,403		3,985			1,124,836	642,425		No 1 RRM Shovel from November 1928.
1930/31	1,849,975	8,432,079	50,722	532,166	1,182,943	84,144				956,890	893,959	10	
1931/32	2,564,890	10,996,969		13,529	1,255,459	1,161,169	134,733			1,274,908	1,285,455	42	No 1 Dredger from July 1929.
1932/33	2,567,534	13,564,503			1,347,408	1,075,107	145,019			1,355,886	1,211,826		
1933/34	2,692,537	16,257,040		35,073	920,715	1,587,915	148,107	727		1,438,929	1,253,941	4	No 2 Dredger from March 1931.
1934/35	1,737,607	17,994,647	81,998		1,044,193	542,370	69,046			912,769	824,949	60,677	
1935/36	2,989,338	20,983,985	313,807	1,561	1,433,474	1,240,496	500,890			1,584,858	1,403,572		175B Shovel transferred from O/B - March 1935.
1936/37	3,099,833	24,083,818	220,500	1,245	1,918,784	959,304				1,684,019	1,415,765		
1937/38	3,597,295	27,681,113	380,729	304	2,421,551	740,103		54,678		1,993,371	1,603,677		100 RB1 from March 1943.
1938/39	3,642,965	31,324,078	545,345	133,774	1,767,818	1,183,672		12,416		2,096,169	1,547,321		
1939/40	3,943,333	35,267,411	317,534	355,152	1,747,854	1,498,622		24,171		2,315,108	1,629,407		120 B1 from March 1944.
1940/41	4,485,933	39,753,344		944,628	2,130,401	1,410,904				2,820,059	1,665,182		120 B2 from May 1945.
1941/42	4,703,595	44,456,939		770,679	2,129,212	1,803,704	120B/1 & 2			3,096,351	1,606,374		
1942/43	4,977,175	49,434,114		814,795	2,171,371	1,969,269	Shovels	21,740		3,344,238	1,634,177		No 3 Dredger from October 1950.
1943/44	4,829,574	54,263,688	155,338	508,248	2,316,427	1,603,381	242,886@	3,292		3,215,266	1,614,215		
1944/45	5,249,493	59,513,181	2,080,822		2,575,495	1,717,901	768,699*	187,398		3,527,060	1,722,248		No 6 Dredger from May 1956.
1945/46	5,448,704	64,961,885		195,569	2,457,877	2,344,104	449,049	2,105		3,525,235	1,923,391		
1946/47	5,618,425	70,580,310		325,816	2,787,957	1,946,750	557,902			3,662,805	1,954,728		No 7 Dredger from October 1956.
1947/48	5,994,707	76,575,017		262,451	3,140,324	1,865,609	724,731			3,763,828	2,230,879		
1948/49	6,235,611	82,810,628		228,805	2,878,288	2,381,483	747,225			4,035,435	2,200,176		No 4 Dredger transferred from O/B - December 1959.
1949/50	6,404,059	89,214,687	No. 3 Dredger	555,288	2,625,237	2,294,730	928,928			4,075,075	2,328,984		
1950/51	6,056,331	95,271,018	627,147	392,153	2,869,152	1,395,929	774,080			3,969,509	2,086,822		
1951/52	6,480,723	101,751,741	1,086,776	280,306	2,500,996	1,536,148	1,059,796	16,224		4,151,742	2,328,981		
1952/53	6,390,288	108,142,029	1,441,141	122,275	2,023,399	2,169,495	630,638	3,305		4,204,197	2,186,091		No 8 Dredger from November 1960.
1953/54	6,718,750	114,860,779	1,639,165	182,265	2,085,959	2,459,499	351,936			4,379,280	2,339,470	Morwell Coal	
1954/55	7,371,144	122,231,923	1,489,586	94,006	3,715,555	1,879,908	781,693	16,512	No 6 Dredger	4,845,476	2,525,668	to Yallourn	
1955/56	7,937,769	130,169,692	1,775,755	137,360	3,241,196	2,304,947	434,079	243,068	40,179	5,409,229	2,528,540	14,694	
				1,295,305				No. 7 Dredger					
1956/57	8,209,806	138,379,498	1,852,430		2,388,816	2,068,080	174,078	1,733,154		5,790,963	2,418,843	55,233	
1957/58	7,714,688	146,094,186	1,511,588		1,847,160	2,470,845	6,625,222	1,884,775		5,285,592	2,429,096	607,726	Yallourn Coal
1958/59	9,710,662	155,804,848	2,399,147	No. 4 Dredger	2,216,528	2,691,983		1,768,477	1,639,897	7,252,614	2,458,048	42,996	to Morwell
1959/60	10,911,827	166,716,675	12,822,735	430,385	1,241,446	2,395,470	No. 8 Dredger	1,012,306	3,802,072	7,456,210	2,498,101	52,087	527,516
1960/61	11,864,704	178,581,379		1,340,231	1,834,402	3,302,923	1,322,886	38,191	4,024,921	6,469,165	2,268,519	754,599	3,127,020
1961/62	12,456,478	191,037,857		1,349,168	785,533	2,912,231	3,173,912	108,094	3,592,940	7,000,969	2,215,497	1,340,568	3,240,012
1962/63	12,892,693	203,930,550		274,876	764,014	2,311,205	5,380,188	276,972	3,884,438	7,388,476	2,128,466	1,533,757	3,388,695
1963/64	13,488,000	217,418,550		164,519	897,327	1,979,011	5,668,537	490,807	4,284,649	7,755,286	2,110,479	1,484,724	3,618,735
1964/65	13,944,456	231,363,006		309,002	521,695	2,004,675	5,597,598	648,655	4,862,181	8,178,115	2,054,896	1,222,355	3,711,145
		231,363,006		3,888,179	71,576,349	63,293,086	21,683,121	7,963,431	26,131,277	144,149,232	69,114,198	7,108,739	18,043,123

Up to 1947 figures are taken from R.J. McKay's History.
Subsequent years' figures are taken from S.E.C. Annual Reports and C.P.S. Yallourn Annual Reports.

@ 120B/1 Shovel
* Includes 685,052 from 120B/1 Shovel

Distribution totals do not agree with excavation totals for various reasons, mainly that of quantities in storage.

This table copied from G F Rusden's History, with some additional remarks.

Table 9.3/2 YOC annual coal output to June 1965 (from Rusden, (1968), Appendix 4). Copyright State Electricity Commission of Victoria.

YALLOURN OPEN CUT
COAL WINNING AND TRANSPORTATION – 1966-1993

COAL QUANTITIES IN MILLION TONS (TONNES from 73/74)										DELIVERIES				
YEAR	TOTAL PRODUCTION	PROGRESSIVE	EXCAVATION NO 1	NO 2	NO 4	NO 6	NO 7	NO 8	AUXILIARY PLANT	TO YPS	TO YBF	TO MBF	TO MPS	MORWELL TO YPS
65/66	13.765	245.133	0.310	2.104	0.023	4.808	0.528	5.992		8.056	2.002	3.707	0.004	1.317
66/67	13.080	258.213	0.061	1.993		4.511	0.296	6.216	0.002	7.576	1.913	3.569	0.021	1.462
67/68	11.986	270.198	0.741	1.438		4.358	0.144	5.304		6.761	1.876	3.344		1.317
68/69	11.888	282.086	0.316	2.900		3.298	0.155	5.218		7.521	1.377	2.985	0.008	0.352
69/70	10.105	292.191		2.040		2.724	0.221	5.120		5.628	1.081	3.395	0.008	0.296
70/71	9.400	301.588		0.872		2.113	0.178	6.234		5.352	0.774	3.176	0.095	0.011
71/72	8.649	310.236		0.940		2.541	0.101	5.063	0.003	5.074	0.368	3.207	0.0003	0.0001
											To YWPS			
72/73*	8.154	318.390	No 12	1.450		2.578	0.085	4.038	0.003	* 4.988	0.006	3.148	0.014	0.026
73/74**	10.105	333.605	0.360	1.415		2.061	0.017	6.251	0.002	**4.710	2.289	3.097	0.012	
74/75	11.942	345.547	4.534	0.341		5.237	0.049	1.781		5.075	3.890	2.955	0.023	0.012
75/76	12.486	358.033	4.295			3.628	0.023	4.540		4.404	5.560	2.512	0.009	0.036
76/77	13.499	371.532	4.646			3.420	0.066	5.367		6.050	4.685	2.763	0.0008	0.021
77/78	13.903	385.435	4.931			4.045	0.060	4.821	0.046	4.988	6.046	2.848	0.021	0.073
78/79	14.975	400.410	5.116			3.196	2.158	4.505		6.649	5.309	3.006	0.010	0.160
79/80	15.410	415.820	5.093			4.777	0.469	5.042	0.028	6.573	5.457	3.350	0.030	
80/81	15.713	431.533	6.373			3.337	1.285	4.709	0.008	6.282	6.535	2.891	0.006	
81/82	22.275	453.807	5.742	No 3		6.435	5.930	4.122	0.045	7.834	11.816	2.622	0.002	
82/83	21.360	475.167	7.523	1.032		4.378	3.230	5.163	0.033	5.106	14.441	1.813	0.0003	
83/84	19.710	494.877	8.505	1.040	No 24	2.348	4.640	3.173	0.005	4.479	14.044	1.188		
84/85	18.984	513.910	5.728		2.384	4.343	2.306	4.223		3.010	13.925	2.050		
85/86	15.281	529.191	4.490		1.607	3.209	1.558	4.418		1.499	11.684	2.098		
86/87	17.357	546.548	2.377		2.065	4.093	3.156	5.667		1.889	13.445	2.023		
87/88	16.210		4.980			3.926	3.588	3.716		1.018	13.141	2.036		
88/89	15.512		5.586			2.448	4.154	3.324		0.036	14.017	1.844		
89/90	15.004		4.781			2.628	3.291	4.304			13.200	1.799		
90/91	16.500		4.321	No 13		3.202	3.189	5.788			14.690	1.802		
91/92	17.110		4.459	0.020		3.201	5.037	4.393			14.930	2.010		
92/93	16.685		5.565	1.056		2.777	4.467	2.820			15.256	1.264		

* tons TO 1972/73
** tonnes FROM 1973/74

Note: Excavation quantities have been adjusted to agree with progressive surveyed quantities
Delivered quantities have been adjusted to agree with excavated quantities up to the end of the 86/87 financial year only. From 87/88 the delivered quantities as shown are as published in the Commission's Annual Reports

Table 9.3/3 YOC annual coal output, July 1965 to 1993 (from Vines, (1994), p. 242, Table 9.2).

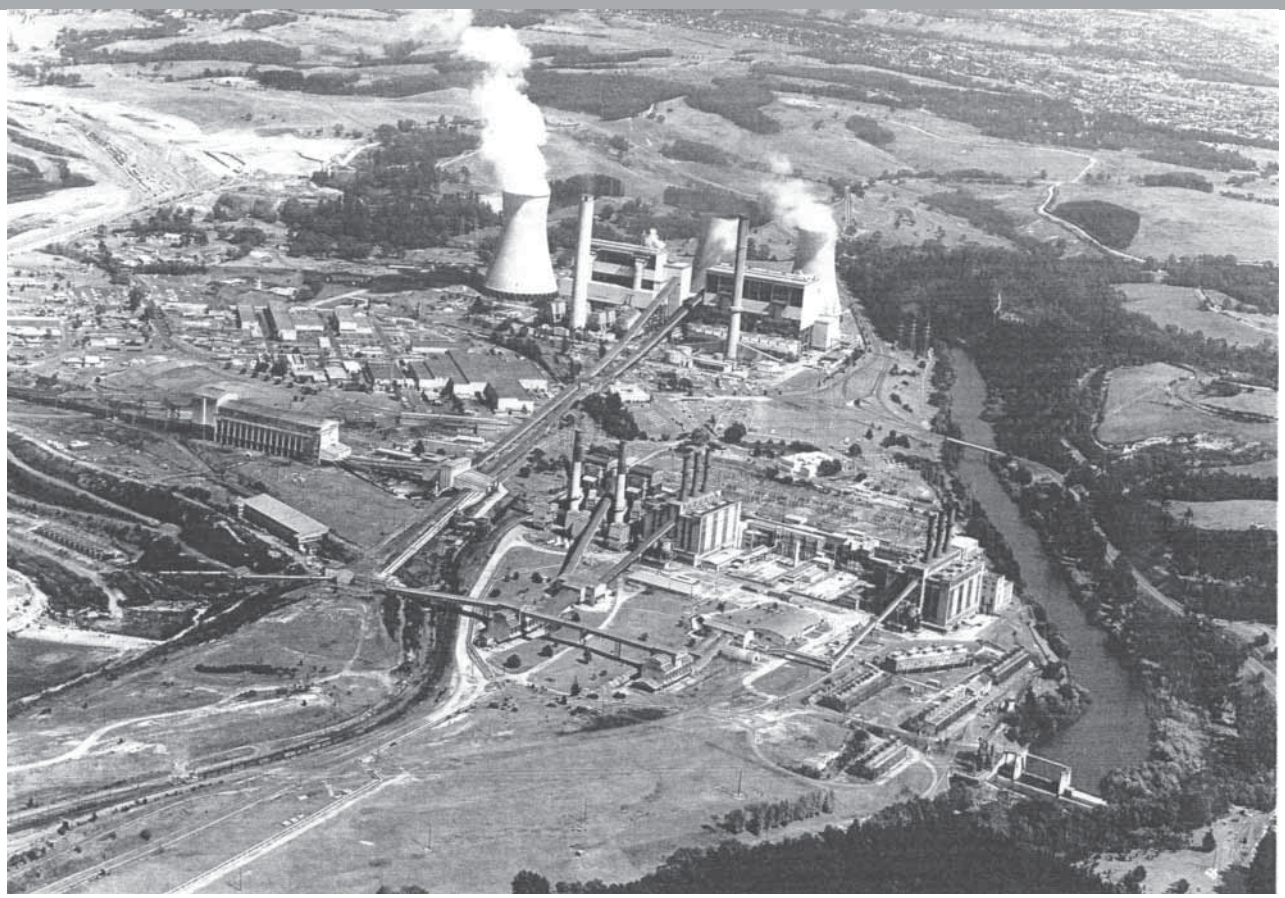


Photo 9.3/16 Yallourn and Yallourn W Power Stations, (the former partly dismantled), showing coal delivery systems, 1992 (from Vines, (1994) p.168).

References

Clark, L 'Letter to The Hon. Arthur Robinson, Minister for Public Works', 6 December 1918, including Appendices 1 to 111

Herman, H, *Brown Coals Of Victoria*, Bulletin No.45, Mines Department, 1922

Herman, H, *Brown Coa*l, SECV, 1952

McKay, RJ, *History of the Development of the Brown Coal Open Cut Workings at Yallourn*, SECV, June 1950

Mehta, R, *Morwell River Diversion and Discovery*, Department of Primary Industries, June 2005, p.27

Rodgers, HCG, *Excavation Equipment for Brown Coal,* AusIMM Latrobe Valley Coal Resources, 1960

Rusden, GF, *History of Yallourn, Yallourn North, and Yallourn North Extension Open Cuts, July 1947 to June 1965*, SECV, 1968

Three Decades, SECV, 1949

Stewart, EDJ, *Planning of Brown Coal Open Cuts*, Aus IMM Latrobe Valley Coal Resources, 1980

'Alliance Mining Innovations', AusIMM Bulletin, Yallourn Energy, January/February 2003, pp.21–24

Power for Victorian Industries, The Industrial Australian and Mining Standard, 17 March 1921

Vines, JA, A *Technical History of Yallourn Open Cut*, *1965 to 1987*, SECV, 1989

Vines, JA, *Train Systems: Yallourn and Morwell Open Cuts*, Generation Victoria, 1994

Live Wire, Yallourn Energy, 1995–2003

OVERBURDEN AND COAL TRANSFERS ON THE ICR – 1955-1993

YEAR ENDED 30 JUNE	OVERBURDEN MORWELL TO YALLOURN CUBIC YARDS	YALLOURN COAL TO MORWELL BRIQ FACTORY & POWER STATION* M TONNES	YNX COAL TO MORWELL BRIQ FACTORY M TONNES	MORWELL COAL TO YALLOURN POWER STATION M TONNES
1956	4 920			0.015
1957	63 505			0.056
1958	51 429			0.617
1959	504			0.044
1960	3 360	0.973		0.053
1961		3.177		0.767
1962		3.292		1.362
1963		3.443	0.013	1.578
1964		3.677		1.509
1965		3.771		1.242
1966		3.770		1.338
1967		3.647		1.485
1968		3.398		1.338
1969		3.041		0.358
1970		3.458		0.301
1971		3.323		0.011
1972		3.259		0.001
1973		3.213		0.026
1974		3.109		—
1975		2.978		0.012
1976		2.521		0.036
1977		2.764		0.021
1978		2.869		0.074
1979		3.016		0.160
1980		3.380		—
1981		2.897		
1982		2.624		
1983		1.813		
1984		1.188		
1985		2.050		
1986		2.098		
1987		2.091		
1988		2.058		
1989		1.847		
1990		1.789		
1991		1.810		
1992		2.010		
1993		(estimate) 1.616		

*The Yallourn coal deliveries to Morwell were almost exclusively to the Morwell Briquette Factory. Less than 0.3M tonnes of this coal was diverted to the Morwell Power Station between 1960-1993, during Morwell coal supply shortages to the Power Station on an irregular and short duration basis.

Table 9.3/4 YOC/MOC overburden and coal transfers on the Inter-connecting Railway, 1956 to 1993 (from Vines (1994), p. 95, Table 5.1/1).

Photo 9.4/1 YNEOC Before operations, August 1955 (Copy from Vines (1989), p.65).

9.4 Yallourn North Extension

Map Reference: **8121-1-2 Morwell Zone 55 YNX Mine Entrance 4485, 57761**

Municipality: **City of Latrobe**

Land Use/Status: **Public**

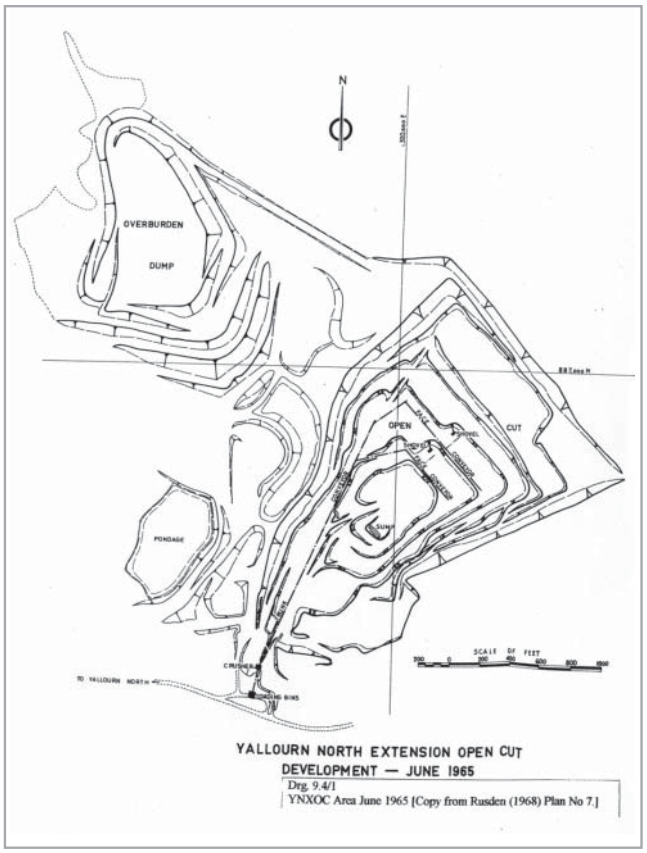
Site History

The Yallourn North Extension Open Cut (YNEOC) is in the City of Latrobe and about 150 kilometres east of Melbourne. It is situated adjacent to the northern side of the Latrobe River, on the Tyers-Yallourn North Road, 4.1 kilometres east of the township of Yallourn North and six kilometres west of the township of Tyers (see Drawing 9.4/1).

The coal deposit mined was part of the Latrobe Seam which extended about 14 kilometres in an east westerly direction along the north bank of the Latrobe River. The seam has a maximum thickness of about 145 metres and has a width which varies from about 100 to 1,600 metres.[439]

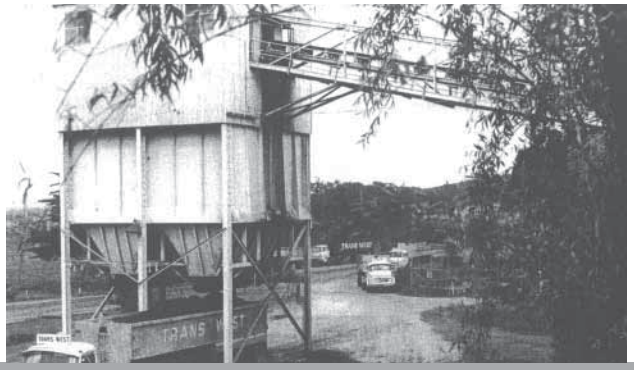
The Latrobe Seam was initially mined for coal in 1887 at a location a few chains west of what was later, from the 1930s, called the Yallourn North Open Cut (YNOC). Mining operations at Yallourn North had been taken over by the SECV in 1924, providing initial coal supplies to the Yallourn Power Station and Briquetting Works and final supplies to the Temporary Yallourn Power Station. By 1927, the Yallourn Open Cut had been developed sufficiently and coal furnace techniques had been modified such that the power station and briquetting works were supplied mainly from Yallourn Open Cut. Coal supply from Yallourn North was then gradually curtailed and was used subsequently for emergency coal supplies to the Yallourn Power Station during coal supply shortages from the Yallourn Open Cut. The YNOC was used also as a supplementary coal supply to Yallourn Power Station in the 1940s. By the early 1950s, YNOC had an annual output from one to 1.5 million tons and was being utilised also at Newport Power station and for industrial steam raising in private industry throughout the State.

By the 1950s, it was evident that the brown coal resource at the YNOC would be worked out by the mid 1960s at the then annual output. After extensive drilling in the Latrobe Seam east and west of the YNOC, the SECV issued instructions to staff on 5 July 1955 to proceed with a new open cut to be known as Yallourn North Extension (YNE), mining the Latrobe Seam at a location about four kilometres west of the YN mine entry.[440] Commissioning of the Morwell Briquetting Works had been delayed by Commonwealth financial restrictions and was not now expected until 1958. Brown coal supply to Newport Power Station in particular and to a range of other customers throughout the State was a vital necessity to substitute for the non availability of briquette supply from Morwell. At mid 1955, it was estimated that the economically minable coal reserves at YNOC would be down to about two million tons by mid 1958. Development of the YNE Open Cut was urgent.



Drawing 9.4/1 YNEOC Area Plan June 1965 (copy from Rusden (1968) Plan No.7). Copyright TRUenergy.

Photo 9.4/2 YNEOC Storage/out-loading bin (Copy from Vines (1989), p.68).



The coal reserves at the YNE location of the Latrobe Coal Seam were estimated in 1956 at over 86 million tons of 'economical winnable coal'. (Further east at the Tyers township, another widening of the Latrobe Seam had a coal reserve assessed at over 25 million tons.[441]) The overburden at the YNE coal deposit was assessed at some 45 million cubic yards overlying the coal with additional overburden in the mine batter system assessed at 22 million cubic yards.[442] Drilling in the selected mining area had indicated an average coal quality of about 53 per cent moisture and 4.5 per cent ash (dry basis). Actual results from weighted averages of excavation samples between 1959 to 1978 were 51.7 per cent moisture and 4.4 per cent ash.[443]

In 1955, it was planned to excavate, transport and dump overburden by contract, placing the overburden at a multilevel dump at the west outside the planned open cut perimeter. It was decided to develop the open cut to depth with two electric shovel/mobile crusher loaders, each delivering partly crushed coal to a separate coal conveyor system, each delivering to a common secondary crusher and then to a storage/out-loading bin of 160 ton capacity adjacent to the Yallourn North – Tyers Road for crushed coal deliveries to road trucks. The conveyor plant had three feet wide belts running at 450 feet per minute for loading by a single excavator or 650 feet per minute for conveyors loaded by two excavators. A dragline was also envisaged to assist with clean-up operations. A small fleet of Euclid wagons (ten cubic yard capacity) and Mack Trucks (six or eight tonne capacity) was also available from the YNOC operations to be loaded with overburden and coal respectively during special development operations or coal conveyor system outages.[444] Delivery by road trucks was carried out to industrial customers in the Gippsland area, to the Australian Paper Mill about four kilometres from YNE, and to the existing VR rail head about four kilometres away at the YN mine entry for use at Yallourn Power Station and in the metropolitan area and beyond in power stations and industrial plants.

Site works at YNE commenced with the stripping and temporary storage of top soil from the site on 15 September 1955. The first contract for overburden removal and dumping commenced on 3 November 1955.[445]

Coal excavation commenced on 9 July 1956 using a 21RB Electric Shovel transferred from YNOC loading road trucks delivering to the rail head at YNOC which outloaded to VR rail trucks. On 1 Nov 1956, coal deliveries to and through the roadside storage/delivery bin at YNE commenced. On 3 July 1957, the secondary crusher and initial coal conveyor came into service. 'From this time, conveyors became the main means of coal transport within the open cut from the coal excavating faces'.[446]

Excavating, crushing and conveying plant were then progressively transferred from YNOC and coal excavation at the old mine was progressively decreased with depleting coal reserves. From 1955 to 1958, the annual coal output exceeded 1.5 million tons sourced from the two open cuts. Annual output then decreased as briquette supply from the new Morwell Briquette Works increased towards full capacity and briquette supply replaced brown coal supply from the two open cuts YN and YNE. Mining at YNOC ceased on 3 May 1963.[447]

By 30 June 1963, the coal output from YNE since commencement of coal excavation in July 1956 was over 1.64 million tons. For the 1963/64 year the coal output from YNE exceeded 0.597 million tons.[448]

At YNEOC, the through-put capacity of the excavation to outloading station plant was tested at 415 tons per hour. Coal face heights of 27 feet were assessed as the optimum for the 100RB shovels as excavating plant. Subsequently when the larger 120B shovels were transferred to YNEOC, face heights of 30 feet were used.[449] Drawing 9.4/2 (Rusden (1968) Plan No.7) shows YNEOC layout at June 1965. A detailed description (by Eric Foote, Coal Production Superintendent) of the early operations at YNEOC is given in Vines (1989), pp. 63–64. Subsequent operations to 30 June 1988 are outlined in Vines (1989), pp. 68–138.

In 1962 and 1963, tests of briquetting of approximately 15,000 tons of YNE coal carried out at Morwell Briquetting Works resulted in general satisfaction with plant capability and quality control. These tests demonstrated that the YNE coal reserve and that at Tyers on the Latrobe Seam were a suitable coal resource for briquette manufacture,[450] although the higher ash content would present disadvantages to reprocessing consumers.

By 30 June 1980, 7.63 million tonnes of coal had been delivered from YNEOC, but the annual demand had fallen to below 0.25 million tonnes[451] and was expected to stay at or below this level in the uncertain future, as natural gas from Bass Strait had proven more economical as a fuel for most previous customers. Reductions in personnel and in plant installations to reduce maintenance costs were implemented.

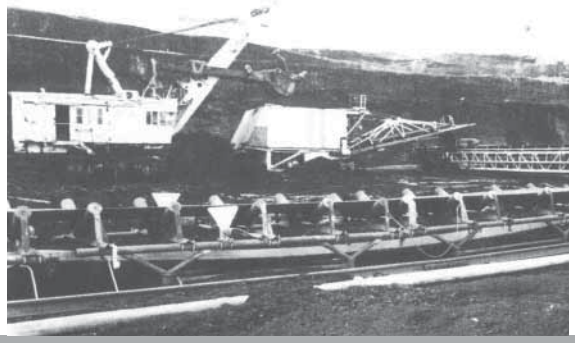
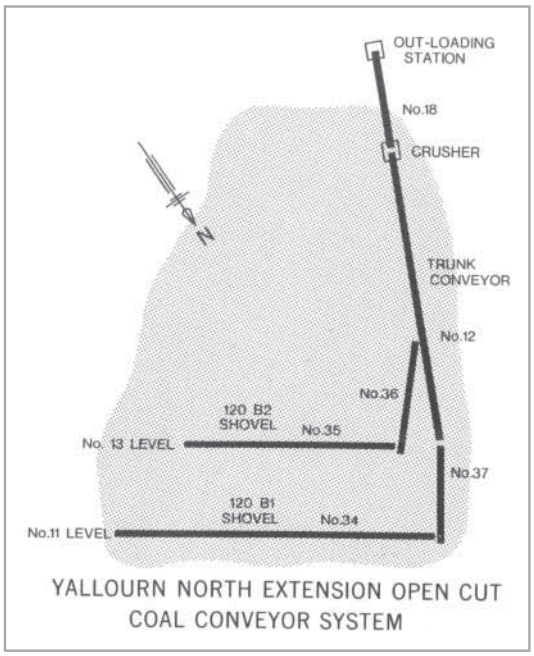
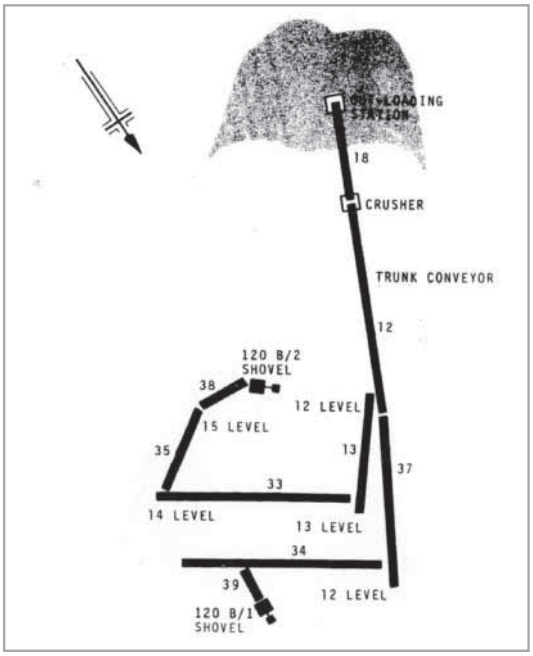


Photo 9.4/3 YNEOC 120B Shovel with crusher/loader and relocaTable conveyors, 1988 (Copy from Vines (1989), p.77).



Drawing 9.4/2 YNEOC Coal conveyor system layout, December 1968 (copy from Vines (1989), p.97).



Drawing 9.4/3 YNEOC Coal conveyor system layout, December 1977 (copy from Vines (1989), p.98).

A new in-pit outloading bin was installed to reduce the in-pit coal haulage distance as the open cut expanded. The roadside storage/delivery bin, the trunk conveyor system and the secondary crusher were eliminated. Used conveyor plant and conveyor belting from Yallourn Open Cut, which had been replaced there by larger capacity plant, were transferred to YNE to avoid capital expenditure at YNE as the open cut expanded. By 1980, the YNE open cut had expanded sufficiently and the bottom of the coal seam had been excavated sufficiently to allow internal dumping of overburden to commence.

Mining at YNEOC ceased in 1989 when the last customer, the Maryvale Mill of the Australian Paper Manufacturers, switched to (natural) gas. In that year the brown coal marketing authority, the Coal Corporation of Victoria stated: 'no significant new customer has been identified in the immediate future'.[452] Total coal mined throughout the mine life was 9.4 million tonnes, leaving about a 40 million tonne coal reserve (at about the same overburden to coal ratio as had been mined). Overburden removal had been 7.416 million cubic metres in total.[453] At closure the immediate planned mining area held seven million tonnes of coal with average properties of 52 per cent moisture and 4.1 per cent ash (dry basis).[454] About 2.5 million tonnes of this could have been mined without further overburden removal before rehabilitation within the mine was implemented in the 1990s.[455]

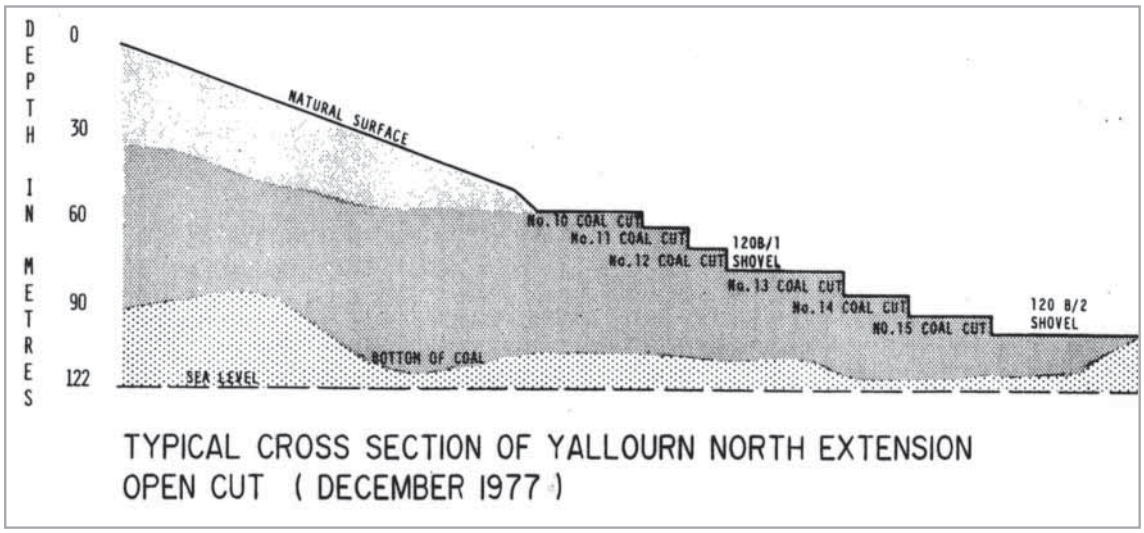
Reclamation of the YNEOC site was completed in the 1990s,[456] with the partly exposed coal resource readily available for further excavation.

