BHP

BHP TRAMWAYS CENTENARY HISTORY

DAVID GRIFFITHS

MILE END RAILWAY MUSEUM (S.A.) INC

This classic photograph sums up BHP at Whyalla! Although taken in the depression years of the 1930s, the engine-man's expression shows true determination of BHP and its employees during those very difficult times.
Artwork: L. Crow. BHP Archives.

Front cover: DE's 04/06 depart Iron Knob working a loaded ore train for Whyalla on 2 December 1981. D. Griffiths.

Back cover:

(Top) Steam locomotive No. 2 shunts on the wharf at Whyalla, while SS Iron King *is unloaded on 27 May 1958.* BHP Archives.

(Below) Baldwin locomotive No. 4 pauses for photographs while working a special steam train to Iron Knob on 9 August 1964. R. Fluck.

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Compiled by

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RAILWAY MUSEUM PUBLICATION

P.O. BOX 487, COWANDILLA, S.A. 5033

ISBN 0959 5073 45

2018 UPDATE

This online version of the original is the result of the author's wish to have the out-of-print book available to a wider audience. This version includes the text and diagrams of the original along with many of the original photographs, almost all of which have now been rescanned from original prints. Only minor corrections have been made. This PDF is fully searchable. A later update will include the remaining original photographs. There will also be a supplement with a summary of the many changes which have occurred since 1985. Please check back from time to time for updated versions of the file (see file date below).

This file released 25 October 2018

FOREWORD

Time, progress and development reflect many changes over a 50 year period. The history of the steel industry, its growth and expansion have been recorded in many books and publications during that time. There has, however, been little or no special recording of the important part played during the growth period of the method of transport of the iron ore mined at Iron Knob and conveyed to Whyalla, for shipment to all parts of the world, by the BHP tramway and the men who worked those trains.

The trains that pounded and clattered and roared as they hauled their long line of wagons laden with ore were manned by men who gave their best, in work which formed a small part in the overall development of steel. Their role was equally as important as those of the men of all nationalities who blasted the ore from the face of the hill, and collected and loaded the trains for transport over the saltbush plain to the port of Whyalla.

This mining went on day and night, week in and out, in summer and winter during the 1930-1940 period and which continues today although at a somewhat more leisurely pace.

The drivers, firemen and railway guards were all charged with the responsibility of delivering their loads in all weathers. They faced heat waves, flash floods and blinding dust storms that reduced visibility to a few yards and made their jobs difficult to perform.

The population of Whyalla was well accustomed to the rush of noise that came from the rake of trucks as they were Shunted at 'breakneck' speeds up to the crusher plant for unloading into ore bins. As each truck opened and discharged its load, they were pushed back down the crusher slope. The creaks and nerve shattering bumps was regular 'music' to residents of the small township in those early days.

And then disaster! News of a rail accident in February 1937 between Whyalla and Iron Baron brought gloom to the township.

An overnight downpour washed away ballast on the railway line. In the early hours of the following morning, the train attempting to use the line overturned, the driver of the locomotive, William Thomas Ring lost his life while the fireman, Dan Kingdom was injured when thrown clear as the train rolled over.

Although 48 years have since passed, rusting remains of the train can still be seen on the way to Iron Baron - a mute memorial of the dangers that accompany heavy industry.

The giant diesel locomotives have now superseded the coal fired steam trains. They are more powerful, quieter and more environmentally acceptable. The huge hill of ore at Iron Knob that once rose dominantly out of a flat saltbush plain, has been reduced to almost ground level.

However the tramway is still a vital link between the excavation of ore and the shipping port of Whyalla.

The written record of the history of this transport and the men who worked on the trains is important and should be recorded for posterity.

Congratulations to the author who has made this record possible as I am sure it will be interesting to people that follow in years to come.

Aileen C. Ekblom
Mayor
City of Whyalla

EDITOR'S NOTES

The Mile End Railway Museum (SA) Inc. was indeed honoured to be given the opportunity to publish BHP's centenary book. Of course David Griffiths is an expert in his field and his enthusiasm to finally get this book published was certainly encouraging from our side!

The Museum's connection with BHP began when they organised a steam train tour of Iron Knob and Baron in August 1964, hauled by Baldwin No. 4.

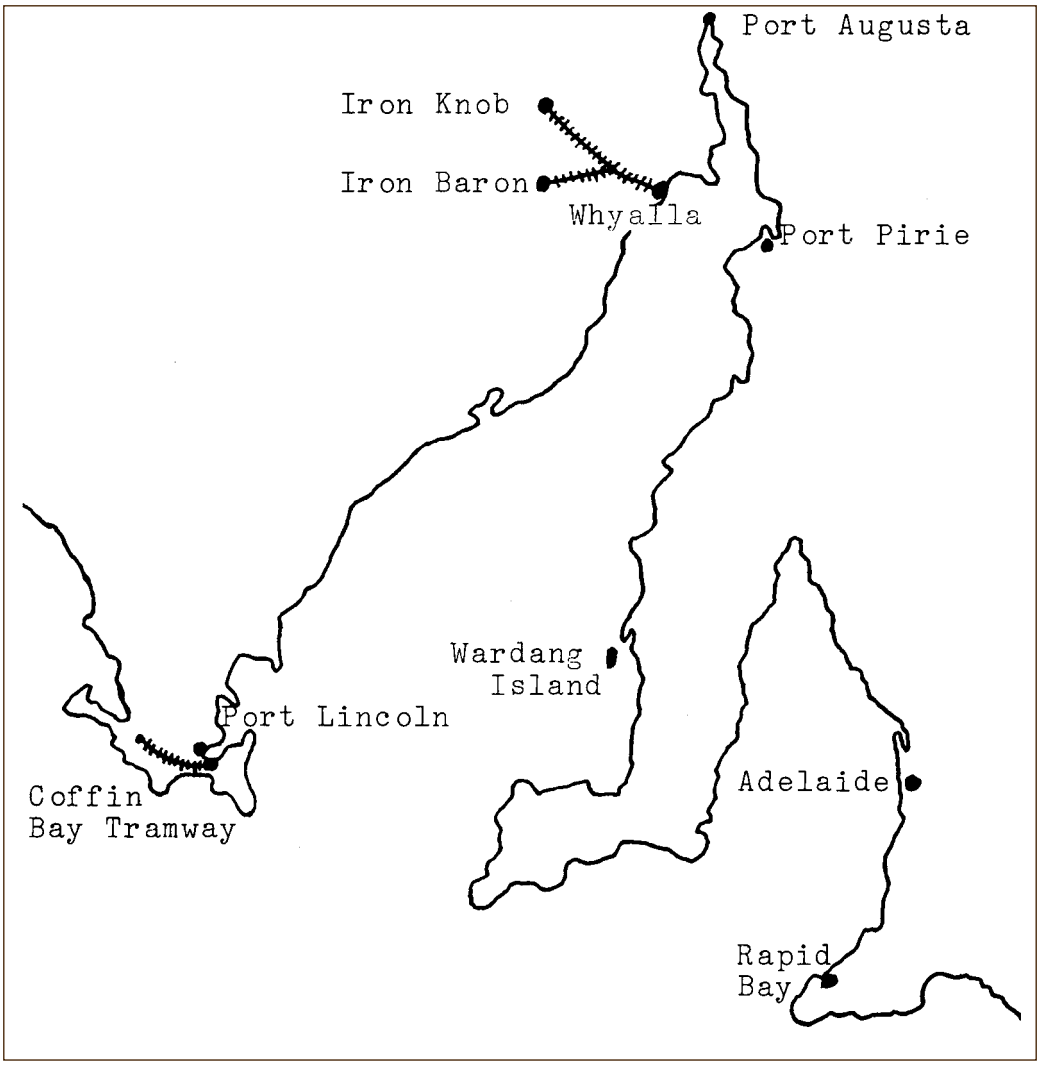
This locomotive was eventually preserved at Mile End, and during 1984 a tender body was constructed to once again complete this fine exhibit. Some of the colour and black & white photographs reproduced in this publication may appear poor to a number of readers. However we believe their historic importance is far greater than if they were not used at all.

A generous donation has been received from BHP and this has been put towards the production costs of the book.

My personal interest in BHP at Whyalla goes back many years also. As a child our family would visit relatives in Ward Street Whyalla, and I can recall watching the trains for hours on end.

Robert Sampson
April 1985

Contents



INTRODUCTION

The Broken Hill Proprietary Company Limited was floated on 10 August 1885, when Australia was a very young country. Establishment of a heavy industry in such a remote region as Broken Hill brought with it tremendous problems of transportation. In order to serve this need the South Australian Railway Commissioners built a railway line from Terowie in the mid north of South Australia to the New South Wales border and a private company connected this to the expanding mines at Broken Hill. BHP's railway links were thus forged very early in the Company's history and BHP purchased its first locomotive within five years of the Company being floated.

The Company has come a long way in the last century. The Company celebrates its centenary this year and this book has been undertaken to review the association between BHP and its railway systems in South Australia.

I have deliberately made no reference to the railways at the steelworks of Newcastle and Port Kembla in New South Wales.

These topics have been left to those who are familiar with them. It has been necessary, however, to transgress the New South Wales border at least as far as Broken Hill, although some would argue that this is part of South Australia anyway, in order to gain a proper appreciation of the operation of BHP's rail systems.

As no doubt some people have already detected, the use of the word 'railway' is strictly incorrect, since by act of State Parliament BHP's rail operations are in fact legally Tramways and are operated in conformance with the Tramways Act of 1884. Notwithstanding the name, however, the operations of BHP are far from small time. They were commenced decades before dieselisation and are now operators of some of the longest and heaviest trains in Australia. The advent of the new iron ore railways of the Pilbara of Western Australia has eclipsed their predecessor from view.

This book is a history of BHP's railway operations in Broken Hill, Hummock Hill (Whyalla), Iron Knob and Iron Monarch, Wardang Island, Rapid Bay and Port Lincoln. It does not consider the tramways in isolation, but presents the railway history as a reflection of the operations of the Company and the people who worked there as a whole.

David Griffiths
Whyalla, 1985

EARLY MINING HISTORY

From the very beginning of time, man has always sought a means of living with the expenditure of the least amount of work. The beginnings of white settlement in Australia saw a continuation of this desire. Whilst most early settlers were eking out an existence from the land by grazing or by cultivation, there was the ever present urge to 'get rich quick'. As the frontiers of discovery were pushed back from the edges of the continent, men looked carefully at every stone they passed, in the hope of finding gold.

Gold, however, was rather scarce and remained elusive in Australia until 1851. Copper had been found in the infant colony of South Australia before this time and had led to the establishment of a major industry at Kapunda and Burra Burra in the mid north of South Australia. This development saved South Australia from the verge of bankruptcy caused by overspending on the part of the early colonial administration. Burra provided the economic incentive to build the first extensive railway link in South Australia, and the subsequent discoveries of gold in New South Wales and Victoria provided the incentive for further mineral searching into the interior of the continent.

Edward John Eyre explored what is now known as Eyre Peninsula in 1840, discovering only a large outcrop of iron for his efforts in mineral exploration. Although he did not envisage the wealth that it would bring to the country, he still reported its presence. Others were more successful or lucky, and in the far west of New South Wales at an unusual sounding place called Thackaringa, silver was found by a man named Green in 1876.

The first parcel of ore from this find was lost whilst enroute to England, but in 1880 another parcel arrived safely. A rush to Thackaringa and nearby Umberumberka ensued. The township of Silverton was surveyed and over 5,000 acres were applied for as mining leases.

Small quantities of extraordinarily rich ore were mined from a number of shallow narrow lodes. The ore consisted mainly of silver chloride and assayed up to 18,000 ounces of silver per ton of ore. Larger lodes but of lower quality were also worked in the area.

The story of BHP, however, begins with Charles Rasp, a boundary rider on the Mt Gipps sheep station near Silverton, who, in 1883, discovered an iron stained outcrop which he thought might be the cap of a similar mineral lode to those discovered in the adjacent district. Rasp thought that he had found tin. In conjunction with two contractors on the sheep run, he secured a mineral lease on the site of his discovery. On the confirmation of the mineral right he mentioned his beliefs to the manager and part owner of the sheep run, a man by the name of McCulloch. Other blocks were pegged out and applied for and thus seven of them, nearly two miles in length, were secured on the line of the reef. A syndicate was formed - the famous 'Syndicate of Seven' and prospecting commenced more thoroughly.

Assays of early samples from the mine showed no indication of tin, but did show silver at about 12 ounces per ton of ore. These days this would be considered good, but when fabulously rich ores were being mined only a few miles away, it was considered to be almost worthless. Interest in the mine lagged until the discovery of silver chlorides in Rasp Shaft late in 1884 and later discoveries in adjacent lode capping in early 1885. These discoveries fuelled a rush in mining and speculative activity.

In this period William Jamieson, a government surveyor, had been persuaded to join the syndicate, the shares of which had been increased to fourteen, in order to raise more capital to pay for the exploration. It became clear

to the syndicate that the capital required to set up a significant mining operation on their leases was beyond their capabilities. In order to overcome this difficulty they decided to float a public company.

The Broken Hill Proprietary Company Limited (BHP) was thus formed on 10 August 1885, embracing the seven blocks numbered 10-16. Subsidiaries Block 14 and British Broken Hill Pty Ltd were floated in 1887; Block 10 was floated the following year.

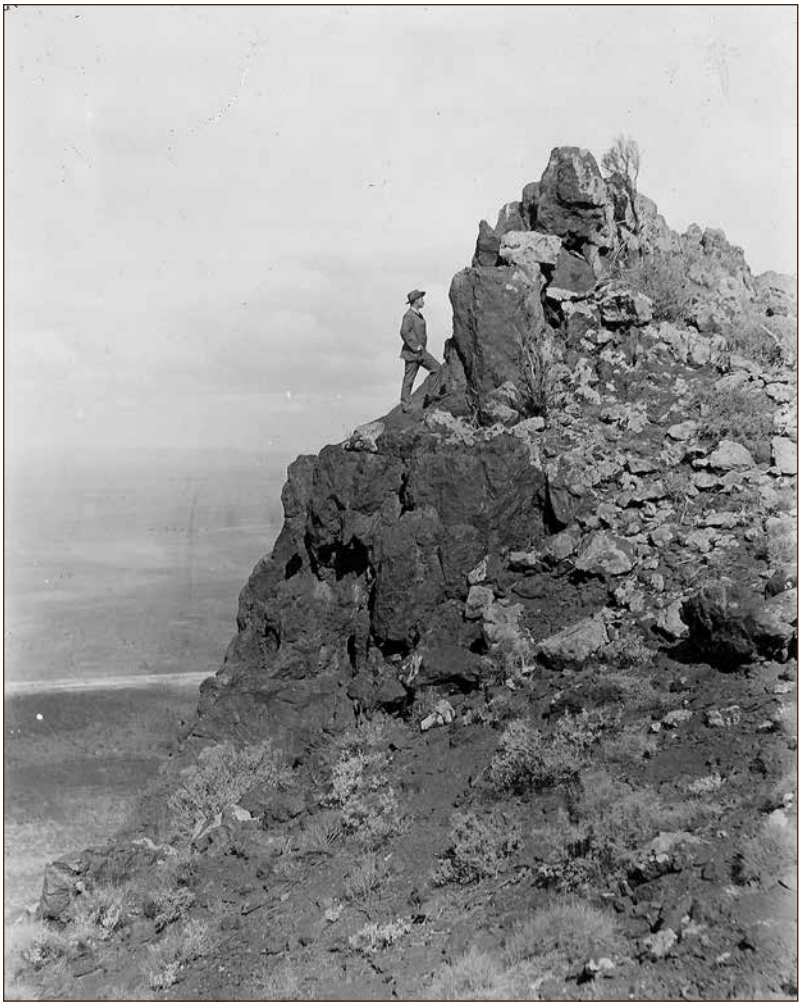
The parent company (BHP) retained Blocks 11, 12 and 13, which in subsequent years have yielded ore exceeding 12¼ million tons with a value of about £54m. BHP's strength was built on the rich oxidised zone at the summit of the ore body. Silver was the prize, with base metals lead and zinc of lesser importance. As mining proceeded in depth, the oxidised ores from which the base metals had been leached, gave way to the primary sulphides. These were the unchanged minerals of lead and zinc, destined ultimately to become the real wealth of Broken Hill.

The South Australian Government quickly realised the importance of the silver discoveries to the colonial economy. Even though the discoveries were in the neighbouring colony of New South Wales, the nearest coastline in that colony was about 700 miles from the mines, whereas the South Australian coastline was only about half that distance. In consequence the South Australian Government passed an act in 1886 authorising the construction of a railway between the existing railhead at Petersburg (now Peterborough) and the colonial border at Cockburn. The line of 145 miles was opened for traffic on 14 June 1887.

The New South Wales Government was not, however, willing to construct an extension of the line from the border, since in its view it would serve no other purpose than swell the South Australian coffers. In order to overcome this problem Silverton and Broken Hill interests formed a company – The Silverton Tramway Company (STC), who were authorised by an act of New South Wales Parliament to construct a tramway. A clause of this act protected the Company against acquisition by the Government of New South Wales, except on the basis of a purchase price equivalent to 21 times the average annual net profit earned by the Company during the preceding seven years. It is of interest to note that on this basis the purchase price based on the first seven years operations would have been £1,952,076. The initial capital of the Company was £62,800.

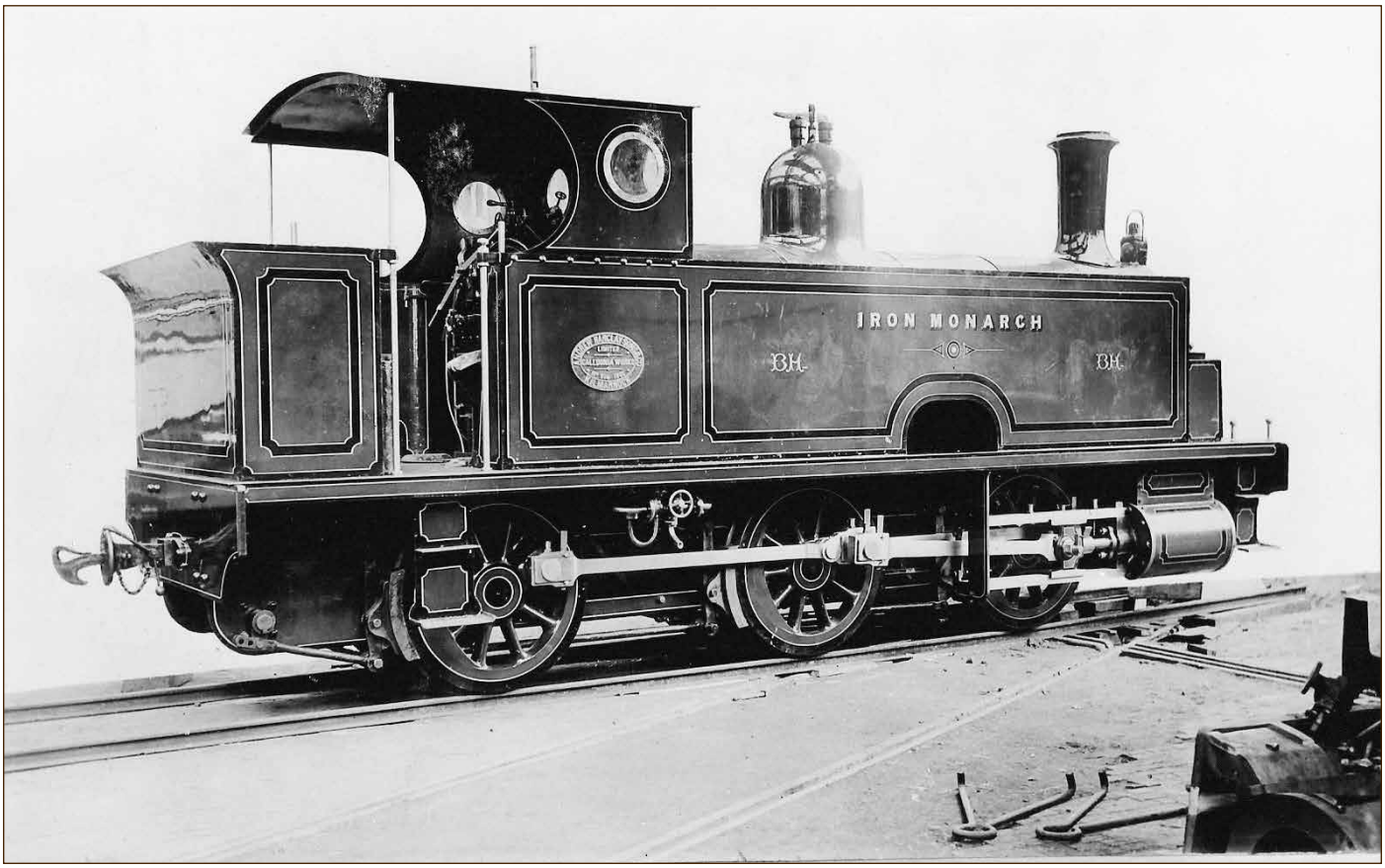
The establishment of these lines reduced the three month trip from Broken Hill to Port Pirie by bullock dray, at a cost of £20 per ton, to 19 hours.

The 'Knob' at Iron Knob looking north east to the Corunna Hills about 1912. J. Jobson.



The hematite ironstone outcrop on the east side of Iron Monarch about 1912. J. Jobson.

The builder's photograph of 'Kilmarnock', shows the name 'Iron Monarch' on the water tanks. This name was never used for the engine at Hummock Hill. Beautiful lining and paintwork was typical of the early 1900's. BHP Archives.



THE FIRST TRAMWAY OPERATIONS

By the time the railway arrived at Broken Hill in January 1888, BHP's mining operation had become well established and BHP was a major customer of the railways. Initially, BHP had imported large quantities of round timber, mainly gum and boxwood, from the Darling River area and later tried locally grown mulga for timbering the stopes.

Depletion of this local resource and the availability of transport allowed Oregon to be brought in from the coast. The other main inward freight was coke to fuel the hungry smelter. The initial outbound freight was bullion silver, with larger quantities of the less valuable lead. At first the quantities were small. Railway wagons were transported to the mines over the Silverton Tramway Company by the South Australian Railways and any shunting required was undertaken by means of horses.

The growth of the mines at Broken Hill was, however, very rapid and the need for a shunter in excess of one horse power was quickly recognised. BHP Management, investigating a suitable unit, discovered that the South Australian Railways 'Y' class was performing admirably on the main line, and identical units operated by the Silverton Tramway Company were also seen to be giving satisfactory service.

These locomotives were built by Beyer, Peacock and Company of Manchester, England, and followed a pattern engine first supplied to the Tasmanian Government Railways in 1884. At this time the Silverton Tramway Company had just taken delivery of a variation of this design. The tender was omitted and a two wheel trailing truck was fitted to carry the extra weight of the coal carried in a coal bunker behind the cab and a pair of water tanks mounted on the footplate on either side of the boiler. The locomotive was thus a 2-6-2 tank type.

BHP placed an order with Beyer, Peacock for an engine to this design; it was built in 1891, receiving Builder's number 3357.

The engine was landed on 14 May 1891 and was erected and placed in service at Broken Hill shortly thereafter.

The engine was very powerful and could easily outperform a whole team of horses. It was also very much heavier and the mine sidings, which were built with very light rail and poor subgrade, began to suffer under the load. It was in fact a larger locomotive than the W, X and Y classes operated on the main line to Port Pirie by the South Australian Railways.

The need became urgent to find an alternative power source. The shunting load by this time reached a level at which it would have been impractical to return to horse traction, so BHP searched for an alternative short term solution.

At this time the South Australian Railways had several small locomotives lying idle, of the 0-4-4T 'V' class. They had been imported to work the Kingston line in the south-east of the state, but had proved too small for the task. This diminutive class of locomotive was built by Beyer, Peacock. The quick solution was a direct swap. The locomotives were exchanged in July 1892, although the terms of the exchange with respect to a cash settlement for the difference in their value had not been agreed upon.

During the time of these negotiations, a small locomotive had been ordered from Nasmyth Wilson, also of Manchester. This locomotive was built in 1892 and was allocated Nasmyth Wilson's number 441 . It was erected in Adelaide and sent to Terowie in early February 1893. An engine crew was sent down from Broken Hill to collect it and was driven from Terowie to Broken Hill under its own steam. This locomotive entered service on 12 February 1893, displacing the South Australian engine V11 from the shunting duties. It was found to be an excellent performer, being criticised only in that the height of its saddle tank partially obstructed the driver's forward vision.

The arrival of the Nasmyth Wilson engine revived the problem of the values of the exchanged engines. The engines were still, on paper, owned by their original owners, but V11 was now idle at Broken Hill and the BHP 'Y' class tank engine was working as a shunter at Terowie and had been allocated the SAR number '0'. Negotiations were reopened for the permanent exchange of the engines, but an agreement on the value could not be reached. BHP therefore returned V11 to the South Australian Railways and asked the SAR immediately to put their engine into first class condition and return it to Broken Hill.

It would appear that the BHP 2-6-2 tank engine had been promised to the Silverton Tramway Company sometime prior to the actual return of the engine to BHP on 31 May 1893, as it appeared on STC's books as Y6 before their Y7 and Y8 which were built in 1892. The number 6 was never actually put on the locomotive; it was a book number only. The later movements of the small 'V' class engine do not bear directly on the history of BHP, and are not dealt with in this text.

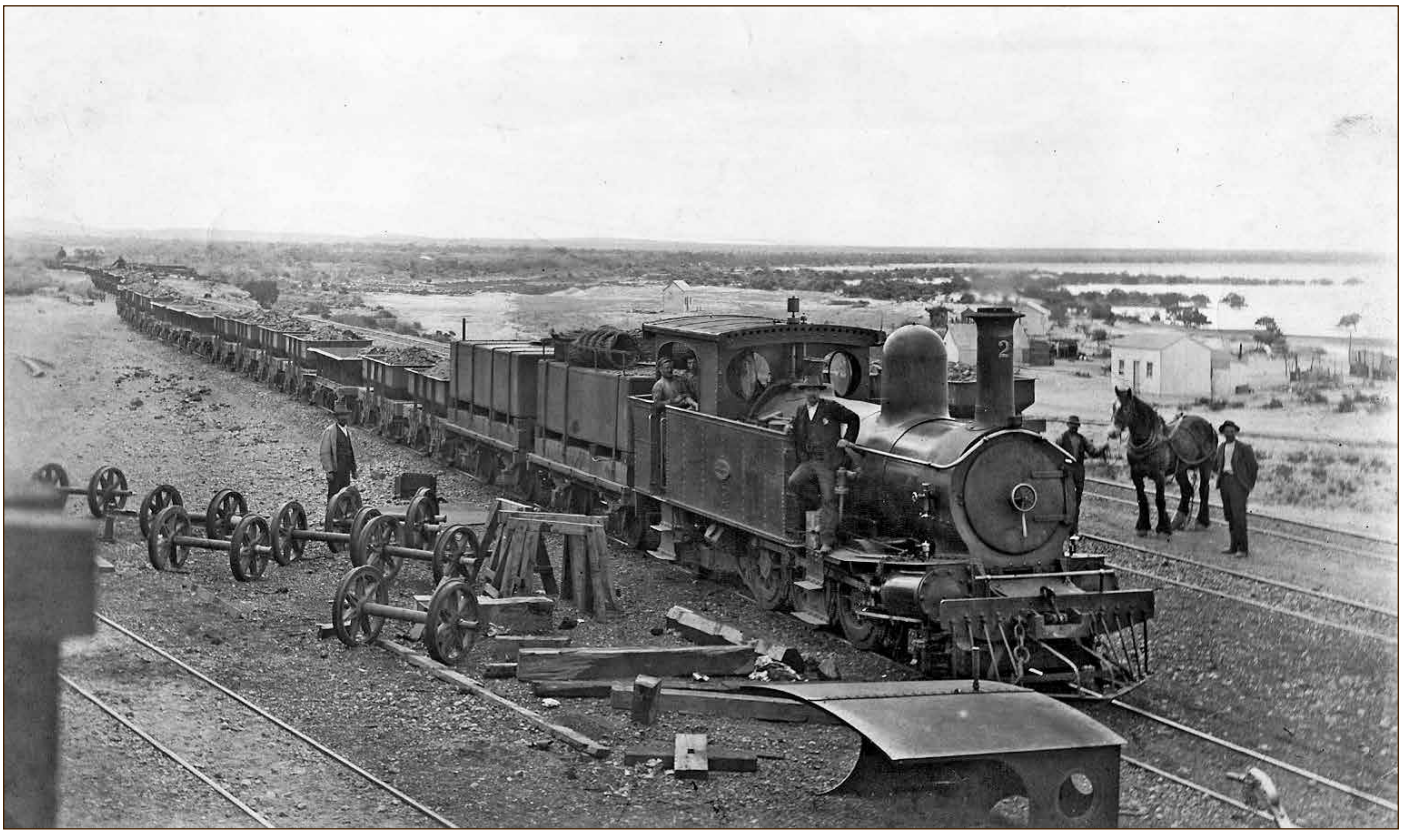
A change in the operating policy of the STC in late 1893 resulted in that company operating the tramway from Cockburn to Broken Hill itself, rather than leasing the track to the SAR. This workload was more than could be handled if the mine shunting was also to be undertaken, and the shunting operations were handed back to the individual mine operators. In order to perform this work, BHP accepted its 2-6-2 tank engine back from STC in September 1893 and allocated it number 2. The number was displayed on the chimney and cab rear in the standard SAR pattern with brass numerals.

The Nasmyth Wilson engine spent some time from 1901 to 1902 on construction work for the Iron Knob Tramway, but was then returned to Broken Hill where it remained until withdrawn in 1935 at the cessation of BHP operation at Broken Hill, and finally scrapped in 1939.

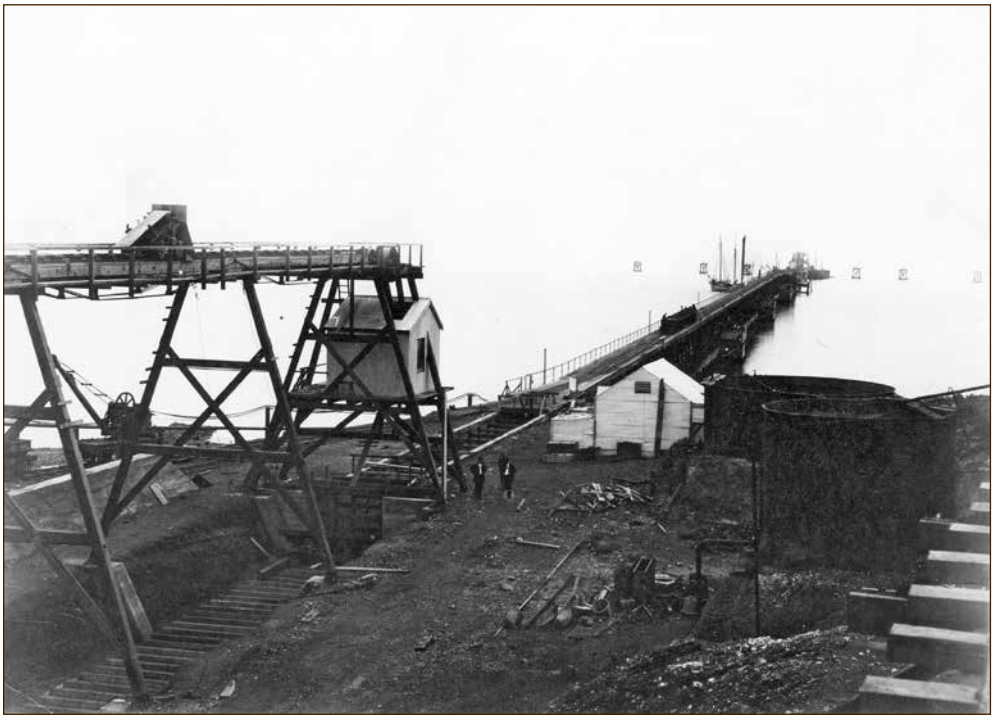
No. 2 was transferred to the Iron Knob Tramway in 1902. A Beyer, Peacock saddle tank engine was purchased new in 1905 for operation at Broken Hill but was transferred to Hummock Hill about 1910; this is described in detail later.

One further second-hand engine was obtained by BHP for use at Broken Hill. This engine was SAR Y class No. 61. It had entered SAR service on 29 September 1885, but was laying idle at Quorn for some time prior to purchase by BHP in October 1926. On delivery to Broken Hill it was converted from a tender engine to a tank engine by the STC workshops for BHP, using the tanks salvaged from STC Y15, when that engine was superheated. Unlike the other locomotives in the BHP fleet based on this design, no trailing bogie was fitted; it remained a 2-6-0 as built.

This engine remained at Broken Hill until the cessation of BHP operations there in 1935. It is believed that neither this engine nor the Nasmyth Wilson were in good working order at the time, as both were scrapped in March 1939, at a time when BHP was purchasing further locomotives from the other Broken Hill mines for its expanding Whyalla operations.



BHP's No. 2 arrives back in Hummock Hill from Iron Knob about 1901. D. Griffiths Collection.



An early scene of the jetty at Hummock Hill about 1912. It shows a horse hauling a rake of loaded ore cars out onto the jetty for possible loading into the waiting ketch. J. Jobson.

THE IRON KNOB TRAMWAY - ITS BEGINNINGS

During his exploration of the western coast of Spencer Gulf in 1802, Matthew Flinders named most of the physical features of the coast and hinterland, including Hummock Hill and Mount Middleback (middle of the back range, as he saw it).