Additional photographs are available from Vines (1989), from the Yallourn North Historical Society, and from the publication *The Old Brown Coal Mine* by Kath Ringin, 1986.

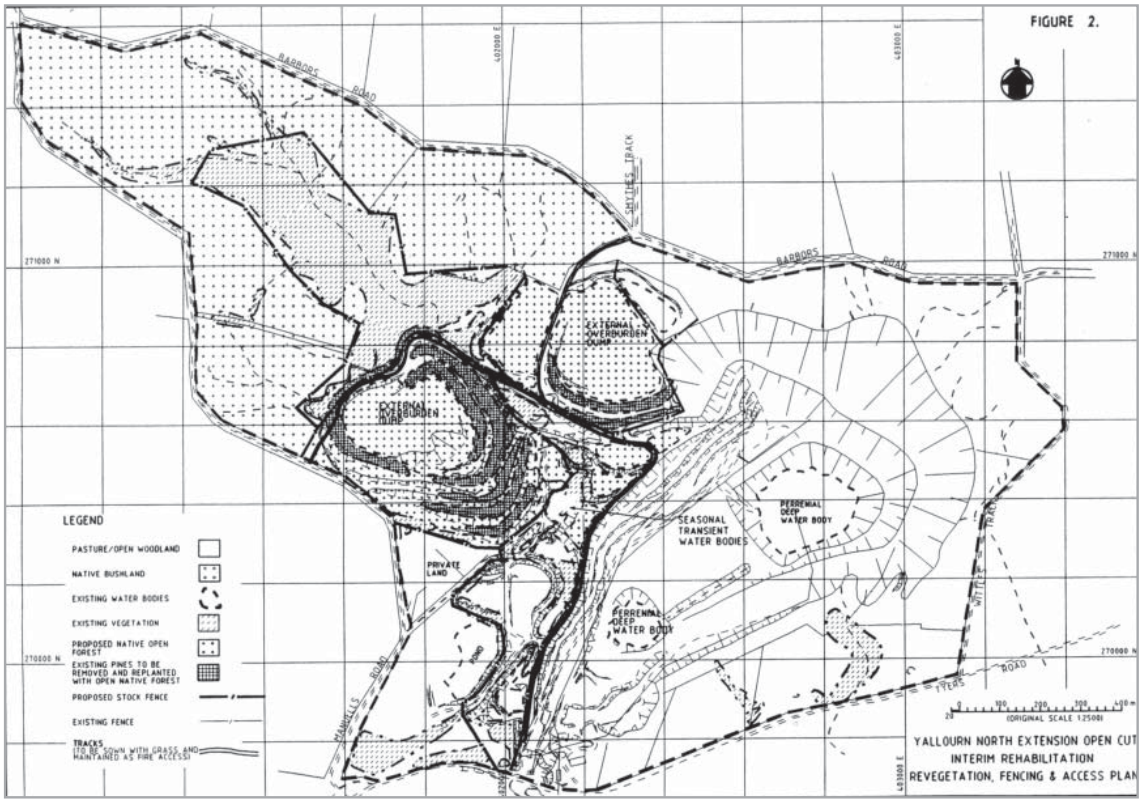
Assessment of Heritage Significance

Historical Significance

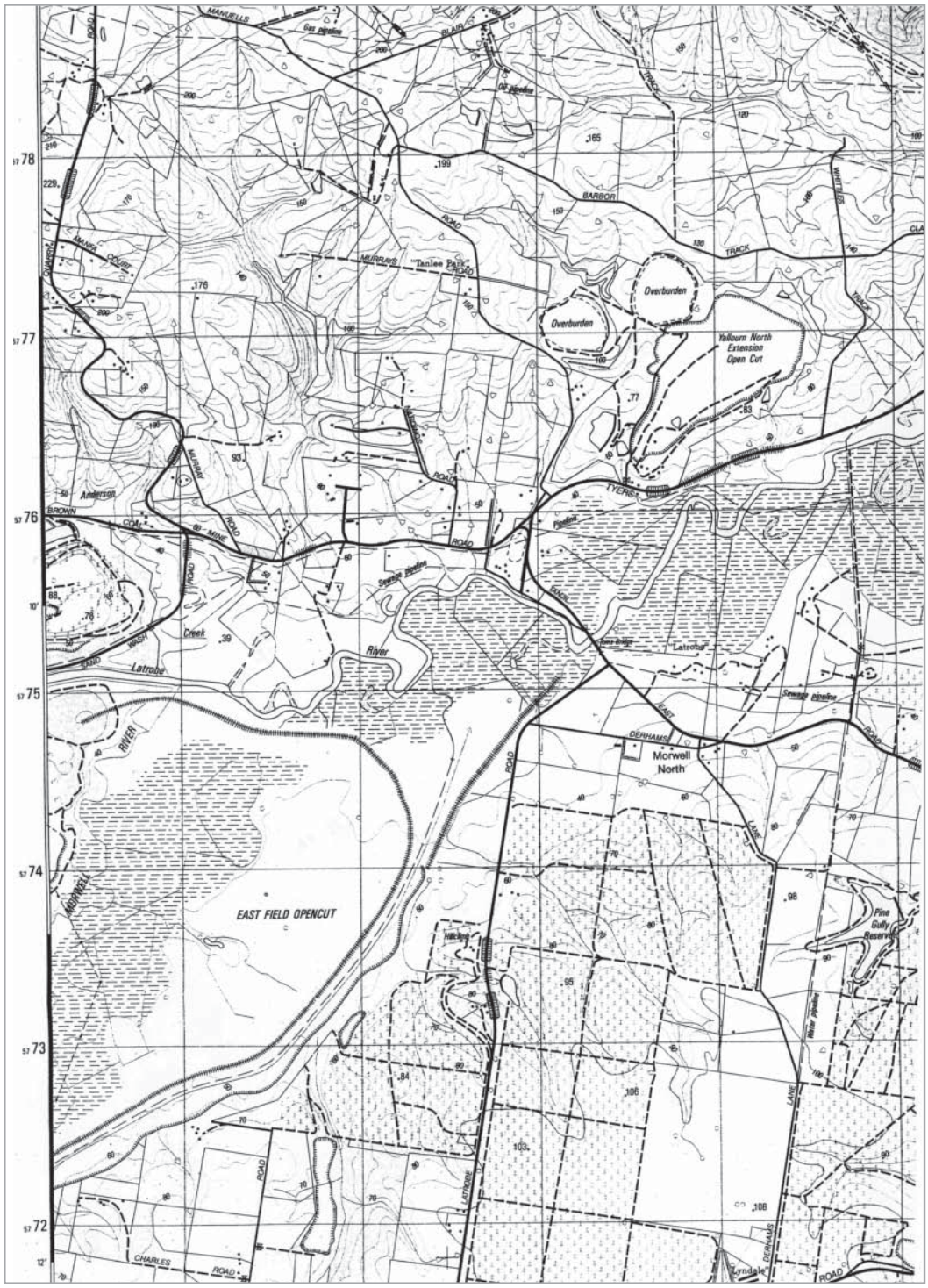
The need for a source of coal to be available to take over coal supply from the limited resource available at Yallourn North Open Cut was recognised in the late 1940s, at which tine there were severe post war shortages of all forms of power and heat in Victoria and of black coal supplies from NSW. The Latrobe Seam brown coal as mined at YNOC was of higher calorific value than other brown coal deposits with significant



Drawing 9.4/4 YNXOC cross section, December 1977 (Copy from Vines (1989), p.99).



Drawing 9.4/5 YNXOC Rehabilitation plan at 1992 (copy from Brown, K et al., The AusIMM, November 1992, p.73).



Drawing 9.4/6 Locality of YNEOC (from topographical map 8121-1-2 Morwell). Copyright State of Victoria, Department of Sustainability and Environment.

YALLOURN NORTH EXTENSION — OVERBURDEN QUANTITIES: CUBIC YARDS UNTIL 30/6/73: CUBIC METRES FROM 30/6/73

TO 30/6	55RB DRAGLINE	21RB D'LINE	100RB1 SHOVEL	100RB2 SHOVEL	120B3 (6A/15)	MOBILE AUX PLANT	BY SEC	CONTRACT	HIGH ASH COAL	EXCAVATION CUBIC YARDS	PROGRESSIVE QUANTITIES
1956	3 550						3 550	441 301		444 851	
1957	61 190	4 140	7 300			880	73 510	516 020	5 264	594 794	
1958	163 680		31 700				195 380	816 060	5 876	1 017 316	
1959	108 839	170	110	45 686			154 805	604 056		758 861	
1960				26 248			68 778	459 083	696	528 557	3 344 379
1961											
1962	116 674						116 674	66 222	120	183 016	
1963	300			1 520			1 820			1 820	
1964					111 046		111 046	641 298		752 344	
1965					163 115		163 115	518 463		681 578	
1966					58 953		58 953			58 953	
1967					91 235		91 235	690 404		781 639	
1968					34 585		34 585			34 585	
1969					25 498		25 498	478 240		503 738	
1970											6 342 052
1971					15 921		15 921			15 921	
1972								1 249 884		1 249 884	
1973					21 816	12 367	34 183			34 183	7 642 040 cu yards 5 846 161 cu metres
1974											
1975											
1976											
1977											
1978											
1979											
1980											5 846 161
1981								747 273		747 273	
1982								258 573		258 573	
1983											
1984											
1985											
1986											
1987								563 723		563 723	
1988											7 415 730 (30/6/88)

Table 9.4/1 YNXOC Overburden excavation, 1956 to 1988 (Copy from Vines (1989), p. 66).

mining reserves in Victoria. The Latrobe Seam coal was harder and less friable and hence was more suitable for transport than brown coal from other sources in Victoria. It was highly important that a new source of coal have the same properties as that being supplied from YNOC to Newport Power Station, to other power and/or steam generating plants and to gas manufacturing plants, so that extensive modifications were avoided to settings of plants utilising coal.

Coal mining at the YNEOC commenced in 1956 before the briquetting and power plant at Morwell came into service and when power from the Kiewa and Snowy Hydro-electric Schemes and from Yallourn additional units were only in embryo service. Although, by the early 1970s, the post-war shortages of fuel and power had been largely overcome by completion of major power generating works and with fuel oil and natural gas now available, demand for brown coal for private industry still existed until 1989.

A coal resource of some 40 million tonnes of coal remains at the YNE site, ready for future utilisation.

Scientific Significance

At 1865, investigations were conducted in Europe on processes for briquetting Lal Lal brown coal.[457] Herman (1922) reports that scientific analyses of brown coal had commenced in the Mines Department by 1866 or 1867.[458] The *Royal Commission on Coal* (1889–1891) stimulated scientific research, including visitation to Germany where brown coal utilisation was more technically advanced than elsewhere. From the 1890s, considerable investigations were undertaken into conversion or processing the Latrobe Seam coal as being mined at the Great Morwell Coal mine (later YNOC).

By the late 1950s, when YNEOC came into operation, the qualities of the Latrobe Seam had been extensively

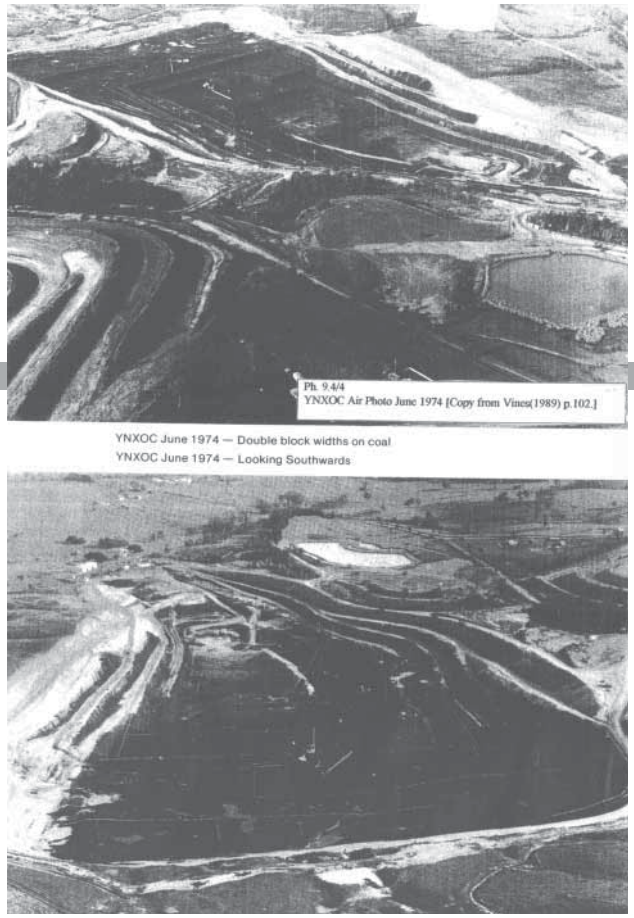


Photo 9.4/4 YNEOC air photo, June 1974 (Copy from Vines (1989), p.102).

researched. YNE coal had proved suitable as a stand alone fuel, as a substitute for briquettes and for briquette making, and in a dried pulverised form for processing for miscellaneous uses. The Coal Corporation of Victoria, established in 1985 to market coal supply to industry, had in 1988 reported that 'Forty-three companies had registered interest in initiating upgrading processes' for conversion of Latrobe Valley brown coal. The CCV had estimated a demand of over five million tonnes per annum by 1994 for these conversion purposes.[459]

Although it was anticipated that this demand of over five million tonnes per annum would be supplied from Loy Yang Open Cut, at 1988, YNEOC was available as a resource of about 40 million tonnes suitable for a significant portion of this demand, and had the advantage of being a separate activity from the larger scale power generating utilisation from the other existing Latrobe Valley open cuts.

Economic Significance

The YNEOC coal supply met a vital demand from private industry, initially in conjunction with YNOC but subsequently from 1963 to 1988 as a stand alone operation. There was no secure alternative fuel supply for heat generating plants in Gippsland which could compete economically with the Latrobe Seam coal. In general, briquettes were in short supply until natural gas from Bass Strait became available progressively from the late 1860s. Additionally, coal supply to the Newport Power Station in Melbourne and other smaller generating stations as a fuel suitable for combustion in boiler grates normally using black coal was of high importance for the capacity and reliability of the Victorian Electricity System, especially during black coal supply shortages up to 1965.

As electricity generation output from the Newport coal burning power station was replaced by more economic generation, the strategic value of brown coal supply to the metropolitan area decreased. In general, briquettes manufactured from low ash/ low cost coal from Yallourn Open Cut, and natural gas, proved more economic fuels than coal from YNEOC.

Industrial Significance

Coal supplies from YNEOC over its 30 year life were used almost entirely for steam raising and heating. Coal supply from this small open cut met demand with total reliability. Manning arrangements and hours of supply were flexible to meet availability of road transport to consumers. Pricing of coal at the mine outlet was such that various enterprises in Gippsland used this coal in preference to other fuels, generally until their existing steam raising plant needed high maintenance or replacement. At this stage, natural gas plant was generally installed. Most of the former coal burning industrial plant could also use briquettes and converted to this fuel where delivery from a rail depot was locally available.

The YNEOC offered availability of lower moisture brown coal for a wide range of reprocessing uses or for pilot plants or laboratory level experimentation. However, in spite of Government support for such ventures, no significant commercial level plant eventuated utilising this coal.

On industrial issues, the YNEOC had some special features. Utilisation of contract removal of overburden had been strongly resisted by unions in the other SECV open cuts. The successful use of sequential contracts at YNEOC led to similar arrangements at the other open cuts. Multi skilling, self reliability and responsibility among the small workforce at YNEOC led to wider application at the other open cuts.

Social Significance

Opening of the YNEOC in 1956 presented an opportunity for the open cut workforce at the old YNOC to continue the exercise of their skills and experience on plant systems with which they were well acquainted. In general there was no domestic relocation required. No disturbance of rural personnel at the mine site was involved. The Yallourn North township was originally established as a dormitory town within walking distance for employees at the Yallourn and Yallourn North Open Cuts to their work location. This township was the domicile of most of the YNEOC workforce. The decline of the

YALLOURN NORTH EXTENSION — COAL QUANTITIES: TONS TO 30 JUNE 1973: TONNES FROM 1 JULY 1973

EXCAVATING MACHINES TO 30/6	100RB1 SHOVEL	100RB2 SHOVEL	21RB SHOVEL	55RB SHOVEL	AUX MACHINES	120B1 SHOVEL	120B2 SHOVEL	120B3 (6A/15) D'LINE	TOTAL EXCAVATION
1957	63 952	56 397	6 594	619					127 562
1958	167 884	203 593	1 794	619					373 890
1959	368 280	88 275	1 338	3 123					461 016
1960	303 872	62 621		1 480					367 973
1961	127 246	25 173							152 419
1962	1 759				793				2 552
1963	91 861	14 103		3 289	340	20 093	116 210		245 896
1964	18 237	9 396				109 192	460 339		597 164
1965	8 180					130 424	320 784	438	459 826
1966						315 895	112 794		428 689
1967					5 416	339 094	77 541	546	422 597
1968					5 928	234 043	178 271		418 242
1969					408	308 588	149 741		458 737
1970					468	291 972	104 131		396 571
1971					1 963	230 214	109 505		341 682
1972					3 745	200 356	106 514		310 615
1973					1 249	152 878	96 276		250 403
TOTAL TONS	1 151 271	459 558	9 726	9 130	20 310	2 332 749	1 832 106	984	5 815 834
TONNES	1 169 745	466 933	9 882	9 277	20 636	2 370 182	1 861 506	1 000	5 909 161
1974						236 155	70 627		306 782
1975					195	208 089	65 353		273 637
1976						133 818	108 232		242 050
1977					26 282	69 308	92 067		187 657
1978					24 681	75 808	111 074		211 563
1979						100 221	155 079		255 300
1980						120 161	123 198		243 359
1981						186 818	42 915		229 733
1982						131 266	76 564		207 830
1983						99 763	130 692		230 455
1984						45 521	173 000		218 521
1985						80 675	111 287	755	192 717
1986						78 819	127 317	10 280	216 416
1987					7 477	112 671	87 319		207 467
1988					15 932	104 927	99 275		219 594
TOTAL TONNES	1 169 745	466 933	9 882	9 277	95 203	4 154 202	43 435 505	12 035	9 352 782

DELIVERIES TO 30/6	TO YALL'N NORTH	TO PUBLIC BUYERS	SEC USE	TOTAL	REMARKS PROGRESSIVE QUANTITIES
1957	49 823	76 060	1 679	127 562	
1958	151 453	216 084	6 353	373 890	
1959	105 023	355 989	4	461 016	
1960	497	367 467	9	367 973	1 330 441 Tons to 30/6/60
1961		152 419		152 419	
1962		1 847	705	2 552	
1963	78 594	151 865	15 437*	245 896*	* Includes 14 413 to MBF
1964	188 337	408 662	165	597 164	
1965	37 117	422 629	80	459 826	845 to YBF
1966		428 655	34	428 689	
1967		422 589	8	422 597	
1968		418 220	22	418 242	
1969		458 707	30	458 737	
1970		396 571		396 571	4 913 134 Tons to 30/6/70
1971		341 682		341 682	
1972		310 615		310 615	
1973		250 403		250 403	
	610 844	5 180 464	24 526	5 815 834	Tons to 30/6/73
	620 646	5 263 595	24 920	5 909 161	Tonnes from 1/7/6
1974		306 782		306 782	
1975		273 637		273 637	
1976		242 050		242 050	
1977		187 657		187 657	
1978		211 563		211 563	
1979		255 300		255 300	
1980		243 359		243 359	7 629 509 Tonnes to 30/6/80
1981		229 733		229 733	
1982		207 830		207 830	
1983		230 455		230 455	
1984		218 521		218 521	
1985		192 718		192 718	
1986		216 416		216 416	
1987		207 467		207 467	
1988		220 134		220 134	
	620 646	8 707 216	24 920	9 352 782	

Table 9.4/2 YNXOC Coal excavation, 1957 to 1988 (copy from Vines (1989), p.67).

YNOC operation with the extinction of coal reserves was offset by the merging and subsequent transfer to YNEOC.

Personnel employed at YNEOC were part of the much larger Yallourn Open Cut employee groups with whom they were fully integrated for training and promotional opportunities.

The YNEOC has undergone extensive rehabilitation and erosion control works since the cessation of mining in 1988. Much of the mine site including the external overburden dump has been restored to pre-mining use as grazing land.

Mine Infrastructure Features

Remaining economically minable coal reserves.

Rehabilitated landscape – leaving resumption of mining as feasible.

Residual water storages for fire fighting and erosion mitigation.

Site of roadside coal storage and outloading bin.

References

Brown, K et al 'Yallourn North Extension Open Cut Interim Rehabilitation'*, Rehabilitate Victoria*, AusIMM, November 1992

Gloe, CS, *Geological Report*, No.1, SECV, 1956

Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No.11, AusIMM, 1984

Herman, H, *Brown Coals Of Victoria*, 1922

Mineral Statistics, Mines Department, 1965

Rusden, GF, *History of Yallourn, Yallourn North and Yallourn North Extension Open Cuts, July 1947 to June 1965*, SECV, 1968

Vines, JA, *A Technical History of Yallourn North and Yallourn North Extension Open Cuts*, 1965 to 1988, SECV, 1989

Vines, JA, *A History of the Loy Yang Mine: Its Origins and Development to May 1997*, SECV, June 2000, p.356

9.5 Morwell Open Cut

Map Reference: **8121-1-2 Morwell Zone 55 Open Cut 4470, 57860**

Municipality: **City of Latrobe**

Land Use/Status: **Private**

Site History

In 1936, Jan Klitzing, a German consultant to the SECV, recommended opening a new open cut south of Yallourn to provide increased reliability of coal supply to the Yallourn Power Station and Briquetting Plant and to provide for future demand.[460] Reliability from the Yallourn Open Cut had previously suffered due to flood and fire. Klitzing's recommendation was not adopted at the time, with the SECV allocating funds for additional hydro-power at Kiewa in 1938 and from 1941 for Newport Power Station burning black coal.

In July 1941, an Investigatory Committee on Utilisation of Brown Coal for Essential Services established by the State Government during a prolonged period of hard fuel shortages recommended that briquetting production (all at that time by the SECV at Yallourn) be increased from about 0.4 million tons per year to 1.2 million tons per year to meet existing demand with further increase to 1.7 million tons per year by about 1960. This proposed output did not include provision for replacement of existing coal usage. In August 1941, the SECV Engineer-in-Charge Coal Supply (R. J McKay) submitted a report 'Yallourn Brown Coal for Essential Services', taking into account the continuing increasing demand for electricity as well as for hard fuel. He submitted that 'there are sound reasons for developing another open cut – the work of investigation should be commenced as early as possible'.[461]

The outcome of these recommendations was that the SECV undertook an extensive drilling program of the brown coal resource in Gippsland and submitted several reports on the selection of a new open cut location. On 13 July 1948, the State Government passed legislation approving a SECV recommendation for an Open Cut and Briquetting Works at the Maryvale South site immediately south of the Morwell township. The nomenclature 'Morwell Briquetting Project' was adopted. The enabling legislation defined the project as supplying coal for two briquette factory units with a combined output of 1.3 million tons per annum of briquettes, noting that there were sufficient coal reserves available in the approved open cut site for a further output of 1.3 million tons per annum of briquettes[462]. The coal in the Maryvale South site was from an older coal seam to that being mined at Yallourn, was of lower moisture content but higher sulphur and ash content.

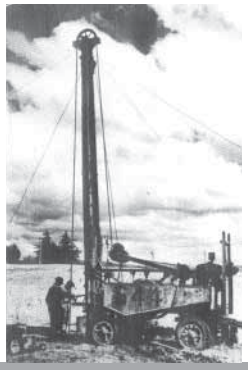
In the selection of the Maryvale South location for the briquetting project, the SECV had nominated the Loy Yang area at the south of the Traralgon township site as being more favourable for an electricity generation site, and that the Loy Yang coal resource as well as the coal resource at a Maryvale North location on the north of Morwell township be reserved for future use by the SECV for power generation[463].

At June 1948, it was noted by the Minister for Electrical Undertakings in introducing the enabling act to Parliament that the SECV had been requested by Government in December 1946 to proceed from that time with procurement of open cut equipment which could be used at Yallourn Open Cut if formal legislation for the Morwell Briquetting Project was delayed.[464]

The development plan proposed by the SECV at 1948 for the 2.6 million tons per annum briquetting output was based on rail mounted ladder dredgers on four operating benches. One dredger was to be on overburden removal with disposal via a rail system to a rail mounted spreader on an external dump. Five dredgers were to be on coal excavation loading to rail tracks with delivery from ditch bunkers on the eastern batters to raw coal bunkers adjacent to the briquette factories. Three of the coal dredgers were planned to be deep digging and two to be high digging ladder dredgers.[465] This plant complex was similar to that in use at Yallourn in the late 1930s and was advocated by senior YOC personnel on the basis of Yallourn experience to the early 1940s.

In 1946, as soon as practical after World War II, a group of senior SECV engineers visited Germany and evaluated trends in German Open Cut practice. Although orders were placed by the SECV in 1947 for three rail mounted bucket chain (ladder) dredgers, consideration was being given to subsequent dredgers for the Yallourn and Morwell Open Cuts to be crawler mounted bucket wheel machines.

Site excavation at the Morwell project commenced by contract on 11 April 1949 on drainage, ramp and road access, water supply, worker accommodation and other infrastructure for



Photos 9.5/1A–B (left to right) MOC: Drilling rigs 1948 (from Vines, (1996), p.132).

the open cut. By June 1950, work had commenced on the interconnecting SECV 90 cm gauge railway between Morwell and Yallourn Open Cuts, a vital provision for initial transfer of overburden and coal from Morwell and for future reliability of coal supplies (Drawing 9.4/5). In early 1950, orders were placed for a bucket wheel dredger (SECV Number 21) and a rail mounted overburden spreader (SECV Number 3; Photo 9.5/4), a five cubic yard walking dragline and a wide range of electric locos, rail trucks and ancillary rail equipment required for service from 1951 to1952.[466]

However in August 1951, the Commonwealth Government imposed severe restrictions on funds for development works throughout Australia. Plant procurement for Morwell Project was delayed and site construction work almost completely postponed until September 1954.

(Number 21 dredger travelled off its erection site at Morwell on 16 November 1953 for travel and digging trials. Total excavation time was about one hour of overcasting before the dredger travelled back for modifications and completion of outstanding contractual items.) Number 21 dredger came into service on overburden excavation with trials in September/ October 1955 delivering over the Interconnecting Railway to the YOC internal dump and also to Number Three Spreader at the MOC external dump.[467]

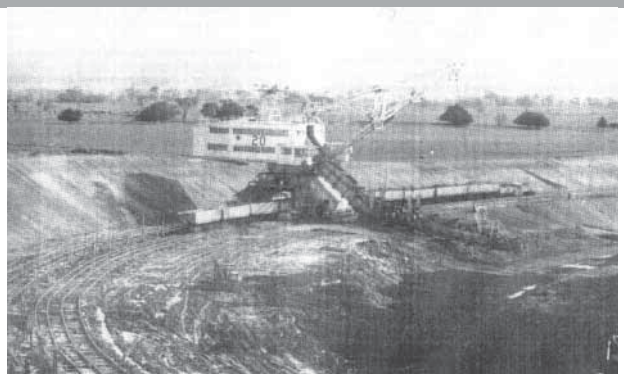
Coal excavation commenced in November 1955 over a period of three consecutive day shifts with Number 21 dredger excavating this coal from the overburden face and delivering this over the ICR to Number Three ditch bunker at Yallourn. Regular coal deliveries on this route from Number 21 dredger commenced in December 1955. The rail mounted Number 20 ladder dredger (Photos 9.5/3 A and B) came into service on 16 July 1956, working additionally to Number 21 dredger on overburden removal as well as development of the first coalface. For the 1956/57 year before coal deliveries commenced to the Morwell ditch bunker, approximately 50,000 tons of coal was delivered over the ICR to Yallourn and about 1.5 million cubic yards of overburden excavated by dredgers 20 and 21.[468]

In late 1957, with forecasts of substantially increased coal demand on MOC, the long term development plan for MOC was changed to provide for coal and overburden transport to be by belt conveyor instead of by rail and for excavators to be crawler mounted bucket wheel dredgers. This change was to apply to future plant orders as the open cut developed in depth and to replacement of rail plant when justified. The new plan envisaged transfer of rolling stock to the expanding rail delivery systems in YOC.[469]

Photo 9.5/2 MOC: Initial excavation area, 1950 (from Vines, (1996), p. 45A).

In November 1958, coal supplies commenced from MOC to Morwell Power Station.[470]

In August 1959, coal supplies commenced from MOC to the Morwell Briquette Factory which had its first test runs on 9 September 1959 with briquette output for November at 16,583 tons. On 8 December 1959, the first deliveries of briquettes from the MBF to the Gas and Fuel Plant at Morwell commenced.[471] However it was found that briquettes from Morwell Coal were not as good in weathering, and in furnace fouling as those made from the cleaner and lower ash content coal from YOC. Although many subsequent trials of briquetting from MOC coal were carried out subsequently, selected briquetting coal (low silica, low ash, low woody content, and light brown lithotype) from YOC was used continuously at the MBF through to the late 1990s when the ICR was taken out of service. Thereafter road haulage of coal from YOC and later



Photos 9.5/3A–B (top to bottom) MOC: 20 Dredger on overburden removal (from Vines, (1996), p.121).

from Loy Yang Open Cut as well as minor supplies from MOC was used as demand for briquettes decreased.[472]

At 1959, the Government on the recommendation of the SECV gave approval for a power station of six 200 MW units be built at Hazelwood fuelled by MOC coal. Approval was given in May 1965 for a further two 200 million watt units at Hazelwood Power Station.[473] The generating capacity at Morwell Power Station was also increased to 170 million watts. The increased coal demand on MOC by these increases in generating plant more than offset the reduction due to transfer of coal supplies to the MBF from MOC to YOC coal, and the cancellation of the installation of two additional briquette factories originally ordered in December 1950.[474]

Long term plans for development of MOC were modified extensively to increase excavation and transport plant capacity to meet the forecasted higher coal demand. Rail haulage of coal and overburden was progressively changed to conveyor transport. The ICR was retained for briquetting coal deliveries to Morwell, and for emergency or supplementary coal transfer from MOC to Yallourn and Yallourn W Power Stations.

Coal supply to Hazelwood Power Station commenced in July 1964. The eighth unit of HPS came into service in late 1970. Coal output met demand of 12.28 million tons per annum in 1969/70, rising progressively with demand to 16.02 million tonnes per annum in 1976/77.[475]

Number 21 bucket wheel dredger proved unsuitable for overburden excavation and uneconomical for coal winning, due to its low output capacity. It was taken out of service in 1982 after 36 years of service excavating 1.92 million cubic metres of overburden and 35.40 million tonnes of coal. This dredger remains as a heritage item on display to the public off the roadside near the former entrance to the Morwell Open Cut at the Power Works Visitors Centre.[476]

Number Three bucket wheel dredger was also a small capacity machine. At MOC it excavated 0.073 million cubic metres of overburden and 13.51 million tones of coal between 1959 and 1983. At YOC it excavated 12.82 million tons of coal between 1950 and 1959, and 2.07 million tonnes between 1983 and 1984. It was withdrawn from service in 1984 after 34 years service, after which the bucket wheel assembly was preserved as a heritage item on display at the Power Works Visitors Site at Morwell and the remainder of the dredger retained as spare equipment or sold for scrap.

Number 20 bucket chain dredger came into commercial service on 16 July 1956 as a rail mounted overburden excavator loading trains delivering to Number Three spreader on an external dump (Photos 9.5/3 A and B). It excavated 19.77 million cubic metres of overburden and 0.86 million tons of coal in its 13 year life from 1957 to 1970. It was taken out of service after its completion of overburden removal in the MOC East Field.

Number 19 bucket chain 'gleisraupen' crawler-mounted dredger came into commercial operation on 10 October 1960 after extensive modifications to convert a German design from rail to conveyor out-loading (Photo 9.5/5). This machine went into service as the excavator at the lowest operating level in the open cut being used for developing the open cut to depth.[477] It had a low output capacity particularly when digging on a deep face. It excavated 40.53 million tonnes of coal to its retirement in 1990. By that time the mine had been opened up to the full depth of the Morwell Number One coal seam. A bucket wheel dredger took over its role of extending the mine on the bottom operating level by excavating on the bottom side of its face conveyor. Number 19 dredger was cannibalised for spares and its remains sold for scrap.[478]

Other excavators of higher capacity than the plant ordered for the initial 'briquetting project' were progressively brought into service. These later machines were all bucket wheel excavators.

Number Nine Dredger (Photo 9.5/8) went into service on coal excavation on 18 May 1964.[479]

Number Ten Dredger went into service on coal excavation in February 1970 and transferred to overburden removal in May 1970 at the commencement of overburden transport by conveyors to the Tripper/Stacker TS2[480].

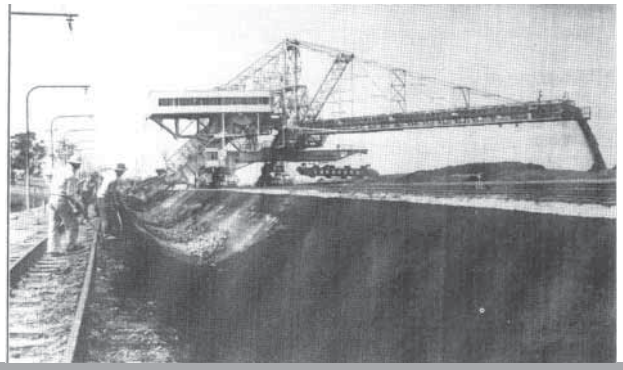
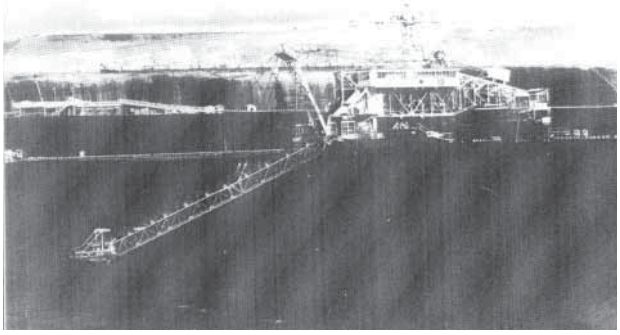


Photo 9.5/4 MOC: Number Three Spreader (from Vines, (1996), p.127).

Photo 9.5/5 MOC: Number 19 Dredger (from Vines, (1996), Drawing 6.6/2, p.90).

Photo 9.5/6 MOC: View at June 1952 (from Vines, (1996), p.116).



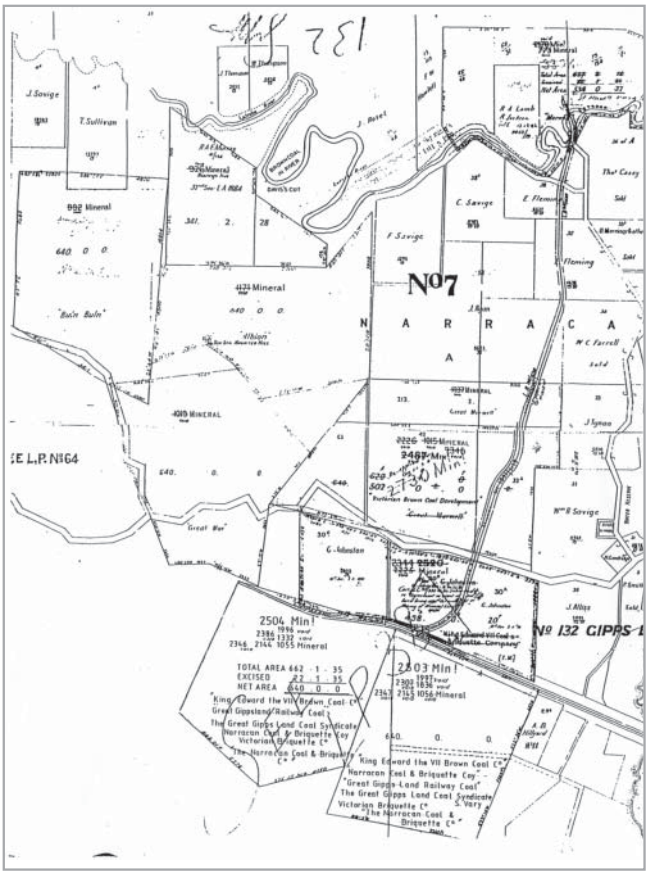
Number 11 Dredger (Photo 9.5/9) came into service on 13 July 1970 and was used mainly as a coal winning machine but at times substituting for Number Ten dredger on overburden removal.[481]

Number 24 Dredger, a compact bucket wheel excavator, commissioned at YOC in July 1984 was transferred to MOC in an emergency when Number Ten and Number 11 Dredgers had coincident major breakdowns. Number 24 dredger operations at MOC commenced on 25 June 1987. It stayed at MOC excavating 13.67 million tonnes of coal to March 1995 when it was mothballed for sale or emergency recall at either open cut.[482] The latter eventuality occurred when dredger Number 24 was recalled to service in MOC, and at 2005 continues to be used in a mobile reserve capacity covering breakdown of other dredgers or for special development excavation.

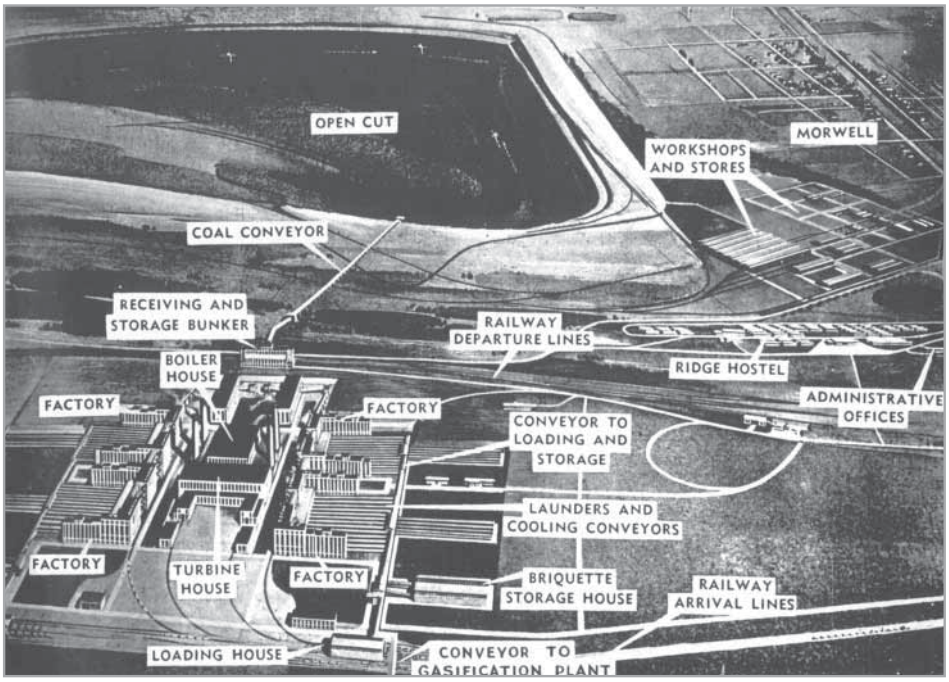
Number 25 Dredger (Photos 9.5/11 A and B) – a compact bucket wheel excavator of somewhat higher capacity than 24 Dredger – came into service on 13 December 1989.[483]

At 2005, Number Nine, Ten, 11 and 25 dredgers remained in service intended for continued operation in the new West Field. These dredgers were all interchangeable being of relatively similar output capacity and excavating reach, albeit that Number Nine Dredger was not favoured for overburden removal and Number 25 Dredger had a somewhat lesser reach.

With the progressive replacement of the rail transport by conveyor systems from about 1960, the open cut was developed in depth and extension predominantly by parallel



Drawing 9.5/1 Mining/Exploration Leases in Morwell River Valley at the West of Morwell circa 1910.



Drawing 9.5/2 Morwell Project Proposed Layout at 1950 (from the *Mining and Geological Journal*, March 1956).

moves of four face conveyors as trunk conveyors extended and pivoted into new 'fields'. At various periods of the development, there were two top side excavation faces and one bottom side accessed by ramp systems at or near the tail end of each conveyor. At various periods two excavators were allocated to the one face conveyor. Two mobile slew conveyors were available for allocation to provide greater reach and flexibility for a dredger.

A significant feature of the mine development was the need for extensive dewatering of the aquifers below the Morwell Number One and Number Two coal seams, to limit earth movement of the mine batter systems and heave of the floor of the open cut. An extensive monitoring system was employed to measure movement of batters, benches and earth surface while aiming for minimum lowering of aquifer pressures to achieve safety from excessive movements. The aquifer water extracted was utilised in fire protection but predominantly was pumped as 'clean water' to the Hazelwood Power Station Cooling Pond to improve water quality therein and reduce the usage of domestic water supply for Power Station cooling water.[484]

Enhancement of community infrastructure for water supply storages and reticulation, for deviations and upgrading of the regional roads and highways, for housing and local service industries and for education through to tertiary level was significant from 1950 as an outcome of initiation of the Morwell Project and its continuation as a major electricity generating complex based on the Morwell Open Cut.

On 1 January 1994, the SECV was disaggregated. The new public authority responsible to Government for management of coal mines and electricity generation was named Generation Victoria. On 1 February 1995, Hazelwood Power Corporation was established by Government to manage the Morwell Open Cut and Hazelwood Power Station as a public authority. On 9 August 1996, the assets of Hazelwood Power (including Morwell Open Cut) were sold by Government to a private consortium with National Power from England as the majority shareholder.[485]

The corporate rearrangements did not lead to significant change in the development proposals for Morwell Open Cut except that the new owners undertook repairs at Hazelwood

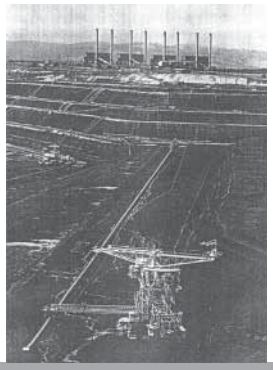
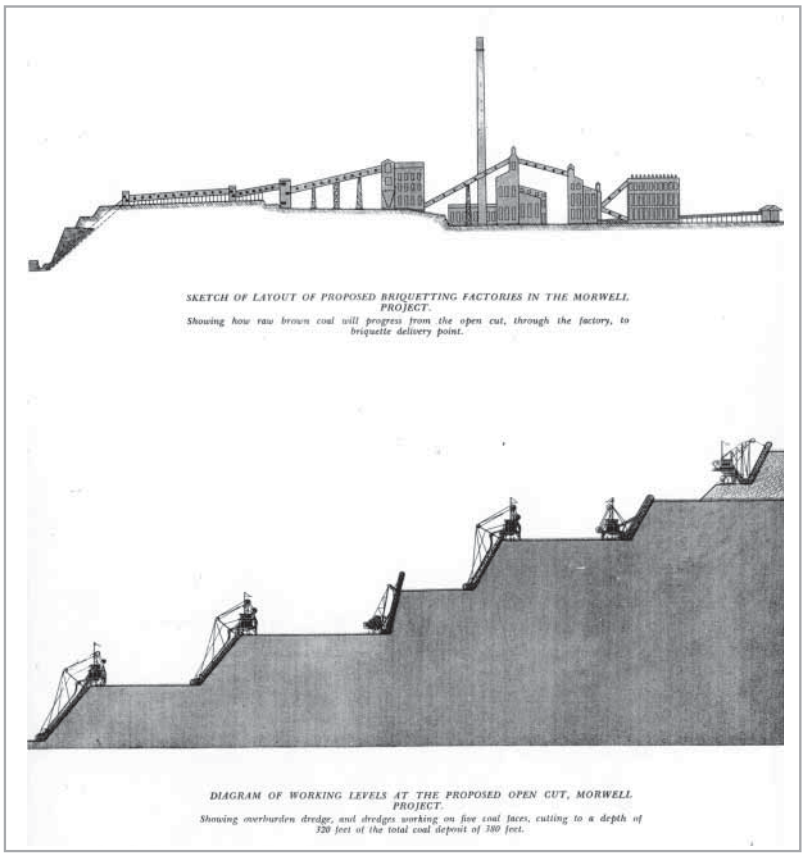
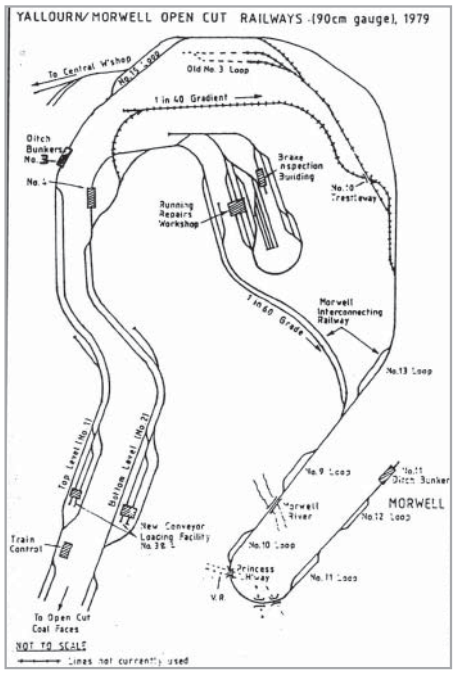


Photo 9.5/7 MOC: Three dredgers loading one conveyor. Copyright State Electricity Commission of Victoria.

Photo 9.5/8 MOC: Number Nine Dredger with eight units of Hazelwood Power Station in service. Copyright State Electricity Commission of Victoria.



Drawing 9.5/3 MOC Proposed Excavator Allocation at 1945 (from *Three Decades*, 1949, p.142).



Drawing 9.5/4 MOC/YOC: Interconnecting Railway Layout from 1956 (from Vines, (1996), p.79).

Power Station to return this station to full operation with eight units resulting in increased demand for fuel.

In August 2000, Hazelwood Power announced details of the Hazelwood West project involving continued development of the Morwell Open Cut by extension of the existing mine at the south, and then westward with site works commencing in 2001 within the existing mining licence area.[486] This was the extension depicted on previous long term plans by the SECV.

In November 2000, International Power now owned 91.84 per cent of the Hazelwood Power Station and Morwell Open Cut complex having purchased 19.9 per cent previously owned by Scottish Power. The Commonwealth Bank retained the remaining 8.16 per cent of the ownership. This ownership structure remained at June 2005.[487]

In April 2001, the first level of the internal dump for overburden disposal was completed after some three years of operation covering about 54 hectares to a depth of up to 28 metres. Relocation of the Tripper Stacker (TS2) and two conveyors to commence a second level dump was then undertaken.[488]

In July 2001, a contract was let for archaeological fieldwork and interpretation of cultural heritage aspects in the proposed Hazelwood West Field. This work involved detailed inspections before and during overburden excavation of old homestead sites. Artefacts were retrieved from Koorie sites, classified and deposited with the Morwell Koorie Co-operative Centre. These archaeological studies were to remain as a continuing feature of the West Field mining operation.[489]

For the 2001 calendar year, 19.77 million tones of coal was excavated and 12,173 Gigawatt Hours of electricity generated

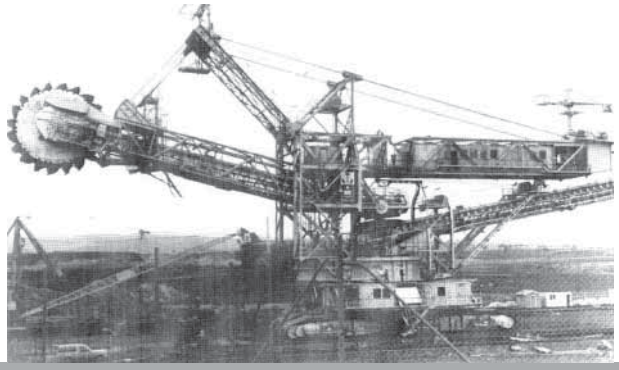


Photo 9.5/9 MOC: Number 11 Dredger (from Vines, (1996), p.186).

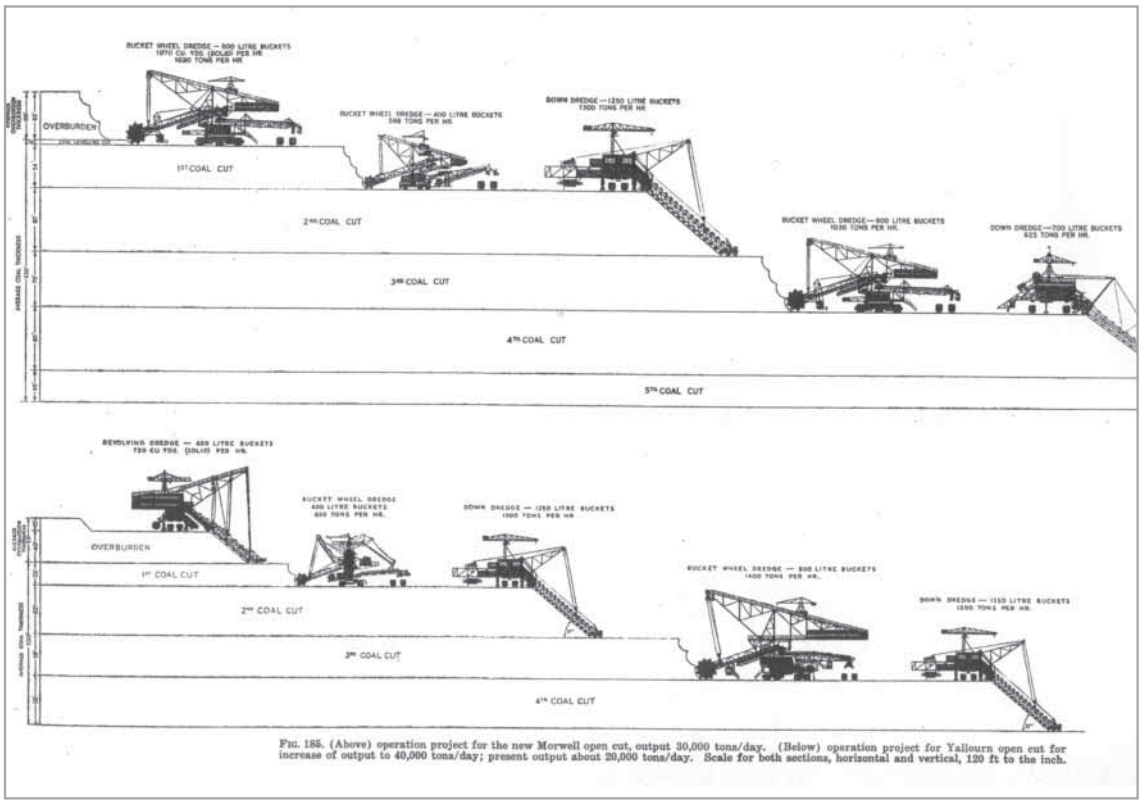
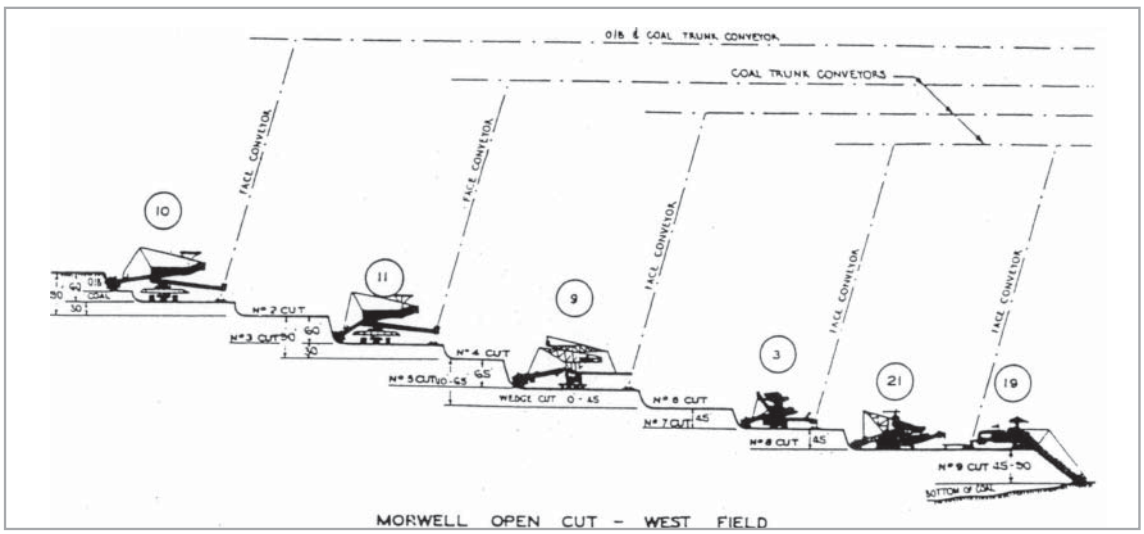


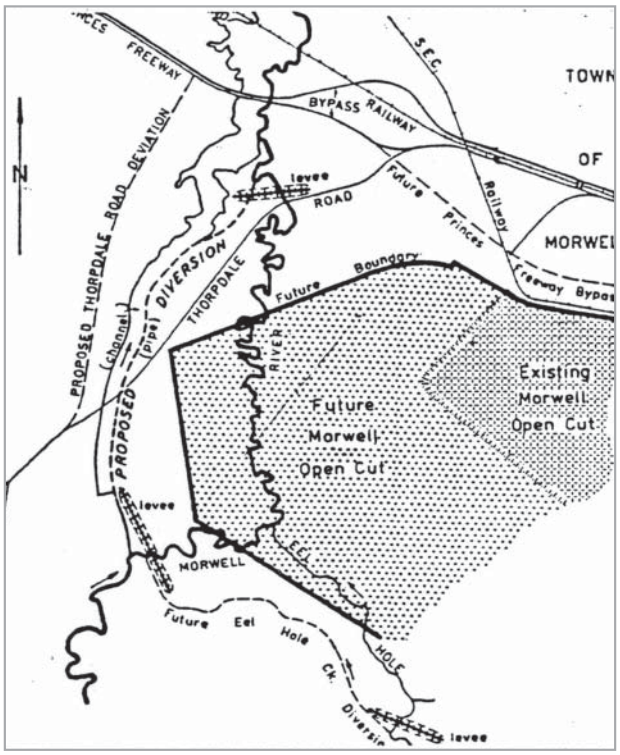
FIG. 185. (Above) operation project for the new Morwell open cut, output 30,000 tons/day. (Below) operation project for Yallourn open cut for increase of output to 40,000 tons/day; present output about 20,000 tons/day. Scale for both sections, horizontal and vertical, 120 ft to the inch.

Drawing 9.5/5 MOC/YOC: 1949 Proposal for introduction of bucket wheel dredgers (from Herman, (1952), Fig.185, p.190A).



Drawing 9.5/6 MOC: 1965 proposal for allocation of dredgers, with only one ladder dredger (from Vines, (1996), p.175).

Photo 9.5/10 MOC: View at 1980 (from Vines, (1996), p.262).



Drawing 9.5/7 MOC: 1978 Morwell River diversion to access southern and western coal resources (from Vines, (1996), p. 231).

(over 11,000 GWh sent out). This was a record annual coal output for MOC. Over four million cubic metres of overburden had been stripped from the West Field by mobile plant and placed in a levee bank on the south side of the West Field and on earth ramps for the site of coal conveyors in the West Field. Sixteen 50 tonne capacity rigid frame trucks and seventeen 40 tonne articulated trucks were used on overburden haulage and placement. Removal and placement of 6.1 million cubic metres of overburden was expected in the 2003 year.[490]

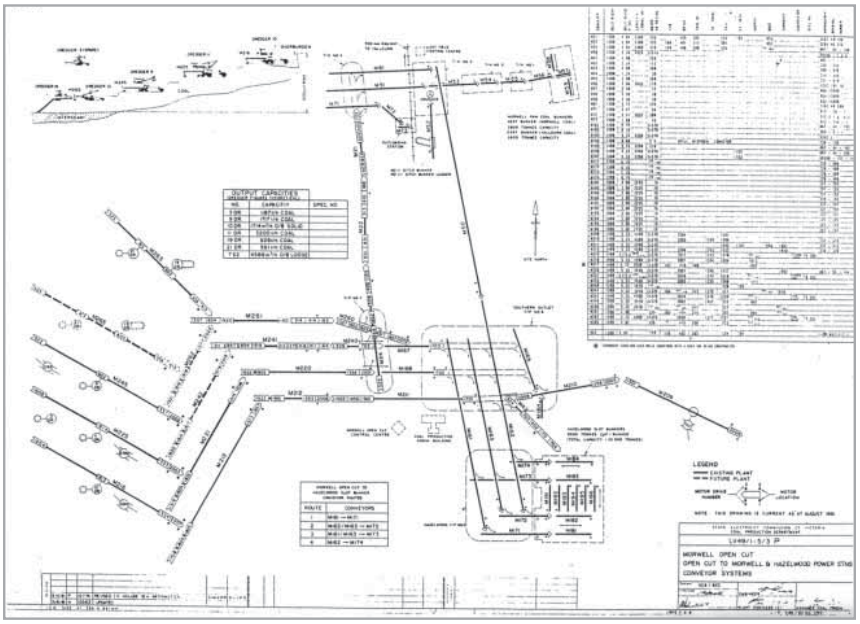
In May 2002, a contract was let for design and construction of four conveyor systems to be used in the Hazelwood West Field, using components from the existing systems in the South East Field where feasible. These four systems were required to be in service progressively from September 2003 to 2006.[491]

In October 2002, the owners of the Power Station and Mine Complex changed the name of the controlling entity to International Power Hazelwood (IPRH). For 2003, only 2.8 million cubic metres of overburden remained to be excavated in the South East Field.[492]

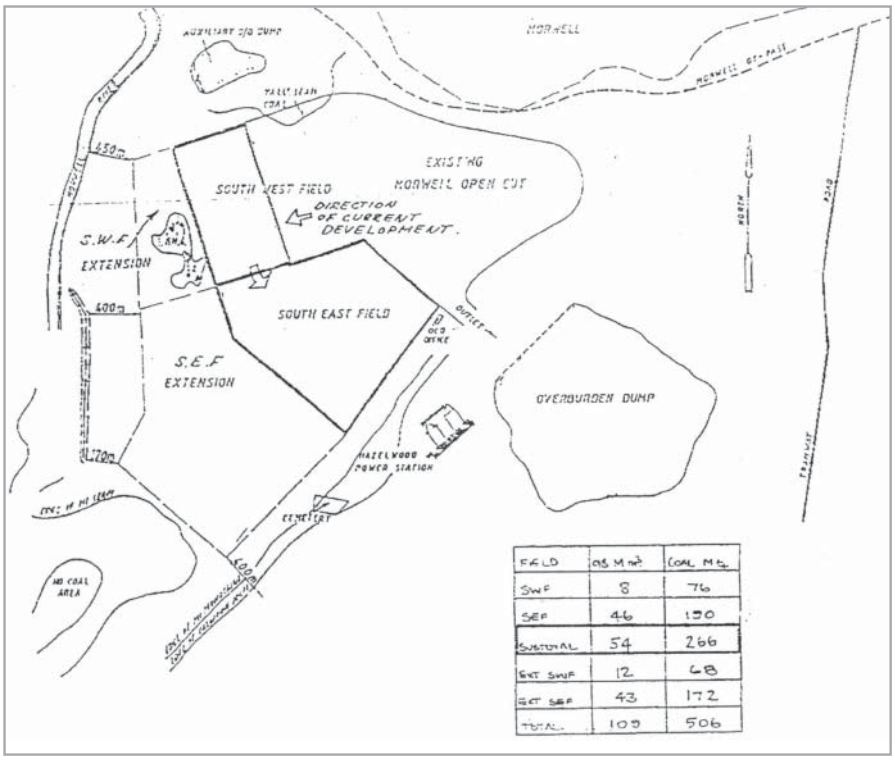
In May 2003, the Hazelwood West Field Development was given Major Project Facilitation Status by the Commonwealth Government. On the basis that the South East Field coal resource would be fully excavated by 2009, Stage 1 of the proposed development was approved for commencement of coal excavation later in 2003 within the existing coal mining licence boundary. However the proposal submitted by IPRH, including provision for coal supply to 2025, involved a deviation over a length of about seven kilometres of the previous diversion of the Morwell River, deviations of two creeks, relocation of the Strzelecki Highway and Brodribb Road, all to provide for extension of the mine via parallel movements of dredger operating faces through the West Field (Drawing 9.5/13). This proposal involved a logical modification of the mining licence boundary which had originally been arbitrarily defined on land occupation boundaries rather than on a rational mining plan appropriate to the existing dredgers in use by IPRH. The IPRH proposal offered an exchange of coal bearing land of 110 million tonnes within the existing licence area for 92 million tonnes outside the existing licence area.[493]

In July 2003, IPRH submitted an Environmental Effects Statement (EES) for public comment and subsequently was engaged in a process of public and government hearings on provisions for environmental protection, including mitigation of greenhouse gas emissions from Hazelwood Power Station. At April 2005, after extensive discussions and modifications or additional commitments by IPRH, an Independent Panel established by the Government recommended approval of the latest IPRH proposals as 'the most economical alternative for the supply of base load electricity to Victoria and the National Electricity Market', and 'as an appropriate use of the Gippsland brown coal resource'. Government response to the Panel's recommendations and formulation of commitments by IPRH were still awaited at September 2005. In the meantime from 2004, IPRH had been involved in land purchases to gain ownership of land required for mining and for infrastructure deviations.[494]

Dredger Number 10 completed overburden removal in the South East Field in July 2003. The first coal from the West Field was delivered in February 2004. The second coal system

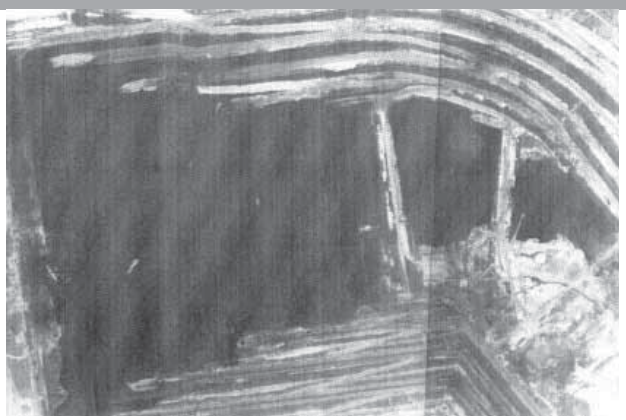


Drawing 9.5/8 MOC: Conveyor systems and dredger locations at August 1981 (from Vines, (1996), p. 258).

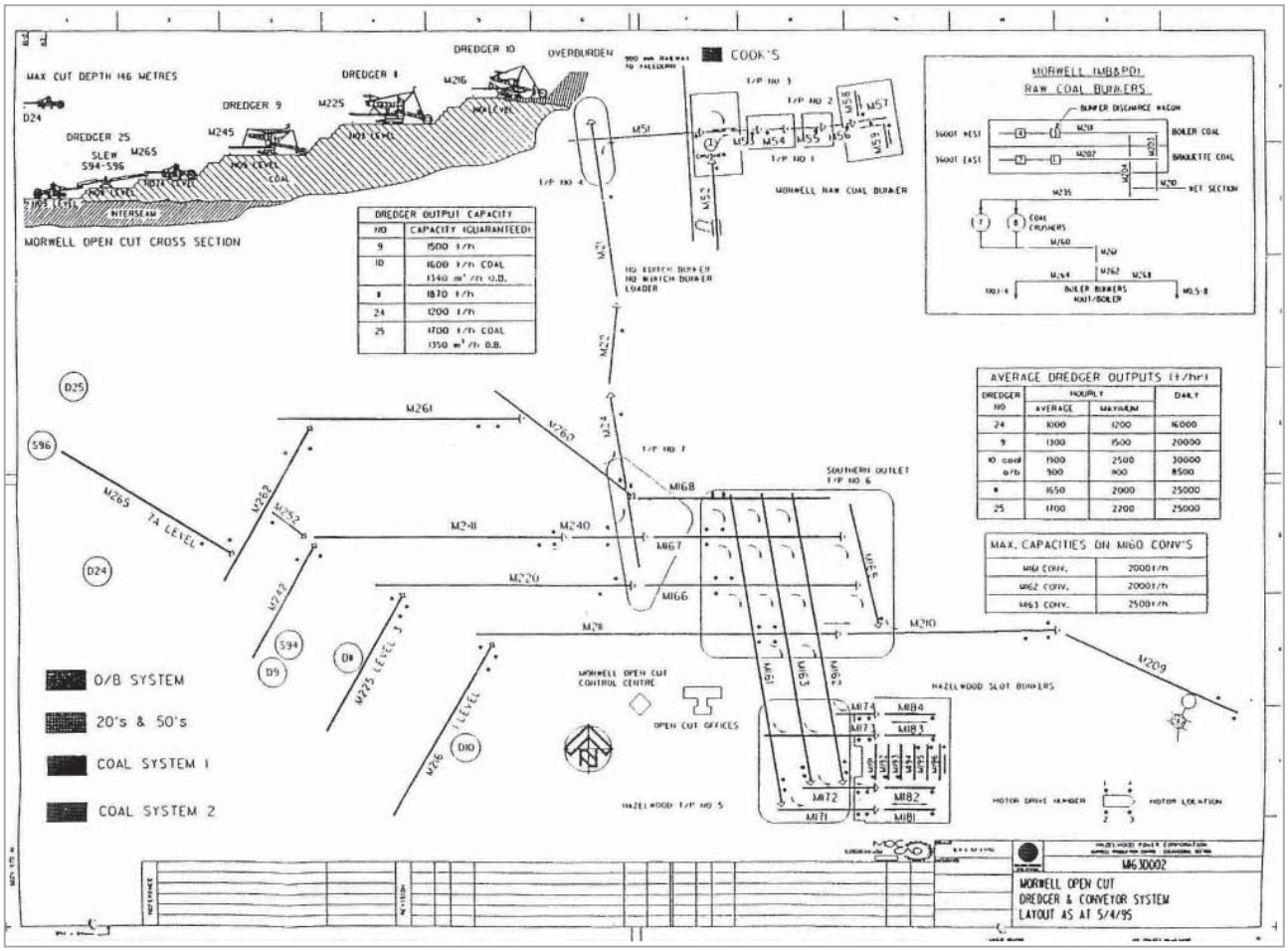


Drawing 9.5/9 MOC: Total accessible coal reserves at 1990, without a further river diversion (from Vines, (1996), p.309).