The famous explorer, Edward John Eyre, is reported to have been the first person to investigate the region in any detail. He noted in his journal of 18 September 1840 that he had ascended a hill at the northern end of the Middleback Range. He recorded that:-

'I found the hills scrubby and barren and rocky, with much prickly grass growing upon their slopes. There were no water courses upon the west side of the range at all, nor could I, by tracing up some of the rocky valleys coming from separate gorges in the face of the hill, find any water. The rock was principally ironstone formation. Upon ascending to the summit of the hill I had an extensive but unsatisfactory view, a vast level field of scrub stretching everywhere around me, interspersed here and there with beds of small dried-up lakes, but with no signs of water anywhere.'

This description by the first white explorer to the region identified both the wealth and the problem of the area. A search of early records of the region by Sir Harold Raggatt, published in 1969, concludes that the 'Iron Knob was named and recognised as a large deposit of ironstone between 1849 and 1854'. It is thought that some prospecting was undertaken in the area in the 1860s shortly after the discovery of copper deposits at Wallaroo and Moonta. There is little doubt that the silver finds in the Broken Hill region also spurred further interest during and after 1883.

Evidence is not precise as to who first recognised that the Iron Knob deposits were potentially a commercial source of iron, but many people seem to have been aware of this fact by 1880. Two companies were formed to mine the deposit. The Mount Minden Syndicate was registered as a no-liability company on 13 May 1891 and held leases covering part of the deposit. This company mined the hill in a small way, but was apparently expecting to find copper beneath an ironstone capping. The Pinnacles Mining Company also had leases on the hill at that time. Although they were in search of more valuable minerals, the Mount Minden Company was aware that the hill was a very high grade of ironstone. They did try to interest others in its development, but the economics were not attractive.

Richard Hematite Burchett claimed that his father, Frederick Charles Burchett, was the original founder of Iron Knob. He said that he was the first child born there and was christened Hematite after the ironstone. He said he remembered his father talking about a syndicate, of which a Mr Kingham and a Mr Pappin were members.

Kingham reported that F. C. Burchett had pegged the Iron Knob in 1894, prospected it for two years and came to the conclusion it was a large mountain of iron. He stated:-

'In 1896 he asked Tom Young, Arthur Pappin and me to go in with him and get a price from Broken Hill Pty Co for ore delivered in ketches in Spencer Gulf, due south from the Knob. We took out a fresh miner's right in Burchett's name and pegged in the Monarch, that being the pick of the Knob. Next year we went to see how Burchett was progressing with the prospecting. We noticed pegs on the western side of ours. Evidently they were put in by Mr Hale, the assayer'.

The Mount Minden leases had been gazetted as forfeited on 26 December 1896, as the rent had not been paid for three years and labour conditions had not been complied with. On 12 April 1897 Mr Hale, assayer of the BHP Company, had pegged, on behalf of the Company, nine claims each of forty acres on the Knob and Monarch. The claims were registered three days later, thus giving the Company preferential right to leases.

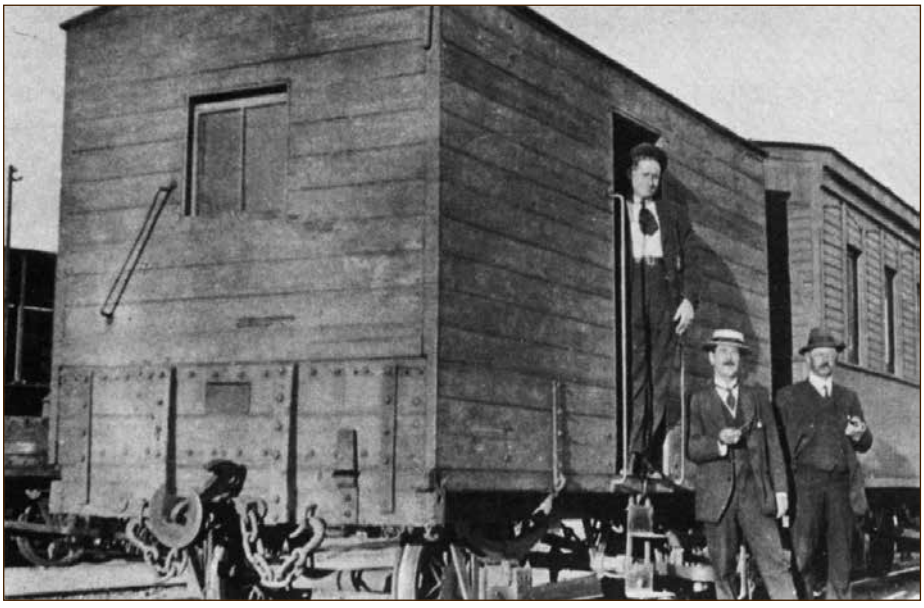
Up to this time the Company had obtained the ironstone, which it needed as a flux in its smelting operations at Port Pirie, from many districts in South Australia, but they were not sufficient to meet the Company's long term needs. The Manager had thus recommended that the Middleback deposits be secured so as to assure a continued reliable supply. After an enquiry by the mining warden, the company's leases were granted and quarrying commenced. The ore was taken out but not via the Cowell area, as envisaged by Burchett. The route was by bullock team to Port Augusta, by rail through Pichi Richi Pass via Quorn to Orroroo to Petersburg and thence down the Broken Hill railway line to Port Pirie. Needless to say, this circuitous route was not only time consuming but also very expensive.

The solution was obvious; a rail link to the coast! Should the line go to the coast and the ironstone be taken by sea to Port Pirie?

Or, should the line go to Port Augusta and link with the existing railway? BHP were of the opinion that a rail link to the coast and barges were the best option. A petition was presented to the South Australian Legislative Council on 28 September 1900 by the Hon John Lewis, MLC (father of Essington Lewis – later General Manager of the Company) from three directors of BHP, seeking leave to introduce a bill for the construction of a tramway from Hummock Hill to Iron Knob and jetties at False Bay.

The petition was granted and a bill was introduced. It was, in typical parliamentary fashion, referred to a select committee for report. Witnesses from Port Pirie gave evidence in favour of the tramway being built to Hummock Hill. They feared that if the Company could not secure adequate and regular supplies of ironstone, they might lose the smelters which had been established there to replace the earlier smelters at Broken Hill. Port Augusta witnesses however, were of opposite views. They argued that the line be built to Port Augusta and the ore be taken from there to Port Pirie by barge or rail. Mr John Bice, who had been a blacksmith at Port Augusta, was a member of the committee and he did his utmost to emphasise that Port Augusta West was the most suitable terminus for the tramway.

No. 2 shunts a string of cars onto the Hummock Hill jetty ore 1914. BHP Archives.



The original guard's van, which was built on a 'C' class truck underframe, was also used for general goods traffic. This 19 12 photograph also shows the 'Vice-Regal' car in the background. This car had glass windows but very little more. D. Griffiths Collection.

In a report to Parliament issued in November 1900, the committee decided in favour of the Hummock Hill proposal and the 'Broken Hill Proprietary Company Limited's, Hummock Hill to Iron Knob Tramways and Jetties Act, 1900' was duly passed by Parliament and assented to on 5 December. It authorised the Company to build and operate a tramway subject to the general provisions of the 'General Tramways Act, 1884'. The bill provided for a single line of tramway 33 miles 5 furlongs and 4.11 chains in length with sidings as shown in the deposited plans. The act restricted the tramway to a gauge of 3'6" with iron or steel rails of at least twenty pounds to the yard. No carriage was permitted to be in excess of eight feet wide and no engine or carriage should 'travel at a greater speed than twenty-five miles an hour'. The tramway was required to be completed within three years of the passing of the act and had to carry passengers and goods as well as flux; charges were not to exceed those of the Government railways. A deposit of £1,120 was required to be lodged with the treasurer, being 2% of the estimated construction cost, as a surety on the completion of the project.

The Governor and/or the South Australian Railways Commissioner were entitled, at any time, with the issue of twelve months' notice of their intention, to purchase the lease granted to the Company, as well as the tramway, jetty and all rolling stock, buildings, and so on. The price to be paid would not exceed the actual cost of construction less a fair deduction for wear and tear and depreciation. Clearly these were much less advantageous terms than those negotiated between the Silverton Tramway Company and the New South Wales Government. In the event of the Company ceasing to operate the tramway for any continuous period of three years, the whole would pass into the possession of the government, at no charge.

A party, led by the Company surveyor George Walls, was transported across the gulf on 10 January 1901 on the *Cadell*, leaving Port Pirie about six in the morning and arriving at Hummock Hill in mid-afternoon. After a camp had been established, construction commenced on the tramway that month. The rails used were of 40lb per yard, resting on 8" x 4" x 6'6" sleepers. The track was lightly ballasted with beach sand.

By March 1901, the construction had progressed to an extent that horse traction was no longer sufficient to keep up with the needs of the construction crews. Arrangements were put in hand to have the Nasmyth Wilson engine transferred from Broken Hill. A problem arose however, associated with the fact that Broken Hill was in the colony of New South Wales, whereas Hummock Hill was in South Australia. When the engine eventually reached Port Pirie, the Sub-Collector of customs refused to allow the engine to be transferred across the gulf until import duty had been paid. The Company requested that a draw-back on this duty be allowed upon return of the engine to Broken Hill when the construction was completed. The Sub-Collector refused, on the grounds that the locomotive would then be second-hand. BHP offered to use the engine 'in bond' at Hummock Hill for six months and then return it to Broken Hill. Negotiations lasted from 13 March until 4 April, when the embargo was lifted and the engine loaded aboard the *Gwydir* for Hummock Hill.

The unit was landed on 9 April 1901 along with seven 'C' trucks at a cost for the lightering of 3 shillings and 9 pence per ton.

The trucks were of an SAR pattern purchased from STC and no duty was paid on them. This was the first 'train' on the Iron Knob tramway. More rails from America in 30 ft lengths were received in early May and more open wagons and tank trucks arrived later in the month. Subsequently, three bolsters and two 'C' trucks were hired from the SAR at a cost of 5 shillings per day, and six bolsters (built in Melbourne for STC) and two 'C' trucks arrived in early June.

Towards the end of June arrangements were made to send six South Australian built trucks to Hummock Hill so that six Melbourne-built trucks could be transferred back to Silverton. This was to avoid attracting customs duty that had never been paid on them.

By August the strain of operating on poor water and with limited maintenance facilities was starting to tell on the saddle tank engine and urgent requests for a replacement were made. Replacement was already on the way. Envisaging the need for another engine, the Company had placed an order with Andrew Barclay of Kilmarnock, Scotland. The 0-6-0 tank engine numbered 914 of 1901 had 3'4" driving wheels, 14" x 22" cylinders and cost £2,103. It was landed at Port Adelaide on 30 October 1901, but during unloading was dropped about 10 inches. No damage was found and it was taken on to Port Pirie to be assembled, all except for the wheels, and sent across to Hummock Hill on 15 November 1901. It was named *Kilmarnock* in reference to its nameplate.

Just prior to this delivery the saddle tank engine had the distinction of hauling the first load of ore along the line. Reports written in the 1920's state that the first shipment went down the line on 28 August 1901. Although this approximate date is supported by contemporary letters, the event received no special mention. The exact date was reported to have been recalled by the driver of the first train, Mr. James Walker, who later became Loco Foreman. The reliability of his memory 25 years later is cast in doubt, since he also recalled that the loco hauling the first train was the locomotive *Beyer, Peacock*, which was not delivered until July of the following year.

It is reported that though by mid-September 300 tons per day were being used at Port Pirie, the locomotive could haul only 60 tons per load and could bring down only one load per day without disrupting the ballasting operation.

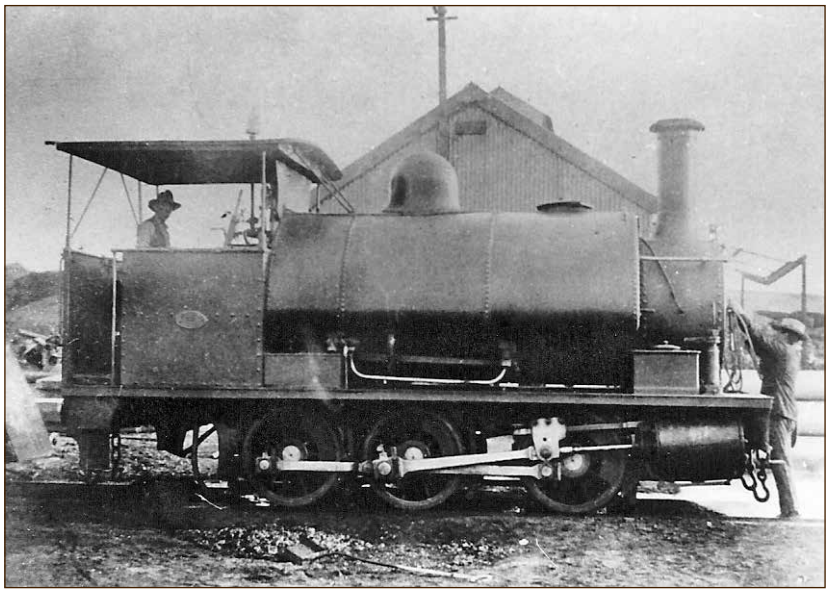
The first shipment of general goods for the public was carried over the line on 1 October 1901, a load of hides and skins from Mr J. Cook of Middleback sheep station. Charges were set at 3 shillings per ton wharfage plus 12 shillings per ton from Iron Knob or 6 shillings per ton from Middleback. This was later modified for wool to 12 shillings per ton over the line, 1 shilling per ton for loading or unloading and 4 pence per bale over the jetty. Rates for firewood and fence posts were set in December 1902 at ¾ pence per ton mile, 6 pence per ton for unloading and 6 pence per ton wharfage.

Passenger fares were set on 10 March 1903 at 2 shillings and 6 pence each way, general goods reviewed to be 15 shillings per ton, returned empties 7 shillings and 6 pence per ton, wool and skins 12 shillings per ton, with a shilling per ton charged for loading and unloading. These passenger fare rates were within the SAR rates of 3 shillings and 4 shillings and 8 pence return at the time, and were thus not contravening the act. A special train was run on Easter Monday of that year at single fare for double journey. The officer in charge at Hummock Hill was instructed to 'make the "C" trucks as comfortable as possible for the passengers' and was offered some extra chaff bags for seats!

Kilmarnock was gratefully received at Hummock Hill and immediately placed into traffic to relieve the ailing *Little Bessie*. It quickly demonstrated its capabilities by bringing a rake of sixteen loaded wagons down from the mine on 16 December 1901 and was expected to be able to manage twenty, representing a load of about 200 tons compared with the Nasmyth Wilson's 60 tons. *Kilmarnock* did not prove to be the unqualified success that was expected. It also suffered from the arduous conditions under which it was expected to perform and developed serious boiler leaks by 2 January 1902. The leaks were so serious that it was necessary to obtain 150 new brass tubes for the boiler before the end of that month, that is, when it was less than three months old.

Work progressed quickly and within nine months of commencement, the first production train ran across the line. Construction was virtually complete by the end of the year with only minor work outstanding. The total cost of the project was reported to have been more than £71 ,000.

Preliminary Expenses:		
Surveying, Law costs and Witnesses	£	2,853 4s 1d
Horses, drays and harness	£	410 7s 4d
Wages	£	18,379 14s 6d
Salaries	£	390 2s 8d
Stores (including water, trucks, rails, sleepers, etc.)	£	38,666 18s 0d
Transport	£	2,941 12s 4d
Jetty Construction:		
Timber, bolts and tar	£	5,438 18s 5d
Less Sundry credits charged to Ironstone expenses	£	2,192 3s 1d



'Little Bessie' (BHP No. 1), the Nasmyth, Wilson loco. Location and photo source unknown.

THE IRON KNOB MINE

Quite some years elapsed between the first awareness of the potential of Iron Knob and its exploitation. Prospectors continued to probe for valuable lodes, but when Hale pegged the lease on behalf of BHP in 1897, there was only one significant shaft sunk from the top and it was evidently some years old.

It was later established that the Iron Knob and the adjacent hill Iron Monarch consisted of two separate masses of very high grade hematite, with varying percentages of manganese. Diamond drilling showed that the surface ore was highest in manganese; in fact certain parts of the deposit contained as much as 10% manganese with 55% iron. The bulk of the deposit assayed about 0.6% manganese, but there were parts of the deposit which were almost free of this metal. The Knob and the Monarch independent ore bodies formed adjacent peaks on the low range. The base length of the hills was about 1½ miles. From plain level to hilltop was 642 feet and was estimated to contain 130 million tons of ore.

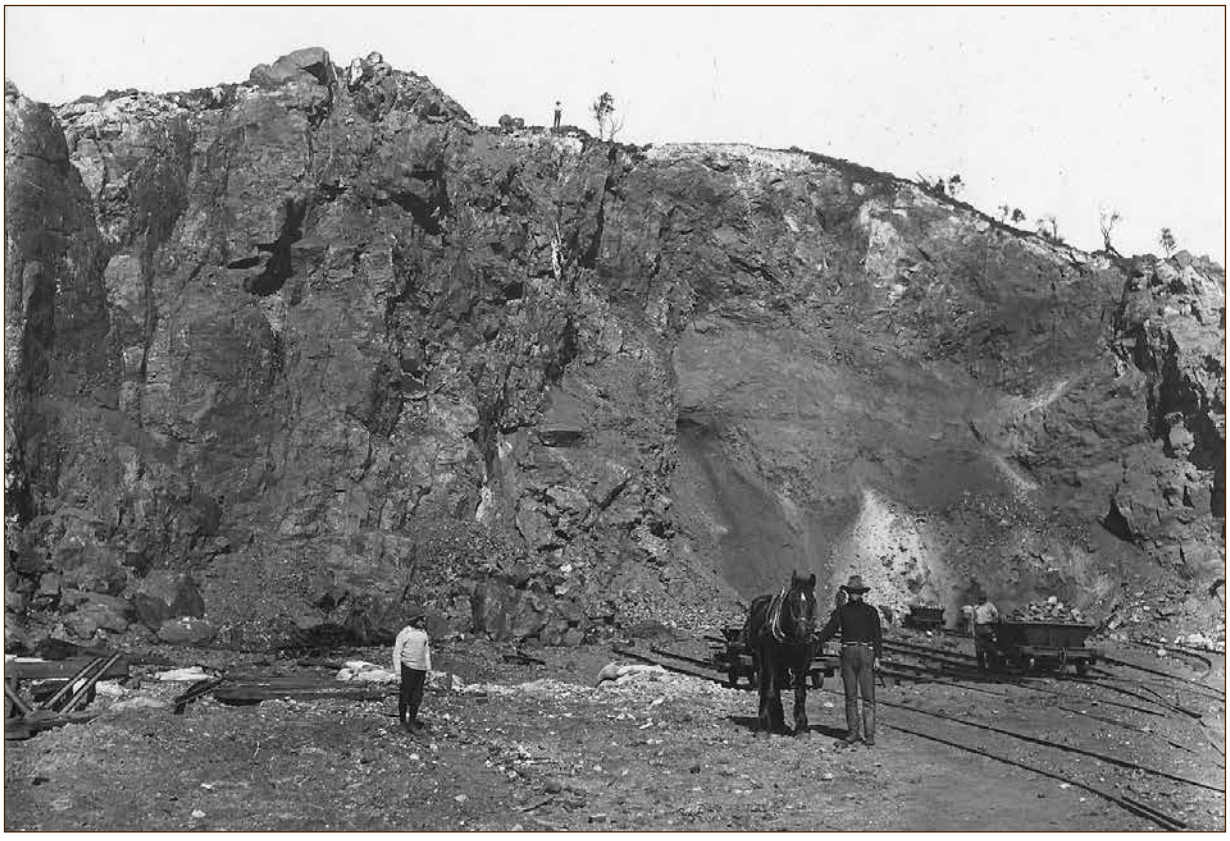
While construction of the tramway was occupying one group of men in 1901 , a second group was busily establishing a quarry. The ore from this quarry, later known as Quarry D, was hauled to Port Augusta by bullock team as already described. A small tramway was established to take ore from the quarry to a transfer point for the main line wagons. Since the quarry was at a considerable height above plain level, it was necessary to get it down from the hill.

When a second quarry, later known as Quarry C, was established nearby, the up and down problem was solved by the establishment of a balanced incline. The balanced incline system used hopper trucks operated on two parallel tracks running from the quarry to a transfer bin at the foot of the hill. The trucks were connected by a heavy wire rope which led from the empty truck at the foot of the incline around a large brake drum at the top and back to a full truck at the top of the incline on the adjacent track. When the full truck was pushed onto the incline its greater mass caused the coupled pair to begin to move rapidly under the effect of gravity. Brakes on the drum prevented the speed from becoming excessive and allowed the loaded truck to be stopped at the foot of the incline and to discharge its load.

The first six hopper trucks were reported to have been landed on 16 June 1 902 off the SS *Gibling*, but were found to be 3' gauge and of very light construction, rather than the required 3'6" gauge. They were sent across to Hummock Hill on 27 June 1902 but only one was assembled before all were resold. During this period quarry traction was entirely of the 'hayburner' (horse) type. Horses were used to distribute empty wagons in the quarry and to return loaded wagons to the top of the incline. The size and type of trucks used in the quarry has not been definitely established, but since the main line wagons were of only 8 ton capacity, it is possible that something similar to the wooden-framed mullock wagons which lasted into the 1930's were in use.

All loading was done by contract labour. Considering that between 1901 and 1911 over 600,000 tons of ore were removed from the quarry, together with an unknown quantity of overburden, it is easy to visualise the muscles that these men developed.

'B' Quarry at Iron Knob in the early years. Pick and shovel, and horses, moved massive tonnages of ore prior to mechanisation of the quarries. BHP Archives.



CONSOLIDATION OF THE TRAMWAY

Once construction of the tramway was completed, a greater quantity of ore could be shipped. *Kilmarnock* took its place as the leading locomotive with *Little Bessie* being used in clearing the remains of construction and as a very second rate back up. *Little Bessie* was also used in special duties such as hauling the General Manager to Iron Knob in August 1902 when a train was not otherwise running. Even the General Manager rode in an open wagon at that time, although it is surmised that he was provided with a chair rather than a chaff bag to sit on!

Rollingstock was very basic. By July 1902, there were 52 hopper wagons in the fleet, of two basic types. Tarrawingee trucks were purchased from the Tarrawingee Tramway, which carried limestone flux from quarries north of Broken Hill to the smelters at the 'Silver City', before smelters were established at Port Pirie. The second type of trucks were known as 'German Hoppers', which is thought to be a reference to their origin, although their official source has not been established.

Nominally, both classes of trucks were of 10 ton capacity, but were reduced to 8 tons in 1903. Water tank trucks had been built on frames obtained from Silverton, while 'C' trucks and bolsters came from STC and SAR.

The original ore trucks were without brakes until early 1902, when screw brakes were fitted to the 'German Hoppers'. The guard then rode on a chaff bag in the last truck and screwed the brakes on or off as called upon by the driver's whistle code signals.

Passengers apparently had some priority over livestock; the first mention of a passenger carriage occurs in August 1903, but an agreement to modify a wagon so as to prevent sheep from jumping out was not obtained until 1904.

The reliability of *Little Bessie* deteriorated to such an extent that it was to be returned to Port Pirie in July 1902. However, the replacement engine broke down with overheated bearings on the way from Broken Hill and it was necessary to retain *Little Bessie* at Hummock Hill. The replacement engine eventually arrived at Port Pirie after five days journey and was sent across Hummock Hill on 22 July 1902, arriving in the middle of the night and being unloaded at 2.30 a.m. This engine was the big engine described earlier as purchased by BHP and later used by the SAR as No.0. It became known at Hummock Hill at that time as *Beyer, Peacock*.

After some adjustments to springing to provide greater adhesive weight, *Beyer, Peacock* was put into service on 29 July 1902 and hauled an impressive load of 28 loaded trucks down from the mine. In a letter of 31 July, the Superintendent stated that he did 'not think that the big loco could haul all 52 empties in one trip and it might be possible to run two engines crossing at the 20 mile. If No. 2 *Beyer, Peacock* could not haul the whole rake up, it could run two trips and No. 1 would only go out when No. 2 is being washed out'.

Advantage was taken of the temporary presence of the extra engine at Hummock Hill to have the boiler of *Kilmarnock* overhauled at Port Pirie. It was returned at the end of August. *Little Bessie* was shipped to Port Pirie on 2 September 1902 and towed to Broken Hill with her springs removed, to avoid fouling on the SAR cattle pits, as had happened when it was brought down.

Life and operations at Hummock Hill settled down during this time to the repetitious hauling of empty and loaded trains between the Knob and Hummock Hill. The trips were not without interest however, as reported in 1928:-

'It is said that on one occasion the driver of *Killie* spotted a parrot's nest in the scrub, upon which he kept his eye until the parrots were ready to "bag". One day *Kilmarnock* lost a crank pin (probably a cotter pin) in very close proximity to the parrot's nest! The driver got his parrots and *Killie* eventually resumed her journey.'

For the rest of the town, occasional special trips were run up the line. For example the General Manager instructed that a special train for Christmas 1902 be run from Hummock Hill to Iron Knob and return, in which employees and their families were to be carried free. The Superintendent was instructed that:-

'"C" trucks are to be used and if there is not enough chaff or Oregon boards to make seats, ask for more now."

A similar train was run on Easter Monday, 1903.

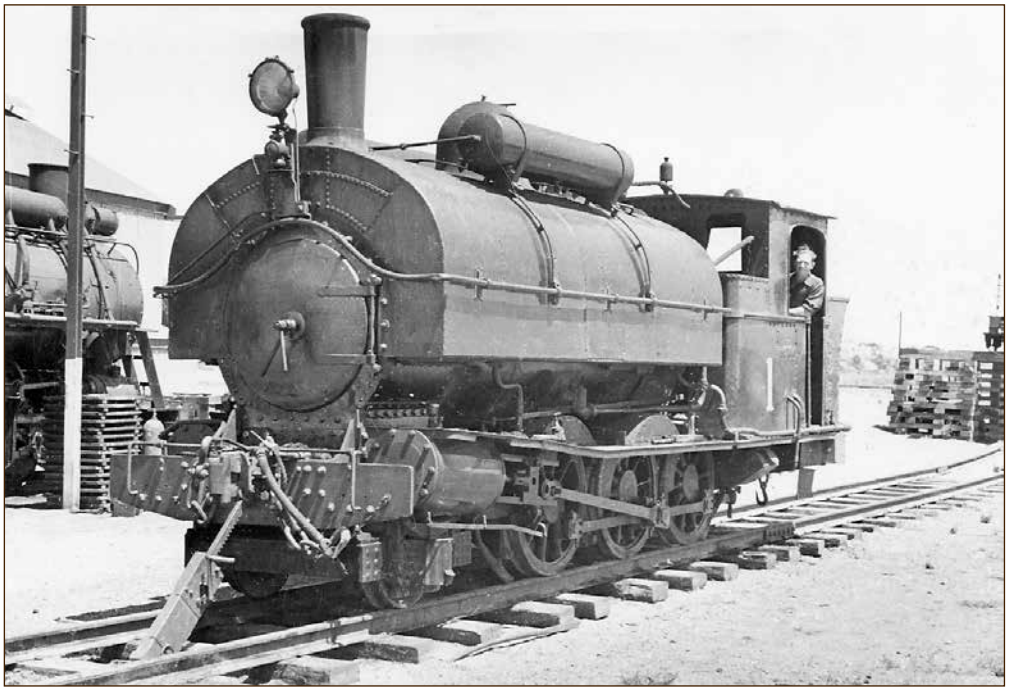
The first truck intended for carrying passengers was not completed until June 1903, but the type of vehicle did not seem to change very much, no matter how important the passenger. In August 1910, Governor Bosanquet visited Hummock Hill. He had a flat truck, specially cleaned out and covered, for 'sufficient protection' in case of wet weather!

Iron ore traffic grew steadily over the first ten years of operation and eventually reached the limit of the two engines. To supplement them, a third engine was brought down from Broken Hill. This engine, Beyer, Peacock number 4723 of 1905, was of similar size and appearance to No. 2 *Beyer, Peacock*, apart from saddle tanks instead of side tanks. The class leader of this design was supplied to the Taltal railway in Chile in 1885. The engine was known as second No. 2 at Broken Hill, but as No. 1 at Hummock Hill, filling the gap in the roster left by the return of *Little Bessie*. With this arrival, the engines became known on the books by their numbers:-

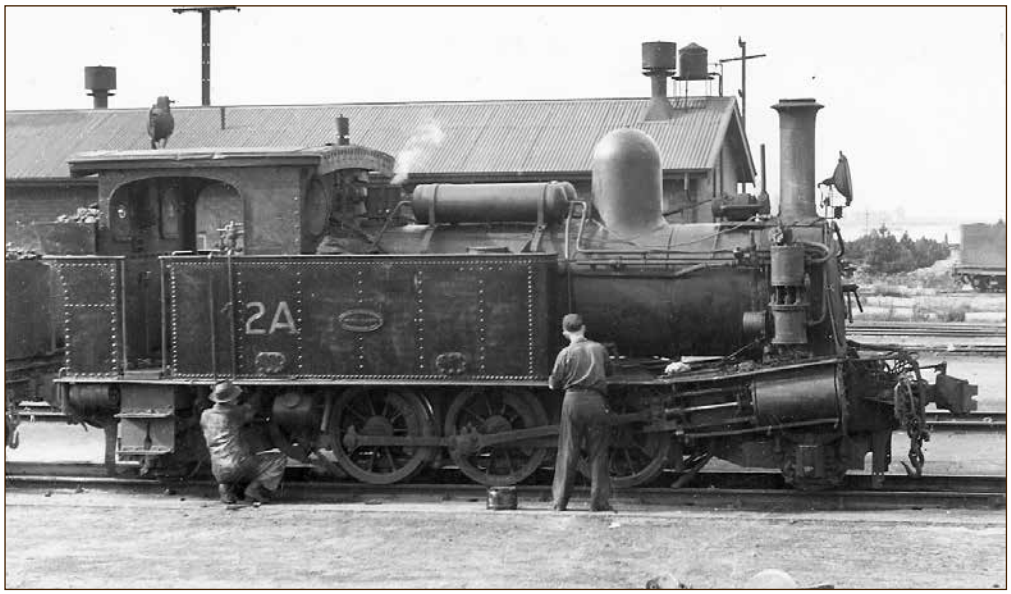
No. 1 - Beyer, Peacock saddle tank
No. 2 - Beyer, Peacock side tank (*Beyer, Peacock*)
No. 3 - Andrew Barclay side tank (*Kilmarnock*)

The date of transfer of No. 1 to Hummock Hill is unclear. (C. C. Singleton reports that it was in 1912, but there is no mention of any locomotive transfers during that year in contemporary records.) There is a record of 'the new loco boiler and fittings, loco wheels, cylinders, etc.' being sent to Hummock Hill on 25 January 1910 in a letter sent from Port Pirie. However, another letter from Port Pirie, dated 7 July 1910, notes the receipt of 'new loco, boiler and

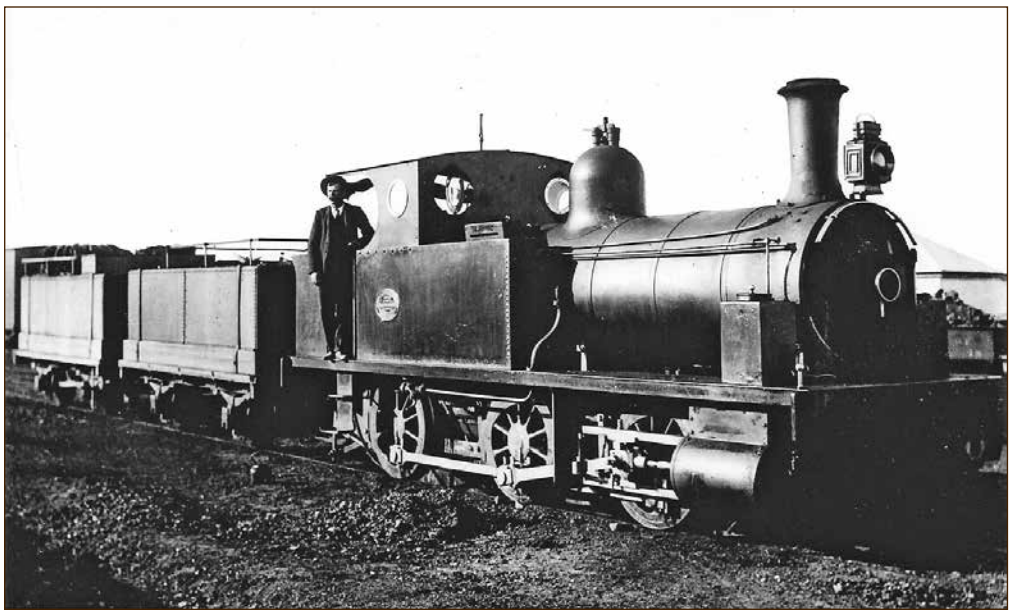
fittings for your new engine' and the intention of sending them that night. Which of these records, if any, refers to the transfer of No. 1, is still to be resolved. The fact that No. 1 was at Hummock Hill by 1911 is supported by a letter dated 16 October 1911, stating that the wheels and part of No. 1 were being returned after overhaul.



No. 1 Beyer, Peacock saddle tank. D. Grundy.



No. 2A was very similar to the first No. 2 at Hummock Hill. Here No. 2A is 'on shed' at Whyalla in 1952. D. Colquhoun.