Photos 9.5/11A–B MOC: Number 25 Dredger and view of open cut at 1989 (from Vines, (1996), p. 301).



in the West Field commenced operation in November 2004. The third system was expected in service by September 2005. The extensive use of mobile plant to open up the West Field eliminated the need for overburden removal by dredger prior to the initial coal excavation and reduced the overburden to coal requirements in the early years of excavation in the West Field. Hence, Dredger Number 25 was allocated the overburden removal and reserve coal excavator task commencing in June 2005. Numbers 9, 10, and 11 Dredgers were allocated to coal excavation in the West Field.[495] Dredger 24 also remained in service for substitution for any of the other dredgers or for special operations.



Drawing 9.5/10 MOC: Conveyor systems and dredger locations at April 1995 (from Vines, (1996), p. 360B).

Photo 9.5/12 MOC: View at 1992 (from Vines, (1996), p. 323).

Briquette factory had been restored to part operation by MECRUS on lease from HRL. At that stage, Morwell Power Station ran on MOC coal and MBF used Loy Yang coal.

In January 2004, a major fire in the Morwell Briquette Works owned by HRL and operated as Energy Brix lead to temporary cessation of briquette manufacture. A reduction of about 5 per cent of Morwell Open Cut output resulted. The small Morwell Power Station continued to be operated. Hazelwood and Loy Yang A Power Stations now had to find alternative fuels for start up and combustion stability. In the short term supplies of black coal were accessed from NSW and Queensland while longer term options were considered. At 2005, the Morwell

Assessment of Heritage Significance

Historical Significance

The original concept of the Morwell Briquetting Complex was a major post war initiative to challenge the virtual monopoly exercised by NSW coal exporters to meet the increasing demand for hard fuels in Victoria.

Commencement of the Morwell Open Cut based on the original concept offered the opportunity to adapt the initial

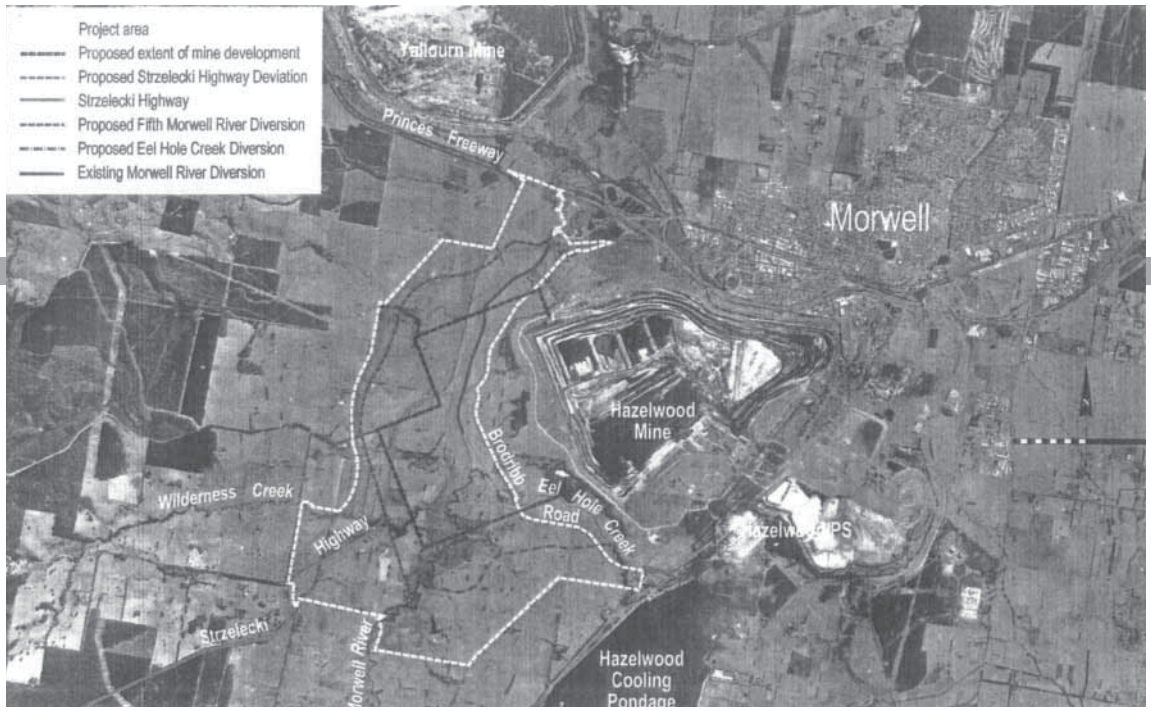
(MORWELL OPEN CUT PRODUCTION) / HAZELWOOD POWER CORPORATION MINE DATA (TONNES)

YEAR ENDING JUNE	DREDGER No. 3	DREDGER No. 9	DREDGER No. 10	DREDGER No. 11	DREDGER No. 19	DREDGER No. 20	DREDGER No. 21	DREDGER No. 24	DREDGER No. 25	Auxiliary Plant	Contractor's Shovels & Coal Carting	Delivered To M.B & P.S.	Delivered To H.P.S.	YALLOURN	TOTAL EXCAVATED	PROGRESSIVE TOTAL
1956							14694							14694	14694	14694
1957						49639	2603				2991			55233	55233	69927
1958						607726								607726	607726	677653
1959	32056					8446	293441					290947		42996	333943	1011596
1960	394529					52721	565806				600	961569		52087	1013656	2025252
1961	714539				620060	142591	1038583					1761174		754599	2515773	4541025
1962	907631				1428610		962077					1957750		1340568	3298318	7839343
1963	474226				2164524	160	1231016				3990	2340159		1533757	3873916	11713259
1964		228432			2418796		1432875					2595379		1484724	4080103	15793362
1965	221484	1593400			2021546		761084					2403858	971301	1222355	4597514	20390876
1966	876344	2533177			2691087		771879					2366381	3189430	1316676	6872487	27263363
1967	1430152	3339124			2419355		1290976					2311819	4705956	1461832	8479607	35742970
1968	1436203	4652432			2184563		1849470					2545026	6260905	1316737	10122668	45865638
1969	953743	4770528			1754690		2638416					2321707	7443950	351720	10117377	55983015
1970	1935557	4411687	1722892		2368589		1848744					2403479	9587590	296400	12287469	68270484
1971	1338828	3398767	1618288	3021730	1576881		845786					2218488	9570690	11102	11800280	80070764
1972	144578	3830646	2877352	5087803	1201881		135802					2349952	10928110		13278062	93348826
1973	23945	5595281	2661932	4035752	344295		1507734					2302329	11840180	26430	14168939	107517765
1974	494411	4369585	3531125	3560751	1647395		1132191					2417918	12317540		14735458	122253223
1975	537975	3342892	3174480	4170397	1110381		1768617					2501908	11590520	12314	14104742	136357965
1976	522490	4689910	1682169	6408881	976488		1073669					2269802	13047710	36095	15353607	151711572
1977	387971	5422631	2340263	5406215	1279971		1187249					2274837	13728450	21013	16024300	167735872
1978	201700	4594263	2318760	5704908	1141149		1306911					1763510	13431030	73151	15267691	183003563
1979	176962	5637117	1365250	5033459	1713128		1760143			14966		2403125	13138300	159600	15701025	198704588
1980	241400	4201239	2189991	5514489	1947586		1849042			500		2348317	13595930		15944247	214648835
1981	19200	3875015	3169882	5150254	1378452		1311594					2447487	12456110	800	14904397	229553232
1982	20500	4345818	2573565	4690306	1302492		696211			144527		2126619	11646800		13773419	243326651
1983	19100	2709762	2826389	3886850	1134652		513535			734276		2258264	9566300		11824564	255151215
1984		2767371	1936616	4930086	929523		570315			581552		2077063	9638400		11715463	266866678
1985		4220977	1686955	5339930	796412		343900			464169		1821043	11031300		12852343	279719021
1986		3477124	1546581	5367312	331042		907045			215920		1810424	10034600		11845024	291564045
1987		4632961	769588	4692906	502961		1247097	46100		176575		1722888	10345300		12068188	303632233
1988		3808470	663447	3704786	520503		858434	2404102		111490		1766232	10306000		12071232	315703465
1989		5069668	485194	5436510	605221		456884	1932900		166510		1816132	12336755		14152887	329856352
1990		4496779	292765	2743115	17833		495337	1680590	2030144	82530		1371076	10468017		11839093	341695445
1991		3340986	446326	3633869			197675	2288146	3510416	221803		1203618	12435603		13639221	355334666
1992		3678363	443747	2828468			536037	2492012	4714736		179360	1180152	13692571		14872723	370207389
1993		3483357	1476052	3591762				1390895	4098819		78750	965986	13153649		14119635	384327024
1994		1975348	461575	1620638				644212	3139793		828	1129935	6712459		7842394	392169418
1995		1212031	335502	3563437				192236	2339938		13674	1258573	6398245		7656818	399826236
1996																
1997																
1998																
1999																
2000																
TOTAL	13505524	119705141	44596688	109124614	40530086	861283	35402872	13071193	19833846	2914818	280193	72063926	315569701		399826236	

NOTE : First Coal delivered to HPS August 1964
Data has been compiled from Survey Adjusted figures where records were available.
Compiled by Hazelwood Power Corporation Mine Statistics Officer.

Table 9.5/1 MOC: Annual coal outputs, 1956 to 1995 (from Vines, (1996), Table 7.5/3, p.109).

Photo 9.5/13 International Power Hazelwood's Rivers and Roads Relocation (RRR) program, part of IPRH's West Field Mine Development – designed to secure power supplies to Hazelwood Power Station for the life of the business. Copyright International Power Hazelwood.



open cut plant readily to meet changed delivery requirements for a revised concept with priority for power generation.

The availability of Morwell Open Cut to supply coal to the Yallourn Power Station over the Interconnecting Railway over a 15 year period included delivery at an annual rate averaging over 1.3 million tons from 1962 to 1968. This substantial supplementary coal supply to Yallourn helped significantly in base load generation while Yallourn Power Station was the main base load generator in the State.

The supply of coal from the Morwell Open cut has provided fuel for base load power generation rising to over 30 per cent of the State Power Generating requirements by the late 1960s through to the early 1980s, and continuing at about 25 per cent at 2005.

Scientific Significance

Properties of the Morwell Number One seam coal were found to be significantly different from Yallourn Seam Coal. The evident need for a more intense mapping of coal constituents and means of mitigating coal quality problems by furnace plant modifications lead to the establishment by the SECV of the Herman Scientific Laboratory (HRL). This laboratory (privatised on 30 June 1994) reinforced traditional operational scientific analysis in the Power Stations and Briquette Factories and was of significant value in studies associated with proposals and trials for coal conversion opportunities and for new power stations at Yallourn W and at Loy Yang.

Economic Significance

The Morwell Open Cut has been the source of fuel for 25 per cent or more of the State's Power Generation for some 40 years to 2005. Government approval has been given in September 2005 for continuation of this vital economic role through access to coal for a further 25 years or so.

The Morwell Open Cut activity established the extensive brown coal resource of the Latrobe Valley as being economically winnable and suitable, with adequate evaluation of significant coal properties, for conversion to gas, liquid fuels, briquettes, hard char, pulverised dried coal, solar dried coal and a variety of by-products investigated for technical and commercial viability by the Coal Corporation of Victoria (CCV) 1985–1994. Subsequently HRL (Herman Research Laboratories) was a major participant in ongoing research. At 2005, research was being carried out by a number of consortia and agencies, especially in revised coal combustion processes to reduce greenhouse gas effluents in existing and future power stations.

Social Significance

The initiation and progressive expansion of Morwell Open Cut required the rapid acquisition of a skilled workforce both by contractors and the SECV. A high level of retraining of employees was necessary to convert or establish their competence in the operations and maintenance activities of the open cut, power stations, briquette factories and service industries.

The initiation and progressive expansion of Morwell Open Cut changed the Morwell Shire from a small rural community to a highly industrial area with rural pursuits remaining on the outskirts of the former Shire.

The employees at Morwell Open Cut were initially transferees within the SECV from the Yallourn Open Cut, being predominantly first generation Australians with European origins. The MOC gave these employees promotion and status

improvement. Subsequent waves of employees were largely new migrants engaged in their first employment in Australia.

Although the early workers on the MOC site were predominantly construction workers housed in temporary hostels on the outskirts of the town, a substantial public housing and infrastructure program matched the progressive increase in the workforce numbers such that ethnicity was not a problem in the harmonious growth of the new community. A new township of Churchill was established as a planned residential town in the early 1960s to provide housing stock for the introduction of new employees and for the expected demise of the Yallourn Township with its 4,500 residents.

Mine Infrastructure Features

Display at Power Works, Visitors Centre Morwell.

External overburden dump restoration.

Hazelwood Cooling Pond.

Morwell River Diversion Number Six.

Interconnecting Railway track and bridges.

Buckley's Reservoir.

References

Discovery, Victorian Department of Primary Industry, February 2003

Herman, H, *Brown Coal*, SECV, 1952

Jumbunna, International Power Hazelwood, August 2000, November 2000, April 2001, July 2001, September 2001, March 2002, May 2002, June 2002, October 2002, January 2003, March 2003

'Latrobe Valley Brown Coal Resources', *Proceedings* No.194, AusIMM 1960. Papers by: Stewart, EDJ; Gloe, CS; Rodgers, HCG; and Alexander, JMA.

McKay, RJ, *History of the Development of the Open Cut Workings at Yallourn*, SECV, 1950

Vines, JA, *A History of the Morwell Open Cut*, Generation Victoria, 1996

9.6 Loy Yang Open Cut

Map Reference: **8221-4-3 Traralgon Zone 55 Open Cut 4618, 57670**

Municipality: **Shire of Latrobe**

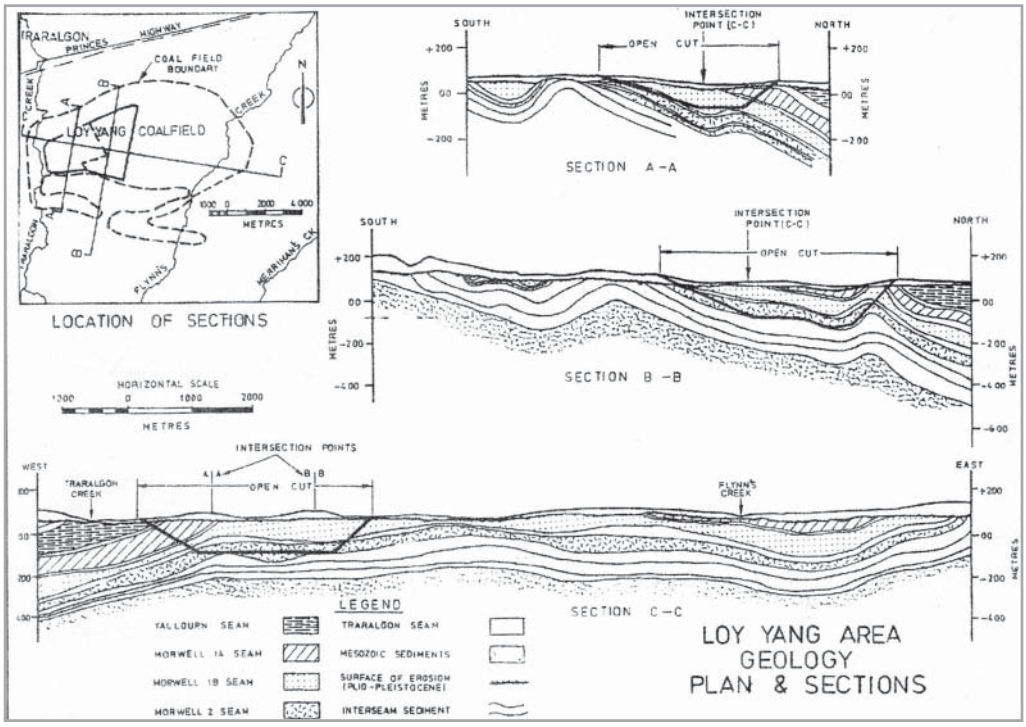
Land Use/Status: **Private**

Site History

It is probable that the existence of brown coal deposits at Loy Yang in the Latrobe Valley was known or at least inferred from other brown coal discoveries in the Gippsland area by 1873. In 1875, lignite (brown coal) was reported officially as having been found at Traralgon.[496] In 1876, the Mining Registrar at Traralgon reported: 'There are several parties prospecting for coal, outcrops of which are to be found south of the Gippsland Railway'[497]. Specific reference to exploration for coal at Loy Yang appears to have first occurred in 1889.[498] The extent of identification at 1890 of the coal resource in the Western Latrobe Valley as far east as Traralgon is shown in Drawing 9.6/1.[499]

Drilling to ascertain the geology and extent of the coal at Loy Yang and Traralgon was undertaken by the Mines Department between 1917 and 1922[500] when Mines Department Loy Yang Bores 1 to 61 were drilled. However, the knowledge gained was not available in time for Loy Yang to be given detailed consideration as an alternative to the proposals coming to fruition by 1915 to develop the Yallourn Coal Field.

No further drilling to investigate the Loy Yang resource occurred until Bore Number 62 was drilled on 8 December 1943.[501] In 1942, the SECV established a Brown Coal Investigation Section to undertake drilling and coal seam evaluation for assessment in selection of a new mining area to provide coal for a briquetting project. An essential feature of this concept was to have a coal transport connection from the new project to the Yallourn Power and Briquetting Complex as an emergency and supplementary fuel source for those economically vital works. In outcome, the Loy Yang coalfield was one of four sites selected for detailed consideration. However, it was the Maryvale South site that was recommended to Government in December 1946. The Maryvale South site was approved by Government in July 1948 as the Morwell Briquetting



Drawing 9.6/1 LYOC Geological Plans and Sections (from Vines, (2000), p. 64).

Project. A major factor in the preference for the Maryvale South site was its location closer to Yallourn than the Loy Yang site, with its coal transport interconnection being more economical and less intrusive on the local community infrastructure. However an associated recommendation by the mining consultant John Bridge in 1945 was that the Loy Yang site be resumed 'to provide for its utilisation as a source of fuel for an additional power station'.

The subsequent addition of the Hazelwood Power Station based on fuel from the Morwell Open Cut, together with the extension of Yallourn Power Station and the provision of the Yallourn W power station, both of the latter based on fuel from Yallourn Open Cut, delayed the commencement of an open cut at Loy Yang. Also, the advent of natural gas supplies from Bass Strait in December 1969 lead to the SECV gaining Government approval for a two by 500 megawatt intermediate load power station at Newport. Although subsequently only one 500 megawatt unit was installed at Newport due to environmental concerns, gas turbines with a total 500 megawatt capacity were installed at Jeeralang near Hazelwood.

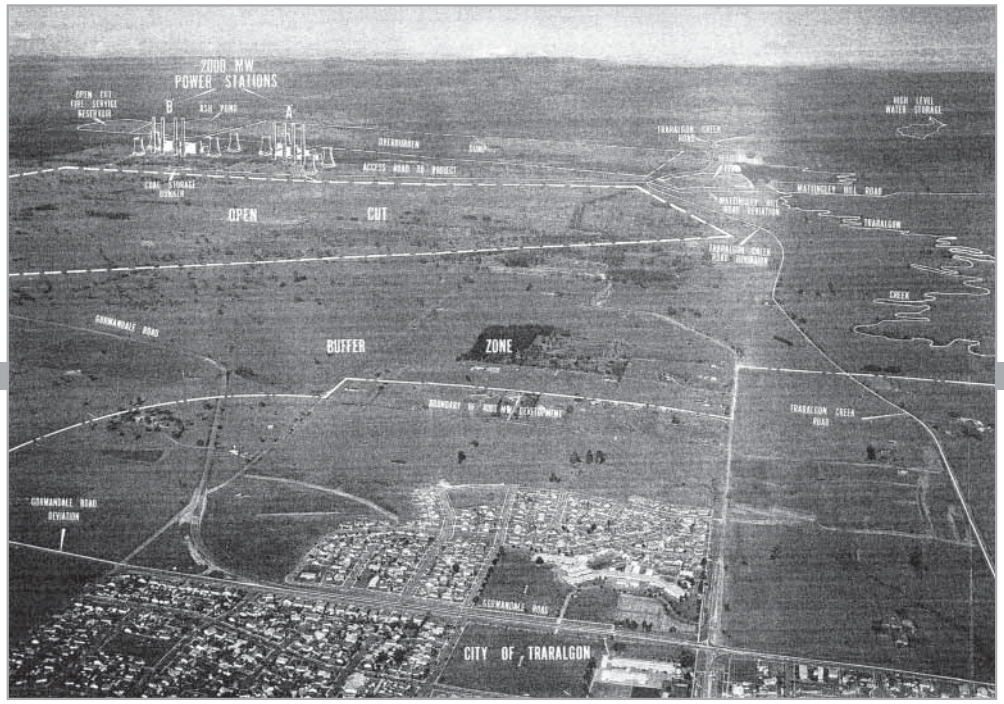
From the early 1960s, design concepts were being developed within the SECV for a Loy Yang base load power station based on the Loy Yang coal resource. In 1949, an Interim Development Order was placed limiting land price speculation in the Loy Yang area. From 1967 the SECV undertook land purchase in the Loy Yang area (Drawing 9.6/2).[502]

'Legislation was passed on 23 November 1976 enabling the SECV to provide for the construction of a 4000 megawatt power generating project with coal supply from a new open cut at Loy Yang.'[503]

Until 1977, the site had been subject to visits by drilling crews, surveyors, engineers and geologists. On 19 January 1977, the first contract was let for site works.[504]

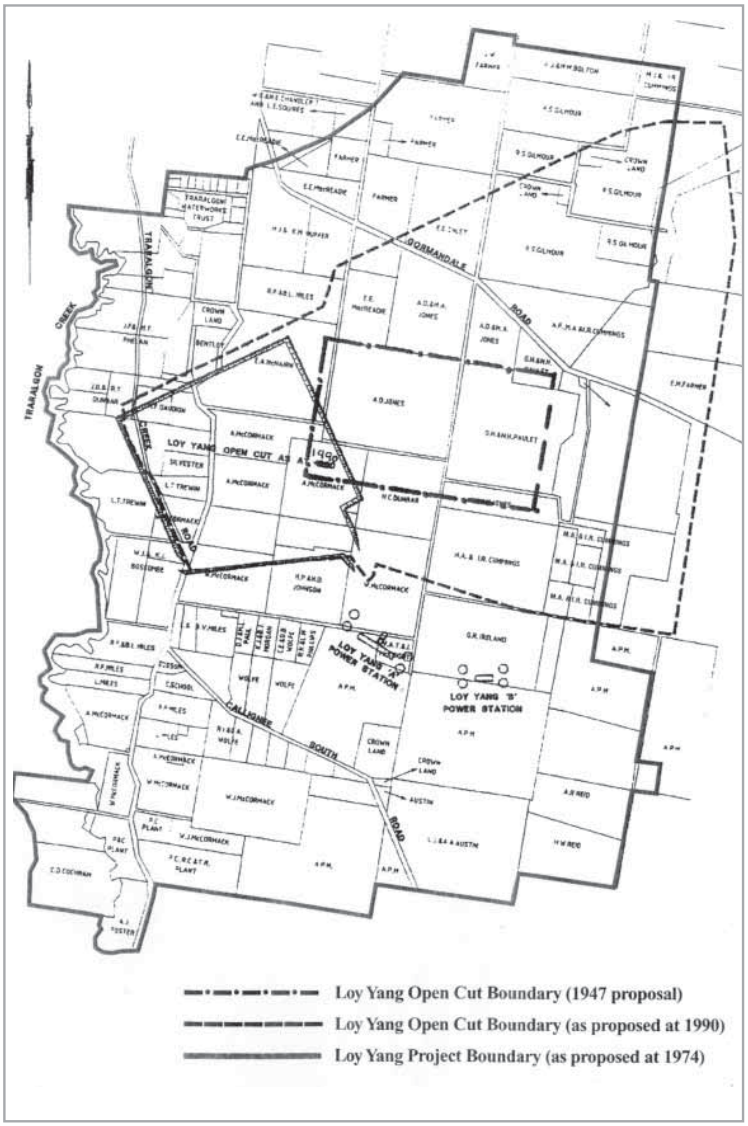
The Loy Yang Open Cut is situated about seven kilometres south east of the centre of Traralgon township. The potential for an open cut site at Loy Yang was identified earlier than 1922.[505] The specific site selected for coal supply from an open cut adjacent to a 4000 megawatt power station site was in a large shallow basin located between Traralgon Creek on the west and Sheepwash Creek on the east.

Photo 9.6/1 Loy Yang project proposal at 1973 (from Vines, (2000), p. 56).



The northern boundary was selected to minimise extraction of overburden and the Yallourn Seam coal, each of which became progressively thicker to the north. The southern boundary was along the southern edge of the Morwell Seams at a geological feature named the Loy Yang Dome. Extensions of all boundaries except at the south were feasible. The selected site in an area of about 1,100 hectares contained about 1,000 million tonnes of coal from the Yallourn and three Morwell seams which were separated randomly by interseam clays and sands. The depth of the open cut excavation was proposed to be at the bottom of the Morwell Seam (M2 Seam) approximately 200 metres below ground surface. It was not intended to mine the Traralgon seam which was separated by some 60 to 70 metres from the base of the lowest Morwell Seam.[506, 507] A multi-level external overburden dump immediately south of the open cut was planned to occupy a further 540 hectares, virtually eliminating future economical coal recovery from under this overburden dump.

Following mining concepts which had proven successful at Yallourn and Morwell Open Cuts, it was planned to use bucket wheel excavators loading to conveyors delivering to a 'just-in-time' coal bunker storage of about 100,000 tonnes capacity (24 hours usage by the 4,000 megawatt power station). All dredgers were to have access for the delivery of overburden, interseam or poor quality coal to the overburden dump. It was planned to commence an internal dump some 15–20 years after initial coal excavation when sufficient space had been opened at the base of the mine.



Drawing 9.6/2 LYOC Land ownership and project boundaries (from Vines, (2000), p. 76).

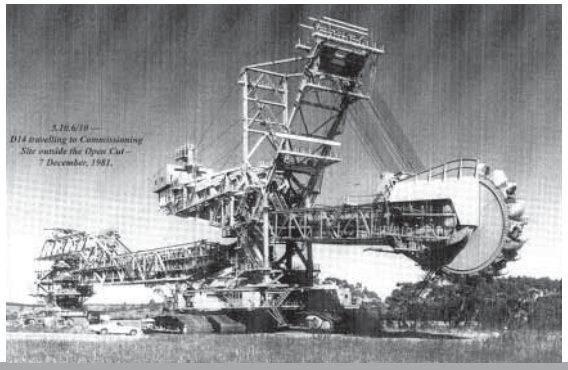
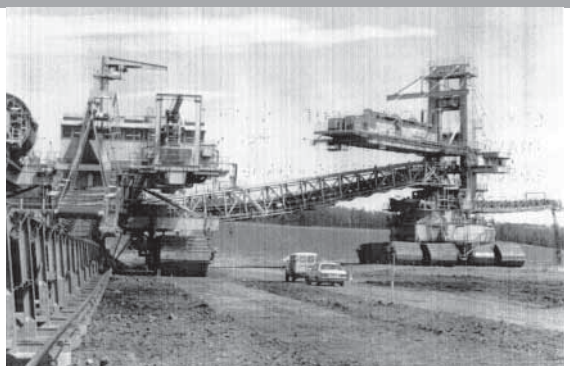
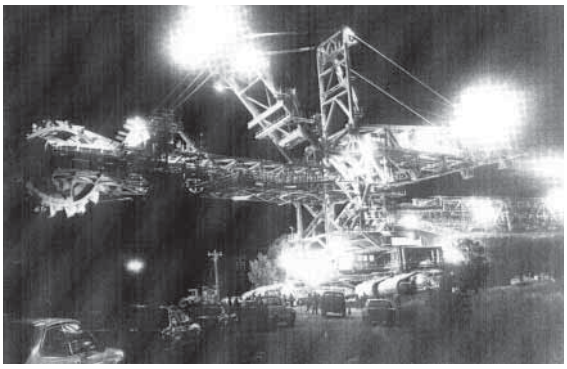


Photo 9.6/2 LYOC Dredger 14 at December 1981(from Vines, (2000), p.123).

Photo 9.6/3 LYOC TS4 Overburden disposal machine in service, October 1983.

Photo 9.6/4 LYOC Dredger 15 at December 1983 (from Vines, (2000), p.156).





The planning outlined above was implemented without major change in concept.

On 1 October 1982, handover for operations occurred after commissioning of the first dredger D14 (Photos 9.6/2 & 5), the overburden stacker TS4 (Photo 9.6/3) and the first conveyor route to the overburden dump was completed following trial runs from 29 July 1982. Overburden removal by contract totalling 2.570 million cubic metres and 0.133 million cubic metres by Dredger 14 had occurred prior to 1 October 1982.[508]

Dredger 15 (Photo 9.6/4), basically identical in design to D14, was placed in commercial operation on overburden on 23 March 1984.[509] Dredger 16 (Photo 9.6/8), somewhat different in design and by a different supplier from the two previous dredgers, came into commercial service in March 1988 after many problems during construction and commissioning and some 30 months after its contracted in-service date. At this time, the fourth 500 megawatt unit at Loy Yang Power Station was about to come on line completing the 2000 megawatt Loy Yang A power station. The option for the SECV to obtain a fourth dredger to the same design and supplier as D16 existed under the D16 contract but was formally declined by the SECV in early 1987.[510]

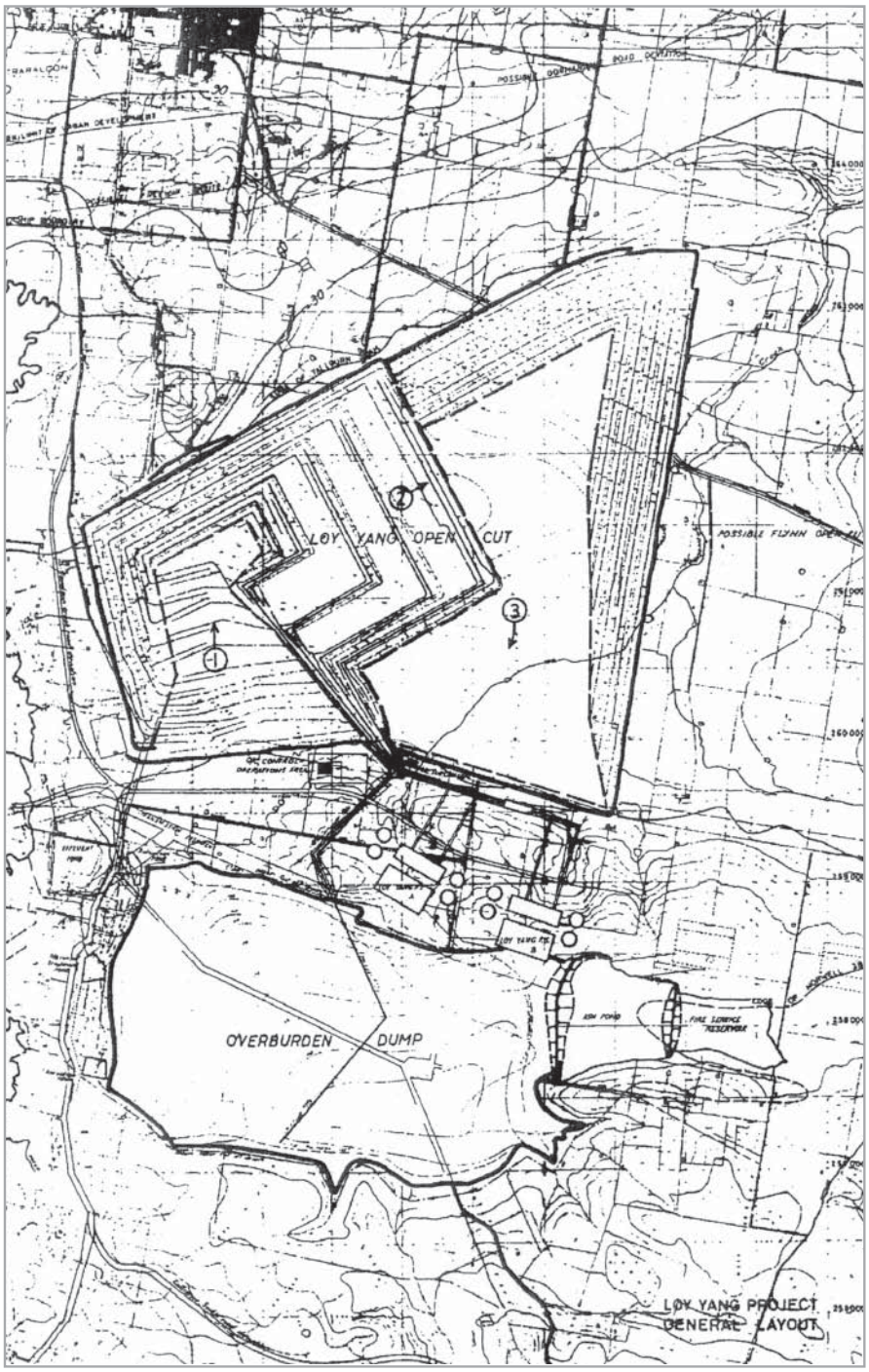
In August 1985, the Government approved the SECV request to place orders for the first two units of Loy Yang B with an in-service date for the first unit to be flexible between November 1991 and November 1994 and for additional flexibility for the second unit.[511] However, by the mid 1980s, electricity supply was 'comfortably' meeting demand. Ordering for the third and fourth units of Loy Yang B was not proceeded with at that time or to date at 2005.