No. 3 became known as 'Kilmarnock'. Its original side water tanks were reduced in size to allow easier access to valve gear after withdrawal from main line traffic prior to 1920. D. Griffiths Collection.

PREPARATIONS FOR THE STEELWORKS

Between 1901 and 1911, over 600,000 tons of ironstone were shipped from Hummock Hill, of which the average assay showed 69.5% metallic iron. Not only was the ore of phenomenal richness, but on a conservative estimate by H.L.Y. Brown, the South Australian Government Geologist, the deposit represented at least 21 million tons. Its magnitude and quality were thus far unequalled in Australia. Actually, the full extent of the deposit was unknown. Having control of the leases of Iron Knob, BHP contemplated the establishment of an iron and steel works, for which these immense deposits of ore would be the life blood. In reviewing this project, the directors were at least assured of a market for the product. The value of steel imported annually into the Commonwealth at that time had reached £6,000,000.

Addressing the 52nd Half-yearly meeting of BHP shareholders on 4 August 1911, Mr John Darling, Chairman of Directors, announced that in seeking to diversify the Company's operation, the directors had decided 'to send the General Manager, Mr Delprat, to England and America to seek the latest information and, if necessary, to secure the services of experts for the development of industries kindred to its resources'.

On his return, Delprat submitted his report on the results of his investigation. The fact that the Company was holding such an immense deposit of ironstone, made it incumbent to ascertain whether the ore could be turned to more profitable use than merely as a flux for the Port Pirie smelters. While in the United States, he had secured the services of Mr David Baker of Philadelphia, who developed the steelworks proposal. He recommended the immediate development of a blast furnace of 350 tons capacity with a corresponding number of open hearth steel furnaces and rolling mills to process the steel produced. In assessing raw materials, Baker agreed that the ironstone deposits were sufficient that the Company need not consider the acquisition of a further supply for at least a generation to come. The limestone deposit at Wardang Island in Spencer Gulf, controlled by the Company, held an abundance of flux of the highest quality. For fuel, large deposits of low sulphur coal of good coking quality were available in the neighbourhood of Newcastle and Port Kembla in New South Wales. As it took more tons of coal than of ore to produce a ton of finished steel, it followed that the works should be nearer to the coal than to the ore. Allowing for such other considerations as water supply, harbour facilities and location of markets for the product, it was decided that the land already owned by the Company at Newcastle, bought as the site of a possible lead smelter in 1896, would be a satisfactory new site, and erected on the site should be:-

One 350 ton blast furnace
Three 65 ton open hearth furnaces
One blooming mill
One heavy rail mill.

To support this, the Company would erect at Hummock Hill and Wardang Island, means of rapidly loading steamers with ore and limestone. At the farthest point south on the Iron Knob/Iron Monarch deposit a prospecting shaft had been put down 150 feet and had exposed ore of excellent quality. It was here that operations would be started to produce ore for steelmaking purposes.

The first ground was cleared for the new quarry in July 1912. Three new inclines were constructed. Two inclines connected different parts of the new quarry by leading down the hill generally following the side of the hill to meet at a platt sited about halfway from plain level to the working level. From this platt a third incline led directly out from the hill, falling to new bins constructed below. A new branch from the main line connected to the bins and a triangle was formed in this track to turn the trains. Two new passing loops were added to the main line and a crusher was installed at Hummock Hill. Forty new quarry trucks were requested and obtained from the Tarrawingee Tramway, whose traffic had steadily declined. Two new, substantially larger locomotives were ordered from the Baldwin works in Philadelphia, USA, and were shipped on 10 April 1914.

At Iron Knob a siding was provided for a brakevan, but procurement of such a vehicle was deferred, and the passenger carriage was roofed with oiled canvas instead. Twenty new hopper trucks for main line operation were ordered from Worham, Sanger and Bates of New York. The new locomotives arrived at Port Adelaide on 7 June 1914 and were transhipped to Hummock Hill where they were assembled. It was expected to have them ready for testing on 5 August, but the day before it was reported that one case of parts, including castings, was missing. The locomotives were eventually commissioned in the presence of Baldwin's representative on 21 August 1914.

At Wardang Island the required ship loader was constructed and a short horse-drawn tramway constructed to haul the limestone from the top of an aerial ropeway to the jetty. The quarry itself was served by a series of short tracks leading from the limestone face, where trucks were hand loaded, to the foot of the aerial ropeway. It is thought, but has not been positively identified, that this system was of 3'6" gauge. The quarry trucks had demountable bodies for transfer to the aerial ropeway, and a capacity of about five tons.

Next page: An original Baldwin, No. 4, has arrived at Iron Knob on an inspection train in December, 1914. Note the headlight, lining, tender and rollingstock behind the locomotive. J. Jobson.

WARTIME PRESSURES

The completion of the steel works and the commencement of increased iron ore production coincided with the outbreak of World War I in Europe. The effects of war were minimal at first but grew to become a major spur to further development and greatly increased production. The initial boom was the result of the demand for munitions in Europe, draining the supply from the marketplace. Australia became starved of its traditional steel supplies from England, as they were diverted to military use. In addition, naval action reduced the availability of shipping from Europe. The defence of Australia, although not severely tested in this war as it was in later years, was considered to be inadequate and in an attempt to remedy this in some way, the Commonwealth Government authorised the construction of the Trans-Australian Railway, which consumed a large proportion of BHP's production of rails during the period of hostilities.

The first shipment of ore across the Hummock Hill jetty for the Newcastle steel works was loaded into the steamer *Emerald Wings* (later renamed *Iron Baron*) on 8 January 1915. The war years led to a rapid increase in production and further improvements were required to handle the traffic. The main line was re-laid with 80lb rail. With the establishment of the steelworks, which was producing 80lb rails for the Commonwealth Railways Trans-Australian line, an opportunity was taken to obtain second grade rails at very low real cost. (A similar programme is currently in hand to gather rails for the Iron Baron to Iron Duke extension).

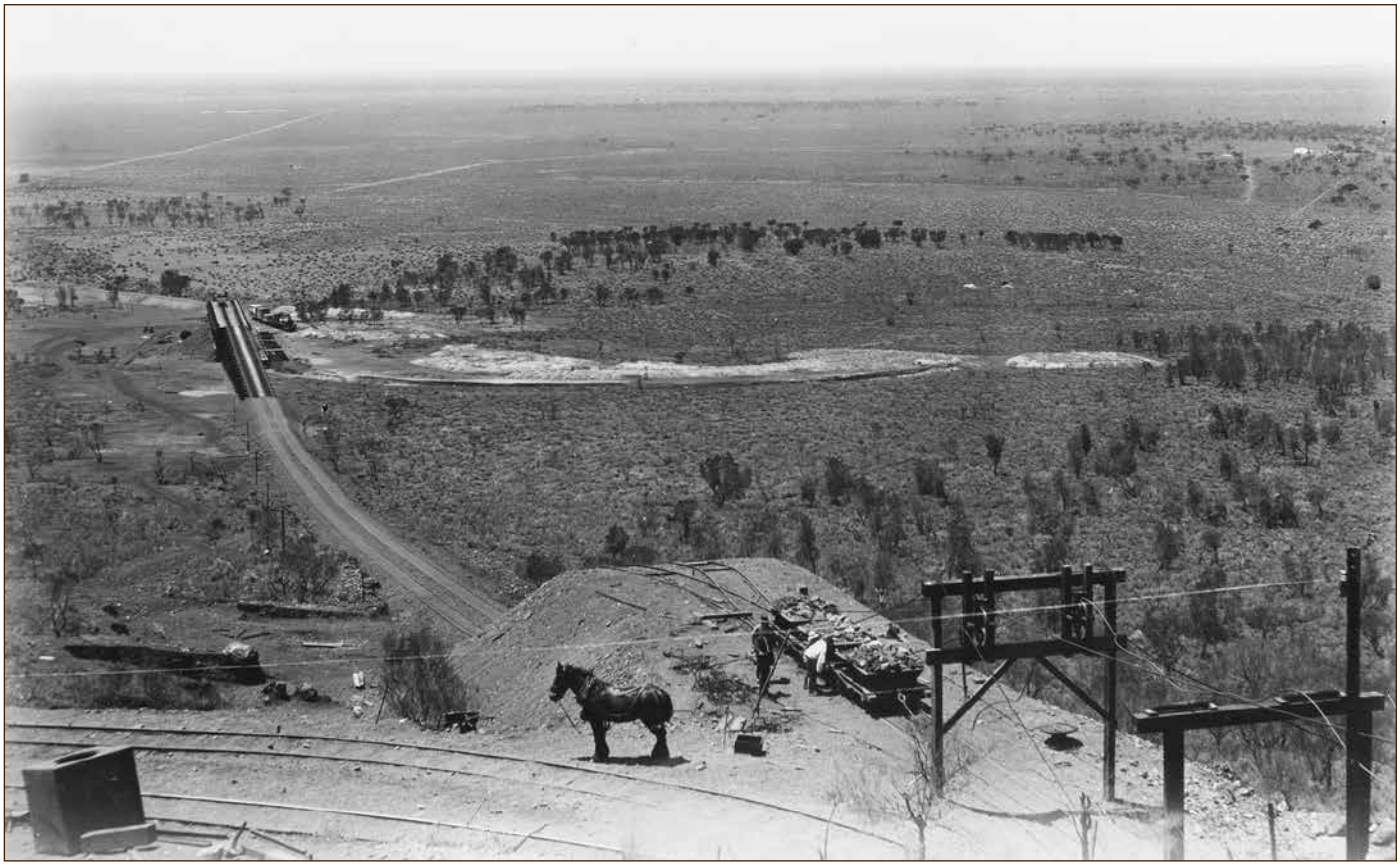
The Tarrawingee trucks were fitted with stronger axles and an evaporative distillation plant was installed at Hummock Hill. The distillation plant produced 78,000 gallons of fresh water per day from seawater to supplement the water brought from Newcastle in the tanks of the steamers. A brakevan was built by the SAR in 1916 and was put in service that year. In order to improve train handling and to permit the use of longer trains, automatic knuckle type couplers were installed on all locomotives and rollingstock for main line use. These replaced the old SAR chopper type couplers.

In addition to these changes some modifications were made to the platt roads at Iron Monarch to facilitate the handling of wagons on and off the inclines. The one single change in operations, which resulted in the most significant improvement in both current and future operations of the tramway, was the fitting of Westinghouse air brakes. The two Baldwin locomotives were fitted first in early 1918, along with a brakevan and two ore wagons. The other engines were fitted the following year. In addition to increasing safety, the automatic brake overcame the dangers of breaking the couplers, always a possibility in long trains of loose-coupled vehicles.

By the end of the war the pressures of work began to show on the Baldwin engines, with recurrent leaky tubes and staybolts in the fireboxes. The frequency of the failures became so serious that a complete new firebox was constructed and installed in No. 5. The engineer also recommended that copper be used in place of the original steel on all future firebox and tube replacements.

At the jetty the deck was reinforced and a third rail was laid on the south side of the existing track. This permitted the use of a wide-tracked crane for the unloading of the increased quantities of coal. This coal was required for both locomotives and the distillation plant. The total ore shipped during the last half year of the war was 108,000 tons in 327 trains. In addition to this ore, other cargo was:-

Inwards			**Outwards**		
Public		822 tons	Public		377 tons
Company	coal	3,097 tons	Company	general	30 tons
	general	2,310 tons		fireclay	666 tons
	explosives	27 tons			



Three loaded four-wheeled incline trucks are prepared for the journey downhill to the bins at Iron Monarch during December 1914. J. Jobson.

Empty trucks start their upgrade trip, from the unloading bins at Iron Monarch, to the quarry face during December 1914. J. Jobson.

POST-WAR DEVELOPMENT

The cessation of hostilities in Europe brought long sought social relief to the world, but had no effect on demands from Hummock Hill or the quarries. In the half year following the war 138,000 tons of ore were shipped in 427 trains, an increase of 30% over the previous half year. The future seemed certain to continue in this manner. In order to meet the demand, new equipment was ordered and the best possible use was made of existing facilities.

At the quarries the need for mechanisation was evident. In order to meet the demands, the number of contract shovelmen was increased to seventy in 1919. During one month of that year between 20 and 30 of these men were off sick at any one time, due to an influenza epidemic, although fortunately no one died from the illness. Easing of the quarry demands came in the form of two Bucyrus steam shovels of 1½ cubic yard capacity imported from the USA and commissioned in late 1920. These machines promised to revolutionize operations at the mine, but proved disappointing because they were too frail for the task. Men were still required to break ore to less than 12" diameter before the shovels could handle it. They were relegated mainly to mullock removal, which they handled adequately, while the tasks of shifting ore returned to the men with shovels.

Digging the ore was not the only area targeted for improvement at the quarries. The air drill replaced the back breaking task of hand drilling. Construction began on a new incline to run directly from the quarry to the plain level in one continuous run. It was completed on 1 September 1921 and this move was certainly none too soon, as mounting pressure of work on the existing incline resulted in two accidents in late 1920, in which considerable damage but no injuries occurred. In the first incident two empty trucks were put down 'A' incline without a rope being attached. They damaged the track at the bottom of the incline and were themselves destroyed. In the second incident the shunter in the quarry lost control of a loaded wagon, which ran down the incline and collided with an empty wagon, damaging both, in addition to the lagging on the brake drum.

Whereas the older inclines ran 8 ton quarry trucks, the new incline was operated using 10 ton capacity Tarrawingee trucks, formerly used on the main line. The wagons were lowered in multiple, initially using three wagons (giving a net load of thirty tons), but after heavy wear on the brake drum was experienced this was reduced to two wagons.

It was the main line, however, which saw the most remarkable transformation. Two new locomotives were bought from Baldwin Locomotive Works, erected at Hummock Hill (by then renamed Whyalla) and put into service late in 1920. These new engines of 2-8-2 (Mikado) wheel arrangement, weighed 134 tons in working order. They represented the forefront of modern technology, and were the biggest and most powerful locomotives in Australia on any gauge. They exerted a tractive effort of 37,500Ib. force and were expected to haul trains of 500-600 tons. Although siding limitations at that time limited trains to 450 tons, it was still a worthwhile improvement over previous load limits of 320 tons. Their full might was not discovered until the 1930's when one of these locomotives hauled a train of almost 2,500 tons from the 'Knob' to Whyalla.

In the short term, operation of heavy locomotives was hampered by the low standard of track. It was found that if they were used after rain then there would immediately follow a rash of broken sleepers and incidents of displaced track. As a result of these occurrences, the Mikados were not used after rain and train sizes had to be correspondingly reduced to match the smaller Baldwin locomotives. Fortunately, rain was and still is very infrequent in Whyalla.

The course for the future became clearer in 1920. The Company envisaged a continued growth in its steel making operation and in order to achieve this, in the cheapest manner, they decided to send Mr F. R. Hockey (Whyalla Superintendent) to observe and report on overseas mining, crushing and transporting methods. He visited a series of mines and equipment suppliers in the USA, UK and in Swedish Lapland. His report recommended some sweeping changes! He recommended that both the quarries and the tramway be electrified; that loading should be taken over by electric shovels into hoist tipped trucks of at least 25 tons capacity, featuring the best American and Swedish practices. He believed that the ore should be tipped from the quarry trucks into a large primary crusher and thence to the main line loading bins via conveyor belt. For the main line operations he recommended the existing four wheel wagons of 17 ton capacity be replaced by modern bogie wagons, of a type seen on the Lake Superior and Ishpenning Railroad in Michigan, USA. These wagons were of the latest design and carried 75 tons of ore. When redesigned for 3'6" gauge operation, their capacity would be reduced to about 50 tons.

The plan to electrify the main line was a bold concept. It was estimated that £300,000 would be ample capital for the project and would cover the cost of the distribution system and seven locomotives. Each locomotive would be of Bo-Bo type and would operate in multiples of two on the main line or individually as shunters. The envisaged advantages accruing from electrification were numerous. Line capacity would be increased from 6,000 to 12,000 tons daily before duplication would be required. Great savings in fuel would be expected. Consumption of fresh water, a scarce and valuable commodity in Whyalla, would be almost entirely eliminated. Locomotive maintenance charges would be reduced by 75%. Running shed, yard and cleaning labour would no longer be required. Track maintenance would be reduced. Reduced traffic delays would occur, due to the much higher reliability of electric locomotives, and the avoidance of a weekly or in Whyalla, sometimes bi-weekly, boiler washout for steam engines. Very small depreciation of the electric locomotives and a direct saving of weight, due to no tender and water tanks on every train, would enable more ore to be carried. The directors spent considerable time deliberating over these very attractive proposals!

Meanwhile in Whyalla, ironstone production, which had been running at about 15,000 tons per week and expected to rise to about 17,000 tons per week, was suddenly reduced. In early 1922 this was reduced to 6,500 tons per week, and then on 22 February that year it was curtailed completely, with all except 8 of the 142 wages men employed, being dismissed. Only No. 2 and No. 5 locomotives were kept in service to run a twice weekly stores train to the Knob. Nos. 1, 3, 6 and 7 were 'laid up'; their motions were white leaded and their boilers drained. No. 4 was at the time being overhauled. For the next year the mines and tramway were almost idle. Only 38 men were retained at Whyalla and 14 at Iron Knob in the latter half of 1922. Some work was done on the strengthening of Quarry 'A' incline tracks and improving the ore flow from them by cutting out the cross-ties in their interior, but no ore was produced. No. 4 was reassembled and salt water was used as a weed killer on the track. Some effort was put into regrading a 24 chain section of track at the 23 mile point, using 3 staff men and 24 contract labourers who were paid 11 shillings per day.

The works were revived on 22 March 1923, when 197 men were taken on in Whyalla and a further 111 at Iron Knob. The locomotives were, apart from No. 3 (*Kilmarnock*) put back to work and in the half year ending November 1923, 585 trains were run between the Knob and Whyalla. *Kilmarnock* had been reboilered as late as 1919, but with no apparent task it was not recommissioned.

It remained inactive until 1936, when a semicircular cover was manufactured to be placed over the footplate. In this form the engine was used as a weighbridge tester (40 tons in 1954) for many years. Retained under the cover were the components necessary to refurbish it, should the need arise. It was finally scrapped in 1959. An indication of the relative use of the locomotives can be seen from the following breakdown of train frequency in that period:-

Locomotive Number	Number of Trains
2	2
4	160
5	17
6	240
7	166

No. 5 showed a low tally, as it was overhauled during the period. No. 1 was used entirely for shunting.

By 1924 the first results began to appear from Mr Hockey's visit and his subsequent report. The directors were no doubt impressed by the apparent savings that could be made as a result of the electrification of the tramway. But the estimated £300,000 to enact the work was, it seems, too much to find. Instead, the board approved the purchase of a third Mikado locomotive, No. 8. Despite Hockey's recommendation that the Baldwin product was inferior, the price of £12,230 delivered to Adelaide compared favourably against £14,250 for a similar unit from Beyer, Peacock and £11 ,950 from the Glasgow works of North British. Naturally, Baldwin won the order from BHP!

The bogie ore car recommended by Hockey did, however, meet with the approval of the board, and design was undertaken during 1924. Drawings were completed during early 1925 and orders were placed for castings to make a trial unit. This car was commissioned in early 1926. To augment this, heavier axles were fitted to the four wheel ore cars and their sides were raised 8 inches. With strengthened drawgear their capacity was increased from 15 to 17 tons. Trials indicated the need to fit apron plates to the 50 ton ore cars to prevent ore falling on the axles and initiating failures. An improved hand geared brake was also fitted and plates added to the ends of the cars to protect the brake system. These modifications proved successful and a contract was let to Perry Engineering Company in Adelaide for the construction of a further ten trucks in early 1927. These trucks were numbered 2–11.

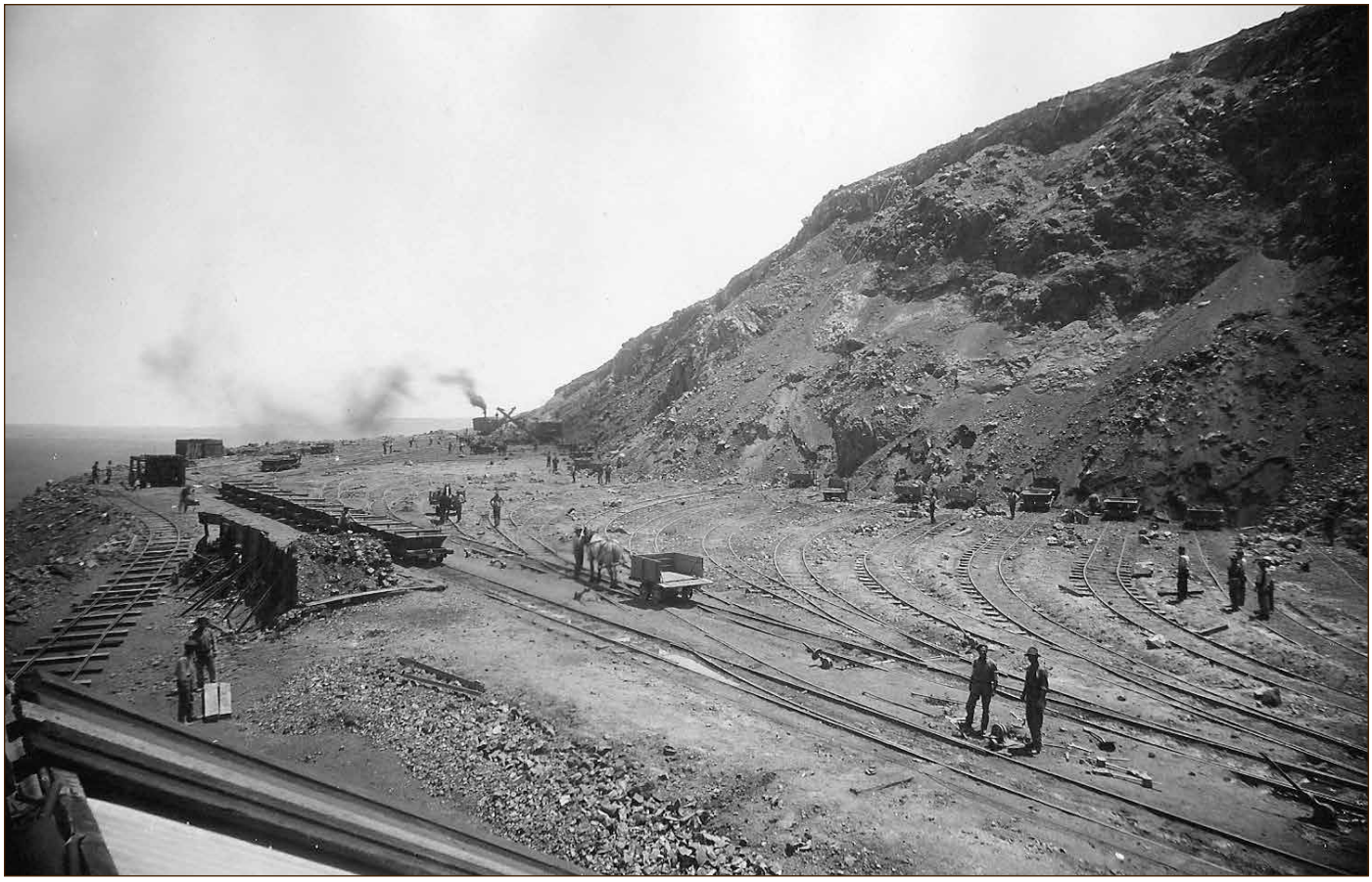
This early photograph of No. 4 shows some modifications. An additional headlight, compressor and a rebuilt tender are obvious alterations to this typical Baldwin locomotive. BHP Archives.

Small Baldwin No. 5 pushes a rake of loaded ore cars towards the unloading bins at Whyalla c.1956. BHP Archives.

Its days are numbered! 2-6-0 ST No. 1A stands 'on shed' in the locomotive depot, Whyalla, in May 1962. BHP Archives.

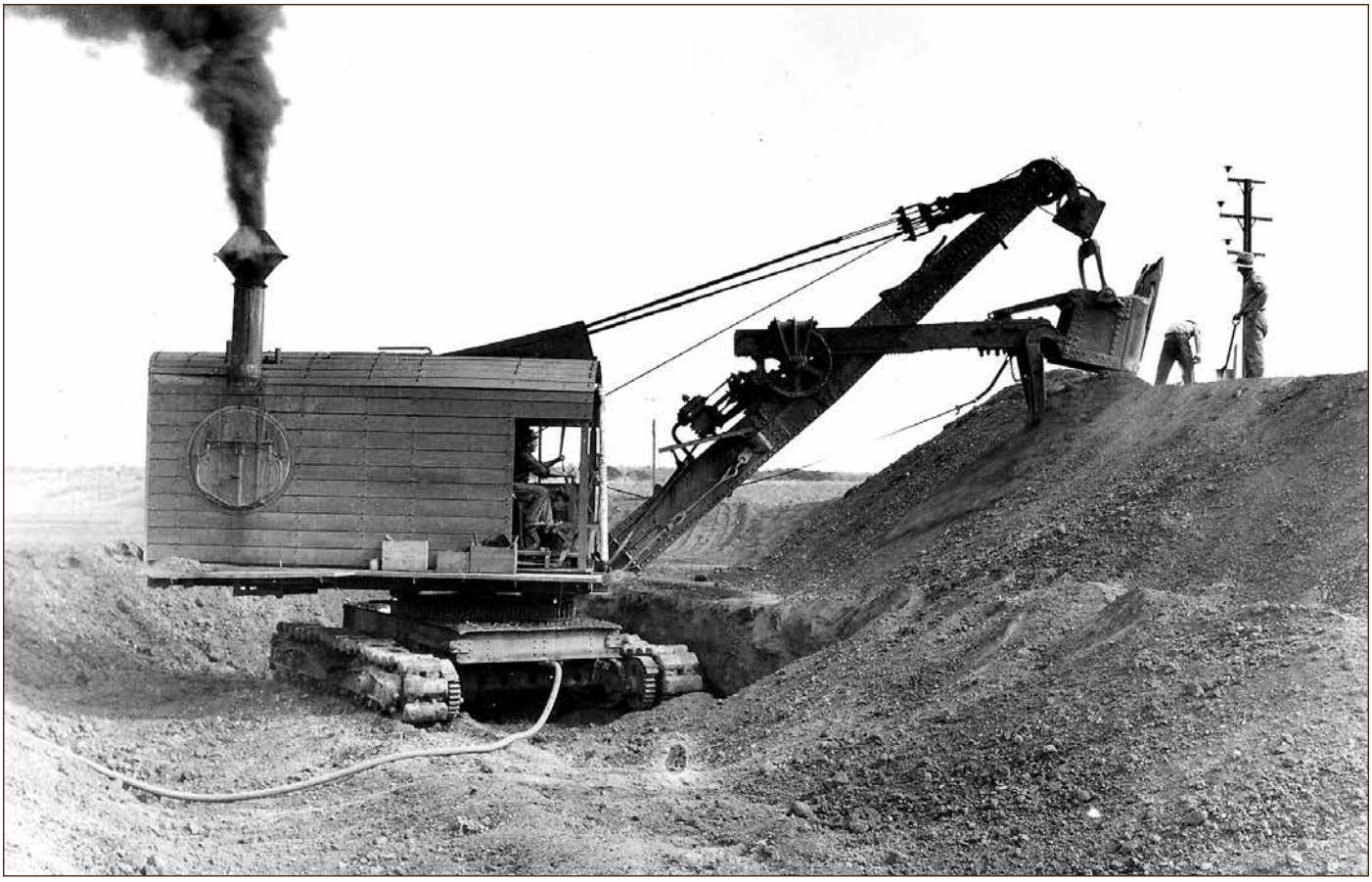
PE1, working as an electric locomotive, assists electric shovel No. 2 to load a quarry train in 'F' bench, Iron Monarch c.1956. BHP Archives.

DE's 04/06 begin to load their train at the Iron Monarch bins on 2 December 1981. D. Griffiths.



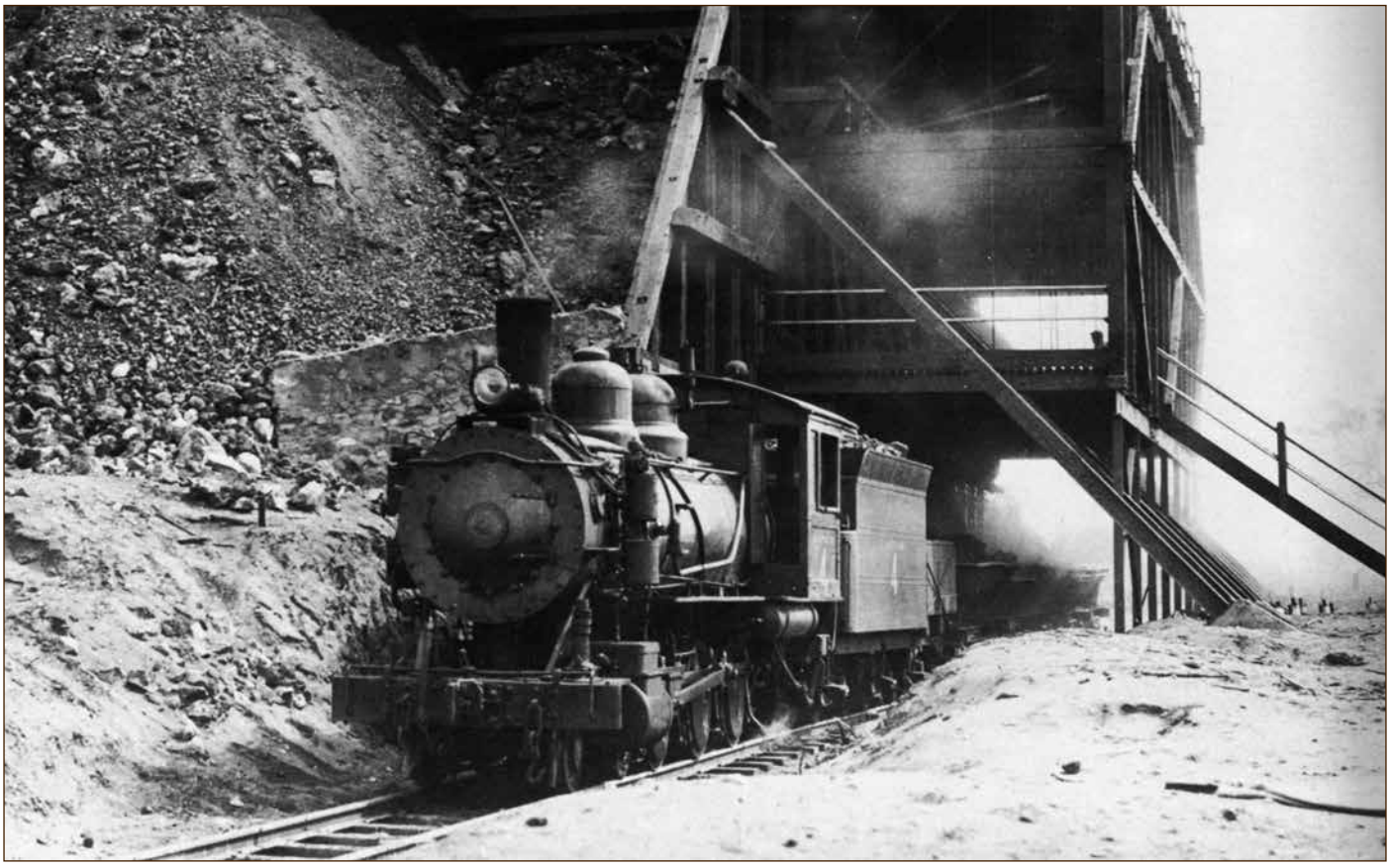
'A' quarry at Iron Monarch in 1920 shows steam shovels at work. Note the complex quarry trackwork. BHP Archives.

This 1928 scene shows another steam shovel loading a quarry train hauled by a Fordson kerosene locomotive. BHP Archives.



An excellent profile of a steam shovel. D. Griffiths Collection.

No. 4 assists with the loading of a rake of Tarrawingee trucks at the old No. 1 incline bin, at the exit of 'C' quarry. This quarry supplied high manganese ore suitable for foundry use. Circa 1920. D. Griffiths Collection.



MODERNISATION OF THE QUARRIES

Until 1926, quarry operations had changed very little since the immediate post-war days and loading was still done by hand shovel. There were two tracks in the quarries to serve the steam shovels on mullock shifting and a further 84 tracks to serve the needs of the contract shovelmen. Compressed air winches had replaced some of the horsepower on the longer hauls, but the compressors were nearing their limits.

Major improvements were required at the quarries to boost productivity, and Hockey's recommendations of electric shovels and electric traction in the quarries, bigger ore wagons and a crusher were about to be implemented.

On 7 January 1926 a start was made on the establishment of a new quarry face known as 'E' quarry. Its level at 1,050 feet above sea level placed it 150 feet above the existing 'A' bench. An immediate crisis was to move the larger tonnages of ore before the arrival of all the new equipment.

The Company purchased four Fordson tractor locomotives, which entered service in June and August of 1927, displacing four air winches. Unfortunately they almost immediately exhibited radiator problems. Also purchased at that time was a second hand steam engine (No. 9) from Millers Machinery Company of Melbourne. It is reported to have entered service on 27 July 1927. A fifth Fordson was assembled from spare parts based on a Whyalla chassis, late in 1928.

Steam locomotive No. 9 had a very short career in the quarry. Its condition was very poor and drawings were made for a complete set of valve gear in February 1928, but they were probably never used. The electrification was completed in 1928 and a boiler inspection set for 22 June was never carried out. Its final demise is uncertain, but its cab and funnel were used to upgrade No. 10 in 1943.

The modernisation at Iron Knob was based on the establishment of a new mechanised bench ('E' bench). All of the equipment was used in that quarry.

The broken ore was shovelled by three Bucyrus-Erie electric shovels of 4 cubic yard shovel capacity, into two quarry trains.

Each train, consisting of five or six 30 ton ore cars, ran on tracks parallel to the face. This was opposed to the tracks running perpendicular to the face in hand loading operations. Each train was hauled by a 22 ton 600 volt Metropolitan Vickers electric locomotive.

The ore cars had a special side tipping mechanism operated by an overhead gantry crane and discharged into the hopper of a jaw crusher. The crusher was capable of handling 1,000 tons of ore per hour, crushing it down to 10 inches. The crusher was situated below the 'E' quarry floor level and delivered into a surge bin cut out of the solid ore between 'A' and 'E' quarries. As the ore discharged from the crusher chute, it was directed into either of the two chutes, using a chain gate.

The surge bin discharged to 'A' quarry level through hand operated chutes into three quarry trains consisting of three 10 ton hopper wagons and a 5 ton Fordson tractor locomotive. These trains worked in a continuous closed circuit, transporting the ore from the surge bin to the edge of the quarry, where they dumped ore directly into trucks running down the No. 5 incline to a 10,000 ton bin below.

Movement of the new ore cars in 'E' quarry was made predominantly with the two new Bo-Bo electric locomotives E1 and E2 from Metropolitan Vickers. At a weight of 22 tons they drew power at 600 volts DC developing 96 horse power (one hour rating). Designed operation was for the haulage of a rake of four 30 ton ore cars at 5 mph. A dummy truck was inserted between the locomotive and the ore cars to avoid damage to the locomotive during loading. Electric current was collected by a side bow in the quarries, but a small pantograph was arranged overhead at the crusher to prevent fouling of the collector with the tipping crane. During development work or whenever the overhead had been damaged by blasting, current could also be collected by a trailing cable held on a powered collector drum in one of the sloping ends of the locomotive.

When no overhead was available, due to track shifting as the quarry face advanced, or in new developments, it was intended to use the petrol-electric locomotive purchased from Davenport Locomotive Company, Iowa, USA.

This locomotive carried builder's No. 2118 of 1928. It was known as PE 1, but in later years was designated DE 10, and was powered by two 105 hp Continental Red Seal petrol engines, each driving a direct current generator. The power was then transmitted directly to four electric motors, each driving one axle.

The independence afforded by the on-board generation of electric power permitted the locomotive to be used over developmental tracks where no overhead had been erected, or where damage had occurred to the conductor, as was prone to happen during blasting.

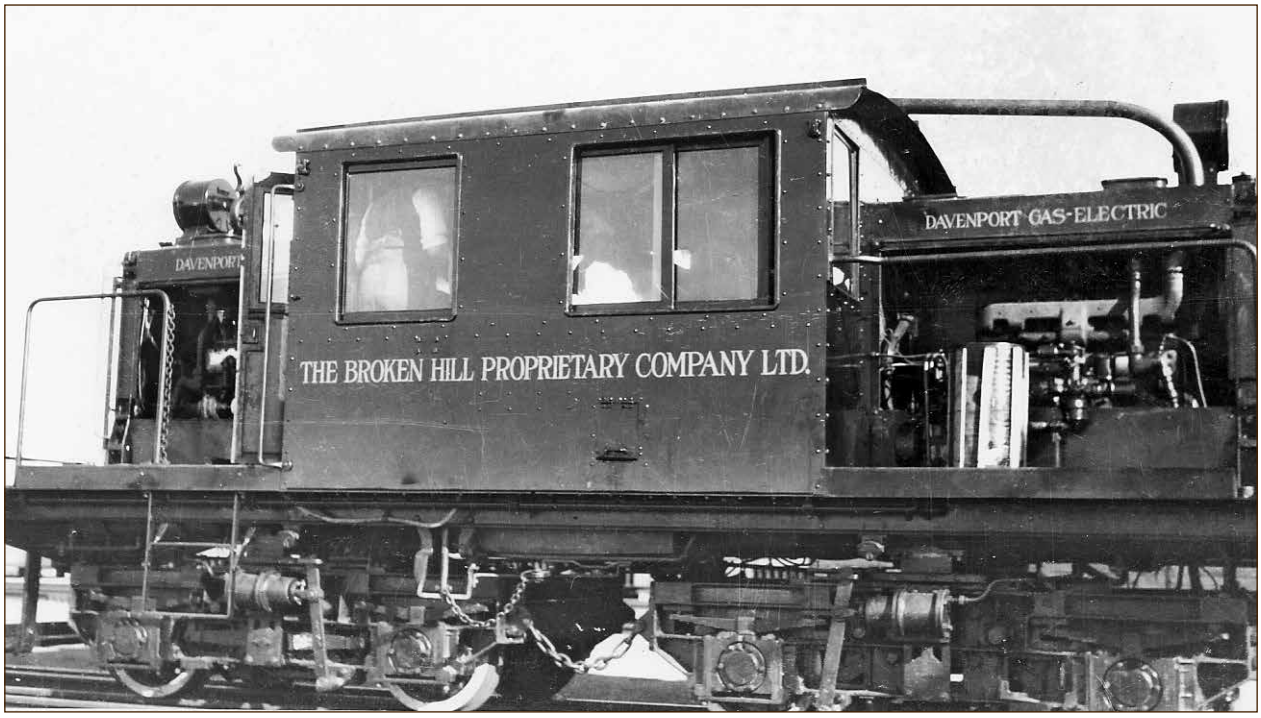
To be offset against these benefits however, was a higher operating cost for fuel and a very much less reliable system, particularly in those early days of internal-combustion locomotives.

The locomotive was hauled to the quarries by truck and placed into service for testing on 20 September 1928. The maintenance problems encountered are illustrated by the following repairs required in the first six months of operation:

Fitting of new throttle controls

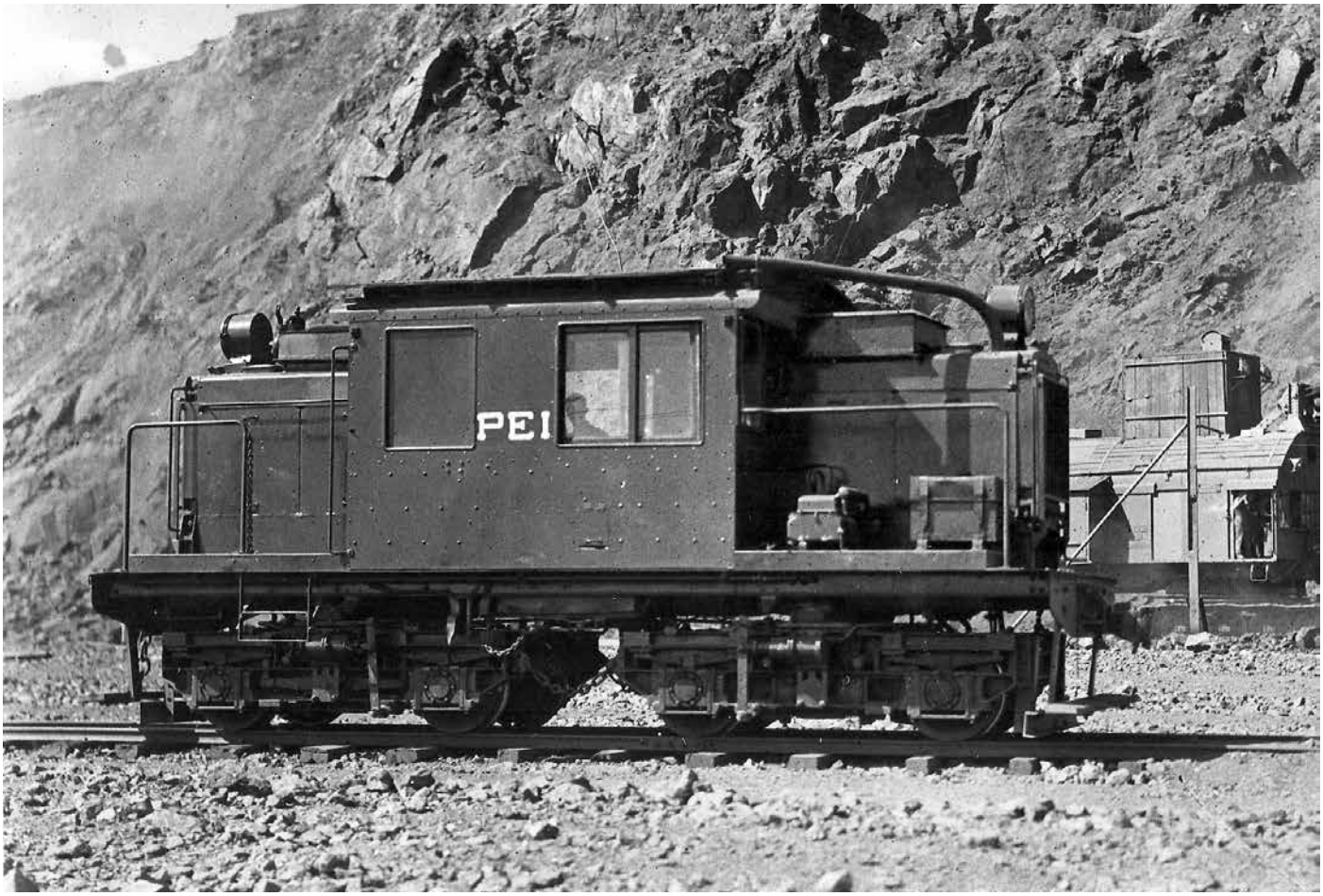
Grinding in of exhaust valves of front engine

Adjusting carburettor for the use of Benzol.



PE 1 shortly after delivery in 1928. Note the original lettering, single roofline and silver tyres. BHP Archives.

PE1 at work in 'E' quarry, Iron Knob during 1935. BHP Archives.



The locomotive was used very infrequently. The hours logged for the years 1929-1938 tabulated below, indicate the usage:

1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
857	364	41	4	16	58	193	99	204	971

The corresponding data for each electric locomotive rose from about 600 hours in the early days, to over 3,000 hours in 1938 for some individual units.

One of the Fordsons was also rendered surplus in the quarry and it was transferred to Whyalla in late 1930 for use as a shunter on the jetty. Growing production at Iron Knob lead to the purchase of a third electric locomotive, E3, which entered service on 26 February 1930.

DE 10 in its final form. Once fitted with bogies off an electric locomotive, the general appearance of the original PE 1 was lost. It stands here in the moulding yard on 11/3/1975. BHP Archives.

E 1 in original condition commences operation in a quarry at Iron Knob in October, 1928. BHP Archives.

THE IRON BARON BRANCH

In his report to the board of directors on the feasibility of establishing a steelworks in Australia, David Baker had said he found at Iron Knob 'a deposit of high grade ore admirably suited for steelmaking by the basic open hearth process. The quantity was such that the Proprietary need not consider the acquisition of any other supply for at least a generation to come.'

On the first comment he was shown to be correct, but on the second it is clear that the demand for steel outstripped his wildest expectations. The demand was such that the Company had considered it appropriate to secure future supplies of ore as early as 1920. In the Middleback Range rich iron ore deposits outcrop in several places. Iron Knob and Iron Monarch were the two most northerly, but there were others to the south. The closest were Iron Prince and Iron Baron about 15 miles from Iron Knob, while further south lay the outcrops of Iron Queen, Iron Duke, Iron Duchess and Iron Knight.

Iron Baron and Iron Prince, being the closest to the existing workings, were a logical choice for the next to be developed.

Surveying and pegging were completed in 1920. After the necessary leases had been taken out, a party of eight men with a 20 hp engine and four horses were employed on shaft sinking to investigate the extent of the deposit. According to mining regulations, this number gave an equivalent to 56 men and entitled the company to hold the lease, safe from takeover.

The iron ore was not immediately required, but the leasing and minimal working assured a future supply should the Knob/Monarch supplies become exhausted.

Construction of a branch line to Iron Baron from the existing Iron Knob line at a point 13 miles from Whyalla was authorised by the Iron Baron Tramway Act of 21 December 1927. Construction was completed in December 1930. It was only lightly constructed, compared to the main Iron Knob line and was therefore worked predominantly by the lighter Baldwin engines, Nos. 4 and 5 and the Beyer, Peacock engine, No. 2.

Ore winning at the Baron and Prince was on a much less ambitious scale than contemporary operations at the Knob. It used methods common at the Knob before the introduction of electrification. The mining was done using the contract party system, first adopted as an experiment by the Company at the Prince during the very depths of the 1929-30 depression. The party, because of its relative isolation, had to be able to depend upon its own resources to a large extent. The men in the original contract party were Fred Collins (leader), machine driller and powder monkey; Alwyn Mathews, horse driver; Jack Quinn, engine driver, mechanic and first aid attendant; Mick Wade, tracklayer and shoveller and Wally Millerd, shoveller. All men took their turn on the shovel from time to time.

The original weekly output was fixed at 500 tons of ironstone. Under the terms of the contract the party was required to load ore into trucks which were horse drawn to a chute delivering into main line wagons. The basis of the contract was that the Company supply the plant and the party supply all the labour and pay for all the stores supplied by the Company; the members of the party were paid for all ore delivered into main line wagons at a price per ton. No payment was made for mullock handled, but this material was required to be worked to keep the working faces in good condition. When assessing the price to be paid per ton of ore, an estimate was made of the percentage of mullock shifted, and this price made provision for in the handling of it.

Water was made available from Whyalla to the party, but used very sparingly. The cost of water consumed was added to the bill! Horses and harness were supplied at a weekly hire.

This successful proven system led to its adoption at the adjacent Iron Baron deposit. In this mine a steam shovel was used, but the basis of the contract differed only slightly in this case.

IMPROVED OPERATIONS

In the years immediately following the electrification at Iron Monarch, there were many notable improvements. These increased the productivity of the quarry and tramway and eliminated some inefficiencies. These were, however, all of a small or relatively simple nature; there was just no money available for 'big jobs' during the depression.

The progressive deliveries of the larger 50 ton ore cars, 12 from Perry Engineering in Adelaide in 1927-28 and 20 from BHP (Newcastle) in 1933-34, had permitted an increase in the ore hauled without an increase in the trailing load behind the locomotives. The unreliability of the Mikado boilers had been eased by the manufacture of a spare boiler, enabling a locomotive to be out of service only about a week for the exchange, rather than several months for the boiler itself to be overhauled. In mid-1933, 'C' quarry at Iron Knob ceased operation and the chutes of quarry 'A' bin at Iron Monarch were raised to allow the 50 ton wagons to be used under the bin. A further 22 ore cars were ordered in late 1934 and put into service the following year.

This provided the first opportunity of marshalling together a complete train of the larger ore cars. With this new payload capability, the limitation to main line capacity shifted to locomotive power and the heavy grades on parts of the track. The original track had been laid in 1901 as a straight line, rising and falling with the existing landscape.

The 23 mile location was the most severe of these hills, because it combined a heavy gradient with sufficient length to prevent roller coasting. With heavy trains it was necessary to divide the loaded train at the bottom of the hill (23 mile) and haul it in two parts to Sly siding (20 mile) before continuing to Whyalla. This practice extended the journey time, largely negating the advantage of a heavier train. It was decided to regrade this section to 1:150 instead of the original 1:100, increasing maximum train loads from 1,000 tons to 1,600 tons.

The approach used would be to form a bank at the lower level and to make a cutting through the high ground. Of the 87,000 cubic yards of fill in the bank, the cutting would yield 33,000 cubic yards. It was decided to form the base of the bank to an average height of eight feet by the use of horse drawn scoops and bullock team ploughs, the earth being scooped from a borrow pit alongside the site of the bank.

An important consideration was that the whole job was to be performed with plant available at the Iron Knob and Whyalla works.

With this in mind, attention was directed to one of the Model 35-B Bucyrus steam shovels, which had been in use at the Knob prior to electrification. This machine was dismantled, loaded onto goods trucks and transported to the site of the regrade. A short siding had been laid from the main line to accommodate the train bearing the shovel parts and to facilitate re-erection.

The shovel was assembled and set to work loading earth into 15 ton centre dump hopper cars (also from the quarries) standing on the main line. From that time locomotive No. 2 was employed to haul the wagons over a new line which had been laid over the partly formed bank raised by the horse drawn scoops. The earth was then dumped and ploughed off. As the horses and scoops completed a portion of the bank, the trackwork was advanced, thus permitting earth from the cutting to be dumped and the bank to be raised to final grade.

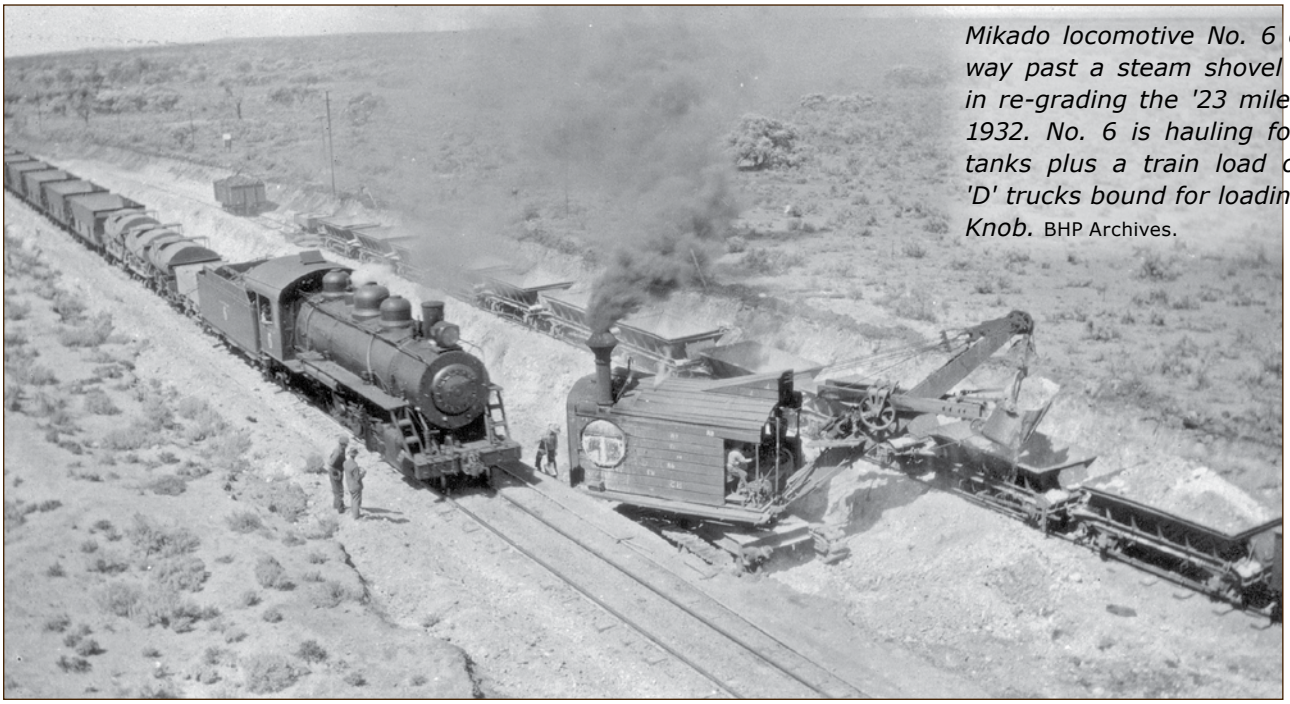
Because of the depth of the cutting and the limited dumping height of the shovel, the cutting could not all be taken out to the required depth in one cut. A 30 chain length of the cutting was completed to the correct level. From this point the floor of the cutting was made just deep enough to permit a convenient loading height into the trucks; the cutting was also widened to the maximum reach of the shovel. This was continued for a further 45 chains until the correct level was again reached. Here the cutting was again narrowed to a 14 foot width (the maximum clearance of the Shovel caterpillars) and continued on the correct grade to the point of convergence with the existing tramway.

In the meantime the new tramway was extended through the cutting on the correct centres where the cutting had been excavated to final grade. Where the final grade had not been reached, the track was laid on the extreme edge of the cutting. This section provided the new loading track for the shovel, which then made its way back through the cutting on the correct grade. On completion of the second cut the track on that portion was broken at all joints. The rails and sleepers were prefabricated and lowered as one section at a time (using the shovel as a crane) onto the true centre line.

With the completion of regrading and the additional forty-four 50 ton ore cars (number D12-D55), trains grew enormously in size. The 600 tons initially envisaged as the capacity of the Mikados was well and truly forgotten. By the end of 1933, trains comprised solely of 50 ton cars, had been run in regular service.

Normal trains reached gross weights of 1,600 tons, shifting 1,300 tons of ore in 27 cars. Less efficient trains resulted from the inclusion of some smaller, older wagons. The heaviest train in Australia at that time was run on 3 November, 1933 when No. 8 hauled a train from the Knob comprising 53 vehicles, stretching for 1,258 feet. The train consisted of:-

Net weight of ore		1,832
Tare (25/50 tons, 25/17 ton ore trucks)		629
Locomotive and tender		137
Brakevan and 2 water tanks		38
	TOTAL (tons)	2,636



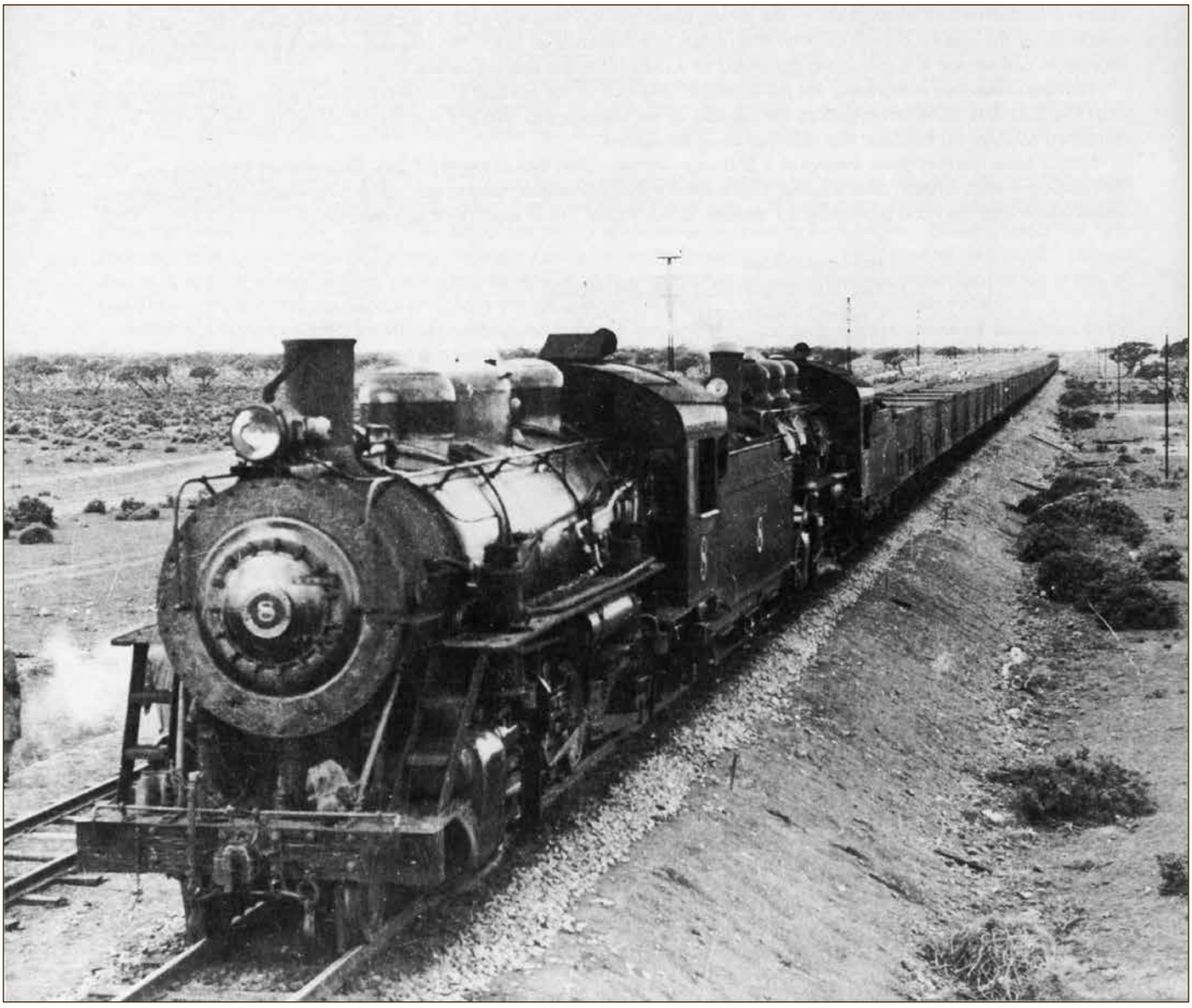
Mikado locomotive No. 6 eases its way past a steam shovel engaged in re-grading the '23 mile soak' in 1932. No. 6 is hauling four water tanks plus a train load of empty 'D' trucks bound for loading at Iron Knob. BHP Archives.

The 1,600 ton train became the norm, with smaller trains being run only when shipping deadlines forced running times to be minimised, and train splitting at the 23 mile had to be avoided. These smaller trains with short journey times could be timetabled in between the standard 1,600 trains.

The introduction of a fourth Mikado in late 1938 brought with it another record train. A double-headed train was tried; the new engine, No. 9, piloted No. 8 to haul a load of 3,763 tons!

The growth of traffic and a similar increase in train lengths saw a change in activity of these Baldwin engines. From the late 1930s until the introduction of diesel traction in 1956, Nos. 4 and 5 took up the task of 'Bin Shunting'. Their task was to assist main line locomotives by pushing empty trains out of the yard (the steepest grade on the line) to the 2 mile siding, where the Mikado at the head of the train was able to continue unaided. The small engine would wait at this point for a returning loaded train, which would pass into the siding and stop. The Mikado would be detached, then return light to the depot for coal, water and any required maintenance or crew change. This left the smaller Baldwin to attach to the quarry end of the loaded train and 'push' it down the grade and up the bank over the bins. The train would then be halted just short of the end of the track. Then began the slow controlled roll back down the bank with the hopper doors of the ore cars being opened in turn, as the car passed over the bin. When the train was emptied, the cycle would begin again.

Double-headed Mikados, Nos. 8 and 7 haul an empty ore train towards Iron Knob c1933. BHP Archives.

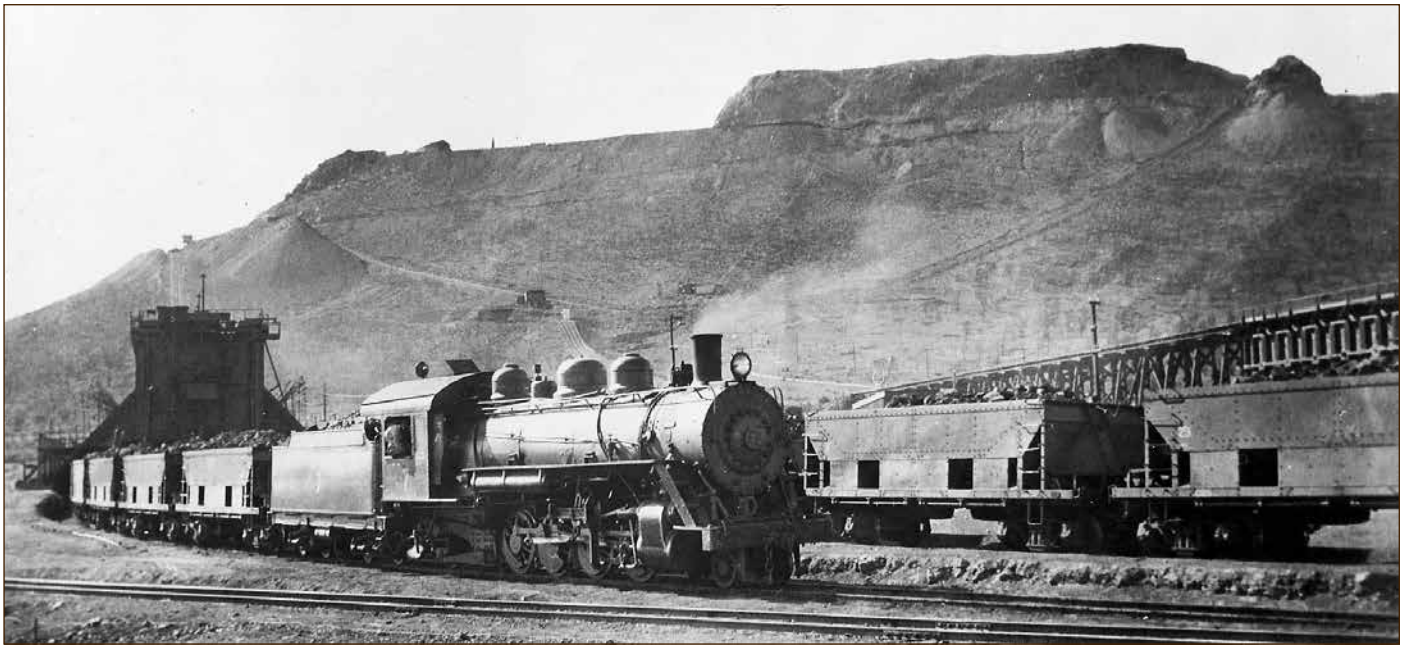


DE's 04/03 ease their way out of Whyalla on 20 January 1957, hauling a trial double header to Iron Monarch. BHP Archives.

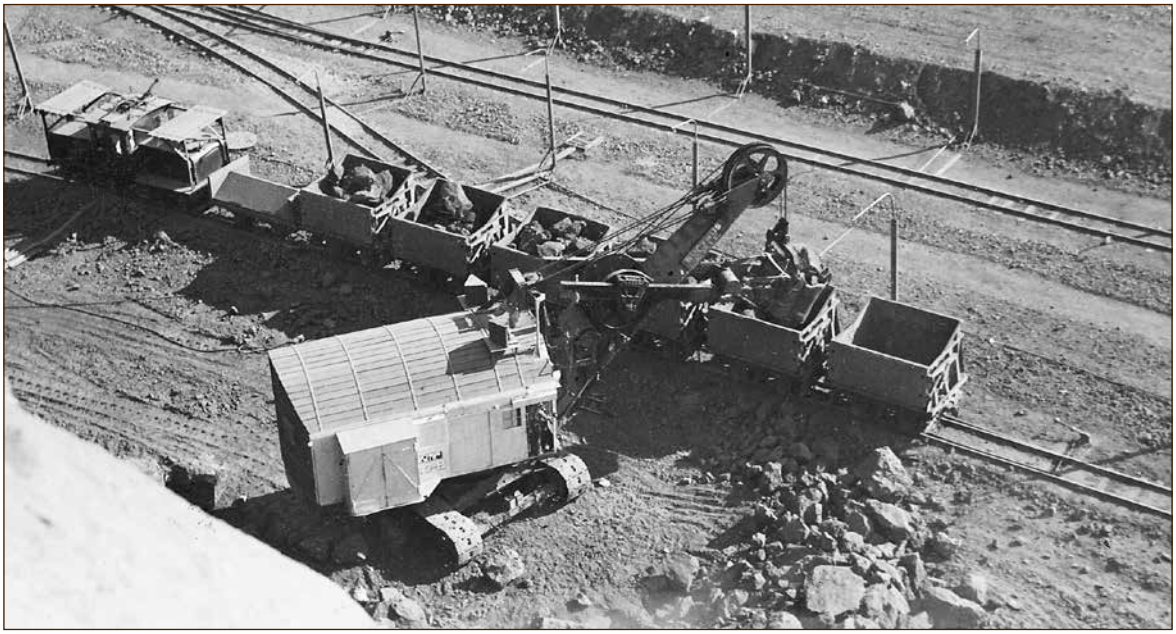
DE's 06103 haul their loaded train around the triangle at Iron Monarch on 10 June 1958. BHP Archives.

Walkers diesel DH 1 comes ashore on March 26, 1962, with the help of steam locomotive No. 2 and the Craven crane. BHP Archives.

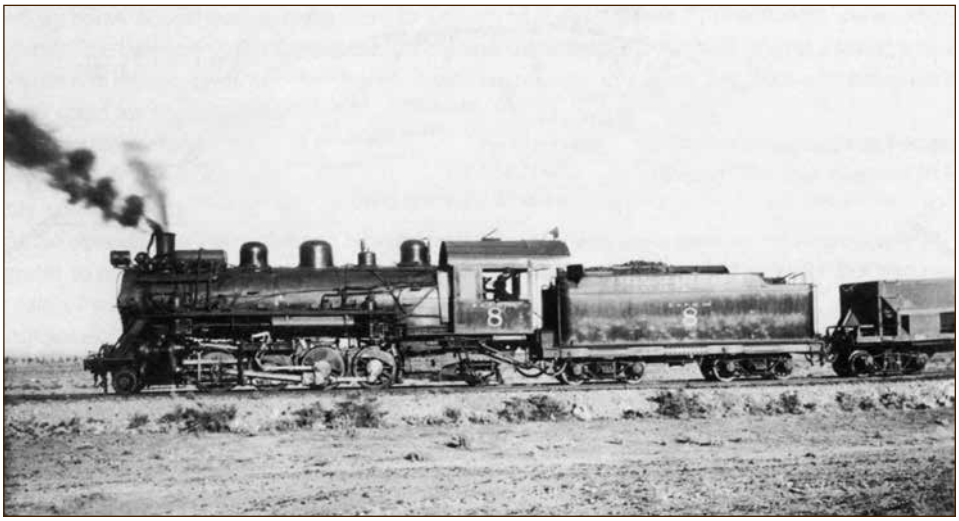
Brand new DE 08 runs a ballast train over the Proper Bay to Coffin Bay line prior to operating limesand trains early in 1966. N. Potter.