A review of the design for the fourth dredger was undertaken in this atmosphere of possible reduction of the Loy Yang generation to a 3000 megawatt total. Economic advantage was seen in making provision for two smaller dredgers, only one of which would be procured at this time with the option to be left open for the fifth dredger to be either of the two sizes depending on coal demand forecasts. Procurement proceeded with an order placed in May 1989 for one compact extending bridge bucket wheel excavator (D27; Photo 9.6/8) with specified dimensions for multi-level excavation and a guaranteed hourly output of 1,850 cubic metres of coal. It was decided that the conveyor system to be installed at the same time as

It was planned to have four dredgers each of output capacity of 60,000 tonnes of coal per day (hourly rate of 3,750 tonnes), each with its separate face and trunk conveyors to a transfer point for delivery to the coal bunker or to the overburden dump. The dredgers were to each have a telescopic connecting conveyor to a crawler-mounted discharge unit on which was mounted an outloading conveyor. This arrangement allowed for multi level operation on each side of a face conveyor. (In the other open cuts, flexibility for multi-level excavation had been provided by scheduling two mobile slew conveyors for allocation between four or more dredgers, but involving additional manning to the normal dredger crew.) Two overburden trunk conveyor routes were planned to avoid excavation delays when dredgers were encountering interseam digging.

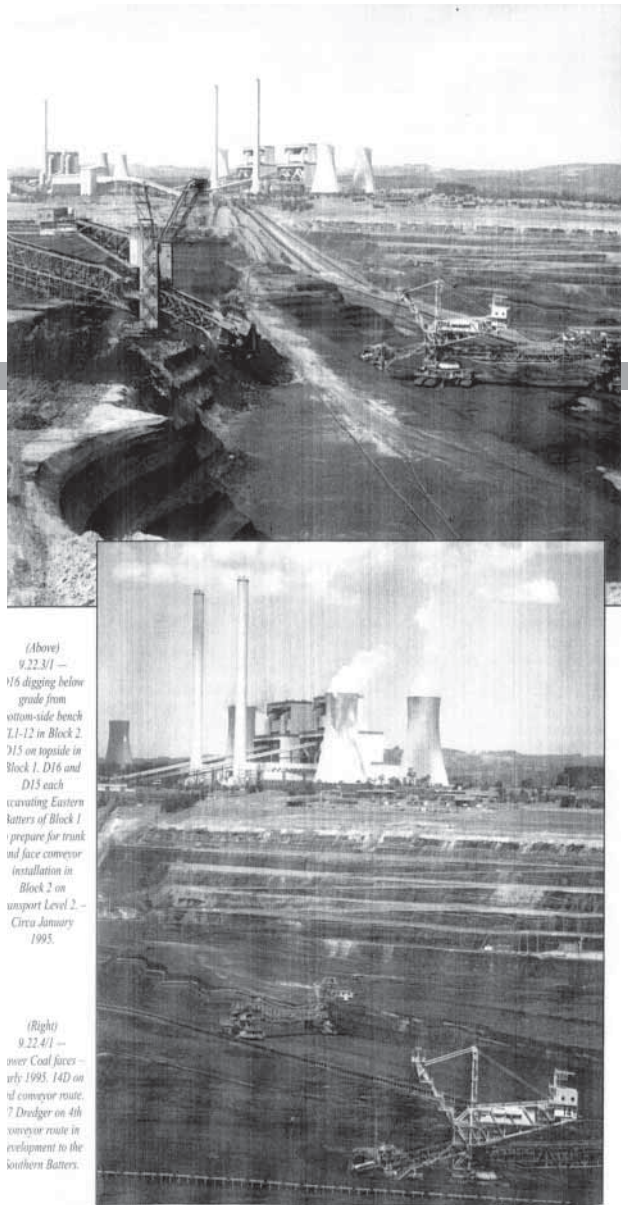
Photo 9.6/5 LYOC Dredger 14 on a high coal face (from Vines, (2000), p. 244).

Photo 9.6/6 LYOC View of Open Cut at 1992 (from Vines, (2002), p. 318).



Drawing 9.6/3 LYOC Proposed project layout at 1973 (from Vines, (2000), p. 52).

Photo 9.6/7 LYOC View of Dredgers 16 and 27 at 1995 (from Vines, (2000), p. 342).



(Above) 9.22.3/1 — D16 digging below grade from bottom-side bench 7.1-12 in Block 2. D15 on topside in Block 1. D16 and D15 each excavating Eastern batters of Block 1 to prepare for trunk and face conveyor installation in Block 2 on transport Level 2. – Circa January 1995.

(Right) 9.22.4/1 — Lower Coal faces – early 1995. 14D on old conveyor route. ? Dredger on 4th conveyor route in development to the Southern Batters.

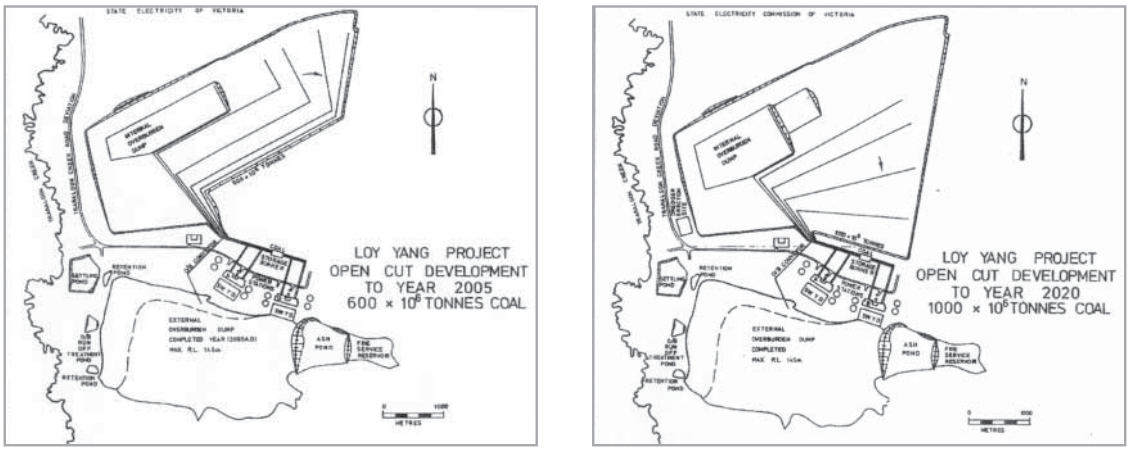
D27 would be of the same capacity as the other conveyor systems. Dredger 27 went into service on 1 June 1992. The fifth excavator has not been proceeded with. A second overburden system with TS5 tripper-spreader came into service in January 1991 to provide for simultaneous excavation of overburden, interseam or poor quality coal from two excavators and for increased availability for waste disposal.

In 1984, the SECV Latrobe Valley activities were dissected into three area based groups, one of which was the Loy Yang Production Centre. In 1994, the SECV was disaggregated. Generation Victoria was formed as a State Authority to take over the management of the generation and associated activities of the State including the Loy Yang Open Cut. On 1 February 1995, Generation Victoria was disaggregated into five authorities one of which was Loy Yang Power Pty Ltd. On 12 May 1977, the Loy Yang activities were privatised by the State Government by sale to a private consortium and renamed by them as Loy Yang Power Management Pty Ltd. Loy Yang B 1,000 megawatt Station was completed on 30 September 1996 and sold by Government as a separate private business entity to Mission Energy on that date, with a formal contract with Loy Yang Power for coal supply from LYOC.[512]

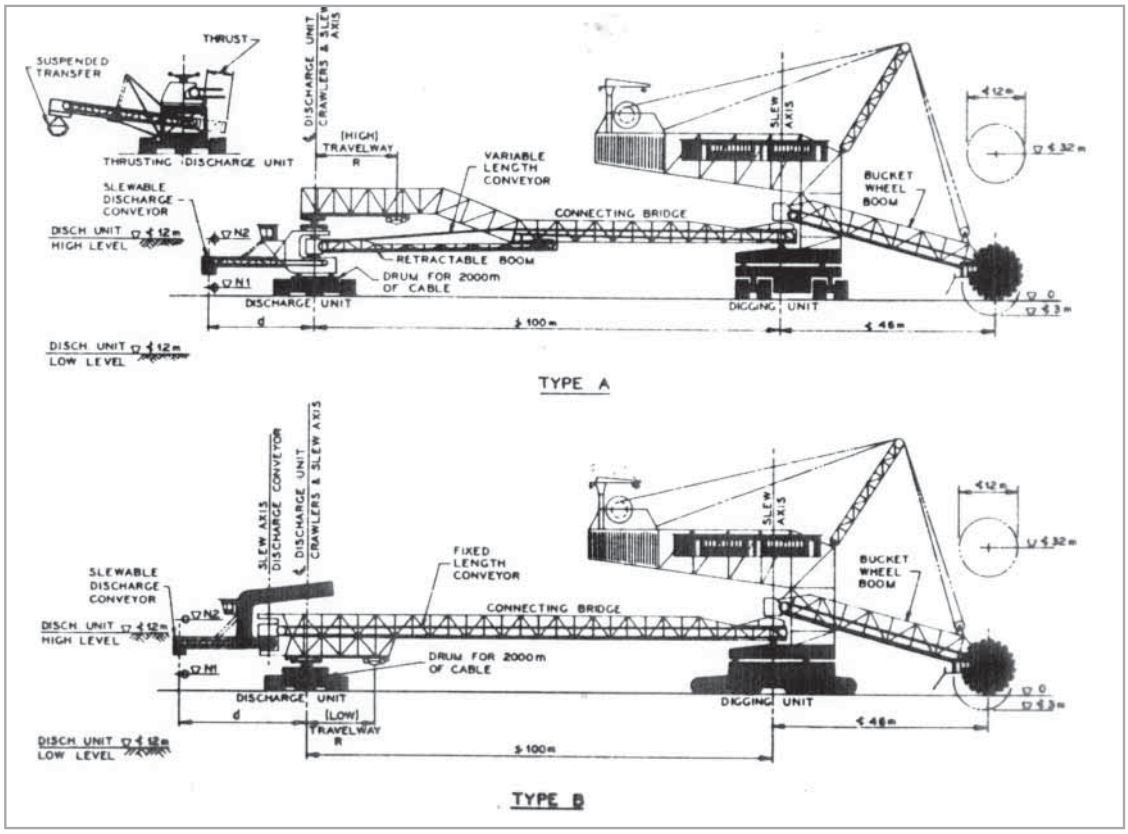
In July 1984, the Government requested reservation by the SECV of an allocation of up to five million tonnes per year of coal from LYOC for utilisation by private industry. 'A quantity of 300 million tonnes of coal was considered to be available from LYOC for this external use in addition to that required for the life-time operation of Loy Yang A & B Power Stations (4,000 megawatt capacity)'.[513]

Significant features of the open cut operation included emphasis on coal quality selective excavation, particularly from broken coal seams at the southern faces and higher sulphur in the Northern and Eastern faces. Dewatering of the aquifers and coal batters commenced in 1985 and was increased progressively to control floor heave and batter movement as the open cut extended in area and depth. In July 2001, dewatering of the Upper Traralgon aquifer commenced with initial free flow of 20 lps and subsequent pumping at about 100 lps.[514] At September 2002, over 84,000 mega litres had been extracted from the aquifers at Loy Yang.[515]

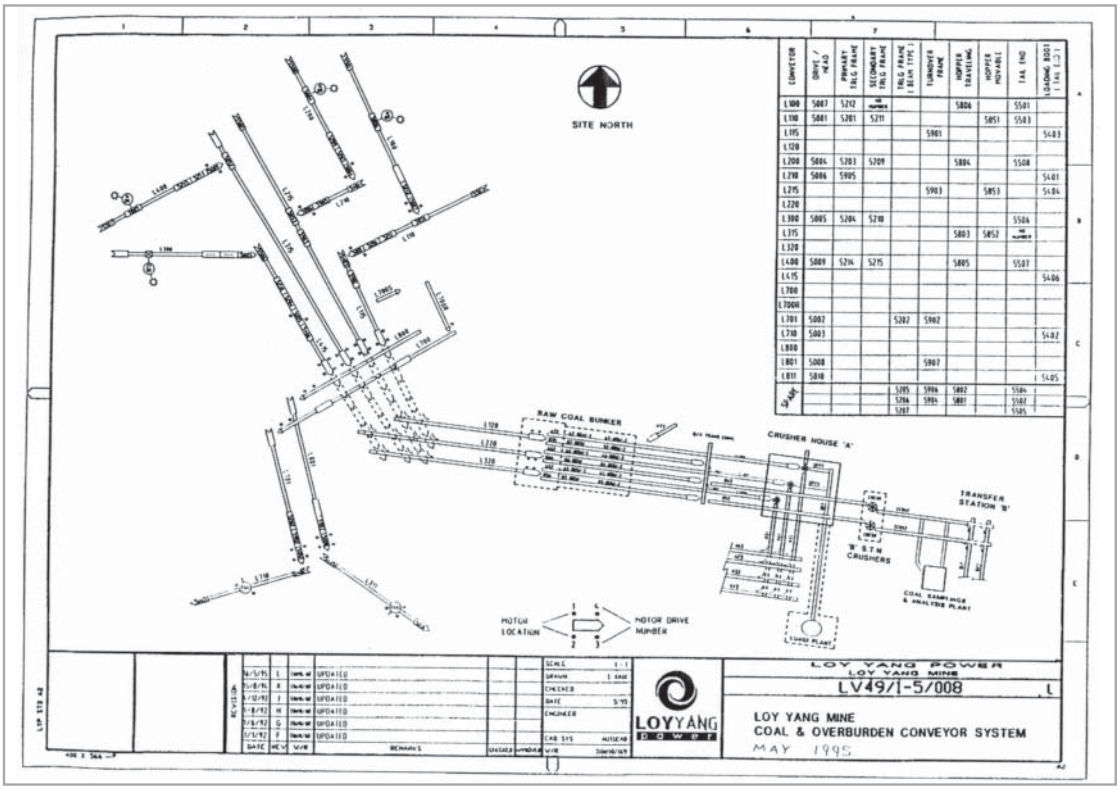
For the 2004 calendar year, coal excavation was 30.333 million tonnes with the forward plan for 2005 at 30.565 million tonnes.[516] Annual coal excavation had reached over 10 million tonnes in 1987, over 20 million tonnes in 1994[517] and had been budgeted at over 30 million tonnes of coal from the 2001 year.[518] In the 2004 year, Coal Supply Reliability had been 99.98 per cent and Contract Compliance for Coal Supply and Quality to Loy Yang B had been 99.85 per cent.[519] These high performance figures had been at this level in previous years indicating the sufficiency of the installed plant and coal storage facilities. An emergency contract for 1.2 million cubic metres of overburden removal had been necessary in January 2001, following a fire on D15 with a 90 day repair program and diversion of D16 to coal excavation. Generally three



Drawings 9.6/4A & B (left to right) LYOC Proposed development to 2005 and to 2020 at 1974 (from Vines, (2000), p.58).



Drawing 9.6/5 LYOC Alternative types of bucket wheel dredgers under consideration at 1974 (from Vines, (2000), p.117).



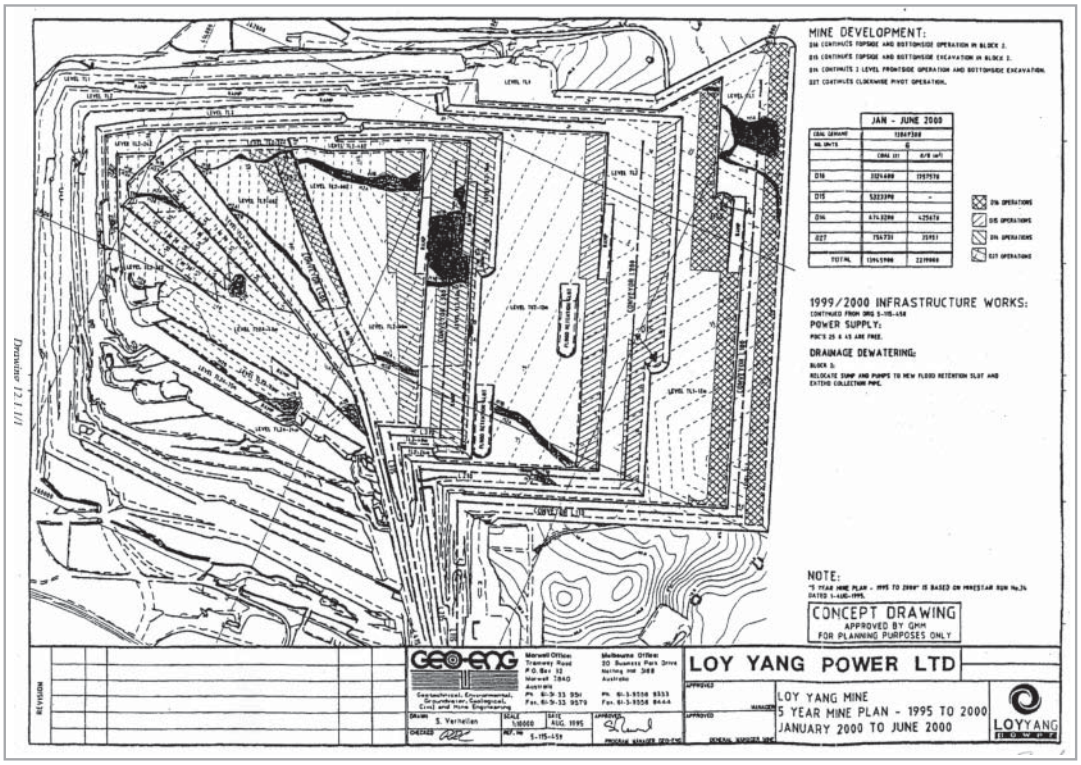
Drawing 9.6/6 LYOC Conveyor systems as in service at 1995 (from Vines, (2000), p. 331A).

dredgers and one stacker were manned on a 24 hour/seven day week basis to meet coal demand and achieve overburden and interseam removal needs while allowing for planned maintenance. Coal demand could generally be met by coal output from only two dredgers except when interseam was being encountered as a large proportion of a face. At 2005, no additions or deletions of plant were intended.

At 30 June 1997, total overall excavation was 275 million cubic metres of which overburden and interseam removal by contract and by dredger and auxiliary mobile plant totalled 73 million cubic metres.[520] These quantities equated to an as-excavated waste to coal ratio of 1 to 2.77 (i.e. overburden and interseam proportion of total excavation of 26.53 per cent). For the period from 1990, after the initial opening up stage, to 1997 the waste to coal ratio as excavated over those years had changed to one in 3.66 with this ratio increasing as the open cut developed further to depth.

At 1 December 2004, 446 million tonnes of coal had been excavated and the mine floor was about 60 metres below sea level (i.e. 170 metres below surface level) with further excavation intended below this level.[521] The edge of the excavation covered an area 3.2 kilometres east-west by 2.13 kilometres north-south.[522] Back filling of the mine with an internal overburden and interseam dump was expected in 2008–2009.[523]

In April 2004, Loy Yang Power was sold to the Great Energy Alliance Corporation (GEAC) with shareholders comprising the Tokyo Electric Power Company, Australian Gas Light, Commonwealth Bank and two Superannuation Fund.[524]



Drawing 9.6/7 LYOC 1995 plan for development at 2000 (from Vines, (2000), p. 406).

In the 2005/6 Victorian State Budget, the coal royalty paid by the Latrobe Valley Coal Producers (including Loy Yang Power) was doubled to provide for funding of various research and development studies and pilot/demonstration plants for combustion and conversion processes based on the Latrobe Valley brown coal resource.[525]

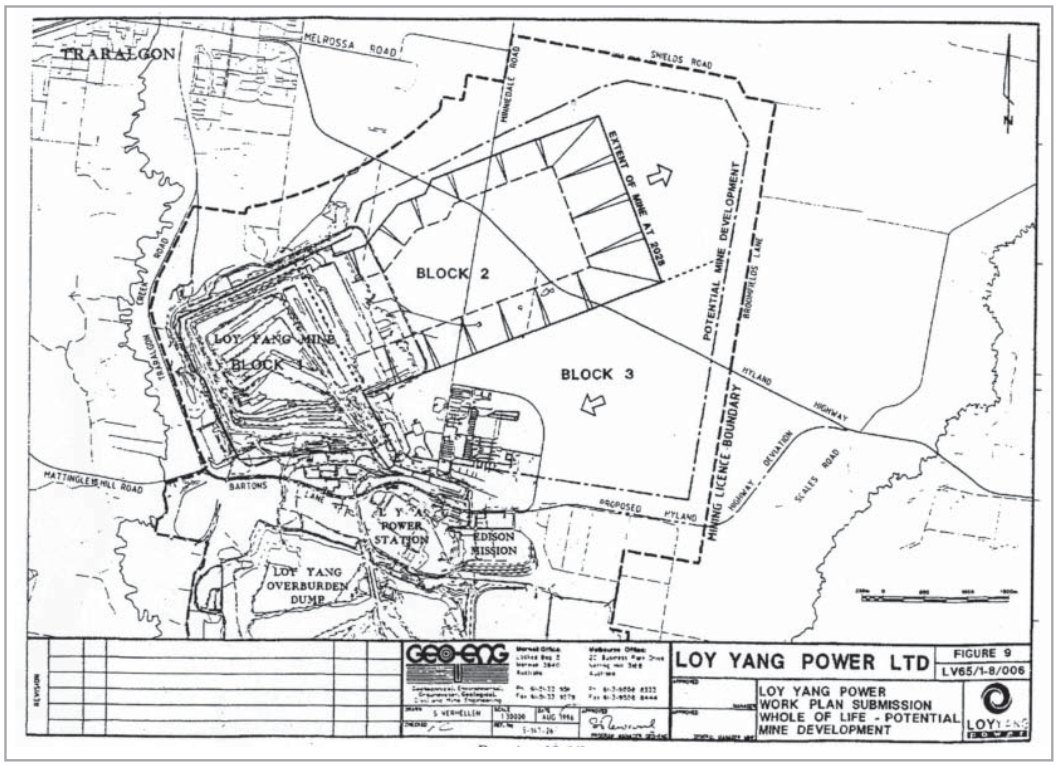
Assessment of Heritage Significance

Historical Significance

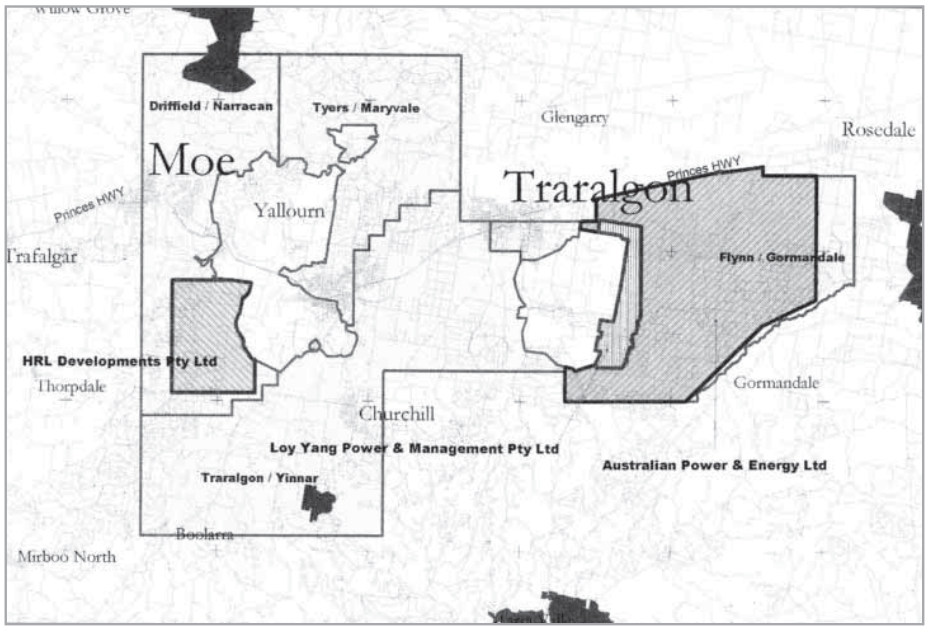
The Loy Yang Open Cut has developed to be the largest producer on a daily, annual and lifetime basis of coal, brown or black, in Australia.

The initial three bucketwheel excavators were the highest volumetric productive rate excavators (with the possible exception of some stockpile excavators) in Australia, and incorporated the experience gained in the Yallourn and Morwell Open Cuts. The detailed specification and design for the bucket wheel excavators adapted the latest appropriate German design to the specific conditions and standards applicable to the mining conditions at Loy Yang. The conveyor systems, the overburden disposal systems and the raw coal bunker storage were also to specific detailed specification by the SECV.

The large coal resource in the Loy Yang area allowed the Government, the SECV, and subsequent operators to offer coal supply for trials from the laboratory stage to the production stage of innovative combustion and/or coal conversion processes without the complication of manning and providing plant in a new open cut.



Drawing 9.6/8 LYOC 1996 plan for Whole of Life Development within licence boundary (from Vines, (2000), p. 413).



Drawing 9.6/9 Map of Latrobe Valley coal field. Copyright State of Victoria, Department of Primary Industries.

LOY YANG OPEN CUT PRODUCTION DATA

PERIOD ENDING JUNE	No. 14 DREDGER			No. 15 DREDGER			No. 16 DREDGER			No. 27 DREDGER			AUX. PLANT M3	CONTRACT EXC'A'N M3	TOTAL EXC'A'N COAL TONNES	TOTAL EXC'A'N O/B M3	O'ALL EXC'A'N M3	PROG. EXC'A'N COAL TONNES	PROG EXC'A'N O/B M3	PROG. O'ALL EXC'A'N M3
	COAL TONNES	O/B M3	TOTAL M3	COAL TONNES	O/B M3	TOTAL M3	COAL TONNES	O/B M3	TOTAL M3	COAL TONNES	O/B M3	TOTAL M3								
Excavation Prior to Dredger Operation														2,570,000		2,570,000	2,570,000		2,750,000	2,570,000
1983	0	5,318,303	5,318,303	0	0	0	0	0	0	0	0	0	0	0	0	5,318,303	5,318,303	0	7,888,303	7,888,303
1984	401,742	4,333,492	4,691,870	0	1,411,700	1,411,700	0	0	0	0	0	0	0	0	401,742	5,745,192	6,103,570	401,742	13,633,495	13,991,873
1985	3,700,564	420,231	3,721,359	1,306,865	3,233,088	4,398,891	0	0	0	0	0	0	0	0	5,007,429	3,653,319	8,120,249	5,409,171	17,286,814	22,112,123
*1986	4,748,363	1,979,427	6,215,255	2,798,667	1,452,208	3,948,789	0	0	0	0	0	0	0	0	7,547,030	3,431,635	10,164,044	12,956,201	20,718,449	32,276,166
1987	6,965,512	325,172	6,538,831	3,816,917	1,908,463	5,313,384	0	0	0	0	0	0	0	1,750,000	10,762,429	3,983,635	13,502,216	23,738,630	24,702,084	45,878,382
*1988	6,310,068	383,740	6,012,703	7,380,508	1,019,567	7,603,428	1,001,428	877,535	1,770,870	0	0	0	0	0	14,692,004	2,280,842	15,387,001	38,430,634	26,982,926	61,265,383
*1989	5,216,391	249,974	4,903,311	9,470,913	262,616	8,711,245	2,171,712	2,842,501,	4,779,800	0	0	0	800,000	0	16,859,016	4,155,091	19,194,356	55,289,650	31,138,017	80,459,739
*1990	9,323,169	286,201	8,603,033	8,052,937	295,997	7,479,705	652,038	1,854,357	2,436,014	0	0	0	1,870,000	0	18,028,144	4,306,555	20,388,753	73,317,794	35,444,572	100,848,492
*1991	9,210,791	182,098	8,398,682	8,335,579	102,564	7,538,406	482,398	3,801,807	4,232,135	0	0	0	800,000	0	18,028,768	4,886,469	20,969,224	91,346,562	40,331,041	121,817,715
1992	8,359,158	6,153	7,463,029	8,887,190	51,597	7,979,510	273,811	5,363,967	5,608,223	0	0	0	750,000	0	17,520,159	6,171,717	21,800,762	108,866,721	46,502,758	143,618,477
1993	5,714,048	7,685	5,104,962	5,264,256	332,859	5,028,895	1,779,523	6,397,492	7,984,934	3,191,301	165,505	3,012,339	0	0	15,949,128	6,903,541	21,131,131	124,815,849	53,406,299	163,749,608
1994	10,797,652	199,680	9,831,841	6,188,822	648,593	6,169,398	3,695,039	6,519,593	9,815,792	2,917,334	606,227	3,208,666	0	0	23,598,847	7,974,093	29,025,696	148,414,696	61,380,392	193,775,304
1995	9,415,807	504,326	8,903,797	9,128,335	359,719	8,502,748	4,076,539	3,642,498	7,279,018	1,664,331	273,820	1,758,504	0	0	24,285,012	4,780,363	26,444,067	172,699,708	66,160,755	220,219,371
1996	8,237,676	147,804	7,496,311	10,849,582	213,213	9,891,698	6,763,894	3,352,430	9,386,234	12,320	1,728	12,718	0	0	25,863,472	3,715,175	26,786,961	198,563,180	69,875,930	247,006,331
1997	3,501,617	352,288	3,475,943	14,707,319	335,171	13,454,992	6,295,974	2,350,052	7,966,443	3,302,881	158,836	3,105,206	0	0	27,807,791	3,196,347	28,002,583	226,370,971	73,072,277	275,008,915
TOTALS	91,902,558	14,696,574	96,679,231	96,187,890	11,627,355	97,432,788	27,192,356	37,002,232	61,259,463	11,088,167	1,206,116	11,097,434	4,220,000	4,320,000	226,370,971	73,072,277	275,008,915			

1977/79 Leighton Contractors
*1986/87 Theiss/Roche Contractors Joint Venture
*1988/89 Major Works
*1989/90 Major Works
*1990/91 Major Works
*1991/92 Major Works

Table 9.6/1 LYOC Annual output of coal and overburden from 1983 to 1997 (from Vines, (2000), p. 210).

Scientific Significance

The extensive uncommitted coal resource in the Flynn and Gormandale Fields to the east of Loy Yang Open Cut offered scope for a variety of uses other than power generation for coal, with properties similar to that well researched and documented before and during the mining in the Loy Yang field.

The Loy Yang coal had proven suitable in commercial scale plants for conversion to dried pulverised coal (the Lurgi Plant at Loy Yang supplying start up and furnace stabilising fuel for Loy Yang B power station), for briquette manufacture (at the Morwell Briquette Works) and for metallurgical char (with briquettes as fuel and processing feed stock).

In May 2005, the Government announced continued funding, in association with LV Power Generators, to the Co-operative Research Centre for Clean Power from Lignite (CRCCPL). The provision included establishment adjacent to LYOC of a pilot scale plant using coal at 15 tonnes per hour in a coal drying process with the aim to prove laboratory trials indicating a reduction of water by 70 per cent, reducing greenhouse emissions by 30 per cent in existing power stations and 40 per cent in more modern power plant. Operation of the pilot plant was expected in 2006. This process and others under research offered opportunity for longer term use of Victoria's major energy resource.

Economic Significance

The economies of scale offered by the larger scale open cut operation at Loy Yang Open Cut compared with the other LV open cuts, as well as the more favourable coal to overburden ratio, demonstrated that generation based on brown coal could be competitive with the cost of base load electricity generation and distribution in Victoria from other fuels. Brown

Photo 9.6/8 LYOC View of Open Cut and overburden dump at 1996 (from Vines, (2000), p. 407A).

coal resources of similar economic advantages to that being utilised at Loy Yang are available for power generation and coal conversion processes.

In July 2002, after analysis of tenders, the State Government announced the granting of exploration licences external to existing brown coal mining licence areas in the Latrobe Valley. Loy Yang Power received an exploration licence over 1,670 hectares of the Flynn-Gormandale Coal Field with an economically mining reserve of over 1,000 tonnes. In their tender submission, LY Power proposed examining a concept of developing, between 2010 and 2016, a 1,000 megawatt station of four 250 megawatt units using improved brown coal drying technology offering increased efficiency and reduced greenhouse gas emissions.[526] The submission forecasted continued generation from the existing Loy Yang A until 2048, with a further 25 year extension if the existing open cut was approved for extension of its existing mining licence into the exploration licence area.