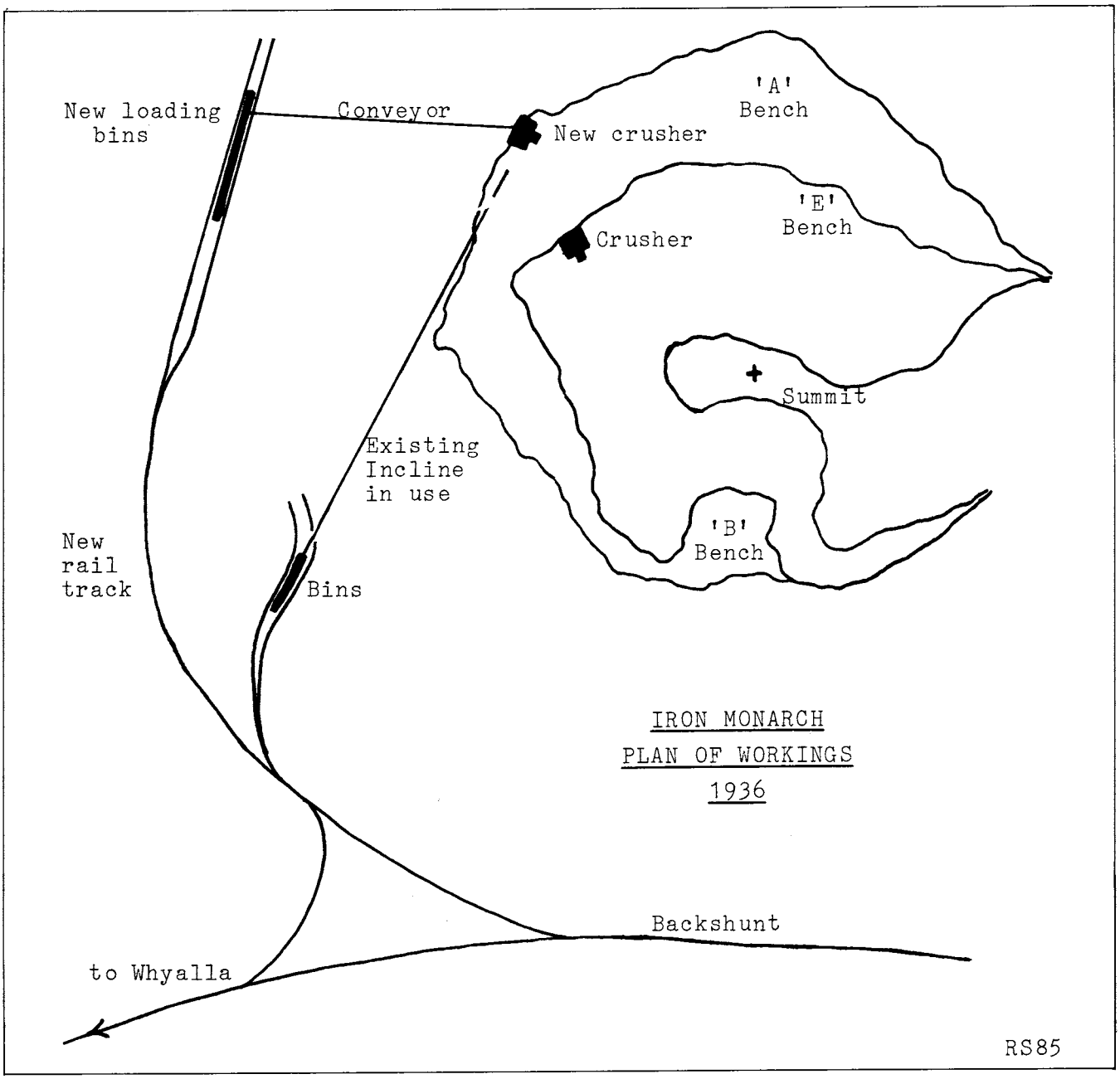
This 1934 scene of Iron Monarch and its bins shows Mikado No. 7 assisting to load 'D' class ore trucks. BHP Archives.



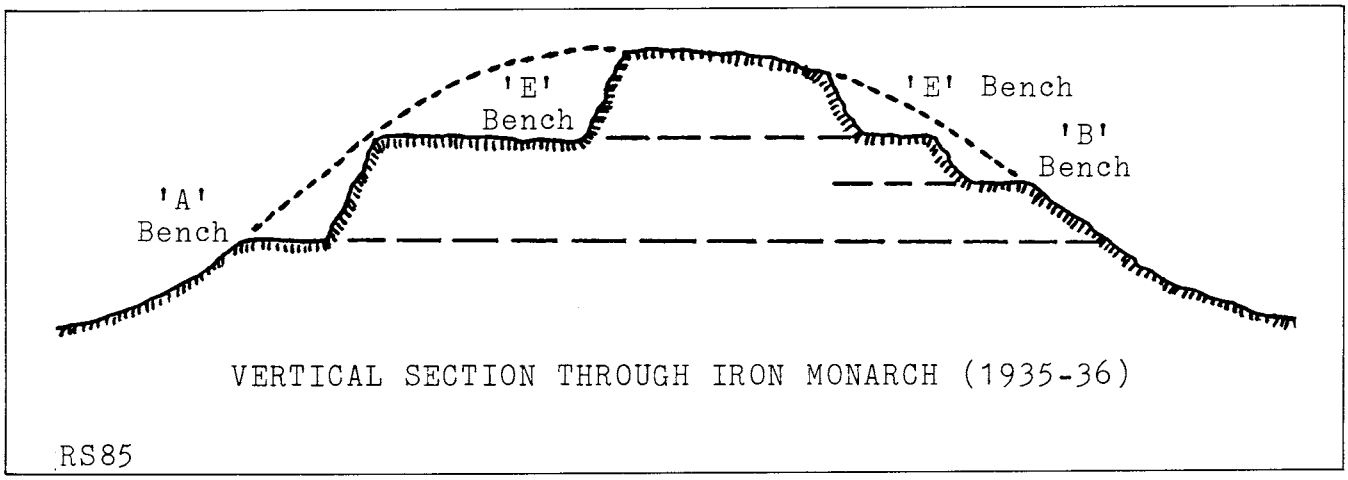
An electric shovel is busy loading 30 ton quarry trucks at Iron Monarch c.1933. The quarry train consists of the electric locomotive, a spacer car, and six quarry trucks, This was the standard quarry train used throughout the various quarries. BHP Archives.



BHP Baldwin No. 8 reverses its train around the Iron Monarch backshunt on 21 December 1939. Note the feedwater heater mounted on the boiler behind the stack.
BHP Archives.



IRON MONARCH
PLAN OF WORKINGS
1936



VERTICAL SECTION THROUGH IRON MONARCH (1935-36)

IMPROVED EFFICIENCY

'E' quarry, opened in 1928 as part of BHP's modernisation, was some 100 feet above the old 'A' bench and 'B' (on the other side of the hill), which had been opened up in 1914 to supply the steelworks. By 1936 it had produced seven of its estimated ten million ton capacity and what remained contained valuable concentrations of manganese, which were useful for blending with leaner ores to achieve best blast furnace feed.

Preparations were put in hand for the reopening of 'A' bench. Experience indicated that a working face height of 80-100 feet gave the most satisfactory conditions. With this height of face, the new bench level corresponded reasonably with the floor of the original 'A' bench level.

Opening of this bench provided the opportunity to review the techniques then in operation to see what changes could be made to simplify the operation. It was clear that the greatest waste of time and effort lay in the number of times the ore was being handled. From when it was first touched by the shovel to the time it was in the main line ore car on its way to Whyalla, the ore was loaded into four different ore cars, passed through three bins and in the interim the ore was also crushed. It had to be reduced down from 30 inches maximum to a maximum of 10 inches before being loaded for shipment to Whyalla for even further crushing.

Clearly, considerable savings could be made if some of the multiple handling could be avoided. It was decided that the best option lay in dispensing with the incline system of transferring ore to the main line loading bins, by the adoption of a belt conveyor system to a new loading bin. This in turn led the way to the introduction of secondary crushing at Iron Monarch. The cost of a belt conveying ore crushed to 4 inches by secondary crushers was much less than the cost of a conveyor capable of handling 10 inch material, as delivered from the primary crusher. Provision was made so ore from the existing 'E' bench could be diverted from the incline to the secondary crushing plant and the new conveyor system, using the Fordson locomotives.

The new plant comprised of primary crushing plant and surge bin; secondary crushing plant; ore pass and conveyor system; main line loading bin and revised track system from 'E' quarry crusher to new secondary crusher.

Operation was the same as that for 'E' bench, up to the point where ore was tipped from the 30 ton ore cars into the primary crusher. Broken ore delivered from the crusher passed into a storage bin, which provided storage for the secondary crushers. This was arranged so that it could also accept ore delivered from the 'E' bench primary crusher. The capacity of the bin was about 350 tons.

A pair of secondary jaw crushers then crushed the ore to 4 inches and discharged it into an ore pass of 8 feet diameter. The ore pass had a capacity of 400 tons and had walls lined throughout with 12 inch thick concrete. The aggregate consisted of hard manganiferous iron ore, into which 12 inch lengths of 90lb rail were embedded horizontally at close intervals to provide added wear resistance.

From the bottom of the ore pass, the ore fed through a chute onto the conveyor belt. Installation of the first section of conveyors required the driving of a tunnel into the hillside to the bottom of the ore pass. The tunnel was driven on an upgrade of 1:30 and at a reduced level, sufficiently low to permit the ore from the next level (below 'A' bench) to be delivered to the conveyor when built. This conveyor delivered ore to a second conveyor running above ground, thence to a third conveyor distributing the ore at the required point in the main line loading bin.

The main line loading bin was similar to the bin at the foot of 'A' bench incline. Both were designed for double track, so that half the main line train could be shunted into each side. The available capacity of the bin was 7,500 tons. 42 chutes were provided on each side of the bin for the loading of main line cars. Construction consisted of a main framing of steel to which was attached karri timbers, planted on the inside with ⅜" steel plate for protection against wear.

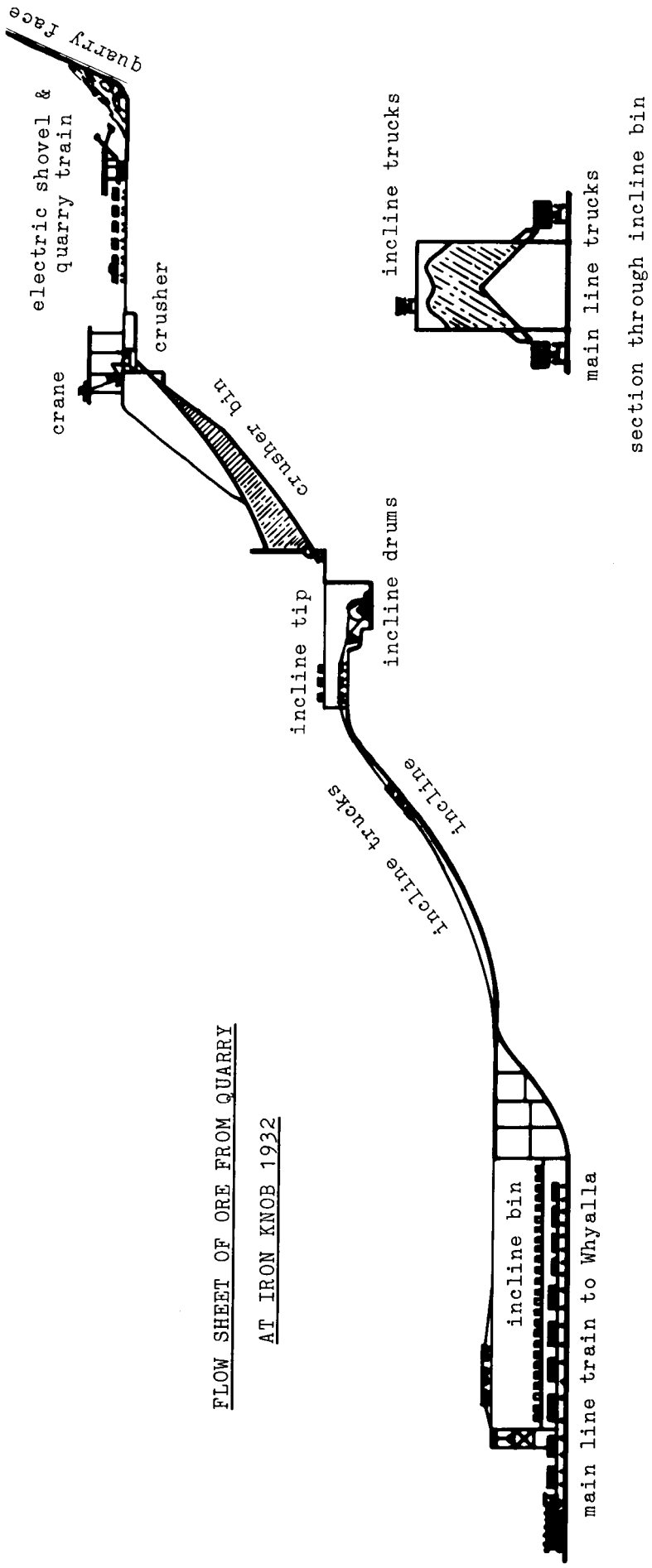
The site of the new bin was dictated by the location of the working face, and hence the crushers in relation to the shape of the hill. In order to avoid an unduly long conveyor system, it was necessary to locate the new bins further to the south of the earlier incline bins. At the most desirable location however, the ground had begun to rise from plain level on the approach to the hill. It was decided that the advantages of the chosen site were sufficient to justify the excavation of a large cutting in which the bins were installed. Construction of the bin and the tramway extension to it commenced during April 1935. The cutting's length was 40 chains, with a maximum depth of 40 feet and required a total excavation of 118,000 cubic yards. Of this amount about 55,000 cubic yards were excavated by horse scoop teams, excavating to a depth of about 12 feet. Fifteen teams were required to complete the work in the allotted time. The balance of 63,000 cubic yards was excavated by a steam shovel loading into hopper trucks.

Because of the limited dumping height of the shovel, it was necessary to excavate a series of benches about 6 feet deep, Similar to the technique used for the regrading of the 'soak'.

To equip the new bench for modern operation, in addition to the work described above, it was also necessary to purchase a fourth electric locomotive from Metropolitan Vickers, a third Bucyrus-Erie electric shovel and a further twelve 30 ton ore cars for the quarry. The whole of the new plant had its first run in June 1936.

The difficulties of the operation in the region are typified by the heavy rains of November 1933, which fell in the area. The rains provided sufficient water to completely fill Whyalla's 'big dam', which had been excavated in 1921 but had never previously held more than a foot or two of water. The capacity of the dam was 12,000,000 gallons.

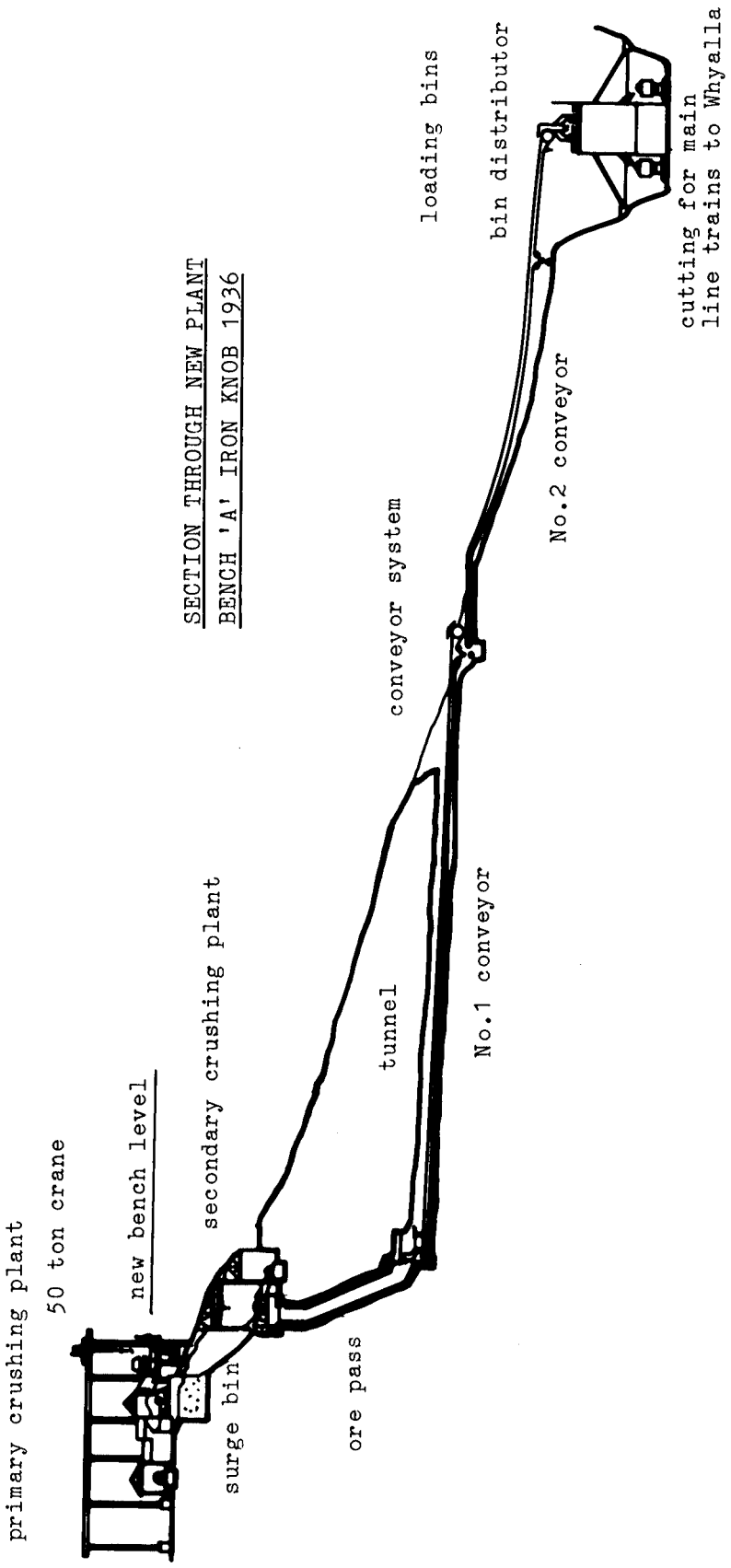
The rains were not always so beneficial. In early 1937 a washaway of the track occurred on the Iron Baron line at the 10¼ mile point, as a result of heavy rains falling in the vicinity of Mount Middleback. Water coming across country completely washed away a 6 foot high bank for a distance of 30 feet. As a result of a washaway, locomotive No. 5 and several trucks were derailed. In the accident No. 5 turned over onto its side, resulting in the death of the engineman, Bill Ring, and injury to the fireman.



FLOW SHEET OF ORE FROM QUARRY

AT IRON KNOB 1932

Drawing: R. Johnson



Drawing: R. Johnson

DEVELOPMENT AT WHYALLA

In 1914, when David Baker recommended to the board that the best site for the new steelworks was Newcastle, his recommendation was based on the fact that at that time it required about three times the quantity of coal to that of ironstone to produce steel at the steelworks. In the ensuing years however, the ratio had been reduced to about two-to-one. This change in the economics showed that it could be worthwhile carrying coke to Whyalla on the return from Newcastle, rather than returning empty, and that some ore could be economically smelted at Whyalla.

The board approved a recommendation that a blast furnace be built at Whyalla and construction commenced in 1938. Keeping in mind a blast furnace consumes materials in large quantities and also produces large quantities of slag waste and iron for shipment, it was decided that the best site for the blast furnace would be to the north of the existing tramway, powerhouse and workshops.

The Whyalla harbour was dredged at the tidal flats, about a mile north of the town, and the spoil obtained was used to fill two areas flanking the swinging basin. The first step in this construction was to build a triangular enclosure bank around the site, using stone obtained from a quarry adjacent to what is now the golf course. The northern reclamation area formed a triangular spit of about 74 acres, with the apex of the triangle about two-thirds of a mile seaward of the high water mark. The blast furnace site was to be in that area.

The reclaimed land was a mixture of sand and clay in various proportions. In such inconsistent soils all foundations of importance had to be carried on piles driven into the original sea-bed. About 3,000 timber and 2,000 concrete piles were driven for various units in the blast furnace area. In addition, 840 special iron-bark piles were used for the wharf and its approaches.

The suction dredge *GFH* arrived at Whyalla on 17 August 1938. Five weeks later a point had been reached where the discharge line could be coupled to commence filling the blast furnace site. Reclamation proceeded apace such that the first piles could be driven on 12 June 1939. For the main foundations about 18,000 cubic yards of concrete were poured utilising 4,000 tons of cement and 1,100 tons of reinforcing steel.

At the commencement of the project very little construction equipment was available at Whyalla and major items of equipment had to be procured. Two locomotive cranes of about seven tons capacity were obtained from the Australian Iron and Steel Kembla works, one of which was converted to 3'6" gauge. Both proved to be useful for the erection of lighter units and for material handling generally. In November 1939, a standard railway wrecking crane of 60 tons capacity, built by Cravens of Loughborough, England, was landed. It was a spectacular unit, boasting an 80 foot jib, capable of handling the heavier and higher lifts for the furnace construction.

In the early days of construction, before the arrival of the Craven crane, and when the harbour works were not sufficiently advanced to allow steamers to berth at the wharf, all components had to be shipped by barge from Port Pirie, then skidded from barge to rail trucks, from rail trucks to motor lorry, using the overhead crane in the machine shop, and finally delivered to the site.

The blast furnace was blown in on 26 May 1941, and from then the furnace consumed a continuous stream of materials and in return yielded a molten mixture about every four hours. The product of the furnace was iron and slag. These materials were separated on the cast house floor and each run into its own waiting ladle car. The molten iron was carried in one of five hot metal ladle cars, on which was mounted a removable brick lined ladle. After each cast, the full ladle car was hauled from the furnace to the pig mill, where the ladle was tilted by an overhead crane and the molten iron cast into a double strand pig casting machine.

Slag handling was performed by locomotives Nos. 1 and 2, which were modified by the addition of the necessary pipework and valves for them to operate the slag cars, which were tipped by means of steam cylinders. The slag was tipped into the remaining part of the unfilled reclamation area.

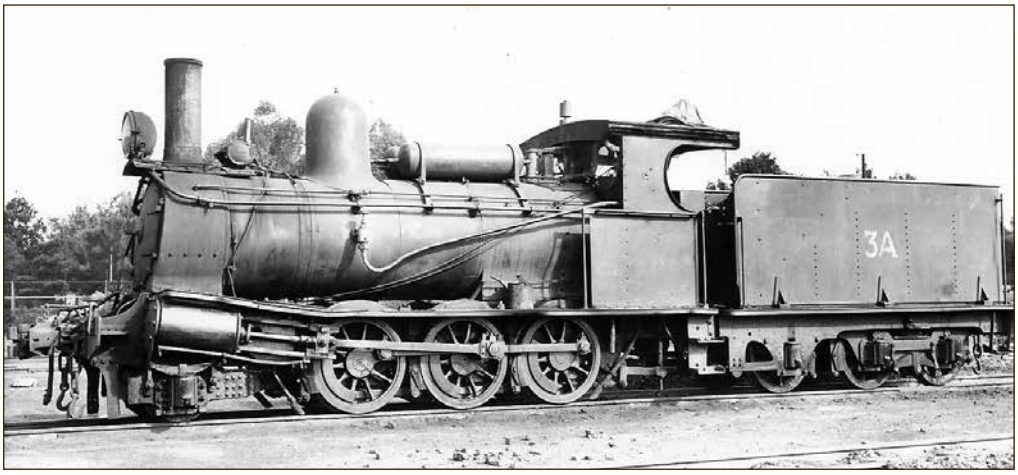
Two further locomotives were obtained from Broken Hill in December 1940, to assist with this work. These two locomotives of the same design as No. 2, were developed from a Beyer, Peacock design of 1865 for a 2-4-0 design for Norway. The design grew to 2-6-2 and was supplied originally to the Minas and Rio Railway Company in South America in 1881 (two units), with a further eight being built for the Alcoy and Gandia Railway of Spain.

No. 2A was Beyer, Peacock's 5125 of 1908. It was imported by the Broken Hill South mining company, who used it for shunting at Broken Hill until it was withdrawn in 1939.

After purchase by BHP, it was shipped to Whyalla and fitted with steam tipping gear and was used principally for hot metal shunting between the blast furnace and the pig plant. It was withdrawn at the time of gauge conversion in April 1962 and scrapped.

No. 3 was bought new by STC. It was Beyer, Peacock's 3170 of 1890. STC gave this engine to the Sulphide Corporation's South Mine at Broken Hill in compensation for a locomotive which had been destroyed in a collision. After transfer, it retained the number 5 issued by STC. It was used at the mine for shunting until sold to BHP in 1940.

At Whyalla it was fitted with tipping gear and allocated the number 3. It was used for similar duties to No. 2A until withdrawn in 1948 for boiler overhaul. It remained idle in the workshops until 1956. A new boiler was fitted and the locomotive became the general cargo shunter, with occasional periods at the blast furnace. It was used extensively for tracklaying, leading up to gauge conversion, which in turn led to its demise in May 1963. It was stored until 1967, when it was relocated to a children's playground in the town. During 1984 its motion was disassembled to facilitate its removal to the Pichi Richi Railway Preservation Society at Quorn. It is unlikely to be restored to operational condition.



BHP's No. 3A, with its unusual semi-bogie tender, stands 'on shed' at Whyalla locomotive depot c.1955. BHP Archives.

Beyer, Peacock's 5911 of 1914 was to the same design as Whyalla No. 1, and arrived in late 1940. It was built for the Zinc Corporation and shunted their mine tracks at Broken Hill until sold to BHP. At Whyalla it shunted at the blast furnace and wharf until July 1963, when it was withdrawn and cut up. There is some evidence that the cabs and hence builders plates of No. 1 and No. 1A were interchanged. An opportunity for this occurred in 1943, when both were shopped for major work.

Railways were required to perform other related duties in the area; the pigs produced were shuttled from the stockpile, assembled near the pig plant and later to the wharf, where steamers came to collect them. A regular passenger service was also run at shift change times between the town and the furnace.

In late 1943 another locomotive similar to the SAR 'Y' class 2-6-0 tender engines on which the tank engines were based, was issued to service. This engine, known as No. 3A, was a composite of parts, predominantly from two Silverton tramway engines, but including some parts from the related 2-6-2 tank engines already at Whyalla.

Both of No. 3A's ancestors were Beyer, Peacock products. The engine and most mechanical parts were pooled together from Silverton's second Y4 (Beyer, Peacock 3397 of 1891), which was sold to the Central mine at Broken Hill in 1907 and later sold to BHP in mid-1944. The boiler and tender used at Whyalla were taken from Silverton's Y2 (Beyer, Peacock 2972 of 1888), which was purchased for parts at the same time.

This mix-up of parts does not end there however, as the tender purchased with Y2 was in fact the tender from Y1 (Beyer, Peacock 2971 of 1888). which had been interchanged at Broken Hill some years earlier.

These engines were combined to produce a single locomotive, which was the smallest tender engine to operate at Whyalla.

The locomotive was a Y class, familiar on all South Australian narrow gauge tracks, but was fitted with a semi-bogie tender instead of the more usual rigid wheelbase three axle type.

No. 3A is reported to have been a popular locomotive with its crews, having much more space than non tender relatives. It was reported to be serviceable continuously from 1944, predominantly on handling pig iron to the wharf and on general cargo shunting.

By 1943, the pressure to supply the north of Australia with men and munitions was so great that the Commonwealth Government had requisitioned all available locomotive power for the Central and North Australia Railways. BHP searched the country for another unit to supplement its needs to Whyalla, but could obtain only a small 0-4-0 tank engine.

No. 10 was built by Baguley (No. 2025 of 1922), but carried plates reading 'Light Railways Company London 1926'. The reason behind the difference in dates is unknown. Two engines of this type were imported for construction of River Murray Works. The completion of the Barrage works at Goolwa in 1942, the last stage of the river works, rendered them redundant. One engine became a steam generator at a dry cleaning plant at Kilkenny, South Australia. The other was purchased by BHP in 1943, becoming No. 10. As built they sported a rather flimsy cab roof supported on slender corner pillars. The Baguley valve gear was a modified form of the radial valve gear, which avoided the use of a radial link, the only component which could not be simply manufactured in a very basic site workshop.

In order to obtain improved use of the locomotives, a coaling tower was erected late in 1944. This saved time previously taken to hand shovel the tender load of coal after each trip.

At the quarries, 'E' bench was almost worked out and 'A' was being rapidly depleted. The next bench quarry 'F' was opened in 1942 at a level 95 feet below 'A' bench. Initial operations were carried out, using the steam shovel loading into 10 ton quarry trucks, which dumped the ore into a chute leading to the crusher. When operations were suspended in 'E' quarry on 14 January 1943, the primary crusher and electrification equipment were transferred to 'F' bench.

The industrialisation of Whyalla was not limited to the building of the blast furnace. The dredging of the turning basin provided the deep water required into which ships could be launched. Wartime shipping losses provided the incentive to build more. A shipyard was built on the site and the keel of the first ship, a corvette for the Royal Australian Navy was laid in 1940, before the blast furnace was completed.

BHP AT RAPID BAY

Calcium carbonate, usually in the form of limestone, is an important ingredient in the process of iron and steelmaking. It is used as a flux in both the blast furnace and, after being calcined, in steelmaking.

When BHP started smelting silver, lead and zinc at Port Pirie they established a quarry to remove lime sand from the old dunes on Wardang Island situated off the coast of Yorke Peninsula in South Australia. The establishment of the steelworks at Newcastle led to a further demand for this lime sand, which was noted earlier in the development of the steelworks. The rapid growth of steelmaking led the Company to investigate alternate sources, preferably somewhat closer to the steelworks. A mine was developed in Tasmania (that is outside the scope of this book) and the role of Wardang Island returned to that of supplying the Port Pirie smelters with its requirements. The ultimate sale of the Port Pirie smelters by BHP in July 1925 severed all connections between BHP and Wardang Island.

In the early years of World War II, attention was focused on the site of a new source of limestone at a coastal cliff south of Adelaide. The quarry, to be known later as Rapid Bay, was hurriedly planned and construction was begun in 1941. The method of quarrying was based heavily on the experience gained at Iron Monarch. It was planned to dig the stone using a Ruston Bucyrus electric shovel, which would load the stone into cars. These ore cars were similar to the type used at Iron Monarch, but with side extensions to take advantage of the lower density of limestone compared with ironstone. The cars were to be hauled to a crusher by an electric locomotive of the same design as the Iron Knob electric locomotives. The ore would be crushed and stockpiled, awaiting the arrival of a steamer. Ships would be loaded by a conveyor fed from the stockpile.

The plan was thwarted to some extent by the unavailability of electric locomotives from Metropolitan Vickers in England, who were already fully committed to the European war effort. Metropolitan Vickers did agree however, to supply BHP's order of 4 April 1940 for two sets of electrical equipment. These were to be used in the manufacture under licence of two locomotives of the desired design by Perry Engineering of Adelaide. In the meantime, the quarry was opened and excavation for the bins was put in hand. The delivery of the locomotives continued to be a problem. At the end of 1940 the non-supply of frames by English Steel Corporation caused Perry's to estimate that delivery of the two units would be delayed until February and March 1941, respectively.

By May 1942 Perry Engineering revised the expected delivery date for the first locomotive; July 1942.

Perry's confidence seems to have been justified, as the quarry commenced operations on 13 August 1942, the first shipment going aboard the SS *Iron Knob* on 5 September 1942.

Limestone was loaded into the 30 ton ore cars, which would only accommodate 12 tons of the much less dense limestone.

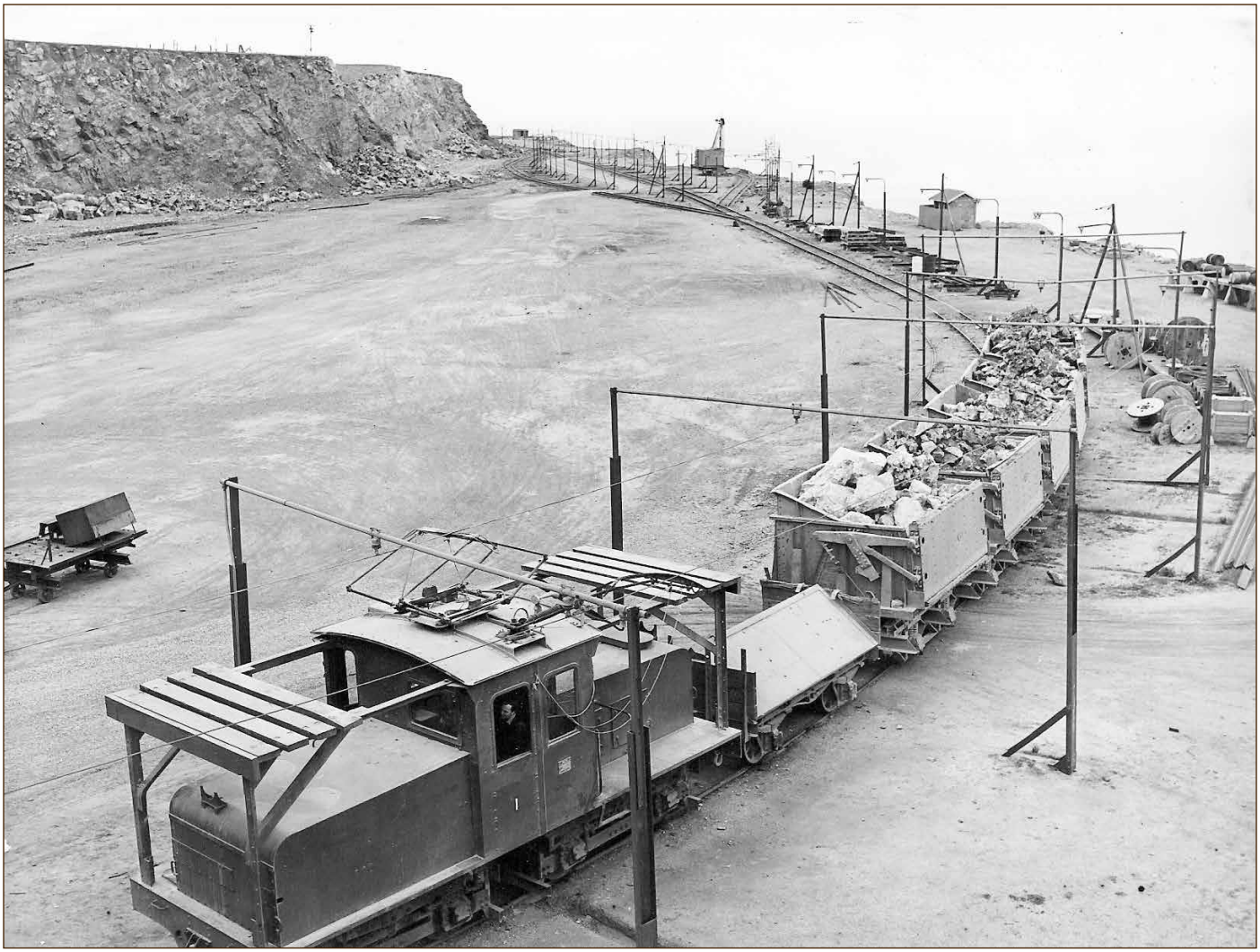
Nine cars marshalled in two rakes were each hauled by a single locomotive. The average length of haul was 2,500 feet. Technically, the quarry railway was the same as the Iron Knob scheme.

The initial delays did not cause the serious inconveniences that might have been expected. In the first half yearly period in which the plant was operational the shortage of shipping precluded any limestone shipments to the eastern states. The only deliveries were made to Whyalla. Production did however, get under way in the following period.

This mode of operation remained unchanged until 18 October 1955, when the electric locomotives and the tramway were removed and replaced by three 'Mack' trucks. The electric locomotives and rolling stock were placed in storage at Rapid Bay for some years. On 10 March 1960 the ore wagons were shipped to Whyalla and thence to Iron Knob.

As no tenders were received for the purchase of the two electric locomotives, they were unfortunately scrapped in August 1964.

An electric shovel loads a limestone quarry train at Rapid Bay during the 1950s. BHP Archives.



Electric locomotive No. 1 hauls a quarry train from the face to the crusher plant at Rapid Bay during the 1950s. BHP Archives.

The Rapid Bay crusher and conveyor plant dwarfs an electric locomotive on the edge of the quarry. Taken during the 1950s this photograph clearly shows the extent of mining construction plant and equipment associated with BHP at Rapid Bay, just 50 miles south of Adelaide! BHP Archives.

THE POST-1945 WAR YEARS

The war years were a busy time for Whyalla and its quarries. The many developments which had taken place had put a strain on the people and the plant. Following the Japanese surrender on 14 August 1945, a public celebration was organised at Whyalla in the form of a picnic at the 23 mile location. A special picnic train was organised. The response was overwhelming and the train consisted of every truck in Whyalla capable of carrying passengers, from the coach and brake vans to the stores vans and a number of open 'C' trucks. The celebrations were reported to have been a great success and were enjoyed by all.

The first stage in the construction of a water pipeline linking Whyalla with the Baroota reservoir near Port Pirie was completed in March 1943. The South Australian Government had agreed to the construction of a water supply pipeline from Morgan, on the Murray River, to Whyalla, in order to provide an adequate water supply for the town which was then beginning to grow rapidly. The Company constructed four 9,000 gallon water tank cars. The first of these was placed in service in the second half of 1946, just after the water reticulation system for the town was completed. The new tank cars allowed the old rectangular wooden and iron tank cars to be withdrawn. The eliptical tankers were retained for salt watering the track to kill weeds.

It might be supposed that the pipeline construction eliminated all of Whyalla's water problems. It certainly ended the shortage, but the period Saturday night to Monday morning, 16–18 February 1946 was a period of oversupply! In that period of time the rain gauge at the Whyalla Post Office recorded 650 points! The impact of nearly seven inches of rain in 48 hours can be best appreciated when it is kept in mind that the average annual rainfall for the district is only 10 inches per year.

The steady and widespread nature of the rain made flooding inevitable. Water banked up in the more remote parts of the district and began to flow seawards. At no place were the existing bridges and culverts engineered to withstand such unprecedented volumes of water. As a result washaways were numerous; road bridges, rail crossings and the pipeline suffered severe damage. The most serious damage occurred to the embankment at the foot of the 'soak' at the 23 mile point on the Iron Knob tramway. The Superintendent at Whyalla reported that he had inspected the tramway on the Monday morning. At 9.00 a.m. he found ‘a gap in the bank at the 10 mile and the usual washaway at the 12 mile siding’. As the water was running about one foot deep at the 15 mile, he had to turn back and arrange an aerial inspection. He found that at 12:00 noon ‘the 23 mile was flooded to the top of the bank. About 2:00 pm, the water went right over the top, and at 4:00 pm a gap about 700 feet wide had been washed right out and the water was still running strong.’

A closer examination undertaken the following day revised the estimate of the gap to 500 feet. An estimated 16,000 cubic yards of fill would be required to repair the damage. A steam shovel and two bulldozers were despatched to the site and repairs took three weeks to complete.

The reduced pressures of the immediate post-war times allowed the diminutive No. 10 to be withdrawn. The date of withdrawal is uncertain, but it is not mentioned in any post war reports. A photograph does exist of it in the early 1950s, showing smoke emerging from the funnel, but this is thought to have been a fire in the smoke box for the purposes of the actual photograph. The other locomotives continued their efforts unchanged. The coal strikes, which affected many of the Government railways at that time and also resulted in widespread change to oil burning in steam locomotives, had little effect in Whyalla. Without coal for the blast furnaces there was no demand for iron ore to be shipped out.

A new goods shed was built and opened on 23 April 1946 near the end of the back shunt to the blast furnace and wharf. It was bigger and thus could more easily handle the traffic being offered. It was more conveniently placed to take goods to and from the blast furnace wharf rather than the iron ore jetty, which had ceased to be the main unloading point for general cargo. In association with this change, the Company increased its charges to 7s 6d per ton for wharfage, transport to and from the wharf, handling and sorting.

In the early 1950s the Company began to consider (as with other State railways systems) the possibilities of alternative locomotive power types as replacements for the ageing main line steam locomotives.

On 2 June 1952 the Company issued a world-wide enquiry to fifteen major manufacturers for alternative locomotives. The enquiry yielded a very large quantity of detailed and often conflicting reports and claims by the prospective suppliers. The engineering department at Whyalla devoted considerable effort analysing this data and issued a report in November 1954. They concluded ‘the comparison of diesel and electric alternatives did not yield significant differences; both were shown to be capable of achieving savings of £100,000 per year, compared to steam. The main savings were in fuel, labour, maintenance and improved locomotive availability’.

Again, as in the 1920s, the management decided that the high initial capital investment for electrification was out of the question, but this time the possibility of using diesel traction was worth further investigation.

Meanwhile at the Knob, 'A' bench was becoming depleted, and while 'F' bench was to become the main operating level, another level known as 'G' bench was planned. It was decided to obtain two more electric locomotives, but Metropolitan Vickers was unable to supply them in the time required. As an alternative, the contract was let to Perry Engineering in Adelaide with only the electrical equipment being supplied from Metropolitan Vickers. For these locomotives, multiple unit connections were dispensed, resulting in a saving of £290 per locomotive. The commission of 5% on the mechanical components was paid as a royalty to Metropolitan Vickers, as has been done for the two Rapid Bay locomotives. Completion was scheduled for May 1953. At the same time nine more quarry trucks and additional 50 ton wagons for the main line were ordered. Delivery of the locomotives was delayed. They entered service in September 1954. Cost for the mechanical components was £20,505.

The solid chunky appearance is noticable in this 1930's photograph of Baldwin No. 6 at Whyalla. BHP Archives.

The main difference between the other 'big' Baldwins and No. 9 was its larger tender. No. 9 is seen here 'on shed' at Whyalla on 9 June 1954. D. Griffiths Collection.

DIESELISATION

Ten manufacturers were invited to quote for the supply of diesel electric locomotives suitable for operation on the Iron Knob tramway. They were to be capable of hauling trains of 2,000 tons net ore weight, resulting in a train gross weight of about 3,000 tons. This size of train, operated four times per day, would provide an annual capacity of 2.5 million tons of ore.

Six of the ten manufacturers approached indicated they were unable to quote against the tender!

Clyde Engineering of Granville, New South Wales, were offering their model G12B, a locally built Bo-Bo diesel electric locomotive powered by an imported EMD 567C V-12 two stroke diesel engine. This basic unit was the standard EMD 'export model'. This type had been supplied to the Queensland Railways in 1955 as their 1400 class (A1A-A1A), and the later 1450 class (Co-Co), the Kowloon Canton Railway and New Zealand Railways; the only difference being the absence of dynamic braking on the QR unit.

The Clyde G12B was the unit eventually selected. It was by far the cheapest unit, yet was still, in the opinion of the Whyalla investigating team, the best unit. At the same time these investigations were being conducted, the Government enacted legislation limiting quarry face heights to a maximum of 65 feet. The quarries at Iron Knob had operated since they were first electrified with a quarry face height of about 100 feet and the immediate effect on the quarries was the necessity to split the existing working benches into two levels! The increase of trackwork was a problem, but not as much as the resulting two levels having to feed into one crusher. This situation meant that it would be necessary to either install another crusher and its ancillary equipment for the additional level, or to haul either loaded or empty trains from one level to another. The second course of action was decided upon, but the electric locomotives which were designed for flat quarry operation had inadequate traction and braking power for ramps and could neither adequately control trains going down nor pull them up the grade. The solution came in the form of two diesel locomotives, externally the same as those being considered for the main line, but powered by an eight rather than a twelve cylinder engine.

Identical units were obtained by Victoria Railways and by Australian Portland Cement Company for operation in its limestone quarry near Geelong, Victoria. The locomotives for the quarries were the first diesel electric locomotives to be introduced to Whyalla, arriving before the main line units were delivered.

These smaller units ordered were Clyde G8 model, which was a General Motors (USA) standard export design built in Australia under licence. The units were fitted with a General Motors EMD 567CR V-8 two stroke diesel engine rated at 875 hp. This is connected to an EMD D15 generator and ultimately to four EMD D19 electric motors, one on each axle.

DE01 first ran under test on standard gauge bogies on NSWR metals in multiple with a similar unit destined for Australian Cement Company of Geelong on 24 August 1956. It carried builder's No. 56-109. After further testing over the next few days, DE01 was hauled to Newcastle on improvised bogies and loaded as deck cargo aboard the SS *Iron Whyalla*, arriving in Whyalla on 23 October 1956.

DE01 was unloaded at the fitting out wharf by the 150 ton crane, to enable delivery of the unit in assembled condition, minus only its bogies. The unit was placed onto its power bogies over the following two days and was used as a shunter in the yard. It officially entered service on 27 October 1956.

In the meantime DE02 was completed by Clyde in New South Wales and ran light engine trials on standard gauge bogies to Campbelltown and return under test on 14 September 1956. It too was hauled to Newcastle as part of a normal train load and shipped on the SS *Iron Whyalla*, arriving about twelve days after DE01. After two days in the workshops DE02 entered traffic on 17 November 1956. Clyde allocated builder's No. 56-111 to this unit.

On 21 November 1956 DE01 worked its first train to Iron Knob. This train consisted of:

26 fifty ton ore cars
2 stores vans
1 flat top.

This made a total of 490 tons. The return loaded train carried 1,460 tons of ore, making a gross load of 1,950 tons.

The first Clyde locomotive for the main line (builder's number 56-116) was landed at Whyalla on 20 November 1956. It also arrived as deck cargo on the SS *Iron Whyalla*. On 23 November 1956, after being assembled onto its power bogies, it was used around the yards, and designated DE03. The following day DE03 hauled a test train to Iron Knob, consisting of:

28 fifty ton ore cars
9,000 gallon water tank
1 guard's van.

The gross load for the outward trip was 550 tons. On the return journey the train was loaded with 1,650 tons of ore, resulting in a gross train load of 2,170 tons. Clearly, one diesel locomotive could haul the same tonnage as one Mikado steam locomotive.

The arrival of DE04 on 28 November 1956 and its entry into service on 8 December enabled a twin unit test train to be run, consisting of:

2 locomotives (DE03/DE04)
54 fifty ton ore cars
1 guard's van.

DE 01 is lifted by the 150 ton fitting-out wharf crane at Whyalla on 23 October 1956. DE 01 was deck cargo on SS 'Iron Whyalla', berthed next to SS 'Iron Spencer'. BHP Archives.

A trial on 13 January 1957 was run at a restricted speed of 30 mph and took 65 minutes for the empty run and 74 minutes for the return trip. The train was 1,700 feet long and grossed 4,100 tons, carrying an ore payload of 3,100 tons. This figure was never approached by the Mikados, even when double-heading!

Both units, DE01 and DE02, were transferred to the quarries during January 1957. One of the units was in use six days per week on three shifts, the other was called upon for an average of three to four days per week, depending on production demands. The units were brought down from the quarries to Whyalla at 500 hour intervals for servicing.

The heavy grades in the quarries, which had been insurmountable to the electrics, were tackled with ease by the Clyde units.

They were capable of hauling eleven 30 ton ore cars from the quarry face to the crusher. The downhill trips however, were causing some problems. Very heavy brake wear was found to be occurring on the locomotives, due to the ore cars being without brakes. This condition was accentuated by the harsh abrasive nature of the quarry dust. The only alternative, other than fitting brakes to all the quarry trucks, was that the locomotives were to be fitted with dynamic brakes. These brakes, fitted in early 1958, proved to be very effective in reducing the brake shoe wear and enabled the train to be controlled reliably at all times. The wheel brakes were only required to bring the train to a complete halt. The locomotives underwent little further change until the quarry railways were later removed altogether, and the haulage of ore was taken over by off-highway trucks.

Another two diesel locomotives were required as soon as possible, so that diesel working of the main line could be accomplished entirely. Clyde were however, having some difficulties meeting their delivery commitments to BHP, as they were at the same time also trying to meet orders with Victoria Railways, New Zealand Railways and others; all for the same model of locomotive.

DE05 arrived in Whyalla on 12 May 1957. This locomotive carried builder's No. 57-136 and entered traffic two days later. The remaining engine in the order, DE06, carried builder's No. 57-156. It arrived at Whyalla on 5 August 1957, also entering service two days later.

By the end of 1957 the Company was secure in its use of diesel traction. Steam had been displaced from main line duties in less than one year and all but Mikado No. 7 had been cut up for scrap. The smaller Baldwins were also of no further use to the railway department. No. 5 was cut up, but No. 4 found a reprieve, if rather an inglorious one, as a portable steam boiler to be used with a pile driver.

The steam locomotives had some manner of revenge when, on 1 August 1958 DE04 was shunting the steam driven Craven crane. An attempt was made to haul the crane under the old coaling tower. The crane did not fit and brought the tower down onto both the crane and the diesel engine. Damage to the steam crane was minor, but the diesel was put out of service. The engine's radiator, radiator fan and speed increaser drive from the main engine were damaged, and all needed replacement. Delivery of spares from Clyde was indefinite and probably had to be imported. It became necessary to run both remaining steam engines whenever any of the other diesels were being serviced, in order to maintain production at the desired level. DE04 was eventually returned to service six months later on 20 January 1959. Steam engines were never again required on the main line to haul ore trains.

IRON BARON AND THE MAIN LINE

Production at Iron Baron and Prince mines was commenced in the early 1930s, as described earlier, using the contract party system of mining. During the 1940s war years two events had happened that made quarry operation no longer useful. The first was the shipping shortage to take the ore to the eastern states. This resulted in that the demand for ironstone could now be met from the one single quarry at Iron Monarch. The second reason was the chronic shortage of labour as a result of recruitment by the armed forces. As a result, production from the Baron dwindled, as the demand was insufficient to justify mechanisation to replace the absent labour.

Production ceased at Iron Baron on 8 February 1943 and the adjacent Iron Prince quarry was shut down in June 1945. The line to the Baron lay unused, being of value only to the local termite population. An inspection in April 1948 estimated that of a total of 36,000 sleepers in the track, 2,246 needed replacement for the following reasons:

white ants	1,958
dry rot	131
cracked or broken	108
doubtful	49

It was noted that reconditioning of the track would take some time, if it was required, as many rail joints and spikes were also loose and needed attention.

No decision was made at that time to proceed with upgrading of the track and it continued to lay idle until 1954. A report in August 1954 stated that the track was unsafe for heavy traffic and that one third of the sleepers needed to be replaced. A decision foIIowed this report that resulted in the spending of £13 million to mechanise the quarry and to install crushing and train loading equipment.

The earlier steam shovel and hand loaders were to be replaced with two Marion 151 M electric shovels, each of 6 cubic yard capacity. The horses and quarry tramway tipping directly into main line ore cars were replaced by 30 ton capacity off-highway 'Mack' trucks, which would transport the ore from the shovels to the primary crushing plant, and the waste to the mullock dump. The primary crusher fed a secondary crusher, from which the ore was run by conveyor to one of four cylindrical silo-like bins each of 2,000 tons capacity. Ironstone was fed from the bottom of each bin through one of four chutes into the standard 50 ton ore cars for haulage to Whyalla. The average loading time for 2,000 tons of ore was only about 25 minutes.

Power for the new equipment was transmitted to Iron Baron by a new 33,000 volt transmission line, but water supply was not considered to warrant a pipeline. The water was to be supplied by 9,000 gallon water tank cars hauled by ore trains. The water supply was to be delivered into a 30,000 gallon tank at the rail side and thence to an elevated tank of 100,000 gallon capacity on the hill. This would provide adequate storage and sufficient head to give good pressure at the tap. Water was reticulated from this tank to the quarries and to the newly established houses in the town. These houses replaced the rough accommodation of the contract parties. Quarrying once again recommenced on 13 January 1958.

THE STEELWORKS

On 7 March 1958, the South Australian Premier, Sir Thomas Playford and the Chairman of Directors of BHP, Mr Colin Syme, released the following statement:

'Agreement has been reached in broad principle between the South Australian Government and the Broken Hill Proprietary Company Limited for an extension of its steel industry in South Australia by the construction of steel making plant, rolling mills and associated works at Whyalla, subject to detailed agreement being reached with the Company and subsequent ratification by the South Australian Parliament. The Broken Hill Proprietary Company Limited agrees to spend £30 million on this project.'

The implications of the announcement on the tramway system were profound. The tracks at the time consisted of a heavy duty main line from Whyalla to Iron Knob and Iron Baron, which had by then been predominantly re-laid with 94 lb rail. The tracks around the blast furnace and subsidiary plant were generally lighter. The notable feature of all the trackwork however, was its common gauge of 3'6".

The addition of a second blast furnace and its association with modern steelmaking furnaces would require that instead of small tonnages of iron being moved about mile to the pig mill, about three times this quantity of molten iron would need to be shifted about ¼ mile from the blast furnace to the steel plant. The alternatives were to use the existing track gauge, extend it to the steel plant and use more of the hot metal ladle cars than presently in use; or to change to a standard gauge rail system and take advantage of the large 200 ton capacity torpedo ladles which could then be accommodated. The possibility of a connection with the standard gauge systems of the Commonwealth Railways at Port Augusta also supported this approach.

A dual gauge track arrangement was selected. All tracks in the blast furnace area were to be changed to 4'8½" gauge, with the exception of the ore line up the trestle on which the ore supply was delivered.

Gauge conversion was envisioned in two stages. The first stage required the construction of a new narrow gauge track from the main Knob line on a more direct route to the blast furnaces, which would avoid the existing workshops and eliminate a switchback at the goods shed. At the same time all new standard gauge tracks would be built to serve the steelworks and the new blast furnace.

The second stage was scheduled to be undertaken during the planned shutdown of No. 1 blast furnace for reline in 1963. At that time existing narrow gauge tracks in the area would be replaced by standard gauge tracks.

During the first phase narrow gauge four wheeled wagons, while in for scheduled repairs, were modified by the addition of new spring mountings. During the four month reline these were quickly fitted with new axles and the springs were re-attached to the modified mountings.

It was expected that three standard gauge diesel shunting locomotives would be required for service at the time of the changeover. These locomotives would need to be provided with large compressed air capacity to operate slag tipping ladles. Their cost was estimated at £135,000.

The conversion was undertaken in a manner very close to that planned. The alteration of some tracks to dual gauge in and around the workshops deserves greater detail. The old narrow gauge tracks were re-sleepered in these areas with standard gauge sleepers and a third rail was laid outside one of the existing rails so that the two gauges then shared one rail in common, but running on different centre lines. Only one section of track was unsuitable for this arrangement; that being the approaches and interior of the Diesel Locomotive Shop. These tracks were laid with four rails to maintain a common centre. A 3-4 rail crossover with a fixed heel was incorporated in this track to enable the change from one track type to the other.

Special turnouts were developed for the dual gauge track. For standardisation a 1:10 frog in 94 lb rail was used. Whereas in single gauge track only three types of turnout are possible, i.e. left, right and 'Y', in dual gauge track there are 28 possibilities! To limit the growth of spare parts, nine were selected to meet all of Whyalla's needs.

During the conversion it was apparent that track occupation to convert the track was in some areas restricted. This problem was overcome, in part, by prefabricating many of the points and lifting them into place, using a mobile crane.

The trackwork to be used for the transport of hot metal was specially constructed to carry the heavy loads. Hot metal cars, known as 'Treadwells' after their designers, are a particularly heavy vehicle. Empty they weigh about 156 tons and with a new lining carry 230 tons of 'metal' when loaded. Although this weight is distributed over eight axles, the load still amounts to 48 tons per axle! With a worn lining this is increased to 53 tons per axle. In order to carry this load the track was laid with 147 lb rail, which is normally installed for crane tracks. In association with this, a special turnout was designed which retains the normal 1:20 track cant through the turnout to match the coning of the wheel tyres.

Gauge conversion commenced in early 1961. Work progressed continuously until the blast furnace was shut down for repair on 23 May 1963, when regauging of the blast furnace tracks was completed. At the time of blowing in the blast furnace however, the slag ladle cars had not been converted from steam to compressed air operation. This problem had been foreseen, and two standard gauge 0-4-0 steam engines had been obtained from Newcastle in 1962 as a stop gap arrangement.

These two locomotives were built by BHP Newcastle to a Porter design already in use at their steelworks, The first engine to be built received no builder's number but entered service as No. 21. It had 15" x 24" cylinders, 46" wheels and 170 psi boiler pressure. The short wheelbase enabled operation through restricted curves, despite being a fairly large locomotive: 43 tons. It was rebuilt in 1951 and in this new style arrived in Whyalla. With a heavier frame and cylinders bored out to 15¼ in x 24 in, the tractive effort was reduced from 16,000 lb to 14,600 lb. The weight was increased to 51 tons – not far short of the small Baldwin engines – and it was all available for adhesion! It was in fact 75% of the adhesive weight of the Mikados. At Whyalla, the locomotive was placed on the power roster as B2.

Whyalla's B1 was originally built at Newcastle as No. 25. While of the same design, it differed in minor detail. Wheel diameter was 47 inches and boiler pressure was 175 psi. The larger wheels more than counteracted the pressure increase, thus tractive effort was reduced to 15,800 lb. No. 25 was rebuilt about 1950, similarly to No. 21, The boiler pressure was reduced to 150 psi and with a weight increase from 47 to 51 tons after this rebuild, tractive effort was reduced to 13,600 lbs, Before transfer to Whyalla, it lost its thick wheel tyres, reducing wheel diameter to 46 inches and increasing tractive effort to 14,100 lb.

After their short use in Whyalla, both were scrapped. B2 was cut up in September 1965 soon after its last use, while B1 remained idle near the heavy machine shop until December 1968.

Top Right: Prior to standardisation of the steelworks, one of the 2-6-2 tank locomotives shunts three slag pot wagons at No. 1 blast furnace, Whyalla c.1960. BHP Archives.

Ex-Newcastle steelworks standard gauge steam locomotive B2 hauls a rake of three hot metal ladle cars from the blast furnace at Whyalla during 1964. D. Worth.

MORE DIESELS AND THE LAST DAYS OF STEAM

The diesel locomotives had quickly proved themselves on the main line and regularly hauled long trains. The long trains however, and the dust, created by the higher speeds of the diesels were problems in themselves. Communication between driver and guard meant a long walk! The guard became reluctant to stop the train unless he was absolutely certain that the train had a hot box or a derailment problem. There were obvious dangers in this method of working. The advantages of radio communication between driver, guard and train control were numerous. The existing safe working system relied only on telephones at each end of the main line tracks and at Baron Junction.

Radio communication was fitted to locomotives and guards' vans. A base station was installed at Mount Laura, five miles from Whyalla. This was automatically controlled by landline from the train control office at Whyalla. The requirement that communication be possible at all times with trains, despite substantial radio 'shielding' at some locations along the track, was satisfied by the provision of a 'talk through' repeater base of 50 watt aerial power. A call from a locomotive or guard's van was transmitted on 72.62 MHz to the base receiver; the base transmitter retransmitted it at 77.84 MHz, to be received on this frequency by all locomotives, guards' vans and simultaneously by landline at the train control office. Outward calls from train control were also distributed at 77.84 MHz.

Locomotive requirements at the quarries and on the main line were reviewed in February 1960. The impending exhaustion of 'F' bench, which was operated on the level by the electric locomotives, meant that after the closure of the old bench all ore would have to be hauled from 'G' quarry. Movement from this quarry however, required hauling over 1:40 grades which had already been shown to be beyond the capability of the electric locomotives and had led to the purchase of DE01 and DE02.

It was considered that production at full capacity in the quarry could not be met with only the two diesel locomotives. When either unit was 'down' for maintenance or overhaul, the quarry would immediately be reduced to about half capacity. In view of the fact that major overhaul periods for the diesel locomotives were approaching, a third locomotive for quarry operations was requested.

A similar overhaul crisis was also looming for main line locomotives, where there were four units available. Three were in continuous service, two on the main line and one as the main line shunter. The fourth locomotive was available during normal servicing and repair periods. It was foreseen that during the impending major overhauls, the absence of the backup unit would necessitate a steam locomotive being continuously available.

The prospect of steam on the main line was considered to be most undesirable. Another diesel locomotive was the only alternative, which could satisfy both these needs. At an estimated cost of £94,000, it was thought to be adequate justification for its purchase. The directors of the Company agreed and an order was placed with Clyde Engineering, despite their earlier poor delivery performance. The locomotive (same type as previous main line locomotives) arrived in Whyalla on 18 June 1961. It carried builder's No. 61-236, identified by BHP as DE07, and entered service on 27 June 1961 as a shunter.

It was noted in the description of the steelworks that gauge conversion would create a need for three new standard gauge locomotives. The choice of which standard gauge locomotives to purchase lay with two units. One was a diesel electric, identical with those at the time being built by A. Goninan & Company Limited of Broadmeadow, New South Wales, for the Newcastle steelworks. The second unit was a diesel hydraulic offered by Walkers Limited of Maryborough, Queensland. Landed price of the Goninan product was £53,731, while the Walker's was £44,470.

Favourable experience at Newcastle, Port Kembla and Whyalla, in addition to American steelplants, supported a decision in favour of the diesel electric. On the other hand, the diesel hydraulic option was offered at a total saving of £27,000 for the three locomotives required. It was also noted that the diesel hydraulic locomotives were being offered by a reputable firm anxious to become established in the diesel traction field, and that both locomotives offered were to be powered by the same Cummins diesel engines. The untried part of the package was a Voith transmission. This item had had extensive use on the German Federal Railways. On this basis, a decision was reached to purchase the locomotives offered by Walkers Limited.

The first locomotive arrived at Whyalla by sea on 26 March 1962, and was unloaded with the aid of the Craven crane. The locomotive carried builder's No. 573 and was identified by BHP as DH1. It entered service on the new standard gauge tracks at the blast furnace on 11 April 1962, and was Whyalla's first standard gauge locomotive.

The other two locomotives, DH2 and DH3, were delivered on 12 April and 7 May that year, entering service on 25 April and 22 May, respectively.

The first three DHs took over the existing work of the steam engines. Due to the extra work entailed in hauling molten iron and moving ingots, a further two were required in time to commence operation of the steelworks. These too were supplied by Walkers and differed only slightly by having slatted vents in the hood doors rather than a mesh screen panel. The two locomotives were numbered and delivered as below:

Builder's No	BHP No.	Date arrived	Date in service
579/1965	DH 4	20 August 1965	24 August 1965
580/1965	DH 5	2 September 1965	6 September 1965

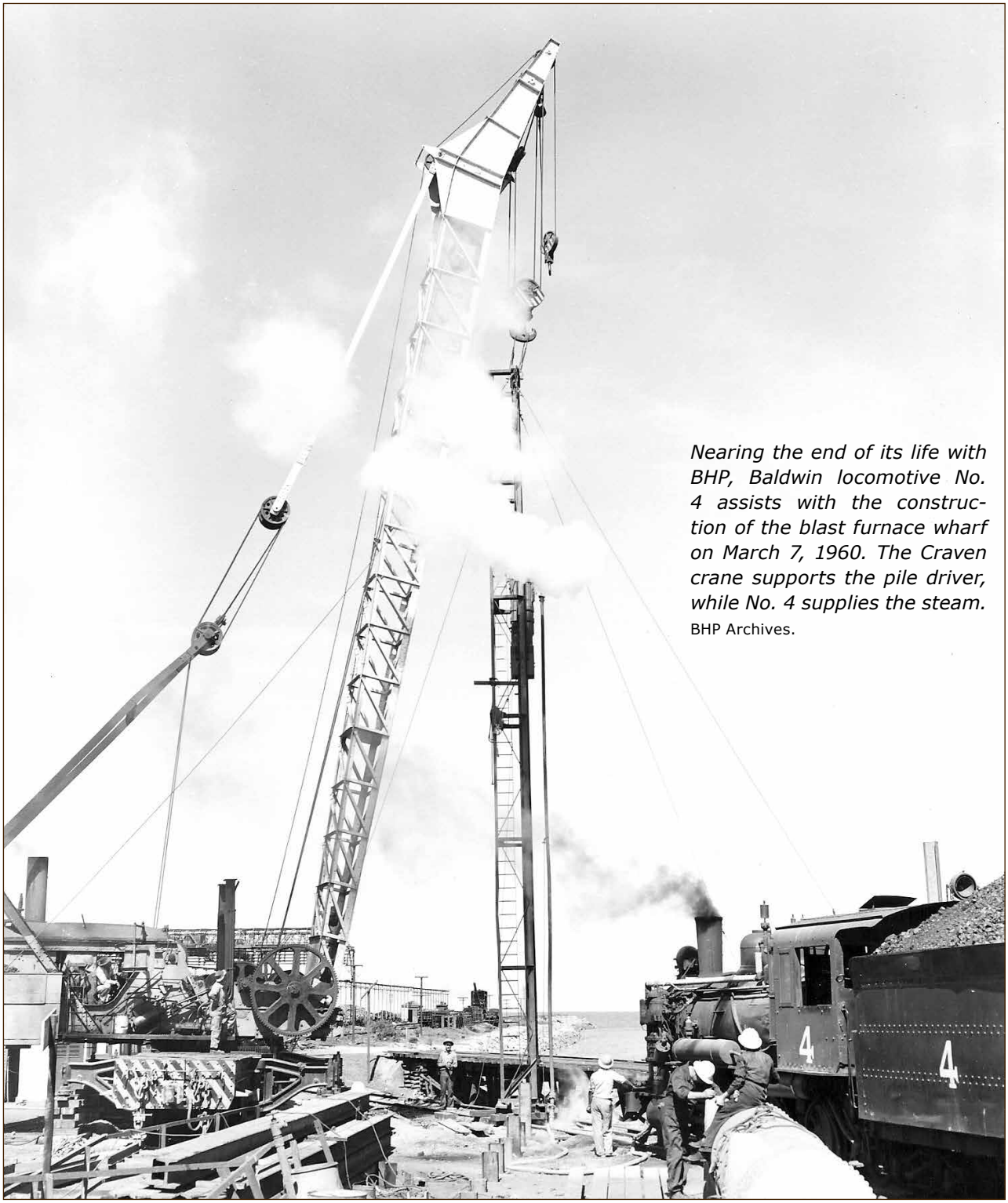
The only steam locomotive to remain after full steelworks commissioning was No. 4. It was retained primarily as a portable boiler and was used extensively to power a steam pile driver for the extension of the blast furnace wharf at Whyalla during the steelworks construction. Due to this fact No. 4 never lost its capability to move under its own steam.