Australian Power and Energy Ltd. (APEL) was also granted an exploration licence over an area to the east of Loy Yang Open Cut with the objective to produce low sulphur liquid fuels and to install a 500 megawatt power plant with greenhouse gas emissions sequestrated.[527]

Social Significance

In the early years of operation of the Loy Yang Open Cut in the late 1970s, the initial personnel were selected and transferred from Yallourn and Morwell Open Cuts. Many of the selected personnel were first generation Australians well established in the Latrobe Valley community. No specific temporary construction camps or settlements had been necessary in the early construction stage, which had mainly followed on from contract construction in the Yallourn and Morwell/Hazelwood area. In particular, the township of Traralgon, adjacent to the Loy Yang Open Cut, had steady growth as Loy Yang employees tended to take up residence near their work location.

The township of Churchill established in the 1950s as a new planned township by the Housing Commission of Victoria was an outcome of the growing need at that time for housing of the workforce engaged in SECV and service activities. The stability of this township and its educational precinct including Monash University Gippsland, has been enhanced by the continuing workforce and servicing needs of the Loy Yang brown coal utilisation.

The proposed long term operation of the Loy Yang Open Cut beyond 2,050 and/or potential opening of other coal resources tends to offset instability in the workforce resulting from greater use of contract and part time work.

A significant downfall in the number of apprenticeships, largely associated with the transfer of maintenance work to short term contracts, has been an adverse feature of the privatisation of the former SECV activities including Loy Yang Open Cut. This deficiency has been recognised by industry and Government. Combined action to increase apprenticeship numbers is anticipated.

Environmental sensitivity has been a prime feature of the LYOC activities. Community consultation and reporting on compliance with specified objectives have been continuous from the detailed project investigations of the early 1960s.

Mine Infrastructure Features

Traralgon Creek water treatment pondages.

Highland highway deviation.

George Bates Lookout.

Miners Lookout.

Power Works Visitors Centre at Morwell.

High Level Water Storage.

References

Alexander, JM, *Planning the Development of Loy Yang Open Cut in Australia*, Braunkohle, July 1981

Discovery, Department of Primary Industry, February 2002, August 2002, December 2002, September 2003, December 2004

Drilling Records, held at 1994 by Geo-Eng at Morwell.

Progress Report, No.3, Mines Department, August 1875, p.284

Herman, H, *Brown Coals of Victoria*, Bulletin No.45, Mines Department, 1922

Business Plan, Loy Yang Power, 2005

House Journal, Loy Yang Report, Loy Yang Power

Mineral Statistics, Mines Department, 1876, p.51

Annual Report, Mines Department, 1889. (Remarks on the Development of the Coal and Lignite Resources of Victoria, Murray, RAF)

Annual Report, Mines Department, 1890.

Vines, JA, *A History of the Loy Yang Mine: Its Origins and Development to May 1997*, SECV, 2000

Photo 10.1/1 Gelliondale Open Cut and Briquette Factory (from Thomas and Baragwanath, (1950), Part 2, p.16).

10 East Gippsland—Brown Coal Mines

10.1 Gelliondale Open Cut

Map Reference: **8220-4-3 Sunday Island**
Open Cut 4621, 57234

Municipality: **Shire of Wellington,**
Parish of Alberton West

Land Use/Status: **Private Ownership**

Site History

The existence of brown coal in the Gelliondale area of Gippsland was known since the late 1800s,[528] although subsequent to brown coal discoveries by RA Murray in 1876 at Won Wron, which later was identified as a different seam. At 1922, it was stated that there is 'a large area of open cut brown coal of good quality around Hedley and eastwards within about four miles of Port Welshpool which at a comparatively small cost could be made available for fairly large steamers'. It was also stated that 'From Toora to near Alberton for a direct length of 18 miles in an east north/easterly direction was a continuous, or nearly continuous, brown coal field'.[529] Between 1902 and 1966, the Mines Department and then the SECV drilled 160 bores in the Alberton Depression including the Gelliondale Coalfield.[530]

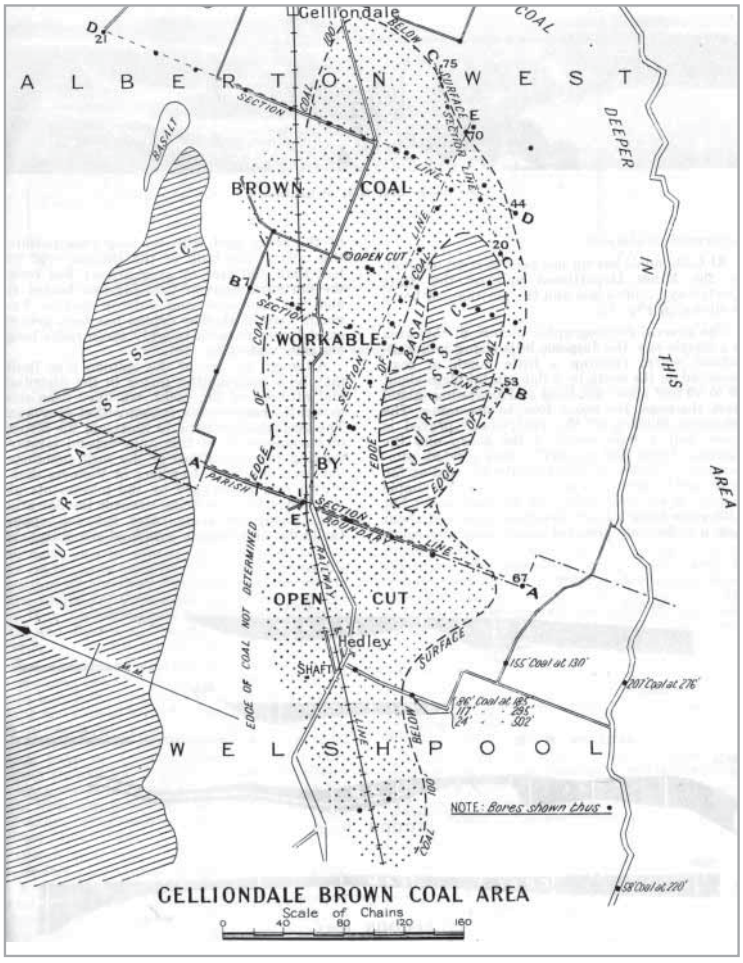
The Gelliondale coal deposit is located to the west of the Gelliondale Rail Siding on the South Gippsland VR rail line. From Gelliondale, the deposit is located westwards for about eight miles to some two miles to the west of the Hedley Rail Siding and is about 0.5 to 1.5 miles wide.[531] The deposit exists on a coastal plain about 30 to 50 feet above sea level and about four to five miles from the coast. At 1950, it was assessed from analysis of bores that the deposit in the Alberton Parish contained 560 million tons of coal over an area of about 4.75 square miles with an average seam thickness of 140 feet and overburden less than 140 feet. Immediately contiguous in the Welshpool Parish, the coal quantity was assessed at about 488 million tons over an area of 5.8 square miles with a somewhat deeper overburden and a lesser coal thickness.[532]

In 1923, a small open cut was opened near Gelliondale supplying coal to a coal drying and briquetting plant.[533] The specific location of the open cut was about two miles west of the Gelliondale VR Rail Siding, about 30 chains south of the rail line and ten chains south of the South Gippsland Highway. The open cut and briquetting plant worked only intermittently. Greer and Smith (1983) state that ICI sank a trial shaft in 1929 extracting 230 tons of coal. (The site of this shaft was probably that shown on drawing 10.1/1 at Hedley, some 5.6 kilometres west of the flooded open pit.)[534]

At Gelliondale in 1931, the first geophysical work in the Victorian coal areas took place with gravimetric and magnetic surveys. Further such surveys continued in other areas in the 1940s and 1950s with mixed success.[535]

In the early 1940s, the open cut was operated by the Gelliondale Coal and Oil Ltd.[536] A tabulation published in 1952 by H Herman stated that 13,940 tons of coal had been mined from the Gelliondale Open Cut to the end of 1950, with no production in 1950.[537] No reference has been found during this Coal Heritage Study of any further mining at Gelliondale after 1950.

In 1941, the SECV undertook investigations to establish a recommendation for the site of a new open cut to provide increased briquetting manufacture and greater security of coal supply by a transport connection with Yallourn Open Cut. One of the sites which came under final consideration was the Gelliondale deposit. The proposed Gelliondale site (named in some reports as the Alberton West Open Cut) included the existing Gelliondale Open Cut in an area of 1,830 acres, containing over 1000 million tons of 'economically winnable' coal under an average of 28 feet of sandy overburden r esulting in an excavation ratio of 3.6 feet of coal to one foot of overburden.[538] In outcome, the Maryvale South site was preferred to the Gelliondale site partly on the basis that the objective of coal transport interconnection between Gelliondale and Yallourn was not economical. The adverse high ash content and high moisture content of the Gelliondale coal were other

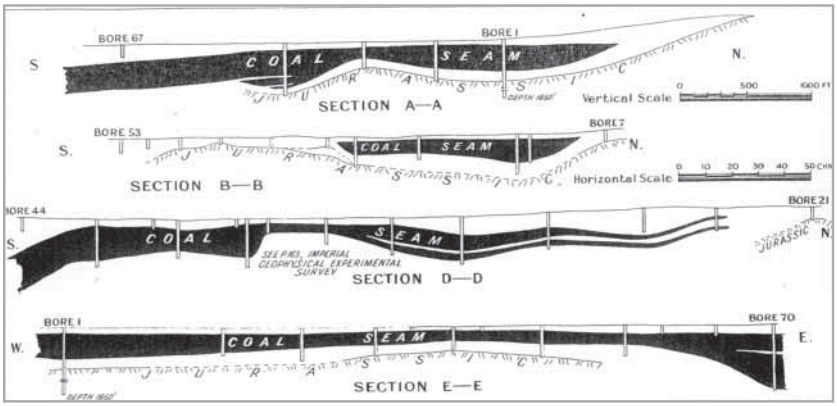


Drawing 10.1/1 Gelliondale Open Cut: Plan of brown coal area (from Thomas and Baragwanath, (1950), Part 2, p.15).

disadvantages. The proximity of the sea for cooling water associated with power generation and the proximity of the ports and rail line for product transport were notable advantages. In September 1944, State Cabinet requested the SECV for information to be provided to private developers on prospects for encouraging private development of the Gelliondale deposit for briquette manufacture. However war time private investment was not forthcoming.

Subsequently, development of the Gelliondale Coal Field did not come under detailed consideration by the SECV for power generation although the SECV fostered private business interests in utilisation of the resource in coal conversion processes. International Oil Explorations NL (later renamed International Oil Proprietary) commenced a limited exploration program in 1968, with CRA as operator until 1979 and ARCO as operator from 1980 engaged in continuing exploration programs until 1982.

In the Mines Department *Annual Report* for 1969 it was stated that testing of coal from Gelliondale was occurring with respect to oil production there from.[539] During the 'oil crisis' of the 1970s prospects for conversion to liquid fuels received private evaluation. Tests were carried out on liquefaction of



Drawing 10.1/2 Sections showing coal seams in the Gelliondale area (from Thomas and Baragwanath, (1950), Part 2, p.16, Fig. 32).

Gelliondale coal and 'a liquids yield of nearly 50 per cent was achieved'.[540] International Oil Pty Ltd and ARCO Aust. Ltd. took out exploration licence 1268 in the Gelliondale Area in August 1976 and carried out drilling for aquifer investigations from 1977. A core shed and site offices were completed at Gelliondale in October 1982. A mining feasibility study was undertaken by the ARGO/IOL consortium in 1982.[541]

At 1980, the coal resources of the Gelliondale Lease area as assessed to that time following 'extensive investigations by the SECV, DME, and a number of private companies' had the following features: resources: 1,700 million tonnes indicated and 3,500 million tonnes inferred; economic reserves: 1,700 million tonnes including 1,050 million tonnes readily recoverable; moisture content averaging 65.9 per cent with net wet energy 6.6 MJ/kg.[542]

At 1982, the Gelliondale Coal Resource, typically 50 metres or more thick, was assessed as split in places to form the Gelliondale A and B Seams extending westwards to Toora and southwards with deeper overburden cover to Snake Island. At 1982, an additional coal resource about four to five kilometres east and south-east of the Gelliondale lease area was delineated by the SECV and DME conjointly as the Alberton Coalfield having economic reserves of 2,000 million tonnes, generally in two seams of combined thickness of some 55 metres with coal quality marginally better than Gelliondale and in a zone of coal five to six kilometres wide over a distance of 18 kilometres between Alberton and Yarram townships.[543, 544] By late 1982, the 'World Oil Crisis' was in abeyance. Further expenditure on the potential Gelliondale Coal to Oil project was not forthcoming. At 1984, the holder of the mining licence in the Gelliondale Coal deposit was ARCO Australia Ltd.

Assessment of Heritage Significance

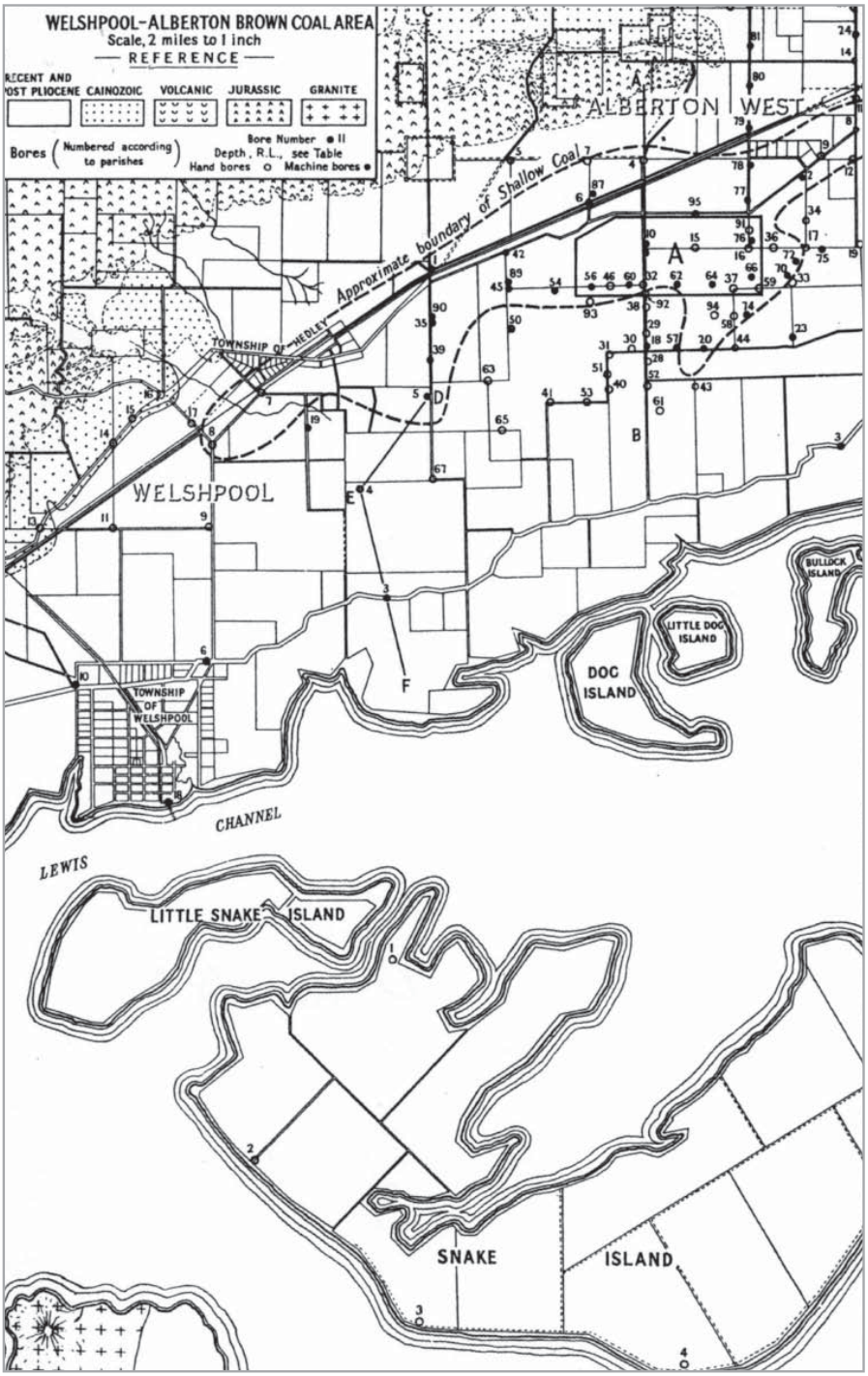
Historical Significance

The Gelliondale mine was the only privately operated brown coal mine in Gippsland from the 1920s. It appeared to have potential to meet commercial opportunities to relieve shortages of briquette supply and locomotive and shipping fuel from the 1920s to the 1960s. It also indicated possibilities for conversion to liquid fuels and by-products from the 1960s.

Together with the adjacent recently delineated Alberton brown coal deposit with combined coal availability of some 3,000 million tonnes of recoverable coal, a fuel resource of world significance awaits private development as a part of 'the Huge Fortune in Chancery' (from H Herman, 1922) represented by the brown coal resources of Victoria.

Scientific Significance

The Gelliondale Coal deposit came under a wide variety of technical investigations by public and private organisations. After 1945, the SECV had indicated that this



Drawing 10.1/3 Depiction of shallow coal areas from Welshpool to Alberton (from Herman, (1952), p.75).

Photo 10.1/2 Gelliondale Scarp, east of Toora (from Thomas and Baragwanath, (1950), Part 2, p.13).

Drawing 10.1/4 Geology of South Gippsland from Foster to Won Wron (from Thomas and Baragwanath, Part 2, Fig. 29).

deposit was not as favourable for electricity generation as known available resources in the Latrobe Valley and that the SECV would not oppose its development by private organisations. The technical feasibility of conversion of this coal to liquid fuels had been proven. The properties of the Gelliondale coal deposit were sufficiently similar to the coal seams in the Latrobe Valley which had been more fully tested than this deposit, such that these fuller investigations were relatively applicable to the Gelliondale seams.

Economic Significance

It appeared that the Gelliondale coal deposit would not be favoured for electricity generation compared with coal resources in the Latrobe Valley, particularly since the granting in 2004 of exploration licences to private firms over designated areas in the Latrobe Valley. The outcome of financial grants for development proposals in these areas would appear to defer any similar proposals based on the Gelliondale coal deposit.

The recent (1982) definition of the large coal resource at Alberton adjacent to the Gelliondale deposit, which also extends eastward to the township of Toora, offers opportunity of a large scale long term utilisation of these resources in the future either as a combined or sequential development. Preservation of these opportunities for development is of economic significance for Victoria.

Social Significance

The location of the Gelliondale (and Alberton) coal deposits is in an almost pristine coastal plain. The main occupation is agricultural/dairying pursuits on small landholdings serviced locally from several small townships spaced east-west along the South Gippsland Highway. Expectations were high in the late 1970s that further development of the Gelliondale coal deposit for conversion to oil was likely by private interests. It was anticipated that a large scale development would occur which would significantly change the local employment mix and service industries, a taste of which was already being experienced from on and offshore servicing of the natural gas developments in Bass Strait.

Mine Infrastructure Features

Site of Gelliondale Open Cut.

Site of Gelliondale Briquette Factory.

Shaft site near Hedley rail siding.

Identifiable bore site(s) on South Gippsland Highway near Gelliondale.

Drawing 10.1/5 Locality of Gelliondale Open Cut (from Topographical Map 8220-4-3 Sunday Island). Copyright State of Victoria, Department of Sustainability and Environment.

References

Garner LJ, *Research in Brown Coal Utilisation*, Monograph No. 11, AusIMM, 1984

Gloe, CS, T*he Geology, Discovery, and Assessment of the Brown Coal Deposits of Victoria*, Monograph No. 11, AusIMM, 1984

Greer, IR 'Geological Report to Arco Aust Ltd', September 1982 to August 1983. Appendix H by Greer, IR and Smith, GL, *Australian Coal Geology*, Vol. 4 No. 1, pp. 71–89

Herman, H, *Brown Coals of Victoria*, Bulletin No. 45, Mines Department, 1922

Herman, H, *Brown Coal*, SECV, 1952

Holdgate, GR 'Coal Exploration for Lignites: Gippsland Basin 1997', *Australian Coal Geology*, Vol. 4 No.1, pp. 57–70

Kitson, AE, *Report on the Probable Occurrence of Coal in the Welshpool District*, Geological Survey Victoria, Vol. 1 Part 1, 1902, pp. 61–66

Thomas, DE and Baragwanath, W 'Geology of the Brown Coals Of Victoria', *Mining and Geological Journal*, Vol. 1–4, 1949–51

Vines, JA, *A History of the Morwell Open Cut*, Generation Victoria, 1996

10.2 Won Wron (Yarram) Open Cut

Map Reference: **8221 2S Carrajung Zone 55**

7221 Traralgon Zone 55

Mine site 4760, 57410 Zone 55 approx.

Township 4752, 57415 approx.

Municipality: **Shire of Alberton, Parish of Won Wron**

Land Use/Status:

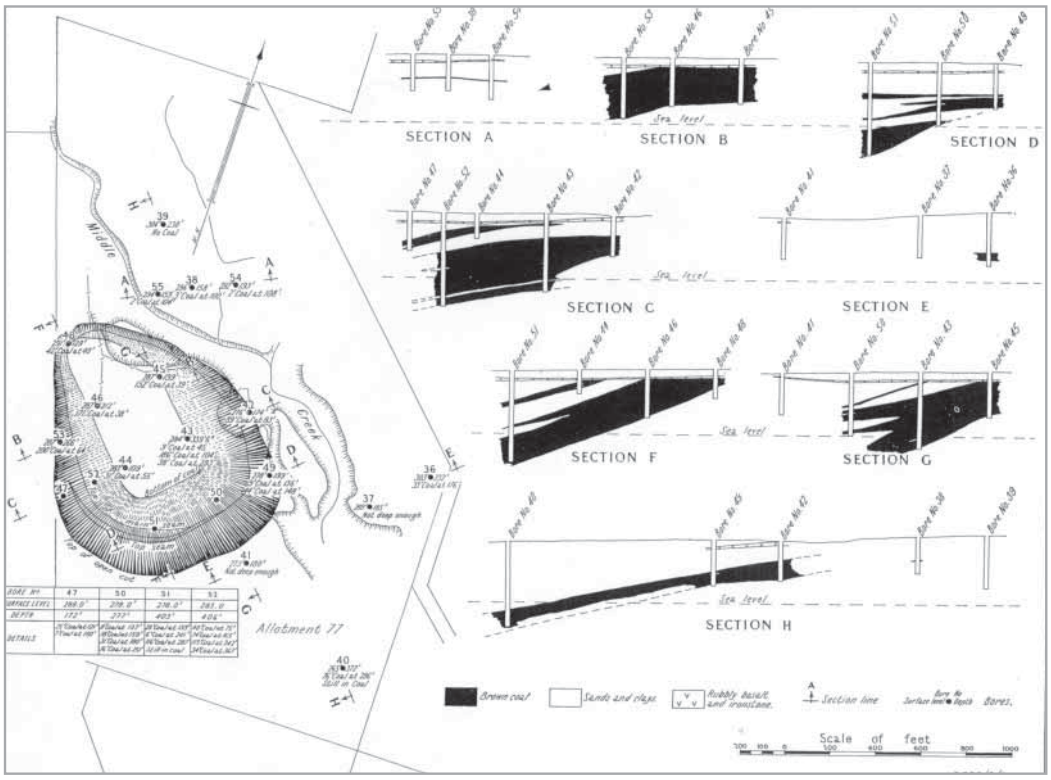
Site History

The location Won Wron is on the Hyland Highway about 14 kilometres north of Yarram in Eastern Gippsland. Won Wron was previously a rail station about 234 kilometres from Melbourne on the South Gippsland Railway.

Brown coal was first recorded in the Won Wron area by RAF Murray in 1876, 'in the Middle Creek, between Mac's and Greig's creeks, north from Yarram'.[545] The deposits in this area were again referred to in Mines Department reports by Stirling in 1892 and 1899, and by Kitson in 1902. An idealised depiction of the Won Wron deposits was made by Stirling in 1899 (p. 78B) as shown below as Drawing 10.2/3. A brief description of the Won Wron brown coal deposit is given by Stirling (1899).[546]

Shallow shafts were sunk by 1892, at least one of which passed 30 feet into coal without reaching the bottom of the seam. Sixteen bores were put down between 1922 and 1929 on C.A.77, Won Wron. These were depicted by Thomas and Baragwanath,[547] showing coal up to 140 feet thick, commencing at eight feet below surface. A further 20 bores were put down in 1954. Bores on the north side of Middle Creek showed little brown coal. On the south of the creek to the western boundary of C.A.77, the main seam of coal on the average was 150 feet thick under 85 feet of overburden. However the overburden increased outside the western boundary and the coal was split into broken seams towards the southern boundary of Lot 77.[548]

The Mines Department *Annual Report* for 1955 (on p.15) reported that two workable seams of coal had been located



Drawing 10.2/1 Won Wron (Yarram) Open Cut: Plan and sections (extracted from JL Knight, *Mining and Geological Journal,* Vol. 6 No. 2*, 1957*, p. 39).

at Won Wron. Drawing 10.2/1 shows cross sections of the coal deposit and the open cut as depicted by JL Knight at 1957/58.[549]

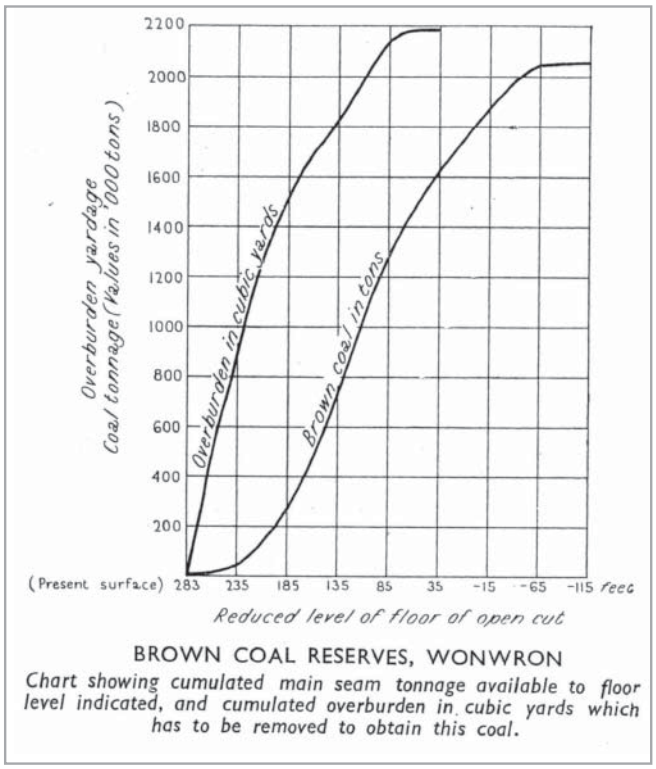
An open cut was commenced circa 1957 by the Won Wron Brown Coal Pty Ltd. There was a temporary lapse in activity but overburden removal recommenced in 1958.[551] A record of the quantity of coal extracted from the open cut or the duration of coal excavation has not been found in this study.

Analysis of the main seam showed a calorific value varying from 5,560 to 6,460 BTU's per lb., marginally better than from Yallourn North, Wensley Bray and Thorpdale. The upper seam of thickness from nine feet to 40 feet had a value from 5,265 to 5,650 BTU's per lb. Ash content varied from 0.8 per cent to 4 per cent.[551]

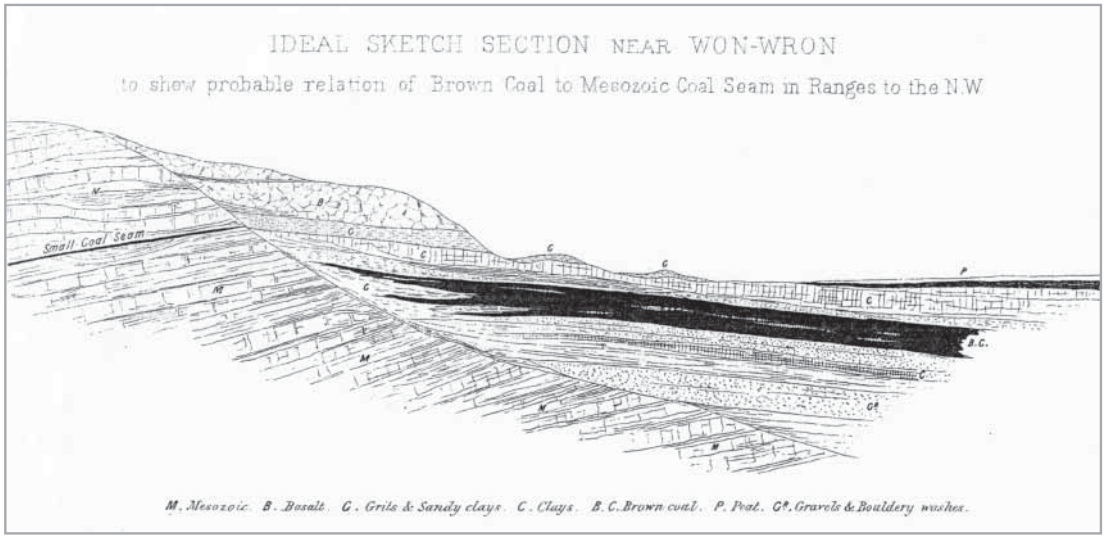
The Mines Department *Annual Report* for 1979 (on p. 46) states that brown coal samples from the Parish of Won Wron were analysed and continuing.

At 1984, the coal deposit at Won Wron was considered to be a small discrete deposit with recoverable coal of the order of two million tonnes. It was geologically associated with a much larger unworked deposit of up to 100 million tonnes at Boodyarn.[552] This latter coalfield was also associated with again-larger unworked but readily mineable deposits at Stradbroke and Alberton, the coal resources of which came under technical appraisal from the 1950s.

No further details have been ascertained with respect to the Won Wron Open Cut in this study. (In some early documentation, this deposit and mine is referred to as the Yarram coal deposit.)



Drawing 10.2/2 Won Wron (Yarram) Open Cut: Coal and overburden quantities in situ (from Knight, *Mining and Geological Journal, 1957*, p. 41).



Drawing 10.2/3 Won Wron: Sketch section of brown coal seam (from Stirling, (1899), Plate No. 9).

Assessment of Heritage Significance

Historical Significance

The brown coal deposit north of Yarram as reported by the Mines Department in 1876 was the first coal discovery so far east in Gippsland. The discovery confirmed propositions that the extensive brown coal fields in the Latrobe Valley probably extended at least as far east as Sale and southwards to the coast south and east of Yarram. The existence of the Won Wron deposit as a coal field, found as an outcrop without basalt or limestone cover, led to extensive drilling in South East Gippsland through to the present time to determine the locations and extent of 'economically winnable coal'.

From the 1920s, the East Gippsland brown coal deposits were progressively confirmed and assessed as being widespread, albeit in much of the area being overlain with thicker overburden and limestone. The Won Wron localised deposit without limestone cover was an indication that similar readily minable deposits would possibly be found by more extensive drilling.

Scientific Significance

No specific scientific outcome arose from the discovery and subsequent geological appraisal of this small discrete brown coal deposit. However resultant further coal discoveries and assessments in South East Gippsland stimulated interest by private industry in coal conversion opportunities from the 1920s.

Economic Significance

The small coal output from the discrete coal deposit at Won Wron was of low economic impact in the region or local community. However the possibility exists that, as at Bacchus Marsh and at Anglesea, more economic deposits other than that found 'by chance in outcrop' at Won Wron could be discovered from continuing detailed investigations of the widespread deposits in East Gippsland.

Social Significance

The coal discoveries which followed the Won Wron find and the geological appraisal of the wide extent of the regional brown coal deposits kept in the public view the potential for future large scale development of the resource. The scope for industries based on brown coal as feedstock, such as associated with the gas and oil industries, was appreciated as a future possibility.

Mine Infrastructure Features

Remnants of the open cut activities may still be visible.