After discussions with BHP, the State division of the Australian Railway Historical Society organised a special steam train tour over the BHP tramway system. This tour ran to Iron Knob and Iron Baron on 8/9 August 1964. This was the last occasion a steam locomotive visited the mines and became the last steam locomotive on BHP's books at Whyalla.

No. 4 spent some time during 1967 distilling water at the shipyard 'fitting out' wharf, until the boiler was condemned in 1968, and the tender was cut down to form a flat car. The engine unit lay idle until a request was received from the Mile End Railway Museum to preserve it.

This request was granted and No. 4's engine unit entered their Museum on 19 June 1969. During 1977 the original tender underframe was located, and forwarded to the Museum on 21 October 1977. The Iron Knob School kindly donated their bell to the Museum, as it was originally off No. 4.

During 1984 the Museum manufactured a new tender body for No. 4, resulting in once again a complete Baldwin 4-6-0 locomotive.



Nearing the end of its life with BHP, Baldwin locomotive No. 4 assists with the construction of the blast furnace wharf on March 7, 1960. The Craven crane supports the pile driver, while No. 4 supplies the steam.
BHP Archives.

The last run of No. 4! A special steam hauled train operated over BHP's main lines to Iron Knob and Iron Baron over the weekend of 8-9 August 1964. (Above) No. 4 prepares to depart Whyalla working this special, while (below) it pauses for photographs enroute to Iron Knob. Both: D. Worth.

END OF THE QUARRY TRAMWAYS

The first off-road Mack truck was introduced into the quarries at the Knob on 6 April 1956, following their successful introduction into the Iron Baron quarry. The Mack trucks quickly established an excellent record in quarry operation, having the advantage of being more able to negotiate inclines than quarry trains, and not requiring repeated track shifting to follow the advance of the quarry

In the first half of 1958, the breakdown of the share of ironstone shifting in the quarry was:

6 Electric locomotives	481,900 tons	'F' and 'G' benches
2 Diesel locomotives	741,943 tons	'G1' bench
4 Mack trucks	886,956 tons	

By the first half of 1 963 the Mack trucks had cornered a much greater share of the operation, taking all the growth and some of the work of the diesel and electric locomotives:

6 Electric locomotives	352,290 tons
2 Diesel locomotives	518,388 tons
4 Mack trucks	1,037,334 tons

Just as the other upper levels had been eaten away by the shovels, so too was 'G' bench, and when operation on 'G1' bench ceased early in 1965, the two diesels were not required until the new 'H' level could be developed. The two diesels were temporarily returned to Whyalla. In the new quarry 4,000 feet of narrow gauge track was laid and the diesels were returned to work in the quarry. Hauling up 1:50 grades however, limited them to only nine trucks. They were clearly not as suited to uphill work as the Mack trucks, which handled 62% of the total ore late in 1965. During the following half year the Mack fleet was increased to ten trucks and it was clear that profitability would be improved by using all off-road trucks. The electric locomotives had been relegated to shunting at the crusher. The relative share of each mode was:

2 Diesel electrics	1,203,574 tons
2 Mack trucks	2,149,823 tons

The electrics were limited by tightening rail curves and the limitations of an ageing mercury rectifier. The overhead was removed from the quarry proper, greatly simplifying track shifting and reducing the hazard of electrocution. The old Davenport engine, formerly PE1 which had been converted to straight electric during the war, was relocated back to Whyalla where a diesel engine was fitted.

The end to quarry traction came on 12 July 1968, when the two diesels were withdrawn back to Whyalla. One electric locomotive was placed opposite the Iron Knob oval for posterity, while the other units were sent to Whyalla, to await their fate. No. 1 was subsequently donated to the Australian Electric Transport Museum at St Kilda, South Australia, where it still awaits restoration.

The bogies off one of the locomotives (probably E4) were regauged for use under the repowered Davenport DE10. A second locomotive was used as a guard's van to provide shelter from the dust on the trip from the screening plant (adjacent to the tramway) to the blast furnace bins. However, it limited train size and restricted communication with the driver. It did not succeed either in providing dust protection, so it was withdrawn a few months later and was scrapped.

The unattractive result of the end of the quarry tramways. Electric shovel No. 3 loads a 'Mack' road truck in Iron Monarch, c.1960. BHP Archives.

MORE CHANGES AT WHYALLA

The mighty locomotive was not immune from the predations of the automobile and its derivatives at the steelworks any more than it was at the quarries. Rail tracks were laid in and around the BOS steelmaking plant to carry ingot moulds to and from the teeming stage and out to the stripping yard. The shunting of rakes of moulds was required to be carried out at a frequency at which heats of steel could be made; that is as little as 40 minutes per cycle. In order to reduce the requirement for a crew of three to drive, observe and act as guard, a modified 'Hough' tractor was provided. This machine looked like a large front end loader in which the bucket was replaced by a heavy buffer beam to which was attached a coupler. The coupling was fixed in the closed position and the coupler was attached and detached from the rake of wagons by using the 'bucket' controls to move the coupling vertically. This unit proved very successful, having the ability to quickly manoeuvre in and out between the rakes without the problem of points and run around tracks.

Some jobs however, are more suited to true train operation. The supplying of ore to the blast furnace became a huge task when the second blast furnace was built. The new furnace could consume ore twice as fast as the original unit. It was noted previously that the old Davenport engine (PE01) had been rescued from the quarries. It had been repowered, using two diesel engines. These replaced the petrol engines that were removed during the 1940s. The locomotive was to have been used to feed the blast furnaces, but the heavy grade up the trestle proved to be too much for it and a sixth diesel hydraulic locomotive was ordered from Walkers for the task.

Walkers supplied locomotive Builder's No. 582-68 as BHP's DH6. It arrived on 1 March 1968 and entered service on 14th.

This locomotive was readily interchangeable with DH1, which had its pilot beam cut away slightly to provide clearance on the blast furnace bins. The interchange was used for the first time late in 1969 when DH6 suffered a clutch failure, resulting in wheel flats.

The untried hydraulic transmission, which had been the cause of some concern at the time of placing the order, showed just cause for alarm when more problems were encountered in early 1971. As a result, the gearboxes on the locomotives were progressively converted from a two to a single speed arrangement. The Cummins engines also began to give problems and a reconditioned engine was required for DH6 in early 1972. The engine situation deteriorated rapidly in the next two years and a decision was made to re-power them, although this was delayed by unavailability of parts.

DH5 was the first to be re-powered. The new engines were Cummins V903 V-8 diesels, each rated at 220 kW. The hydraulic transmissions were replaced at the same time by units made by Niigata; final drive via cardan shafts to the bogies remained the same.

During the engine rebuilding programme, the exhaust stack was rerouted away from the centre of each cab front and the cab window was enlarged to provide a full width view in both directions. DH4 was next repowered and the others followed as shown below:

Locomotive No.	Date Repowered
DH5	17 March 1976
DH4	13 September 1976
DH3	1 June 1977
DH2	5 December 1978
DH1	18 December 1979
DH6	29 August 1980

The old Davenport was, it seems, somebody's pet project, as it was re-engined again with a pair of Mack engines and tested on 3 November 1967. This time it was somewhat more successful, but with the arrival of the new diesel hydraulic from Walkers (DH6), it once more became the 'ugly duckling'. A potentially useful task was envisioned as a relief engine in the steelworks when maintenance on the DHs was required. A gauge conversion was undertaken by mounting the engine on a pair of bogies salvaged from one of the former Rapid Bay electric locomotives, which were easier to regauge than its own. Sporting the new number DE10, the former PE1 re-entered traffic on 30 April 1968. It was then no longer necessary to keep one of the Clyde DE locomotives on standard gauge as a relief unit.

DE10 had a chequered career. It saw regular use, due to the unreliability of the DH locomotive transmissions but was not popular with crews, as it was cramped and engine fumes were found to infiltrate the cab. A plan was drawn up for the cab to be replaced with a design based on the Walkers engines, but it never eventuated.

A cutback in the steelworks production in mid-1977 saw DE10 relegated to a siding outside the steelworks maintenance shed, where it remained until early 1982. It was then officially withdrawn and removed to a site outside the Diesel Loco Shop, where it remained until mid-1984. The Mack engines were removed (they were still almost new) and the empty shell was donated to the Pichi Richi Railway Preservation Society, which had earlier obtained its original narrow gauge bogies.

The Walker diesel hydraulic locomotives received various colour schemes over the years. DH 5, working on standard gauge, shunts on inter-works tracks at Whyalla during 1980. D. Griffiths.

DH 1 sports its new blue and yellow colours, as it shunts on narrow gauge near the locomotive workshops in 1982. D. Griffiths.

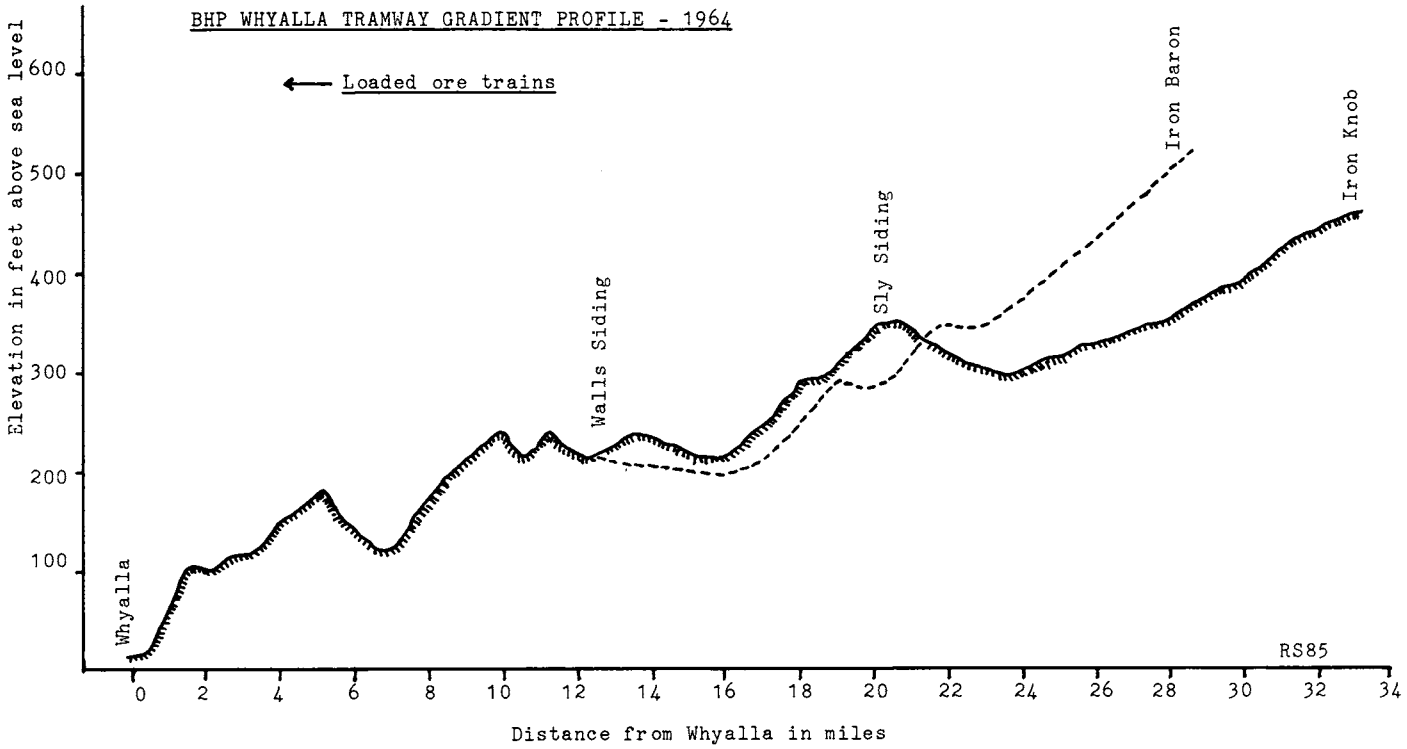
DH 1 assists with the loading of iron ore at the screening plant near Hummock Hill, which it will then haul to the blast furnace, during early 1985. D. Griffiths.

DE 01 was the first locomotive at Whyalla to be repainted in BHP's new blue and yellow colours during 1980. Although 29 years old, DE 01 still appears in excellent external condition. D. Griffiths.

Some modifications to the main line diesels began in the mid 1960s, as major overhauls became due. The first air flow indicators were fitted in May 1965 and vigilance controls were added to all of the locomotives from June 1970. The Clyde locomotives were based on a standard design for service on light and narrow gauge railways throughout the world, often with restricted loading gauge. The Iron Knob Tramway was not hampered by such a restrictive loading gauge and the cutaway cab corners provided annoyance to crews without providing any operating advantages. Modifications started in January 1971, resulted in enlarged cabs to provide extra head room and noise absorbent material was incorporated in the engine bulkhead.

In February 1973 the first of a locally designed and built noise suppression unit was fitted to the exhaust. The silencers were a cumbersome unit measuring 9 ft x 3 ft x 2 ft, mounted externally on the roof, but were certainly effective.

Class leader DH 1 shunts a hot metal ladle car near the blast furnace during February, 1978. L. Oberg.



THE PORT LINCOLN OPERATION

BHP's early interest in limesand had led to the construction of a small tramway on Wardang Island off Yorke Peninsula. In the early 1960s investigations had revealed a similar deposit of limesand at Coffin Bay, 25 miles west from Port Lincoln. Unfortunately, the coast at that point is a shallow bay, completely unsuitable for shipping. It was decided that this limesand deposit justified the expense of building a tramway, connecting the deposit at Coffin Bay with a dumper and ship loader at Proper Bay on the outskirts of Port Lincoln.

The sand was to be dug up using a 2 cubic yard electric face shovel and loaded into a tyred truck, transporting it to a storage bin. The bins, similar to those that had been built at Iron Baron, allowed direct loading of 76 ton wagons running on standard gauge track. Trains comprising one locomotive and sixteen wagons were run over the 25 miles to Proper Bay, where the trucks were inverted on a tippler and the sand conveyed to a storage bin and ultimately to a ship.

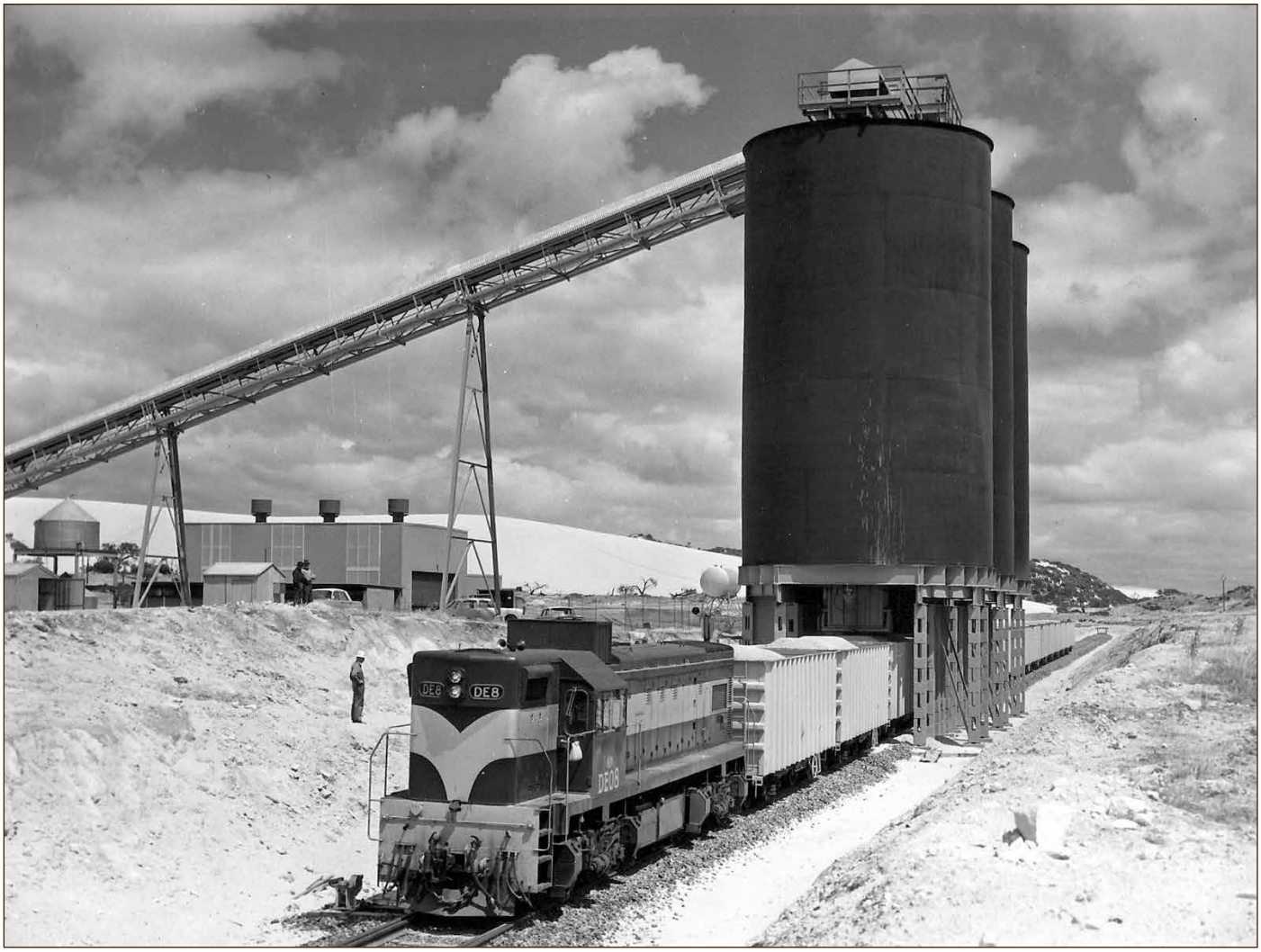
To provide motive power for the trains, a further two diesel-electric locomotives were ordered from Clyde Engineering. These were basically the same as previous main line locomotives but differed in some external details. They lacked air ventilation louvres on the side of the hood as air was drawn in through large Farr 'Dynavane' filters contained in a large box above and behind the cab. The hoods also extended to the end of the frame.

The first of these units was delivered to Whyalla on 19 November 1965 and was numbered DE08. It carried builder's No. 65-429. After a spell in traffic at Whyalla from 25 November 1965, running 1,000 miles on DE04's bogies, it was sent to Port Lincoln by road on 11 January 1966. DE09 was delivered to Whyalla on 30 November 1965 carrying builder's No. 65-430. This locomotive was not quickly despatched to Port Lincoln however, as only one was required for construction and coincidentally DE04 had been damaged, due to a loose bracket lodging in a pole face winding of the main generator. DE09 was put on DE04's narrow gauge bogies (one of the advantages of diesels) and used on the Iron Knob Tramway on 6 December 1965, pending the repair of DE04. The opportunity was taken to repaint DE04 and it emerged sporting a new dull pink and chocolate colour scheme instead of the original red and silver.

At Port Lincoln DE08 was busy hauling old Commonwealth Railways hopper cars up and down the line, unloading ballast. The production rolling stock was delivered late in 1966 and the first revenue trains were run. Speeds were restricted by poor track, due to unsatisfactory ballast and some subsidence in the new embankments. Clearly, the experience gained in building railways at Whyalla could not be used without some modification in the much wetter Port Lincoln district. Tamper breakdowns delayed an early end to this problem. The first trains were of 15 wagons, carrying 1,140 tons of sand. In the second half of 1968 the motive power was reorganised; DE01 and DE02, which had been in the quarries, were fitted with multiple unit connections and transferred to Port Lincoln, along with the standard gauge bogies from DE09. DE08 was returned to Whyalla and both the new locomotives were placed on old bogies from the quarry diesels DE01 and DE02, and put into service on the main line. DE08 recommenced working at Whyalla on 8 November 1968. The availability of two locomotives at Port Lincoln, albeit of lower power than those bought for the job, allowed the running of two trains per day. Each train consisted of 17 wagons with a net load of 1,300 tons. During the following half year, trains were increased to 20 wagons until a derailment of 11 wagons late in December 1968. Subsequently, anti-derailment plates (angle sections attached to the underside of the axle box guides) were fitted to all wagons.

Operations at Port Lincoln were cut back by the end of 1975. Coffin Bay limesands performed poorly in the blast furnace. Better value material was obtained overseas. This decision to cut production reduced the number of men working on the project from 14 to 4. These men were retained to keep the plant in an operable condition and about one train per week has been run since then on limited production.

DE 02 is seen hauling an empty limesand train from Proper Bay to Coffin Bay on February 8, 1982. L. Oberg.



Still relatively new, DE 08 assists to load a limesand train at Coffin Bay on 8 December 1966. BHP Archives.

The surrounding area looks much more overgrown at Coffin Bay in this photograph from 1982. DE 02 begins to load its train before returning to Proper Bay, Port Lincoln, during February. L. Oberg.

THE COMMONWEALTH RAILWAYS CONNECTION

One of Premier Sir Thomas Playford's many 'baits' to encourage BHP to establish a steelworks in South Australia, was a promise to investigate the possibility of constructing a rail link to the existing Commonwealth Railways track at Port Augusta. This line would connect the steelworks to the Australian railway system for the shipment of products and the supply of materials.

In line with the agreement, a preliminary estimate was called for in 1958, after the steelworks agreement was signed. Probable traffic and operating results were called for. From the data available at the time and a short trial survey at Spencer Gulf and Lincoln Gap, a preliminary assessment of construction cost was set at £2 million. The forecast traffic consisted mainly of general goods, livestock and only a small quantity of steel products. At the time it appears that the line could be justified only in conjunction with the standardisation of the Adelaide-Crystal Brook railway line.

The project lapsed until 1966, when the Federal Government called for a report and estimate of cost. A figure of £6.5 million was reached after a more detailed survey. In a move apparently aimed at supporting the construction of the track by indicating the potential traffic, BHP changed its main product shipping method from coastal shipping to road transfer of products to Port Augusta, for delivery by rail.

An initial shipment rate of 1,000 tons per week was commenced in August 1968. Shipments were intended for Sydney customers initially, with trial shipments to Melbourne taking place soon afterwards. Steel was railed from Port Augusta via Port Pirie to Adelaide, Melbourne and Sydney. The approaching completion of the Broken Hill-Port Pirie standard gauge link was expected to further speed the delivery of product to customers. The traffic soon reached twice the original estimate and no doubt reinforced the case for construction of the Port Augusta-Whyalla rail link.

Design work and detailed specification continued during 1969, including the decision to use new pre-stressed concrete sleepers and used rail from the Trans-Australian Railway, for track construction. Agreement for the construction was signed by the Prime Minister and the South Australian Premier in February 1970. The construction however, was delayed by a political crisis in South Australia when the State Government was defeated on the Dartmouth Dam issue. The first tenders for the work were called two days later and construction commenced in December.

Construction of the line proceeded apace and was completed in time for the official opening to take place on the scheduled day of Friday, 6 October 1972. During the opening ceremony a new standard gauge diesel-electric locomotive, CL17 of the Commonwealth Railways, was named *William McMahon*, in honour of the Prime Minister. The wife of the Federal Minister for Shipping and Transport, Mrs P. J. Nixon, performed the naming ceremony. The locomotive had been delivered earlier that year by Clyde Engineering and represented the latest in locomotive technology in Australia.

In conjunction with the opening celebrations, the New South Wales Rail Transport Museum ran a commemorative steam train from Sydney to Port Augusta, hauled by 3642 and 3801. On Saturday, 7 October 1972, 3642 ran a special train from Port Augusta to Whyalla and return. This train crossed GMs 42/40 at Roopena, which were returning with an empty press-media special to Port Augusta.

A daily passenger and goods train connected Whyalla with Port Augusta. By May 1973, 17,161 tons of general goods had been brought into the works by rail and 3,871 tons had been despatched. This was grossly overshadowed by the 116,905 tons of steel products railed out during that period.

A siding was laid connecting the Commonwealth Railways Whyalla station to BHP's finishing end and product despatch area. Here steel was loaded by overhead gantry crane. BHP locomotives had access to the loading yard and by means of a new track connection via the wharf, they could move incoming trucks to any part of the plant. The connection between BHP and Commonwealth territory was crossed only by wagons and a truck placer (built by Comeng Aresco), to enable trucks to be moved quickly and easily. The truck placer was supplied in 1973 and numbered PM08.

The unit was powered by a GM diesel driving through a hydraulic transmission to rubber tyred wheels. Guidance when operating 'on track' is by two pairs of Hi-Rail wheels.

With the advent of rail rolling at Whyalla, the number of wagons to be shunted at the Finishing End of the Rolling Mill outgrew the hauling and braking capacity of the truck placer. PM08 was withdrawn early in 1982 and replaced by one of the diesel-hydraulic locomotives. It was offered for sale by tender in November 1984, but was not sold.

Steel products have continued to provide the vast majority of tonnage for the rail link. The passenger service was run by 'Budd' railcars, using the new railway station. The break of gauge at Port Pirie and the dilapidated condition of the 'Budd' cars resulted in slow and, on many occasions, delayed services. Insufficient patronage did not justify major improvements. The service was unfortunately discontinued in 1975. It remains to be seen whether the Crystal Brook gauge standardisation will result in resurrection of the passenger service, although Australian National may feel that another intrastate passenger service may just not be viable.

With a reduction in coastal shipping during the early 1980s, further increases in the tonnages of steel products railed to various destinations throughout Australia has given the line a solid future. During 1984 it became viable for ICI to rail coking coal from Whyalla's supply to Osborne, near Adelaide.

The railway link has been financially successful; a notable achievement in Australian railway engineering. This success has thoroughly justified the decision to build the railway.

The special headboard carried by steam locomotive 3642 when it hauled a N.S. W. Rail Transport Museum enthusiast train to Whyalla on 711011972. R. Sampson.

The special 16-car train returns from Whyalla to Port Augusta on 7/1011972, crossing one of the many floodway bridges on the line. R. Sampson.

Australian National's GM class locomotive No. 22 prepares to depart Whyalla on a steel train for Port Augusta on January 9, 1985. D. Aikins.

BHP WHYALLA UPDATE

The 1970s brought many minor refinements rather than major changes on the tramway. The radio communication system was replaced in 1971 by a solid state system, giving better reception, reduced maintenance and also incorporated radio control of the Iron Baron Junction. This enabled the points to be operated by an approaching train (with the approval of the train controller) and eliminated the need for a guard. Road transport had long since eliminated the demand for passenger and parcels traffic required by the Tramways Acts, and the guard's vans were removed from all trains in March 1972.

One of the guard's vans was donated to the Whyalla Society of Model Engineers, but unfortunately the van body was smashed and burned by vandals. The frame was then transferred to the Pichi Richi Railway Preservation Society at Quorn. A second van body was 'blocked up' and used by the BHP plumber's department for many years. Recently, it was refurbished for use as a store by the Diesel Loco Shop. The third brakevan was sold and purchased locally for use as a shed.

The reduced demand for limesand resulted in a decision to restrict operation at Port Lincoln. DE01 was transferred back to Whyalla, leaving DE02 alone at Port Lincoln.

In Whyalla, DE01 was repainted in the then standard pink and was allocated the task of relief standard gauge locomotive at the steelworks.

As the result of an accident in late 1978, when DE01 was seriously damaged, it was bogie-exchanged with DE08 and lay idle in the Whyalla yard until May 1979, awaiting replacement parts. Along with the repairs came a facelift. DE01 was the first locomotive to emerge with the new yellow and blue colour scheme which has since been applied to both the steelworks and the main line locomotives. Only DE02 at Port Lincoln now retains the original maroon and silver colour scheme. Both G8 locomotives, DE01 and DE02, now spend much of their time idle. DE01 works only occasionally in the steelworks, and DE02 ventures onto the Coffin Bay line about once per week.

DE07, when overhauled in 1984, was given the yellow and blue colour scheme, but also received an *Advance Australian Steel* emblem on both sides of its long hood. A reduction of iron ore demand, to about one million tonnes per year was necessary in order to conserve local supplies for Whyalla, resulted in the withdrawal of DE08 from service. It has been dismantled and some parts used for spares.

THE FULL CIRCLE

The Broken Hill Proprietary Company Limited was established a hundred years ago in Broken Hill and was a regular buyer of rail manufactured overseas. Initially, its small shunting sidings at Broken Hill, a later tramway to Iron Knob and its various steelworks at Whyalla all required large quantities of rails. The first steel products rolled by the Company in Newcastle were rails to satisfy a growing demand in the young colony. This situation has reversed itself at Whyalla. $30 million has been spent to establish rail rolling and finishing facilities at the Whyalla steelworks. These facilities enable an ageing plant at Port Kembla to be closed. The new plant at Whyalla was opened by the Premier of South Australia, Dr Tonkin, on 3 June 1982.

In 1977 the first steel sleepers were produced (on a trial basis) for an order by the Mt Newman Mining Company. An improved design of steel sleepers enabled their use with insulated rail fastenings, and hence electrically signalled track. Steel sleepers were not new to Whyalla. Nine were laid in the tramway in late 1930, followed by others in small numbers during the following years. The economics at the time did not favour the high capital expense associated with steel sleepers, despite their long service life. The price of timber has however, risen markedly in recent years and this, coupled with the enormous appetite of the great northern termite in northern Western Australia, where the new mining Company tracks run, has renewed interest in this alternative.

The future looks bright for these products. Omark Australia Limited has established a plant at Whyalla to form the finished sleepers from blank section rolled at the adjacent steelworks. The availability of rails in lengths of up to 27.4 metres, has attracted interest from rail users in Australia. Longer rail lengths mean fewer joints or welds required in the track, not only reducing costs, but eliminating points of weakness. The movement of rails in lengths longer than wagons has been overcome by marrying wagons into pairs, each with a bulkhead at the outer end. The rails are arranged in tiers and are dunnaged, so as to be free to slide as the wagons negotiate curved track.

Head hardened rails are now being produced at Whyalla. These rails have a life double that of conventional rails and are especially suited to heavily used lines and small radius banked track.

Whyalla has now become Australia's railway supplier, rather than just one of the customers!

FUTURE PROSPECTS

In this, the 100th year since BHP was established at Broken Hill, it will be 85 years since iron ore was first carried across the 'metals' to the coast

Iron Knob and Iron Monarch are now well depleted and Iron Baron and Iron Prince are virtually exhausted. In order to preserve a future for Whyalla, the east coast steelworks now obtain their iron ore supplies from the Mt Newman deposits, Whyalla is the sole user of the Middleback ores and the rate of shipment has been cut back to a two shift operation, hauling 2 million tonnes per year in line with these requirements. This is a far cry from the 7 million tonnes being handled in the 1970s, which kept BHP's tramway operation 'up with the leaders' of mineral railways in Australia.

With the depletion of the existing mines, work has commenced on detailed planning for the extension of the tramway from Iron Baron for a further 30 km south to a new mine at Iron Duke. The proposed line begins on the southern leg of the existing triangle at Iron Baron, and after deviating around Iron Queen, heads south. The alignment passes through Sinclair's Gap before once more heading south on the western side of the range to Iron Duke.

Plans envisage the operation of two locomotives on 45 car trains, but the 11 km of continuous 1:200 grades uphill to Iron Baron on this new track will make the locomotives strain as they have never had to in the past 20 years. With numerous curves, cuttings and hills, photographically this extension will certainly be a railway enthusiast's delight!

There does appear to be a future for the Iron Knob Tramway, although by the turn of this century, it may no longer go to 'The Knob'.

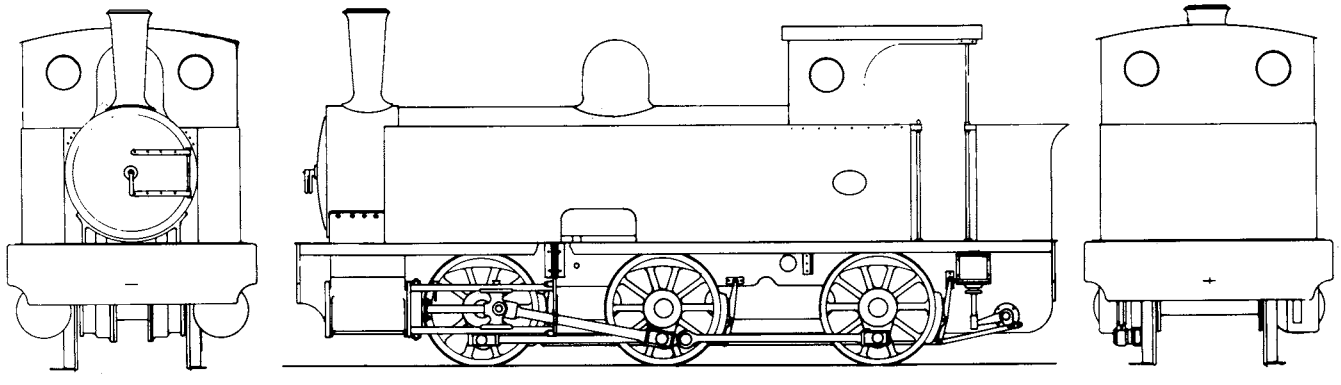
LOCOMOTIVE POWER

A brief summary of the locomotives is shown in the tables provided. A significant omission from the tables is the horses and bullocks which hauled BHP's first wagons in the mine sidings at Broken Hill.

The use of animal power continued to be associated with the Company's operations for a further 50 years! Horses were used on the tramway construction in 1901 and in many construction tasks later. The last major construction involving horses was for the Blast Furnace in 1941.