References

Gloe, CS, *The Geology, Discovery and Assessment of the Brown Coal Deposits of Victoria*, Monograph No.11, AusIMM, 1984, p. 89

Knight, JL 'South Gippsland Brown Coal Field at Won Wron,' *Mining and Geological Journal*, Vol. 6 No.2, 1957/58, pp. 38–41

Murray, RAF, *Progress Report*, No.111, Mines Department, 1875/6, p.148

Stirling, J, *Progress Report*, No.10, Mines Department, 1899, p. 80

Thomas, DE and Baragwanath, W *Geology of the Brown Coals Of Victoria*, Part 2, Mines Department, p.14

Endnotes

Endnotes: Chronology and Contextual History

1 Martin, CH et al. *History of Coal Mining in Australia*, Monograph No 11, AusIMM, 1993, p. 5
2 ibid.
3 *Official Yearbook of the Commonwealth of Australia*, No. 32, Commonwealth Bureau of Census and Statistics, Canberra, 1939, p. xxiv
4 Vines, JA, *A History of Morwell Open Cut*, Hazelwood Power Corporation, Morwell, 1996, p.1
5 Halford, M *The Coal Industry of South Gippsland, the Land of the Lyrebird*, 1920, p. 230. Halford writes that this was c1938 by Captain Cole who sent it by boat to Melbourne. This coal, mined on the shore, was not from the same seam(s) as that found by Hovell in 1826.
6 Martin, C et al *History of Coal Mining in Australia*, AusIMM, 1993, p. 8
7 Coglan, J, *The State Coal Mine and Wonthaggi*, 1979, p. 20
8 ibid.
9 Martin, C et al *History of Coal Mining in Australia*, 1993, p. 8
10 Knight, JC 'The Story of Black Coal in Victoria', *Geological and Mining Journal*, Vol.4 No.4, September 1951
11 Martin, C et al, *History of Coal Mining in Australia*, 1993, p. 8. A year is not stated for this mine in this reference.
12 Halford, M, *The Coal Industry of South Gippsland*. This reference gives a description of the early Kilcunda mine operations.
13 Owen, Wilfred 'Miners', *Collected Poems*, Chatto & Windus Ltd., 1946, (Reprinted by New Directions Publishing Corporation 1963)
14 Branagan, DF 'A History of NSW Coal Mining', The Third Edgewood David Day Symposium, The University of Sydney, 1990
15 Martin, CH et al *History of Coal Mining in Australia*, Ausl.M. M.,Melbourne, 1993, pp. 2–5
16 ibid. p. 3
17 *Heritage in the NSW Coalfields*, AusIMM, Nov/Dec 2002, p. 74
18 ibid. p. 5
19 Clark, M, *Sources of Australian History*, Oxford University Press, London, 1957, p.110
20 Horton, T and Morris, K, *The Andersons of Western Port*, The Bass Valley Historical Society, Maryborough, 1983, p.19 – states Hovell's party as consisting of three convicts only.
21 Sutherland, A, *Victoria and its Metropolis,* McCarron, Bird and Company, Melbourne, 1888, pp.1, 17.
22 Horton and Morris,*The Andersons of Western Port*, The Bass Valley Historical Society, 1983, p. 66
23 ibid. p. 55
24 Labilliere, FP, *Early History of the Colony of Victoria*, 1878, pp.1, 246–247. Horton and Morris, *The Andersons of Western Port*, 1983, p. 72
25 Knight, JL 'The Story of Black Coal in Victoria', *Mining and Geological Journal*, September 1940, p. 39
26 Horton and Morris, *The Andersons of Western Port*, 1983, p. 66
27 ibid. p. 55
28 Knight, JL (1940), p. 39
29 Gregory, E. et al *Winchelsea: A History of the Shire*, 1984, p. 48
30 Information in this paragraph is extracted from Martin, C.H. et al *History of Coal Mining in Australia*,1993, pp. 2–3
31 *Heritage in the NSW Coalfields*, AusIMM Bulletin Nov/Dec 2002, p. 74
32 Clark, M. *Sources of Australian History*, Oxford University Press, London, 1957, p. 278
33 Knight, JL 'Geological Survey of Victoria', (unpublished paper) Mines Department, April 1975
34 ibid.
35 Selwyn, A 'Report on Cape Paterson Coal Fields', Geological Survey Offices, October 1867, pp.1–2
36 Brough, Smyth R, *Goldfields and Mineral Districts – Carboniferous Rocks*, Mines Department, p. 48
37 ibid. p. 48
38 *Mineral Statistics*, Mines Department, 1865, p. 42
39 Murray, RAF, *Early Coal Exploration in Gippsland, Land of the Lyrebird*,Shire of Korumburra, 1920, p.182
40 ibid. p.183
41 Coglan, J 'The Early history of South Gippsland Coal, 1826–1909', [Extract from *The State Coal Mine at Wonthaggi* (1909–1968)], 1979, p. 20
42 Brough Smyth, R. 1869, p. 49
43 Brough Smyth, R. 1869, p. 436.
44 *Mineral Statistics Report*, Mines Department,1865, p. 42

[45] Thomas and Baragwanath, *Geology of Brown Coals of Victoria*, Part 1, 1949–51, pp.1–4
[46] *Progress Report*, No 1, Mines Department , 1873, p. 29
[47] Sutherland, A, *Victoria and Its Metropolis*, Vol 1, Melbourne, 1888, p. 384
[48] Victorian Yearbook, 1980 p. 297
[49] Sutherland, A (1888), Vol 1, p. 384
[50] *Victorian Yearbook*, 1980, p. 297
[51] Vines, JA, *A History of Morwell Open Cut*, Generation Victoria, 1996, p.140
[52] Sutherland, A, *Victoria and its Metropolis*, Vol. 1, 1888, p.193
[53] ibid. p. 270
[54] Murray, RAF, *Early Coal Exploration in Gippsland*, 1920, p.184
[55] *Mineral Statistics*, Mines Department, 1872, p. 52
[56] *Mineral Statistics*, Mines Department, 1874, p. 53
[57] Knight JC 'The Story of Black Coal in Victoria', *Mining & Geological Journal*, Vol. 4 No. 4, 1954, p. 40
[58] Bowden, K, *Early Days of Korumburra*, 1967, p.14
[59] *Borings in search of coal and lignite*, Mines Department, 1890, pp.101–102 and *Annual Repor*t, Mines Department, 1890, p. 9
[60] *Mineral Statistics*, Mines Department, 1873, p. 52
[61] Murray, RAF, *Geology and Mineral Resources of South Western Gippsland*, Mines Department, 1875, pp.158, 159
[62] Legg S., *Heart of the Valley: a History of the Morwell Community*, 1992, p. 77
[63] *Annual Report*, Mines Department, 1889, p. 22
[64] Legg S. (1992), p. 82
[65] Adams, J *So Tall the Trees*, 1978, p. 94
[66] ibid. p.101
[67] ibid. p. 94
[68] Wells, J, *Gippsland – People, a Place, and their Past*, Landmark Press, 1986, p.158. (J Adams, p. 94, places the date as early 1879 and the shaft as 26 metres deep. The workings were visited by a government and municipal party in June 1879, stimulating interest in coal ventures in the Narracan Valley. The company mined a few tons only but collapsed financially in the early 1880s.)
[69] Adams, J (1978), p. 96
[70] ibid. p. 94
[71] ibid. p. 95
[72] ibid. pp. 95–96
[73] ibid. p. 97
[74] Adams, J (1978), p. 97
[75] *Morwell Advertiser*, 1 September 1888, p. 3
[76] *Mineral Statistics for Victoria*, Mines Department, 1873, p. 52
[77] Morley, W 'The Great Morwell Coal Mining Company', (unpublished M.A. thesis), 1983, pp.13–15
[78] ibid. pp. 40,41
[79] 'Brown Coal in the Latrobe Valley', *Mining & Geological Journal*, March 1947, p. 4
[80] Stirling, J, *Report on the Brown Coals and Lignites of Victoria*, Mines Department, 1899, p. 78
[81] Wright, J, *Notes on the Geological Features of South Gippsland*, Mines Department, 1894, p. 34
[82] Stirling, J, *Report on the Brown Coals and Lignites of Victoria*, Mines Department, 1899, p. 75
[83] ibid.
[84] ibid.
[85] Adams, J (1978), p.105
[86] Stirling, J (1899), pp. 73, 77
[87] Morwell and Mirboo Gazette, 1890
[88] Adams, J (1978), p.105
[89] ibid. p.104
[90] Stirling, J, *Report on the Brown Coals and Lignites of Victoria*, Mines Department, 1899, p. 74
[91] Adams, J (1978), p.104
[92] Thomas and Baragwanath (1950), Part 3, p.12
[93] *Mineral Statistics*, Mines Department, 1878, p. 49
[94] Priestley, S, *Altona – A Long View*, City of Altona, 1988, p. 86
[95] Priestley, S (1988), p. 86 dates this bore and mining at 1982.
[96] Thomas and Baragwanath (1950), Part 3, p.12 and Gloe, C (1984) state that shaft sinking and actual mining of brown coal also occurred at Newport at 1890.
[97] Gregory, E et al. *Coast to Country: A History of the Winchelsea Shire*, Winchelsea, 1984, p. 48
[98] *Geological Survey Progress Report*, No. 1, Mines Department, 1873, p. 29
[99] Gregory, E et al. (1984), p. 48
[100] Wells, J, (1986), p.163
[101] Adams, J(1978), p. 98
[102] ibid.
[103] ibid. p.100
[104] ibid.
[105] ibid.
[106] Wells, J, (1986), p.160 Adams, J(1978), p.100
[107] Adams, J, (1978), p.101
[108] White, J, *History of the Shire of Korumburra*, Shire of Korumburra, 1987, p. 271. Extensive use of this reference has been made with quotation of page number. The author J White has made specific references to his source documents thus facilitating further research.
[109] Bowden, K, *The Early Days of Korumburra*, 1967, p. 59
[110] White, J (1987), pp.133,134
[111] ibid. p.126
[112] ibid. p.122
[113] ibid.
[114] ibid. p.122
[115] ibid. p.128
[116] Bowden, K (1967), p. 67
[117] White, J (1987), p. 271

[118] ibid. p.128 Bowden, K (1967), pp. 67, 78
[119] Bowden, K (1967), p. 85
[120] Harper, P *The Wonthaggi Coal Fields*, Electrical Industry Advertising, Oak Park, 1987, p. 79 White, J (1987), p.129 Bowden, K (1967), p. 79
[121] White, J (1987), p.130
[122] Harper, P(1987), p. 79
[123] Halford, M *The Coal Industry of South Gippsland*, c1910, pp. 234–237
[124] White, J (1987), p.131
[125] Halford, M (c1910), p. 236
[126] Gleeson, K 'The Rise and Fall of Outtrim', *The Korumburra Times*, 16 September 1965, p. 71
[127] White, J (1987), p.132
[128] Bowden, K (1967), p. 79
[129] White, J (1987), p.132
[130] Harper, P (1987), p. 9
[131] ibid. pp.17–20
[132] Coglan, J *The State Coal Mine and Wonthaggi*, 1979, p. 78 Harper, P (1987), p. 55
[133] Halford, M (c1910), p. 236
[134] ibid. p. 236
[135] Harper, P (1987), p. 20
[136] bid. p.17
[137] ibid. pp. 34, 81, 99, 100
[138] ibid. p. 33
[139] Fahey, C *Wonthaggi State Coal Mine*, Department of Conservation, Forests and Lands,1987, p. 21
[140] ibid. pp. 23, 24
[141] ibid. p. 24
[142] Herman, H Brown *Coals of Victoria*, Mines Department, 1922, p. 6
[143] *Mineral Statistics*, Mines Department, 1878, p. 49
[144] Thomas and Baragwanath (1949), Part 1, p. 4
[145] ibid. Herman, H (1922), p.7
[146] See Fig 14
[147] Gloe, C 'The Geology Discovery and Assessment of the Brown Coal Deposits of Victoria', *Victoria's Brown Coal*, AusIMM, 1984, p. 95
[148] Thomas and Baragwanath (1949), Part 1, p. 4
[149] Thomas and Baragwanath (1950), Part 3, p.12
[150] ibid.
[151] Stirling, J (1899), p. 82
[152] Priestley, S (1988), pp.112, 113
[153] Priestley, S (1988), p.104. See also Herman (1952), p. 49 for annual outputs.
[154] *Australian Mining Standard*, 15 August 1912, p.157 and *Australian Mining Standard*, 17 March 1921, p.13
[155] Priestley, S (1988), p.113
[156] ibid. pp.134, 135
[157] *Mining and Geological Journal*, March 1947, p. 7, Table 11
[158] Herman, H, *Brown Coal,* SECV, 1952, p. 49
[159] Kenny, JPL 'Benwerrin Brown Coal Mine', *Mining and Geological Journal*, March 1947, p.10
[160] Thomas and Baragwanath (1950), Part 3, p.18 Herman, H (1952), p. 5
[161] Kenny, JPL (1947), p.10
[162] Thomas and Baragwanath (1950), Part 3, p.18
[163] Millard, R, *The Deans Marsh Story*, Geelong, 1985, p. 57
[164] Thomas and Baragwanath (1950), Part 3, p.18. Drucker (1984), p. 48, states that the mine at Benwerrin was an open cut operation. I have not yet found confirmation of this. Others including Herman, H (1952) refer to tunnelling operations, which is more likely.
[165] Herman, H (1922), p. 7
[166] 'Brown Coal in the Latrobe Valley', *Mining and Geological Journal*, March 1947, p. 6
[167] Herman, H (1922), pp. 7, 8
[168] *Mining and Geological Journal*, March 1947, pp. 6–8
[169] Herman, H (1922), p. 8
[170] Herman, H (1952), pp.157–159
[171] 'Power for Victorian Industries', *The Industrial Australian and Mining Standard*, 17 March 1921, pp. 20–25
[172] White, J (1987), p.126
[173] ibid. p.134
[174] White, J (1987), p.128
[175] ibid. p.133
[176] ibid. pp.134, 135
[177] Harper, P (1987), p. 79. Details stated in Harper are quoted from G Broome, Manager of the State Mine.
[178] White, J (1987), p.133 – from information extracted from specified company records and Mines Department records.
[179] Fahey, C, *Wonthaggi State Coal Mine*, Department of Conservation Forests and Lands, 1987, pp.17–19. Fahey states Knight, JL 'The Closing of the State Coal Mine Wonthaggi', *Mining & Geological Journal*, Vol. 6 No. 6 1970, p. 63 as his information source.
[180] Fahey, C (1987), p. 24. Fahey states JL Knight (1970), p. 66 as his information source.
[181] ibid.
[182] Fahey, C (1987), p. 47. Fahey states JL Knight (1970), pp. 65–66 as his information source.
[183] ibid.
[184] Fahey, C (1987), p. 24. Fahey states JL Knight (1970), pp. 63–64 as his information source.
[185] Fahey, C (1987), p. 25. Fahey states JL Knight (1970), p. 66 as his information source
[186] Fahey, C (1987), p. 48. Fahey states JL Knight (1970), p. 66 as his information source.

[187] Fahey, C (1987), pp. 48–49. Fahey states JL Knight (1970), pp. 66–68 as his information source.
[188] Fahey, C (1987), p. 53. Fahey states JL Knight (1970), p. 68 as his information source.
[189] Harper, P (1987), p.141 and JL Knight (1970)
[190] Harper, P (1987), p.17
[191] ibid. p.17
[192] Griffiths P. *Three Times Blest: A History of Buninyong and District*, Buninyong and District Historical Society, 1988, p. 99
[193] Brown, G 'Coal Resources in Victoria', *Mining & Geological Journal*, September 1948, p.11
[194] Thomas and Baragwanath (1950), part 3, p.14
[195] Griffiths P. (1988), p.100
[196] ibid.
[197] Herman, H (1952), p. 49
[198] Priestley, S (1988), p.168
[199] Priestley, S (1988), pp.168,169
[200] Kenny, JPL 'Benwerrin Brown Coal Mine', *Mining & Geological Journal*, March 1947, p.10
[201] ibid.
[202] ibid.
[203] *Mining & Geological Journal*, March 1947 to September 1948
[204] Herman, H (1952), p. 49 and Table 11
[205] Thomas and Baragwanath (1950), Part 3, p.17 and Vol. 3, p. 23
[206] Thomas and Baragwanath (1950), Part.3, pp.18 and 22 to 24
[207] Millard, R (1985), p. 58
[208] ibid.
[209] Thomas and Baragwanath (1950), Part 3, p.18. Date of mining commencement is stated as 1921.
[210] Herman, H (1952), pp. 49, 85
[211] Thomas and Baragwanath (1950), Part 3, pp.18, 19
[212] Thomas and Baragwanath (1950), Part 3, p.19 use this nomenclature but the spelling Wensleybrae is also used by others. The name Winchelsea South Coal Mine was also used colloquially.
[213] Swift, D 'The Wensley Bray Brown Coal Mine', *Mining & Geological Journal*, March 1948, p.10
[214] Thomas and Baragwanath (1950), Part 3, pp.18, 19. Herman, H (1952), p. 85. Note that Herman's descriptive location of the mine is incorrect, the mine being about five miles north west of Deans Marsh not south east thereof.
[215] Gregory, E et al. *Winchelsea: A History of the Shire*, 1984, p. 48
[216] Gregory, E et al. (1984), p.140, 141. A photo of the mine when under Roche Brothers operation is shown on page 141.
[217] ibid. p.134
[218] Gloe, C (1984), p. 81
[219] ibid. p.134
[220] Gloe, C (1984), p. 97
[221] Edwards A. *Fuel*, 1950, Vol 29, p.125 Thomas and Baragwanath (1951), Part 4, p.15
[222] Gloe, C (1984), p. 81
[223] Thomas and Baragwanath (1949), Part 1, p. 5
Gloe, C (1984), p. 98
[224] Herman, H. (1952), p. 81. Note that the depth and thickness of the coal, and the levels at which the mine was worked as stated by Herman do not reconcile with the figures as stated by Thomas and Baragwanath (1949), part 1, p. 5 or as stated by Gloe (1984), p. 81.
[225] Gloe, C (1984), p. 98
[226] *Annual Report*, Mines Department, 1947
[227] Thomas and Baragwanath (1950), Part 3, p.10. This output figure appears to be low. Another source states 120,000 tons by 1947.
[228] Herman, H (1952), p. 49
[229] *Annual Report*, Mines Department, 1954
[230] Thomas and Baragwanath (1950), Part 3, p.10
[231] Herman, H (1950), p. 49
[232] Thomas and Baragwanath (1950), Part 3, p.10 and Herman, H (1950), p. 49
[233] Thomas and Baragwanath (1950), Part 3, p.10 and Herman, H(1952), p. 49
[234] *Mining & Geological Journal*, March 1951, March 1952 and September 1952
[235] Thomas and Baragwanath (1951), Part 4, p. 8, 9
[236] Thomas and Baragwanath (1951), Part 4, pp. 8–10
[237] *Annual Report*, Mines Department, 1948
[238] *Annual Report*, Mines Department, 1947 and 1948
[239] Thomas and Baragwanath (1951), Part 4, pp. 8–10
[240] Assessed from *Annual Reports*, Mines Department 1947 to 1965
[241] Vines, JA, *A Technical History of Yallourn North and Yallourn North Extension Open Cuts*, SECV, 1989, p.13
[242] Vines, JA *Train Systems –Yallourn and Morwell Open Cuts*, Generation Victoria, 1994, pp. 31–35
[243] Vines, JA, *A History of Morwell Open Cut*, Generation Victoria, 1996, p.140 and Table 8.3/1
[244] Rusden, GF, *History of Yallourn, Yallourn North and Yallourn North Extension Open Cuts* 1947–1965, SECV, 1968. Appendix 10 is the source of annual coal outputs 1924 –1963.
[245] Vines, JA (1994), p. 35. See Photo 1.31/5
[246] Rusden, GF (1968), pp. 82–84, 98
[247] Vines, JA (1989), p. 93
[248] Vines, JA (1989), p. 67, Table 5.1/2
[249] Brown, K et al *Yallourn North Extension Open Cut Interim Rehabilitation*, Rehabilitate Victoria, AusIMM, 1992, pp. 71–76
[250] Vines, JA, *A History of Morwell Open Cut*, Generation Victoria, 1996, pp. 7–11
[251] Vines, JA (1994), pp.17, 21

[252] Rodgers, HC 'Excavation Equipment for Brown Coal', *Proceedings*, AusIMM, 1960, No. 164, Fig. 1 Cross Section showing proposed disposition of dredgers in Yallourn South Field circa1962/63. Number 13 dredger was subsequently installed in 1977 and number four dredger was retired.

[253] 'Yallourn Energy-Alliance Mining Innovations', AusIMM *Journal*, Jan/Feb 2003. pp. 22–24

[254] Vines, JA (1994), p.143, Table 6.15/4 and p. 241 Table 9/1 and p. 242 Table 9/2

[255] *Live Wire*, Yallourn Energy, January 2003, p. 2

[256] Vines, JA (1996), pp.18–38

[257] Vines, JA (1996), pp.101–116

[258] Vines, JA (1996), pp. 264, 265

[259] *Jumbunna*, International Power Hazelwood, Vol. 9 No. 5 (August 2003), p. 7 and Vol. 9 No. 6 (Sept 2003), p. 3 and Vol.10 No.1, (Jan/Feb 2004), pp. 3, 10–13

[260] 'This River is a Mover', *Discovery*, Dept of Primary Industries, February 2003, pp.10, 11

[261] Vines, JA (1996), p.109, See Table 7.5/3

[262] Vines, JA, *A History of the Loy Yang Mine*, SECV, 2000, p. 97

[263] ibid. p. 221

[264] ibid. pp. 310–316

[265] ibid. p. 293 and Table 9.1/1; see also Table 7.1.1/1

[266] ibid. pp.180, 295–297

[267] ibid. p. 379

[268] ibid. p. 210 See Table 7.1.1/1

[269] Information from I. Draper, Statistics Officer Loy Yang Mine, on 11 March 2004.

[270] Speirs, C 'A mine with a view for the future', *House Journal*, Loy Yang Power, 19 July 2000, pp. 3–5

[271] Speirs, C 'Loy Yang Mine marks 20 years', *Discovery*, Department of Natural Resources & Environment, December 2002, p. 20.

[272] Gloe, C (1984), pp. 85, 91.

[273] Herman, H (1952), p. 49

[274] Greer, I & Smith, GO 'Geology of the Gelliondale Coalfield', *Australian Coal Geology*, Vol. 4 No. 1, 1982, pp. 71–79 and Gloe, C (1984), p. 95

[275] ibid. (1984), p. 90

[276] Stirling, J, *Progress Report*, Mines Department, No.10, 1899, p. 76

[277] Thomas, DE and Baragwanath, W, *Geology of the Brown Coals of Victoria*, Part 2, 1950, p.14

[278] Gloe, CS, *The geology, discovery and assessment of the brown coal deposits of Victoria*, AusIMM Monograph Series, No 11, 1984, p. 89

[279] Knight, JL 'South Gippsland Brown Coal Field at Won Wron', *Mining & Geological Journal*, Vol. 6, No. 2, c1969, pp. 38–41

[280] 'Eight Billion Dollars in brown coal proposals', *Discovery*, Department of Natural Resources & Environment, August 2002, pp. 5–7

[281] *Jumbunna*, International Power Hazelwood, Jan/Feb 2004, p.15

Endnotes: Mine Sites Identification

1 Thomas, DE and Baragwanath, W 'Geology of the *Brown Coals Of Victoria*', Part 1, p.1, *Mining and Geological Journal* Vol. 3 No. 6 Sept. 1949
(This publication was initially published in four consecutive parts in the *Mining and Geological Journal* from Sept. 1949 to March 1951 and subsequently reprinted in four parts by the Department of Mines Victoria. The Mines Department pagination will be used in this Coal Heritage Study in further references to this four part document.)

2 ibid.

3 ibid.

4 Garner, EL & Barton, C, *The Importance of Lignite in South Asia*, AusIMM Spectrum Series No. 8, 1987, p.1

5 Horton, T and Morris, K *The Andersons of Western Port*, Bass Valley Historical Society, 1983, p. 55
(This publication has numerous references to early source documentation. Some writers incorrectly attribute the coal discovery at Cape Paterson to the exploration of Hume and Hovell in 1824 which did not reach Western Port.)

6 ibid. p. 55

7 ibid. p. 54

8 ibid. pp. 66–72

9 ibid. pp. 72–73

10 Knight, JL 'The Story of Black Coal in Victoria', *Mining and Geological Journal* Vol. 4 No. 4 , September 1951, p.39

11 *Royal Commission on Coal*, 18 December 1891, p.19

12 Knight, JL (1951), p.40

13 Knight, JL (1951), p.39

14 Selwyn, A, *Cape Patterson Coal Fields*, Mines Department, 1867, p. 2

15 Brough Smyth, R 'Goldfields and Mineral Districts 1869', *Carboniferous Rocks*, 1869, p. 48

16 Knight, JL (1951), p. 40

17 Knight, JL 'The Closing of the State Coal Mines , Wonthaggi', *Mining and Geological Journal*, Vol. 6 No. 6, 1970, p. 73

18 Knight, JL (1951), p. 40

19 Coglan, John, in 'The Early history of South Gippsland Coal, 1826–1909', *The State Coal Mine at Wonthaggi 1909–1968*, p. 20

[20] *Mineral Statistics*, Mines Department, 1864, p. 38 and 1865, p. 42
[21] ibid.
[22] *Mineral Statistics*, Mines Department, 1864, p. 38
[23] Selwyn, Alfred, *Report on Coal Seams, Cape Patterson*, Mines Department, 1867, p. 2
[24] *Mineral Statistics*, Mines Department, 1874, p. 53
[25] *Mineral Statistics*, Mines Department, 1875, p. 51
[26] Murray R. A. F, *Report on the Geology and Mineral Resources of South West Gippsland*, Mines Department, 6 August 1875, pp.159–160
[27] Coglan, John, in 'The Early history of South Gippsland Coal, 1826–1909', *The State Coal Mine at Wonthaggi, 1909–1968*, p. 20
[28] Horton, T and Morris, K, *The Andersons of Western Port*, Bass Valley Historical Society, 1983, p.118
[29] Coglan, John, in 'The Early history of South Gippsland Coal, 1826 – 1909', *The State Coal Mine at Wonthaggi*, *1909 – 1968*, 1979, p.20, says the WPCC was formed in 1865.
[30] Horton, T and Morris, K (1983), pp.117–118
[31] *Mineral Statistics*, Mines Department, 1872, p. 52
[32] ibid.
[33] Horton, T and Morris, K (1983), p.120 (The quantity may be overstated. *Mineral Statistics*, 1874 records 4,589 tonnes mined, but it was not unusual for quantities of coal as stated by operators to the Mines Department to be lower than actual.
[34] ibid. p.122
[35] Knight, JL 'The Closing of the State Coal Mines, Wonthaggi,' *Mining and Geological Journal*, Vol. 6 No. 6, 1970, p. 54
[36] Horton, T and Morris, K (1983), p.139. However, John Coghlan, in 'The Early history of South Gippsland Coal,1826–1909', *The State Coal Mine at Wonthaggi, 1909–1968*, p. 20, says the mine closure was 1883. Interpretation of Horton and Morris suggests 1893 as being the more likely date.)
[37] *Mineral Statistics*, Mines Department, 1873 and 1874
[38] Brown, George 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948, p.6
[39] *Mining and Geological Journal*, Mines Department, March 1947, p. 48
[40] ibid. September 1948
[41] Brown, George (1948), p. 6
[42] *Annual Report*, Mines Department, 1954.
[43] *Mining and Geological Journal*, Mines Department, March 1947 to March 1950
[44] ibid. March 1952 and March 1953
[45] ibid. September 1953
[46] ibid. September 1948
[47] *Annual Report*, Mines Department, 1947
[48] *Mining and Geological Journal*, Mines Department, March 1947 to March 1950
[49] Knight, JL 'Coast Coal Mine Woolamai', Mines Department memo to Chief Government Geologist, 3 May 1957
[50] *Mining and Geological Journal*, Mines Department, September 1952
[51] *Annual Report*, Mines Department, 1954
[52] Knight, JL 'Coast Coal Mine Woolamai', Mines Department memo to Chief Government Geologist, 3 May 1957
[53] *Annual Report*, Mines Department, 1966, p. 22
[54] Bowden, K, *Early Days of Korumburra*, 1967, p.13
[55] Murray, RAF *Early Coal Exploration in Gippsland, Land of the Lyrebird*, Shire of Korumburra, 1920, pp.182–190.
[56] *Progress Report*, No 3, Mines Department, 1876, pp.156–157
[57] Bowden, K (1967), p.15
[58] *Annual Report*, Mines Department, 1889
[59] *Annual Report*, Mines Department, 1890
[60] *Annual Report*, Mines Department, 1891
[61] White, J *The History of the Shire of Korumburra*, 1987, p.121
[62] Bowden, K (1967), p. 55
[63] *Company Records No. 4651*, Public Records Office
[64] Bowden, K (1967), p.14
[65] ibid. p. 78
[66] White, J *The History of the Shire of Korumburra*, 1987, p.121
[67] White, J (1987), p.134
[68] *Korumburra Times*, 5 September 1968, as referred to by J White (1987), p.135
[69] White, J (1987), p.119
[70] *Company Records No. 5109*, Public Records Office
[71] White, J (1987), pp.119–121
[72] ibid. p.119 and *Southern Mail*, 27 May 1895
[73] ibid. p.121
[74] *Company Records No. 8732*, Public Records Office
[75] *Mining and Geological Journa*l, Mines Department, March 1942
[76] Kenny, JPL *Boring on the Korumburra Coal Field*, September 1947, p. 34
[77] *Mining and Geological Journal*, Vol. 6 No. 2, Mines Department, 1957
[78] Murray, RAF *Geological Survey Progress Repor*t, No. 3, 1876, pp.156–157
[79] White, J (1987), p.133
[80] White, J (1987), pp.133–134
[81] White, J (1987), p.134. Most of the information in this Section 3.1.4 has been taken from J White (1987), with some additions from Bowden, K (1967). Where company record numbers in the Public Records Office are quoted, these have been extracted from White, J (1987).
[82] Company Records No. 5187, Public Records Office
[83] White, J (1987), p.126
[84] White, J (1987), p.122. Other figures quoted by White pp.122–125 state total excavation varying from about 26,000 to 49,500 tonnes.

[85] White, J (1987), p.128
[86] White, J (1987), p.133 referring to *The Advocate*, 17 September 1925
[87] White, J (1987), p.133 referring to *The Korumburra Times*, 30 January 1937
[88] *Annual Report*, Mines Department, 1949
[89] Kenny, JPL 'Coal Near Warragul,' *Mining and Geological Journal*, March 1947, pp.18–19
[90] ibid.
[91] Murray, RAF 'Recollections and Experiences', *Annual Report*, Mines Department, 1891, p.300
Murray, RAF, *Remarks on the Development of the Coal and Lignite Resources of Victoria*, 1889, p.22
[92] Harper, P, *The Wonthaggi Coal Fields*, E. I. Advertising, 1987, p.79
[93] White, J (1987), p.271
[94] See VR Jumbunna and Outtrim Railway Map 1895, No.138
[95] White, J (1987), p.130
[96] Harper, P (1987), p.86 and p.19 states closure as 1929. White, J (1987) says 1939. There was a suspension of operations in 1929 but mining resumed in 1931until 1939.
[97] White, J (1987), p.129
[98] Harper, P (1987), p.79
[99] *Mining and Geological Journal*, Mines Department, March 1947, p.51
[100] Harper, P (1987), p.79
[101] White, J, *The History of the Shire of Korumburra*, 1987, p.131
[102] Murray, RAF 'Recollections and Experiences', *Annual Report*, Mines Department, 1891, p.301
[103] Wells, John *Gippsland: A People, a Place, and their Past*, Landmark Press, 1986, p.162
[104] Gleeson, K 'The Rise and Fall of Outtrim', *The Korumburra Times*, 16 September 1965, p.71
[105] White, J (1987), p.131
[106] ibid.
[107] *Company Records* Nos. 4792, 5145, Public Records Office.
[108] White, J (1987), p.132
[109] *Mining and Geological Journal*, Vol. 6 No. 2, Mines Department, 1957
[110] Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948, p.7
[111] Knight, JL 'The Story of Black Coal in Victoria', *Mining and Geological Journal*, Vol. 4 No. 4, 1954, p.41
[112] Brown, G (1948), p.7
[113] Harper, P, *The Wonthaggi Coal Fields*, E.I. Advertising, 1987, p.7
[114] Fahey, C, *Wonthaggi State Coal Mine*, Wonthaggi Coal Mine Committee, 1987, p.15
[115] *The Melbourne Age*, 28 October 1909
[116] Harper, P (1987), p.9
[117] ibid.
[118] ibid. p.34
[119] ibid. p.81
[120] ibid. pp.99, 100
[121] Fahey, C (1987), pp.55, 56
[122] Knight, JL 'The Closing of the State Coal Mines, Wonthaggi', *Mining and Geological Journal*, Vol.6 No.6, 1970, p.53
[123] Fahey, C (1987), p.56
[124] Knight, JL (1970), p. 68
[125] ibid.
[126] Knight, JL 'The Closing of the State Coal Mines, Wonthaggi' *Mining and Geological Journal*, Vol. 6 No. 6, 1970, p.70
[127] Sleeman, J, *Black Coal In Gippsland*, 1976, p.4
[128] Harper, P, *The Wonthaggi Coal Fields*, E. I. Advertising, 1987, p. 55
[129] Knight, JL (1970)
[130] Adams, John, *So Tall the Trees*, p.93. The majority of information collated in this sub-Section has been taken from interlocking information in this John Adams writing, pp.93–99, and from John Wells' *Gippsland: A People, a Place, and their Past*, 1986, pp.158–161
[131] Wells, John, *Gippsland: A People, a Place, and their Past*, 1986, p.158
[132] *Mineral Statistics*, Mines Department, 1876, p.51
[133] Wells, John (1986), p.158
[134] ibid. pp.95–96
[135] Ringin, Kath 'Bundilla and Coalville', *Coach News*, June 1983, pp.10–12
[136] Wells, John, *Gippsland: A People, a Place and their Past*, pp.158–161
[137] Daley, C, *The Story of Gippsland*, 1960, p.132
[138] Adams, John, p.97
[139] Hillbrick, G 'Memories of Coalville', *Coach News*
[140] Ringin, Kath 'Bundilla and Coalville', *Coach News*, June 1983
[141] Wells, John, *Gippsland: A People, a Place and their Past*, 1986, p.158
[142] Kenny, JPL 'The Hazelwood Coal Seam', *Mining and Geological Journal*, March 1947, pp.19–20
[143] *The Gippsland Times*, 24 November 1874
[144] Murray, RAF 'Report on the Geology and Mineral Resources of South Western Gippsland', *Geological Survey Progress Report*, No.3, 1876, pp.158–159
[145] ibid.
[146] Murray, RAF *Geological Survey Progress Report*, No. 7, 1883, p.74
[147] Kenny, JPL 'The Hazelwood Coal Seam', *Mining and Geological Journal*, March 1947, pp.19–20
[148] Legg, Stephen M, *Heart of the Valley: A History of the Morwell Municipality*, 1992, pp.76–77
[149] *The Morwell Advertiser*, 3 March 1883

[150] ibid. Legg (1992), pp. 78–79
[151] 'Borings in search of Coal and Lignite or Brown Coal', *Annual Report*, Mines Department, 1890, p.102
[152] *Annual Report*, Mines Department, 1889, pp. 21–22
[153] Knight, JL 'The Story of Black Coal in Victoria', *Mining and Geological Journal*, Vol. 4 No. 4, September 1951, p. 41
[154] *Annual Report*, Mines Department, 1890, p. 9
[155] *Progress Report*, Mines Department, No. 10, 1899, pp. 4, 5
[156] Murray, RAF, *Geological Survey Progress Report*, No. 3, Mines Department, 1876, p.159
[157] ibid.
[158] *The Morwell Advocate*, 6 October 1888, p. 3
[159] Stirling, J, *Reports on the Victorian Coal Fields*, Report on the Yarragon District, 1892, p.16
[160] ibid.
[161] *Annual Report*, Mines Department, 1889, p. 92
[162] *Annual Report*, Mines Department, 1890, p.101
[163] *Mining and Geological Journal*, Vol. 6 No.2, 1957
[164] *Annual Reports*, Mines Department, 1957, 1958, 1959
[165] Murray, RAF, *Annual Report*, Mines Department,1890, p. 9
[166] *Dickers Mining Record*, June 1864, p.100. A visit to the Lignite Deposits at Lal Lal, near Ballarat. This article provides a contemporary account of the lignite discovery and early development of the lignite mining at Lal Lal.
[167] Griffiths, Peter M, *Three Times Blest: A History of Buninyong and District, 1837–1901*, Buninyong and District Historical Society, 1988, opposite p.1
[168] Dickers *Mining Record*, June 1864, p.100
[169] ibid.
[170] ibid.
[171] *Minerals Statistics*, Mines Department, 1864, p. 88
[172] Dickers *Mining Record*, June 1864, p.100
[173] Dickers *Mining Record*, June 1864, p.101. The Victoria Lignite Company, Lal Lal near Ballarat.
[174] ibid.
[175] *Minerals Statistics*, Mines Department, 1864, p. 38
The 200 tons mined previously from the second prospecting shaft had been mined spasmodically for product trials and was not officially recorded in Mines Department production records or statistics.
[176] *Minerals Statistics*, Mines Department, 1865, p. 48
[177] Brough Smyth, R, *Goldfields and Mineral Districts*, Mines Department, 1869, p.436
[178] ibid. p.437
[179] Griffiths, Peter M, *Three Times Blest: A History of Buninyong and District*, The Buninyong & District Historical Society, 1988, p.95
[180] *Mineral Statistics*, Mines Department, 1870, p. 48
[181] *Mineral Statistics*, Mines Department, 1878, p. 49
[182] Thomas, DE and Baragwanath, W *Geology of the Brown Coals of Victoria*, Part 3, Mines Department, 1950, p.15
[183] Griffiths, Peter M (1988), p. 99
[184] Herman, H, *Brown Coals of Victoria*, Bulletin No. 45, Geological Survey of Victoria, 1922, p. 7
[185] Griffiths, Peter M (1988), p. 99
[186] Kenny, JPL *Victorian Central Brown Coal Mine*, Lal Lal, Mines Department, 1921. Drawing signed by JPL Kenny on 12 November 1921, now on microfiche DRMG CM 2002/5/1 and 2002/B/1. This same layout of the underground workings and adjacent bores and shafts is also shown by Jenkins, HC (1920), *Brown Coal Mine*, Parish of Lal Lal, Microfiche DRMG CM 2466/D/@.
[187] Griffiths, Peter M (1988), p.100
[188] ibid.
[189] Thomas, DE and Baragwanath, W, *Geology of the Brown Coals of Victoria*, Part 3, Mines Department, 1951, p.17. Pages 14 to 17 of Part 3 of this publication provide a geological analysis of the Lal Lal brown coal deposit.
[190] *Mining and Geological Journal*, March 1952 and September 1952
[191] Brough Smyth, R, *Goldfields and Mineral Districts 1869*, Mines Department, 1869, pp. 436–438
[192] *Minerals Statistics*, Mines Department, 1865, p. 43
[193] Griffiths, Peter M. (1988), p.16. Map of gold leads south of Ballarat c.1860.
[194] *Progress Report of Geological Survey*, No.111, Mines Department, 1876, p. 284
[195] *Mineral Statistics*, Mines Department, 1874, p. 54
[196] *Progress Report*, No. 1, Mines Department, 1873, p. 29
[197] *Progress Report*, No. 3, Mines Department, 1876, pp.172,173
[198] *Mineral Statistics*, Mines Department, 1875, p. 51
[199] ibid.
[200] *Mineral Statistics*, Mines Department, 1873, p. 53
[201] Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No.11, AusIMM, 1984, p. 97
[202] *Progress Report*, No. 2, Mines Department, 1874, p.8
[203] ibid.
[204] *Progress Report*, No. 3, Mines Department, 1876, pp.149, 172
[205] *From the Dawning: A History of Yarragon and District,* Back to Yarragon Committee, March 1978, p.120
[206] Stirling, J 'Report on the Brown Coals and Lignites of Victoria,' *Progress Report*, No. 10, Mines Department, 1899, p. 74
[207] ibid.
[208] Thomas, DE and Baragwanath, W *Geology of the Brown Coals of Victoria*, Part 1, Mines Department, 1949, p.11
[209] *From the Dawning* (1978), p.120
[210] ibid. p.121
[211] Stirling, J (1899), p. 74

[212] Stirling, J, *Report on the Victorian Coal Fields Report on the Yarragon District*, Mines Department, 1892, pp.15–17
[213] *From the Dawning* (1978), p.121
[214] Adams, John, *So Tall the Trees*, 1978, p.105
[215] Stirling, J (1892), p.15
[216] Fraser, N 'Exploration Licence 1800 Trafalgar', Final Report to the Mines Department, 1983, p. 8
[217] Stirling, J *Report on the Yarragon District*, Mines Department, 1892, pp.15–16
[218] *From the Dawning* (1978), p.103
[219] ibid.
[220] Stirling, J 'Report on the Brown Coals and Lignites Of Victoria', *Progress Report*, No. 10, Mines Department, 1899, p.75
[221] Adams, John, *So Tall the Trees*, 1978, p.97
[222] ibid.
[223] Thomas, DE and Baragwanath, W *Geology of the Brown coals of Victoria*, Part 4, Mines Department, 1951, pp. 8–10
[224] Stirling, J (1899), Plate No. 5
[225] Thomas, DE and Baragwanath, W (1951) pp. 8–10
[226] ibid.
[227] Stirling, J (1899), p.75
[228] Stirling, J (1899), Plate 6
[229] Thomas, DE and Baragwanath, W (1951), p.10
[230] Stirling, J (1899), p. 75
[231] ibid.
[232] *Annual Report*, Mines Department, 1947
[233] *Annual Report*, Mines Department, 1948
[234] Thomas, DE and Baragwanath, W (1949), Part 1, pp.10,11,17
[235] Thomas, DE and Baragwanath, W (1951), Part 4, p. 8
[236] *Mining and Geological Journal*, March 1955
[237] *Mineral Statistics*, Mines Department, 1873, p. 52
[238] Stirling, J 'Report on the Brown Coals and Lignites of Victoria', *Progress Report*, No. 10, Mines Department, 1899, p. 74 Gloe, CS *Geology of Brown Coal Deposits*, Monograph No.11, Mines Department, 1984, p. 97
[239] *Mineral Statistics*, Mines Department, 1873, p. 52
[240] ibid.
[241] *Annual Report*, Mines Department, 1889, p.93
[242] *Borings in search of Coal and Lignite or Brown Coal*, Mines Department, 1890, p.103
Stirling, J 'Report on the Brown Coals and Lignites of Victoria', *Progress Report*, No. 10, Mines Department, 1899, p. 74
[243] *The Morwell and Mirboo Gazette*, 1890. Some dates in this reference are in disagreement with those signified in the Company Agreement dated 19 December 1889.
[244] Stirling, J (1899), p. 77
[245] *Final Report*, *Royal Commission on Coal*, December 1891, pp. 267–269
[246] Stirling, J (1899), p. 76
[247] ibid. Plate 7
[248] Vines, JA, *Technical History of Yallourn Open Cut*, SECV, 1989, pp. 72–73
[249] Thomas, DE and Baragwanath, W *Geology of the Brown Coals of Victoria*, Part 4, 1951, pp. 8–10
[250] ibid. pp. 6–8
[251] Stirling, J (1899), p. 79
[252] Thomas, DE and Baragwanath, W *Geology of the Brown Coals of Victoria*, Part 4, Mines Department, 1951, pp. 5–6
[253] *The Cyclopaedia of Victoria*, 1905, p. 554
[254] *Australian Mining Standard*, 1 August 1912, p. 98
[255] Cecil, KL, *Along the Great Ocean Road: A Chronological List of Events at Anglesea and Aireys Inlet*, Anglesea and District Historical Society, 1988a, p. 4
[256] Gregory, EB et al *Coast to Country: Winchelsea, A History of the Shire*, Shire of Winchelsea, 1985, p. 48
[257] Cecil, KL (1988a), p. 4
[258] Stirling, J, *Report on the Brown Coals and Lignites of Victoria*, Mines Department,1899, pp. 80, 83
[259] Cecil, KL (1988a), p. 4
[260] Krause, FM, *Progress Report*, No.1, Mines Department, 1873, p. 29
[261] Holdgate, GR *Brown Coal Prospects in the Area of the Otway Ranges*, Mines Department, 1974, pp.1–2
[262] Gregory, EB et al (1985), p. 48
[263] Millard, R, *The Deans Marsh Story*, 1985, p. 57
[264] Thomas, DE and Baragwanath, W (1949–51), Part 3, p.18
[265] Jenkins, HC, *Report re Utilisation of Brown Coal*, Mines Department, 1900, p. 2
[266] Thomas, DE and Baragwanath, W (1949–51), p.18
[267] ibid. p. 24
[268] ibid. p.18.
[269] Kenny, JPL 'Benwerrin Brown Coal Mine', *Mining and Geological Journal of Victoria*, Vol. 3 No. 1, 1947
[270] Thomas, DE and Baragwanath, W (1949–51), pp. 20–24
[271] Anecdotal information
[272] Millard, R (1985), p. 58
[273] Thomas, DE and Baragwanath, W (1949–1951), pp. 23, 24
[274] Millard, R (1985), p. 58. He writes that the shaft was sunk by a local partnership of Messrs A. Clissold and N. Caldwell. Millard does not refer to subsequent mining by the Globrite Colliery Company as being via an adit as described in the earlier writings by Thomas and Baragwanath.
[275] Thomas, DE and Baragwanath, W (1949–51), pp.20–24
[276] Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No.11, AusIMM, 1984 p. 92
[277] Houghton, N, *The Saddle Line: A History of the Moriac to Wensleydale Railway*, 1982, J A. Hoskin and Son Pty. Ltd, p. 38
[278] ibid. pp. 39–42
[279] ibid.

[280] Kenny, JPL 'Wensley Bray Brown Coal Mine, Wensleydale', *Mining and Geological Journal*, March 1947, p.10
[281] Thomas, DE and Baragwanath, W (1949–1951), Part 3, pp.18–22
[282] Houghton, N (1982), p. 42
[283] Thomas, DE and Baragwanath, W (1949–1951), Part 3, pp.18–22
[284] Swift, D 'The Wensley Bray Brown Coal Mine', *Mining and Geological Journal*, March 1948, pp. 9–11
[285] ibid.
[286] ibid.
[287] Herman, H (1952), p. 49
[288] Gregory, EB et al (1984), p.140
[289] Gregory, EB et al (1984), p. 48
[290] Knight, JL 'Boring for Brown Coal near the Wensley Bray Brown Coal Mine', *Mining and Geological Journal*, Vol. 3 No. 5, 1949, pp. 33–37
[291] *Mining and Geological Journal*, March 1951
[292] Cecil, KL and Carr, RV, *Anglesea, A History*, Vol.1, Anglesea and District Historical Society, 1989, p. 97
[293] Cecil, KL and Carr, RV, *Aireys Inlet, A History*, Anglesea and District Historical Society, 1987, p. 74
[294] Knight, JL, *Preliminary Report on Structure of the Anglesea Coalfield*, Mines Department, July 1960
[295] ibid.
[296] Gloe, CS (1984), p. 81
[297] Blainey, G, *White Gold*, The Story of Alcoa of Australia, Allen and Unwin, 1997, p. 44
[298] ibid.
[299] ibid. pp. 45–46
[300] Foran, B, *Australia's Aluminium Since 1963*, Alcoa World Alumina Australia, 2004, p.1
[301] Rolland, C, *The Ongoing Rehabilitation of the Anglesea Brown Coal Mine,* Rehabilitate Victoria, AusIMM, No. 11, November 1992, p.134
[302] Blainey, G (1997), p.107
[303] Rolland, C (1992), p.134
[304] Blainey, G (1997), p.107
[305] ibid. pp.133–137
[306] Foran, B (2004), p. 3
[307] Holdgate, GR *Brown Coal Prospects in the area of the Otway Ranges*, Mines Department, (1974), p. 2
[308] ibid. p.1
[309] Foran, B (2004), p. 3
[310] Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No.11, AusIMM, 1984, p. 81
[311] *Annual Report*, Mines Department, 1889, p. 22
[312] Priestly, S, *Altona: A Long View*, City of Altona, 1988, p. 95
[313] Knight, JL, *Brown Coal in the Melbourne Area*, Mines Department, (unpublished), March 1960, p.1
[314] Priestley, S (1988), p. 95
[315] Knight, JL (1960), p.1
[316] Priestly, S (1988), p.100
[317] Thomas, DE and Baragwanath, W Geology of the *Brown Coals Of Victoria*, Part 3, 1950, p.12
[318] Priestly, S (1988), p. 97
[319] *Australian Mining Standard*, 15 August 1912, p.157
[320] Priestly, S (1988), p.135
[321] ibid. p.168
[322] Thomas, DE and Baragwanath, W G*eology of the Brown Coals of Victoria*, Part 1,1949, p. 5
[323] Herman, H *Brown Coal*, SECV, 1952, p. 49
[324] Priestly, S, *Altona: A Long View, City of Altona*, 1988, p. 86
[325] Herman, H, *Brown Coals of Victoria*, Bulletin No. 45, Mines Department, 1922, pp.11, 12
[326] Thomas, DE and Baragwanath, W *Geology of the Brown Coals Of Victoria*, Part 3, 1950, p.13
[327] Stirling, J 'Report on the Brown Coals and Lignites of Victoria', *Progress Report*, No.10, Mines Department, 1899, pp. 81–82
[328] Herman, H (1922), p.12
[329] Thomas, DE and Baragwanath, W (1951), Part 4, p.12
[330] Thomas, DE and Baragwanath, W (1950), p. 9
[331] 'The Parwan Coal Field', *The Bacchus Marsh Express*, 15 July 1933
[332] Thomas and Baragwanath, (1950). Also, *The Bacchus Marsh Express*, 15 July 1933.
[333] Kenny, JPL 'The Bacchus Marsh Brown Coal Mine, Parwan', *Mining and Geological Journal*, March 1947, p.13
[334] ibid.
[335] *The Bacchus Marsh Express*,15 July 1933
[336] Kenny, JPL (1947), p.14
[337] Thomas, DE and Baragwanath, W (1950), p. 9
[338] Kenny, JPL (1947), p.15
[339] *Mining and Geological Journal*, September 1947, p. 37
[340] Thomas, DE and Baragwanath, W (1950)
[341] Thomas, DE 'Brown Coal Deposits at Bacchus Marsh', *Mining and Geological Journal*, September 1947, p.17
[342] Thomas, DE and Baragwanath, W (1950), Part 3, p.10
[343] Brown, G 'Coal Resources of Victoria', M*ining and Geological Journal*, September 1948, p. 9
[344] Thomas, DE and Baragwanath, W (1950), Part 3, p.10
[345] Moffat, G 'The Maddingley Brown Coal Open Cut, Bacchus Marsh,' *Mining and Geological Journal*, March 1954, p. 4
[346] Moffat, G 'New Coal handling Plant at the Maddingley Open Cut Bacchus Marsh', *Mining and Geological Journal*, Vol. 4 No.6, September 1952, p.10
[347] ibid. p.9
[348] *Annual Report*, Mines Department, 1947
[349] *Annual Report*, Mines Department, 1951, p. 25
[350] Moffat, G (1952), p. 4

[351] Thomas, DE and Baragwanath, W (1950), Part 3, p. 9
[352] Moffat, G 'New Coal Handling Plant at the Maddingley Open Cut, Bacchus Marsh', *Mining and Geological Journal*, September 1952, pp. 9–10
[353] Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948
[354] *Mining and Geological Journal*, March 1950
[355] Moffat, G 'New Coal Handling Plant at the Maddingley Open Cut, Bacchus Marsh', *Mining and Geological Journal*, September 1952, p. 9
[356] *The Bacchus Marsh Express*, 21 March 1953
[357] *Mining and Geological Journal*, March 1955
[358] Moffat, G 'The Maddingley Brown Coal Open Cut, Bacchus Marsh,' *Mining and Geological Journal*, March 1954, pp. 5, 6
[359] *Annual Report*, Mines Department, 1969
[360] *Annual Reports*, Mines Department, 1973, 1975 and 1979
[361] *The Melton/Bacchus Marsh Independent*, 3 August 1999
[362] Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948, p.10
[363] *Mining and Geological Journal*, September 1947
[364] Brown, G (1948)
[365] *Annual Report*, Mines Department, 1947
[366] *Mining and Geological Journal*, September 1948
[367] *Mining and Geological Journal*, March 1950, pp.27–30
[368] Thomas, DE and Baragwanath, W, Geology of the *Brown Coals Of Victoria*, Part 3, *Mining and Geological Journal*, September 1950, p.19
[369] *Mining and Geological Journal*, September 1951
[370] *Annual Reports*, Mines Department,1969–1979
[371] Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948, p.10
[372] *Annual Report*, Mines Department, 1947
[373] *Mining and Geological Journal*, March 1947
[374] Brown, G (1948)
[375] *Mining and Geological Journal*, March 1948, September 1948, March 1949 and March 1950
[376] Thomas, DE and Baragwanath, W, *Geology of the Brown Coals Of Victoria*, Part 3 *Mining and Geological Journal*, September 1950, p.10
[377] *Mining and Geological Journal*, March 1951, pp. 30–35
[378] *Annual Report*, Mines Department, 1951, p. 25
[379] *Mining and Geological Journal*, September 1952, pp. 35–36
[380] Thomas, DE and Baragwanath, W 'Geology of the Brown Coals Of Victoria', Part 3, *Mining and Geological Journal*, September 1950, p.10
[381] *Mining and Geological Journal*, September 1947
[382] Brown, G 'Coal Resources of Victoria', *Mining and Geological Journal*, September 1948, p.10
[383] *Mining and Geological Journal*, September 1949
[384] *Mining and Geological Journal*, March 1951, March 1952 and September 1952
[385] *Mineral Statistics*, Mines Department, 1873, p. 52
[386] *The Gippsland Times*, 24 March 1879
[387] *Morwell Advertiser and Weekly Chronicle*, 15 September 1888
[388] ibid. 6 October 1888
[389] *Australian Mining Standard*, 24 November 1889, p.11
Note that this reference contains some technical errors specifically on pages 22 and 23 on the location of the mine with respect to the Latrobe River.
[390] Stirling, J 'Preliminary Report on the Brown Coal Deposit at the Great Morwell Coal Mining Company's Mine', *Quarterly Report*, Mines Department, 31 December 1889 Appendix F.
[391] 'Victorian Lignite', *Australian Mining Standard*, 8 April 1890
[392] *Final Report*, Victorian Royal Commission on Coal Mining Industry, December 1891
[393] McKay, RJ, *History of Development of the Brown Coal Workings at Yallourn*, SECV Internal Report, June 1950, p. 4
[394] *Half Yearly Report*, The Great Morwell Coal Mining Company NL, May 1894
[395] *Half Yearly Reports* by the Great Morwell Coal Mining Company NL June 1889 to October 1898 James Stirling, Government Geologist, in *Report on the Brown Coals and Lignites of Victoria*, Mines Department, 1899, p.5, states somewhat higher outputs apparently combining coal and briquette outputs for a total of 31,869 tons from September 1890 to 1897.
[396] *Mining Lease* 2176, Registry of Applications
[397] Herman, H, *Brown Coals Of Victoria*, Department of Mines, 1922, p. 7
[398] ibid.
[399] Vines, JA, *Train Systems: Yallourn and Morwell Open Cuts*, Generation Victoria, 1994, Notes to Table 9.7, p. 247
[400] Herman, H (1922), pp.103–108
[401] Herman, H (1922), pp.108–128
[402] Herman, H (1922), p.103
[403] *Annual Report*, SECV, 1925, p. 27
[404] McKay, RJ *History of the Development of the Brown Coal Open Cut Workings at Yallourn*, SECV, 1950, p. 4. This collation is the definitive text covering technical aspects of the Yallourn and Yallourn North Open Cuts to 1947.
[405] *Three Decades: The Story of the State Electricity Commission of Victoria from its Inception to December 1948*, SECV, March 1949, pp. 44–46
[406] McKay, RJ (1950), p. 91
[407] ibid. pp. 91, 92, 95
[408] Rusden, GF, *History of Yallourn, Yallourn North, and Yallourn North Extension Open Cuts, July 1947 to June 1965*, SECV, December 1968, pp. 71–94
[409] ibid. pp. 80, 81

[410] Vines, JA, *A Technical History of Yallourn North and Yallourn North Extension Open Cuts, 1965–1988*, SECV, 1989, pp.15, 16
[411] Rusden, GF (1968), p. 85
[412] ibid. pp. 82, 98
[413] ibid. Appendix 5, p.13
[414] *Power for Victorian Industries*, The Industrial Australian and Mining Standard, 17 March 1921, pp.10–12 This report of 80 pages provides a contemporary technical collation of the decision making and implementation related to the establishment of the SECV and the Yallourn Open Cut.
[415] Clark, L 'Letter to The Hon. Arthur Robinson, Minister for Public Works', 6 December 1918 including Appendices 1 to 111
[416] *Power for Victorian Industries*, The Industrial Australian and Mining Standard, 17 March 1921, pp.10–13
[417] McKay, RJ *History of the Development of the Brown Coal Open Cut Workings at Yallourn*, SECV, June 1950, pp. 4–6
[418] ibid. p. 20
[419] Vines, JA, *Train Systems: Yallourn and Morwell Open Cuts*, Generation Victoria, 1994, p.14
[420] ibid. pp. 8–28
[421] ibid. Appendix 1, pp. 237–239. This Appendix details a list of all rolling stock employed at YOC and YNOC through to 2005 by which time no rail transport was in service.
[422] ibid. pp. 41–44
[423] ibid. Appendix 1, pp. 237–239
[424] ibid. Tables 9.1 to 9.4, pp. 241–244
[425] ibid. Table 9.1, p. 241
[426] Rusden, GF, *History of Yallourn, Yallourn North, and Yallourn North Extension Open Cuts, July 1947 to June 1965*, SECV, 1968, p. 56
[427] ibid. p. 40
[428] Rodgers, HCG, *Excavation Equipment for Brown Coal*, AusIMM Latrobe Valley Coal Resources, 1960, pp.160–170
[429] Vines, JA (1994), Table 9.2, p. 242
[430] ibid. Drawing 6.15/4, p.143
[431] Stewart, EDJ, *Planning of Brown Coal Open Cuts*, AusIMM Latrobe Valley Coal Resources, 1980, pp. 44,45
[432] Vines, JA (1994), Photo 7/13, p.181
[433] ibid. Post Script, p. 249
[434] *Live Wire*, Yallourn Energy, February 2002, p.1
[435] *Environmental Effects Statement Summary*, Yallourn Energy, 2004
[436] Metha, R 'Morwell River Diversion', *Discovery*, Department of Primary Industries, June 2005, p.27
[437] *Live Wire*, Yallourn Energy, February 2002, p.1
[438] 'Alliance Mining Innovations', AusIMM Bulletin,Yallourn Energy, January/February 2003, pp. 21–24
[439] Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No.11, AusIMM, 1984, p. 85
[440] Rusden, GF, *History of Yallourn, Yallourn North and Yallourn North Extension Open Cuts*, July 1947 to June 1965,SECV, 1968, pp. 82–84
[441] Gloe, CS, *Geological Report*, No.1, SECV, 1956
[442] ibid.
[443] Gloe, CS, *Geology of Brown Coal Deposits*, Monograph No.11, AusIMM, 1984, Table 1, p. 91
[444] Vines, JA, *A Technical History of Yallourn North and Yallourn North Extension Open Cuts*, 1965 to 1988, SECV,1989, p. 64
[445] Rusden, GF (1968), p. 99
[446] Rusden, GF (1968), pp.101–102
[447] Rusden, GF (1968), p. 98
[448] ibid. Appendix 10
[449] Vines, JA (1989), p. 64
[450] Vines, JA (1989), pp. 71–72
[451] ibid. p. 87
[452] Brown, K et al *Yallourn North Extension Open Cut Interim Rehabilitation*, Rehabilitate Victoria, AusIMM, November 1992, p. 71
[453] Vines, JA (1989), p. 67
[454] Brown, K et al (1992), p. 71
[455] Vines, JA (1989), p.124
[456] Brown, K et al (1992), pp. 71–76
[457] *Mineral Statistics*, Mines Department, 1865, p. 48
[458] Herman, H, *Brown Coals of Victoria*, Bulletin No. 45, Mines Department, 1922, p. 5
[459] Vines, JA, *A History of the Loy Yang Mine: Its Origins and Development to May 1997*, SECV, June 2000, p. 356
[460] McKay, RJ, *History of the Development of the Brown Coal Workings at Yallourn*, SECV, 1950, Appendix No.5(b), pp.102–107
[461] McKay, RJ, *History of the Development of the Brown Coal Workings at Yallourn*, SECV, 1950, Appendix No. 7, pp.133–137
[462] Vines, JA, *A History of Morwell Open Cut: Its Origins and Development to June 1995*, Generation Victoria, 1996, pp. 37–38
[463] ibid. p. 27 and pp. 24–25
[464] ibid. pp. 37, 38
[465] ibid. pp. 29–32. Drawing 9.6.1 shows the plant layout as proposed at 1946.
[466] Revised program at July 1950
[467] Vines, JA (1996), pp. 95–100
[468] ibid. p.103
[469] ibid. p.105
[470] ibid. pp.110–111
[471] ibid. pp.112, 140, 153
[472] ibid. pp.153–155
[473] ibid. pp.141–144
[474] ibid. p. 56

[475] ibid. p.109
[476] ibid. p. 345
[477] ibid. pp. 44, 87–88, 89–93
[478] ibid. p. 319
[479] ibid. pp.155–163
[480] ibid. pp.183–185
[481] ibid. pp.186–190, 225
[482] ibid. pp. 303–306, 345
[483] ibid. pp. 298–302, 318
[484] ibid. pp.163–168, 216–217, 234–235, 313–314, 325–330
[485] *Jumbunna*, International Power Hazelwood, June 2002
[486] ibid. August 2000
[487] ibid. November 2000
[488] ibid. April 2001
[489] ibid. July 2001 and September 2001
[490] ibid. March 2002
[491] ibid. May 2002
[492] ibid. October 2002, January 2003 and March 2003.
[493] ibid., July 2003. Also, *Discovery*, Victorian Department of Primary Industries, February 2003, pp.10, 11
[494] ibid. April 2005 and December 2004
[495] ibid. August 2003, January 2004, January 2005
[496] *Progress Report*, No.3, Mines Department, August 1875, p. 284
[497] *Mineral Statistics*, Mines Department, 1876, p. 51
[498] *Annual Report*, Mines Department, 1889, p. 22 (Remarks on the Development of the Coal and Lignite Resources of Victoria, Murray, RAF)
[499] From Mines Department, *Annual Report*, 1890. The drawing of the Coal Field in the County of Buln Buln in the copy of the 1890 *Annual Report* held by me is rather illegible. Drawing 9.6/1 of this *Coal Heritage Study* was redrawn from the 1890 report superimposed on a more recent topographical and infrastructure map and included as Drawing 1.8/1 in Vines, JA *A History of the Loy Yang Mine*, 2000.
[500] Vines, JA *A History of the Loy Yang Mine: Its Origins and Development to May 1997*, SECV, 2000, p.11
[501] Drilling Records held at 1994 by Geo-Eng at Morwell
[502] Vines, JA (2000), p. 48. See also Drawing 3.3.17/1 on p. 75 depicting land acquisition areas.
[503] Vines, JA (2000), p. 77
[504] Vines, JA (2000), p. 85
[505] Herman, H, *Bulletin* No.45, Geological Survey of Victoria, Mines Department, 1922, p.18
[506] Vines, JA (2000), p. 62
[507] Alexander, JM, *Planning the Development of Loy Yang Open Cut In Australia*, Braunkohle, July 1981
[508] Vines, JA (2000), p. 97
[509] Vines, JA (2000), pp.154–157
[510] Vines, JA (2000), pp.180–181
[511] Vines, JA (2000), pp. 354, 357
[512] Vines, JA (2000), pp.102–105, 368–370, 363, 379
[513] Vines, JA (2000), p. 356
[514] *Report*, Loy Yang Power, 4 July 2001
[515] ibid. 25 September 2002
[516] *Business Plan*, Loy Yang Power, 2005, p. 5
[517] Vines, JA (2000), p. 210
[518] *Report*, Loy Yang Power, 30 January 2001
[519] ibid.
[520] Vines, JA (2000), p. 210 (LYOC Production Data Chart to June 1987)
[521] *Discovery*, Department of Primary Industries, December 2002 and September 2003
[522] *Report*, Loy Yang Power, 1 December 2004
[523] *Report*, Loy Yang Power, 6 April 2005
[524] *Business Plan*, Loy Yang Power, 2005
[525] *Report*, Loy Yang Power, 18 May 2005
[526] *Discovery*, Department of Primary Industries, August 2002, p. 5
[527] *Discovery*, Department of Primary Industries, December 2004, p.16
[528] Gloe, CS, *The Geology, Discovery, and Assessment of the Brown Coal Deposits of Victoria*, Monograph No. 11, AusIMM, 1984, p. 90
Kitson, AE, *Report on the Probable Occurrence of Coal in the Welshpool District*, Geological Survey Victoria, Vol. 1 Part 1, 1902, pp. 61–66
[529] Herman, H. *Brown Coals of Victoria*, Bulletin No.45, Mines Department,1922, pp.10–12
[530] Greer, IR 'Geological Report to Arco Aust Ltd. Sept.1982 to August 1983', Appendix H by Greer, IR and Smith, GL.
[531] Thomas, DE and Baragwanath, W 'Geology of the Brown Coals Of Victoria', *Mining and Geological Journal*, Mines Department, Vol. 4 No.1, 1950, Fig. 31
[532] Thomas and Baragwanath (1950), Vol. 4 No.1, pp.50–52
[533] Thomas and Baragwanath (1949), Vol. 3 No. 6, p. 31
[534] Greer, IR and Smith G. E. *Geology of the Gelliondale Coalfield*, Appendix H of 'Report to Arco Aust Ltd.', September 1982 to August 1983
[535] Gloe, CS (1984), p.100
[536] Vines, JA *A History of the Morwell Open Cut*, Generation Victoria, 1996, p. 24
[537] Herman, H, *Brown Coal*, SECV, 1952, p. 49
[538] Vines, JA, (1996), Table 2.2.2/1, p.22, (Table extracted from report by J Bridge, 1944)
[539] *Annual Report*, Mines Department, 1969
[540] Garner, LJ, *Research in Brown Coal Utilisation*, Monograph No.11, AUSIMM, 1984, p.184
[541] Greer, IR 'Geological Report to Arco Aust Ltd.', September 1982 to August 1983, p.10
[542] Gloe, CS (1984), pp. 90–91

[543] Gloe, CS (1984), pp. 89–91
[544] Holdgate, GR, *Coal Exploration for Lignites: Gippsland Basin*, 1997
[545] Murray, RAF, *Progress Report*, No.111, Mines Department, 1875–1876, p.148
[546] Stirling, J, *Progress Report*, No.10, Mines Department, 1899, p. 80
[547] Thomas, DE and Baragwanath, W (1949–1951), Part 2, p.14
[548] Knight, JL 'South Gippsland Brown Coal Field at Won Wron', *Mining and Geological Journal*, Vol. 6 No.2, 1957/58, pp. 38–41
[549] ibid.
[550] ibid.
[551] ibid.
[552] Gloe, CS, *The Geology, Discovery and Assessment of the Brown Coal Deposits of Victoria,* Monograph No.11, 1984, p. 89