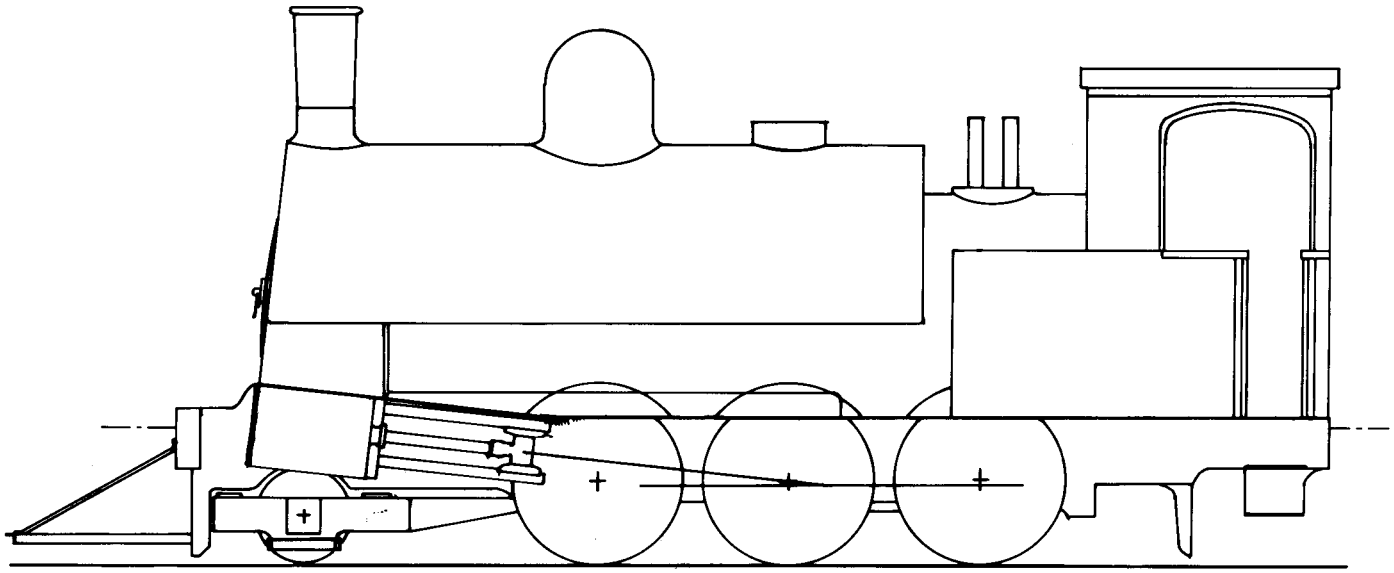
Horses also operated in the quarries at Iron Knob and Iron Monarch until 1928. They were used at Iron Baron and Iron Prince until 1945.

Bullocks were also used around Whyalla. They were utilised as late as the mid-1930s on regrading 'the soak'.



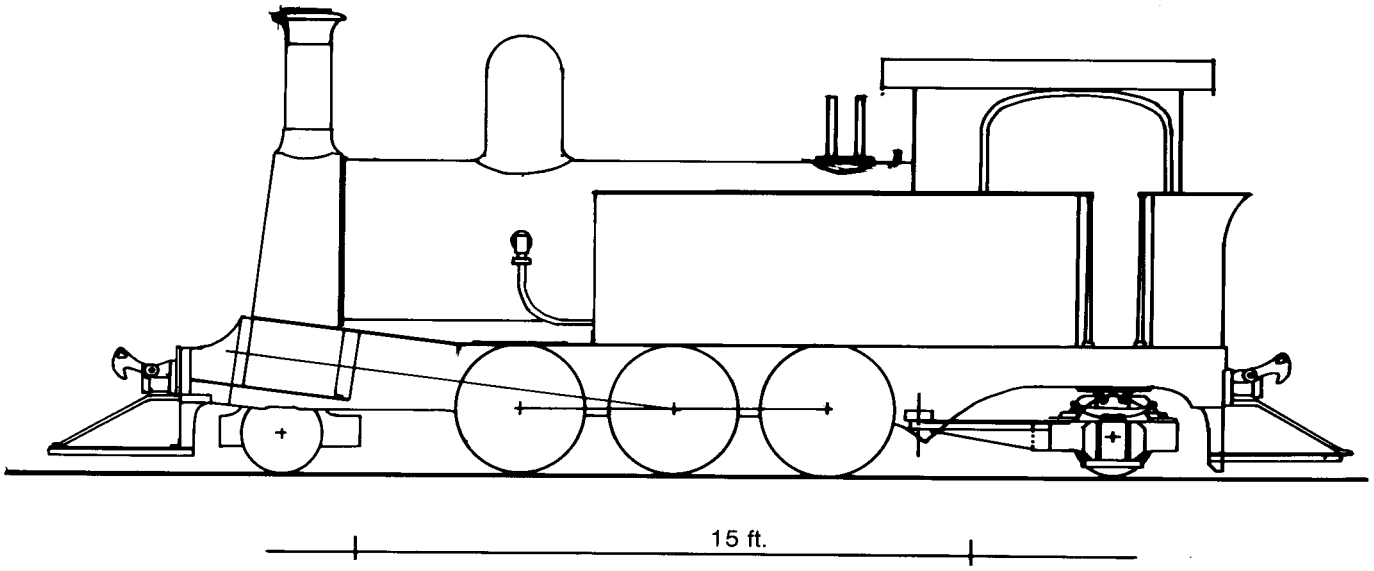
'Kilmarnock'

Drawing: David Griffiths



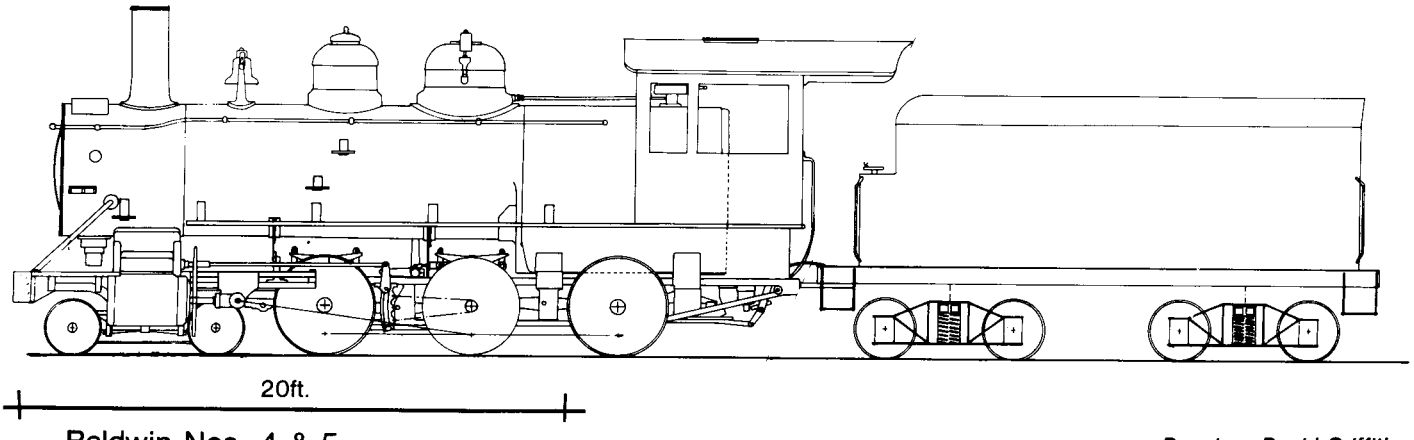
No. 1 & 1A

Drawing: David Griffiths



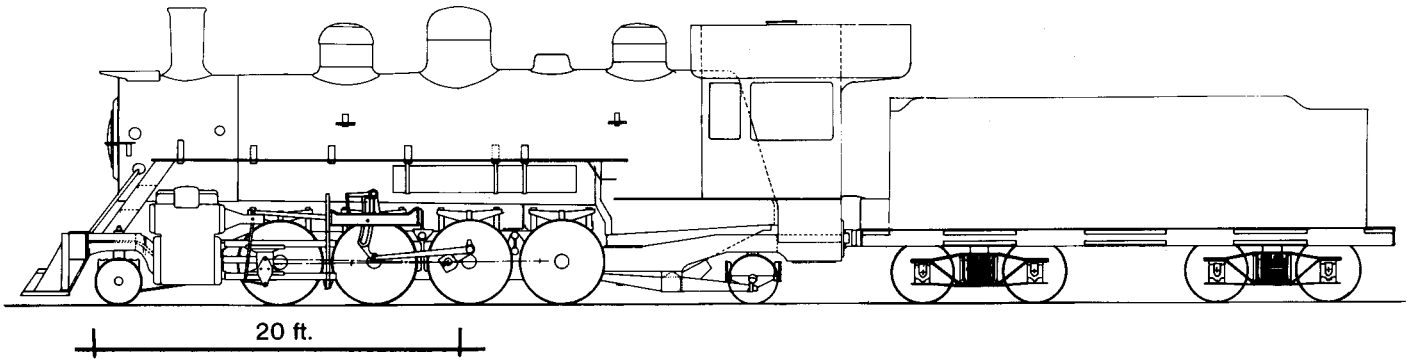
No. 2, 2A Second No. 3

Drawing: David Griffiths



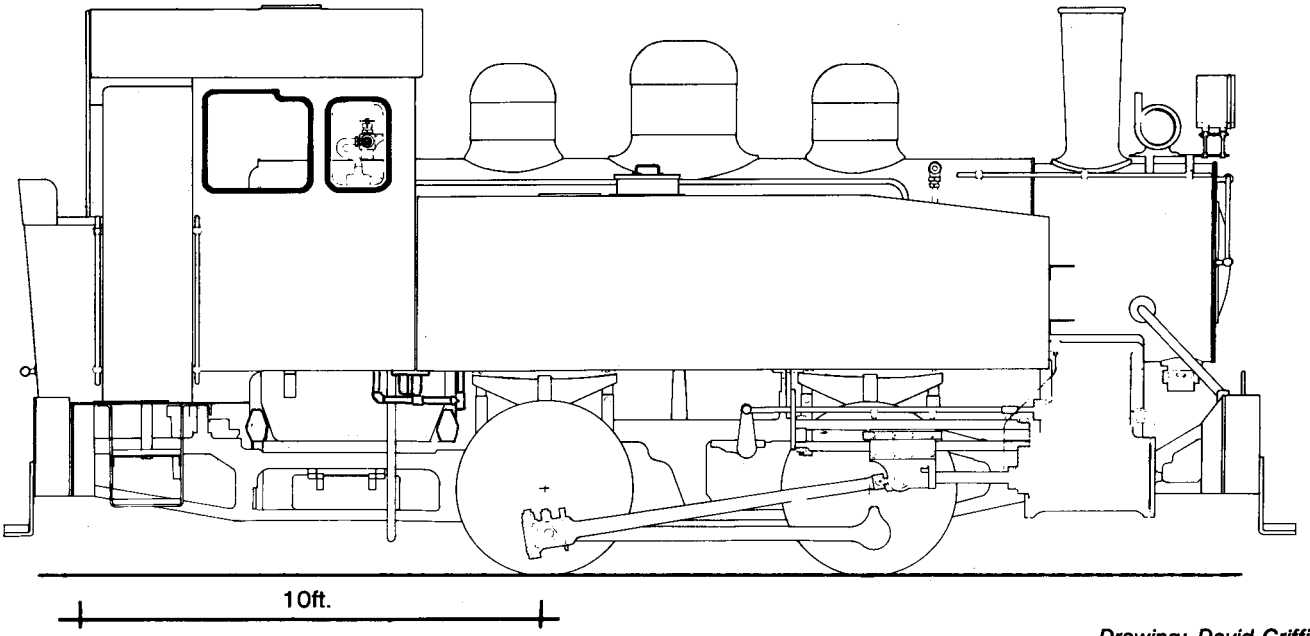
Baldwin Nos. 4 & 5

Drawing: David Griffiths



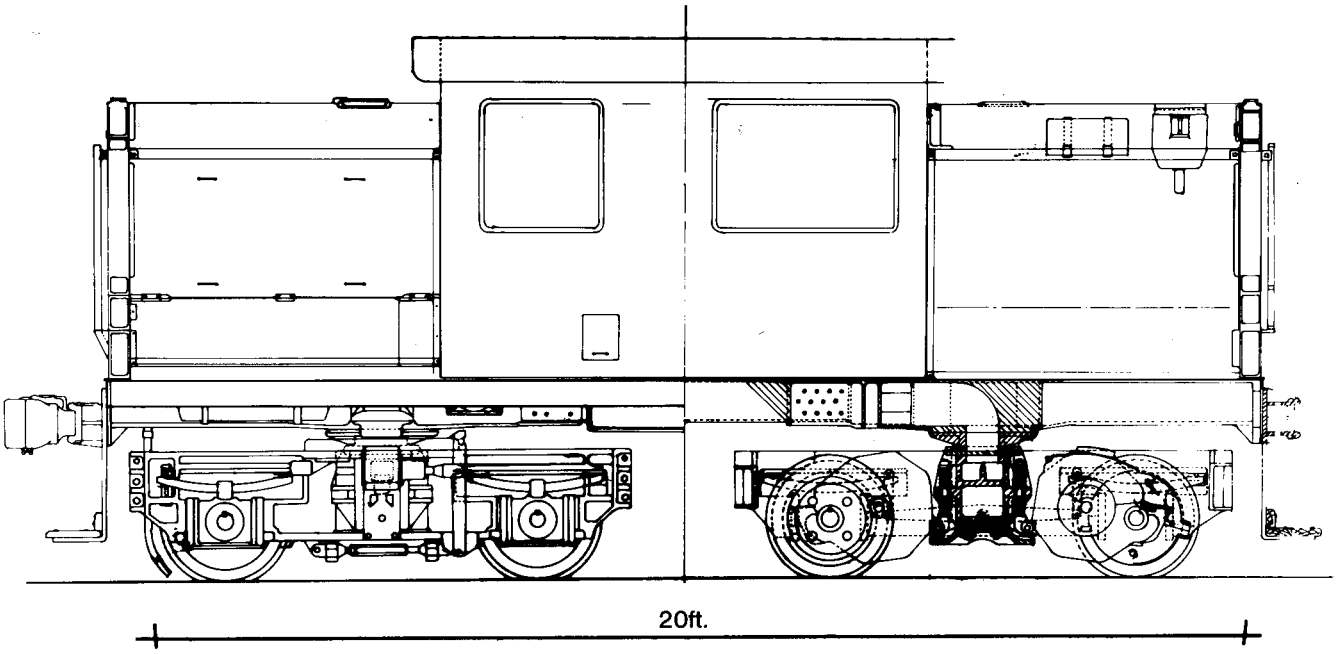
Baldwin Nos. 6, 7 & 8

Drawing: David Griffiths



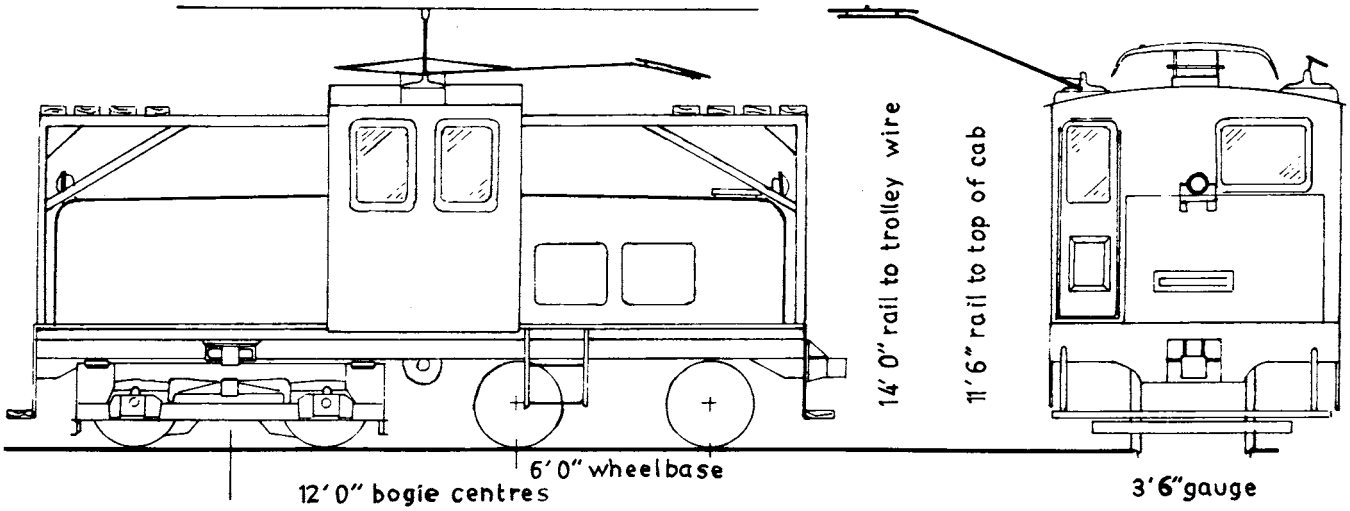
B class

Drawing: David Griffiths



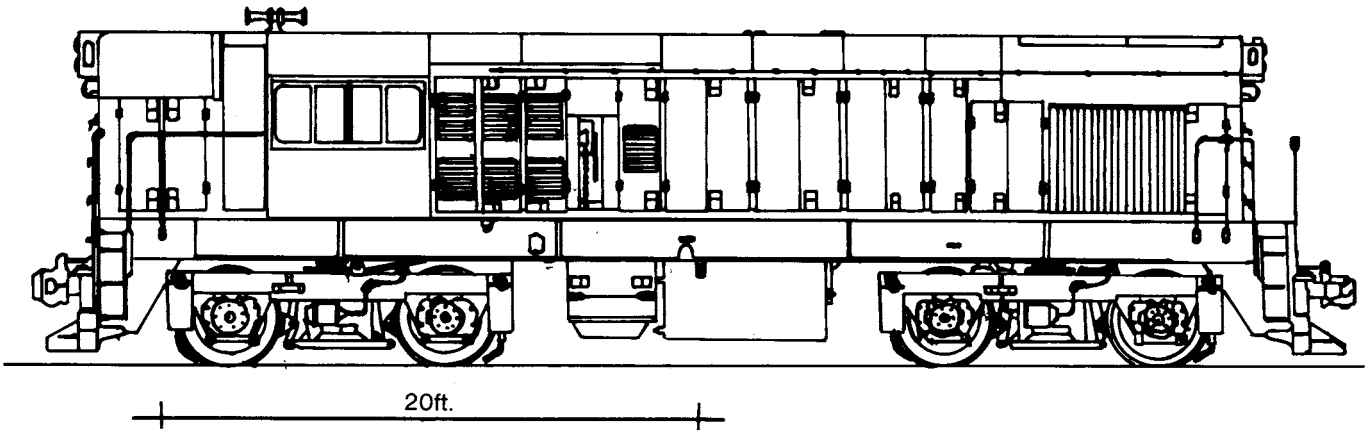
Davenport PEO1

Drawing: David Griffiths



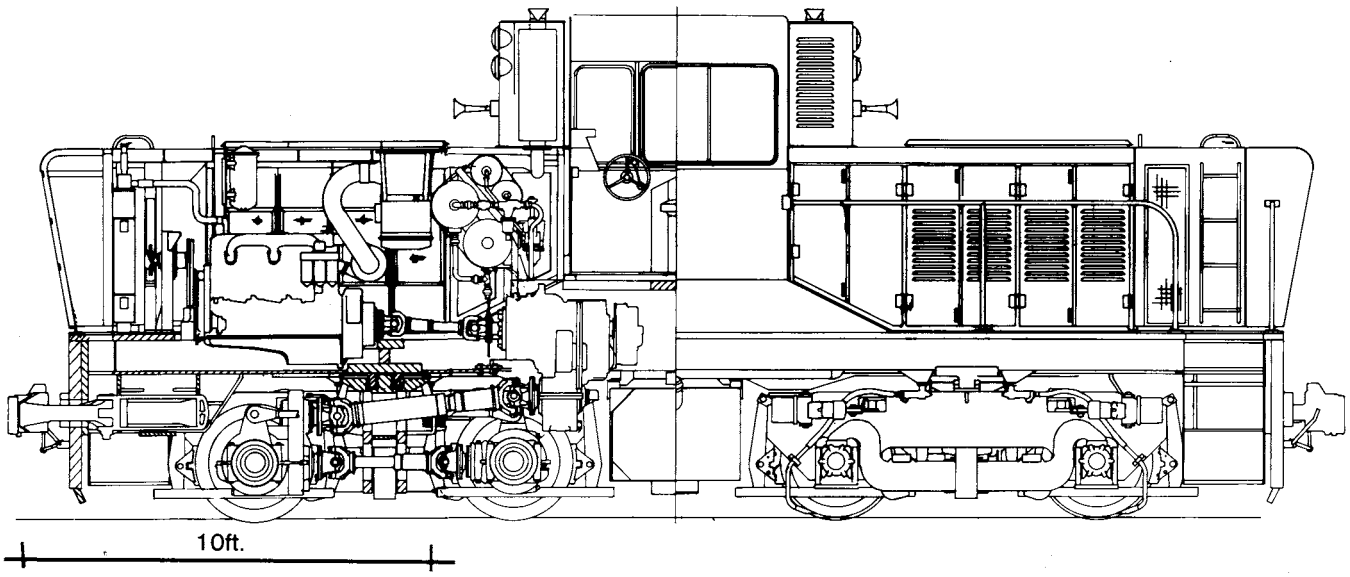
E class

Drawing: David Griffiths



DE class

Drawing: David Griffiths



DH class

Drawing: David Griffiths

STEAM, DIESEL AND ELECTRIC LOCOMOTIVES OPERATED BY BHP IN SOUTH AUSTRALIA

IDENTITY	BUILDER/DATE	GAUGE	NOTES
First No. 2 SAR No. 0 Whyalla No. 2 Silverton No. 6 (*Beyer, Peacock*) 2-6-2T	Beyer, Peacock 3357/1891 England	3 ft 6 in	Bought new by BHP 1891. To SAR in July 1892, returned to BHP, and loaned to STC (No. 6) about March 1893, returned to BHP in September 1893 at Broken Hill. Transferred to Hummock Hill 23 July 1902. Withdrawn April 1962. Placed on Whyalla Foreshore in August 1962. Moved to Mt Laura Homestead in 1983.
SAR V 11 BHP (*SAR Little Engine*) 0-4-4T	Beyer, Peacock 1599/1876 England	3 ft 6 in	Bought new by SAR 1876. To BHP 1 July 1892, returned to SAR March 1893. To Goodwood Timber and Railway Company, Noojee, Victoria, August 1924. Scrapped 1939.
First No. 1 (*Little Bessie*) 0-6-0T	Nasmyth, Wilson 441/1892 England	3 ft 6 in	Bought new by BHP. In service at Broken Hill on 12 February 1893. To Hummock Hill on 4 April 1901. Returned to Broken Hill on 2 September 1902. Withdrawn in 1935. Scrapped at Broken Hill in March 1939.
First No. 3 *Iron Monarch* (*Kilmarnock*) 0-6-0T	Andrew Barclay 914/1901 Scotland	3 ft 6 in	Bought new by BHP for Hummock Hill. In service 14 November 1901. Withdrawn in February 1922. Altered to weighbridge test car in 1936. Scrapped c. 1965.
Second No. 2 at Broken Hill ('Big Ben') No. 1 Whyalla 2-6-0T	Beyer, Peacock 4723/1905 England	3 ft 6 in	Bought new by BHP for Broken Hill. To Hummock Hill c. 1910. Withdrawn and scrapped late 1962. Some evidence that cab (and builder's plate) were exchanged with 1A in early 1943, when both engines in shops at the same time.
No. 4 4-6-0	Baldwin 41242/1914 Philadelphia, USA	3 ft 6 in	In service August 1914. Condemned and engine unit donated to the Mile End Railway Museum (SA) Inc. in June 1969.
No. 5 4-6-0	Baldwin 41243/1914 Philadelphia, USA	3 ft 6 in	In service August 1914. Scrapped late 1956.
No. 6 2-8-2	Baldwin 52694/1920 Philadelphia, USA (Baldwin Design No. 37-F.45 Class 1236 1/4E)	3 ft 6 in	In service late 1920. Condemned and scrapped 1958.
No. 7 2-8-2	Baldwin 52695/1920 Philadelphia, USA	3 ft 6 in	In service early 1921. Withdrawn in early 1958. Returned to service from 1 August 1958 to 20 January 1959. Condemned and scrapped in December 1960.
No. 8 2-8-2	Baldwin 60311/1927 Philadelphia, USA	3 ft 6 in	In service July 1928. Condemned and scrapped in 1958.
First No. 9 *Kaiser* 0-4-0WT	Arnold Jung 680/1903 England	3 ft 6 in	Built for Australia, but location unknown 1903-1912. Used by Smith & Timms for Willunga line construction 1912-1915. Whereabouts not known 1915-1927. Purchased by BHP in 1927 from Millers Machinery Company, Melbourne. In service BHP 27 July 1927. Withdrawn 22 June 1928, pending boiler inspection. Scrapped c. 1943.
No. 9 (second) 2-8-2	Baldwin 62232/1938 Philadelphia, USA	3 ft 6 in	In service late 1938. Withdrawn early 1958. Scrapped 1959.
No. 10 0-4-0T	Baguley 2025/1922 England	3 ft 6 in	To Australia in 1926 for River Murray Barrage construction. Purchased by BHP in early 1943, overhauled, in service June 1943. Withdrawn c. 1945. Scrapped 1957.
No. 2A 2-6-2T	Beyer, Peacock 5125/1908 England	3 ft 6 in	Built new for Broken Hill South Ltd. Withdrawn 1939. Sold to BHP Whyalla 1940. Overhauled, into service mid-1941. Withdrawn and scrapped late 1962.
No. 3 (second) STC Y5 Sulphide Corp No. 5 2-6-2T	Beyer, Peacock 3170/1890 England	3 ft 6 in	Built new for Silverton Tramway Company. Given to Sulphide Corporation 1901. Sold to BHP Whyalla, December 1940. In service late 1941. Withdrawn in May 1962. Preserved in playground. Sold to Pichi Richi Railway Preservation Society, Quorn in 1983.
No. 1A 2-6-0ST	Beyer, Peacock 5911/1914 England	3 ft 6 in	Built new for Zinc Corporation, Broken Hill. Sold to BHP Whyalla in December 1940. In service early 1941. Withdrawn and scrapped late 1962.

IDENTITY	BUILDER/DATE	GAUGE	NOTES
No. 3A STC No. 4 (second) BH South No. 4 Central Mine No. 4 STC No. 2 2-6-0	Beyer, Peacock 3397/1891 England Beyer, Peacock 2972/1888 England	3 ft 6 in	Combination of parts from two locomotives ex Broken Hill. Rebuilt and in service late 1943. Withdrawn and scrapped early 1958. Used tender supplied with STC Y2.
No. B1 Newcastle No. 25 0-4-0T	BHP Newcastle 1/1938 New South Wales	4 ft 8½ in	Built to Porter design. In service April 1938. Transferred to Whyalla early 1963. Scrapped in December 1968.
No. B2 Newcastle No. 21 0-4-0T	BHP Newcastle 6/1930 New South Wales	4 ft 8½ in	First locomotive built by BHP and built to Porter design. In service June 1930. Transferred to Whyalla early 1963. Scrapped in September 1965.
No. 61 SAR Y61 2-6-0T	Beyer, Peacock 2538/1885 England	3 ft 6 in	Built new for SAR. To BHP in 1925, converted to tank engine by STC for BHP.
Fordson No. 1 -B-	Fordson/Tractor Appliance Company, Melbourne, Victoria, 1927	3 ft 6 in	In service 8 June 1927. One of these Fordsons was sent to Whyalla in September 1930 for yard shunting. Others active at least until 1943. Probably withdrawn when 'A' bench worked out.
Fordson No. 2 -B-	Fordson/Tractor Appliance Company, Melbourne, Victoria, 1927	3 ft 6 in	In service 9 August 1927.
Fordson No. 3 -B-	Fordson/Tractor Appliance Company, Melbourne, Victoria, 1927	3 ft 6 in	In service 21 August 1927.
Fordson No. 4 -B-	Fordson/Tractor Appliance Company, Melbourne, Victoria, 1927	3 ft 6 in	In service 21 August 1927.
Fordson No. 5 -B-	Fordson/BHP 1928	3 ft 6 in	In service mid-1928.
PE 1 DE 10 Bo-Bo	Davenport 2118/1928	3 ft 6 in 4 ft 8½ in	In service 20 September 1928. Petrol engines removed 1942-43. Rebuilt by BHP, Whyalla . Dieselized 31 August 1966. Re-engined, regauged 30 April 1968. Out of service mid-1977. Sold to Pichi Richi Railway Preservation Society in 1984.
E 1 Bo-Bo	Metropolitan Vickers Trafford Park, Manchester England	3 ft 6 in	In service October 1928. Withdrawn 12 July 1968. Donated to Australian Electric Transport Museum, St Kilda, South Australia, 1968.
E 2 Bo-Bo	Metropolitan Vickers Trafford Park, Manchester England	3 ft 6 in	In service 19 November 1928. Withdrawn 12 July 1968. Scrapped 1969.
E 3 Bo-Bo	Metropolitan Vickers Trafford Park, Manchester England	3 ft 6 in	In service 26 February 1930. Withdrawn 12 July 1968. Scrapped 1969.
E 4 Bo-Bo	Metropolitan Vickers Trafford Park, Manchester England	3 ft 6 in	In service late 1936 at Iron Knob. Withdrawn 12 July 1968. Scrapped 1969.
E 5 Bo-Bo	Perry Engineering E1/1942 Adelaide, South Australia	3 ft 6 in	In service 13 August 1942 at Rapid Bay. Withdrawn 18 October 1955. Scrapped August 1964.
E 6 Bo-Bo	Perry Engineering E2/1942 Adelaide, South Australia	3 ft 6 in	In service 13 August 1942 at Rapid Bay. Withdrawn 18 October 1955. Scrapped August 1964.
E 7 Bo-Bo	Perry Engineering E3/1954 Adelaide, South Australia	3 ft 6 in	In service 24 September 1954. Withdrawn 12 July 1968. On display at Iron Knob.
E 8 Bo-Bo	Perry Engineering E4/1954 Adelaide, South Australia	3 ft 6 in	In service 24 September 1954. Withdrawn 12 July 1968. Scrapped 1969.
DE 01 Bo-Bo	Clyde Engineering 109/1956 Granville, New South Wales	3 ft 6 in and 4 ft 8½ in	In service Whyalla 25 October 1956. To Iron Knob January 1957. To standard gauge at Whyalla 23 July 1968 and transferred to Port Lincoln. Returned to Whyalla late 1975. Temporarily on narrow gauge 1978 to May 1979.
DE 02 Bo-Bo	Clyde Engineering 111/1956 Granville, New South Wales	3 ft 6 in and 4 ft 8½ in	In service Whyalla 6 November 1956. To Iron Knob January 1957. To standard gauge at Whyalla 12 July 1968 and transferred to Port Lincoln.

IDENTITY	BUILDER/DATE	GAUGE	NOTES
DE 03 Bo-Bo	Clyde Engineering 116/1956 Granville, New South Wales	3 ft 6 in	In service 21 November 1956 at Whyalla.
DE 04 Bo-Bo	Clyde Engineering 122/1957 Granville, New South Wales	3 ft 6 in	In service 5 December 1956 at Whyalla.
DE 05 Bo-Bo	Clyde Engineering 136/1957 Granville, New South Wales	3 ft 6 in	In service 14 May 1957 at Whyalla.
DE 06 Bo-Bo	Clyde Engineering 156/1957 Granville, New South Wales	3 ft 6 in	In service 7 August 1957 at Whyalla.
DE 07 Bo-Bo	Clyde Engineering 236/1961 Granville, New South Wales	3 ft 6 in	In service 27 June 1961 at Whyalla.
DE 08 Bo-Bo	Clyde Engineering 429/1965 Granville, New South Wales	3 ft 6 in and 4 ft 8½ in	In service 25 November 1965 on test at Whyalla on narrow gauge. To Port Lincoln standard gauge traffic on 12 January 1966. To Whyalla narrow gauge on 8 November 1968. Temporarily on standard gauge late 1978 to May 1979. Withdrawn in 1984, and cannibalised.
DE 09 Bo-Bo	Clyde Engineering 430/1965 Granville, New South Wales	3 ft 6 in	In service 6 December 1965 at Whyalla.
DH 1 B-B	Walkers 573/1962 Maryborough, Queensland	3 ft 6 in and 4 ft 8½ in	In service 11 April 1962 with intermittent exchanges of bogies with DH 6. Repowered December 1979.
DH 2 B-B	Walkers 574/1962 Maryborough, Queensland	4 ft 8½ in	In service 25 April 1962. Repowered December 1978.
DH 3 B-B	Walkers 575/1962 Maryborough, Queensland	4 ft 8½ in	In service 25 April 1962. Repowered 1 June 1977.
DH 4 B-B	Walkers 579/1965 Maryborough, Queensland	4 ft 8½ in	In service 24 August 1965. Repowered 13 September 1976.
DH 5 B-B	Walkers 580/1965 Maryborough, Queensland	4 ft 8½ in	In service 6 September 1965. Repowered 17 March 1976.
DH 6 B-B	Walkers 582/1968 Maryborough, Queensland	3 ft 6 in and 4 ft 8½ in	In service 7 March 1968. Repowered 29 August 1980.

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Doug Colquhoun
John Southern
John Buckland


IRON KING


3
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