MOONTA MINES CONSERVATION AREA
INTERPRETIVE CONCEPT PLAN

DEPARTMENT OF ENVIRONMENT AND PLANNING

14

Department of Environment and Planning

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Reference

Contact Officer

Heritage Conservation Branch

14 March, 1983.

Mr. K. Bonython,
Chairman,
Jubilee 150 Board,
G.P.O.Box 1986,
ADELAIDE. S.A. 5001.

Dear Mr. Bonython,

RE: Moonta Mines Conservation and Interpretation Plan

Being aware that the Jubilee 150 Board were interested in supporting a proposal for the development of an appropriate project which would mark the significant role that copper mining has played in the history of South Australia, the Heritage Conservation Branch has prepared the following report for the consideration of the Board.

The report sets out a concept plan for the overall interpretation of the Moonta Mines. The geographical area covered is as you may know to be declared a State Heritage Area under the South Australian Heritage Act. The National Trust of South Australia (Moonta Branch) have for many years operated a museum facility in one of the miner's cottages and at the Moonta Mines Model School. They have also maintained an interest in the conservation of the former mining lease areas. The Heritage Conservation Branch has, through the State Heritage Fund and the process of identifying and recording State Heritage Items, expended funds on the physical conservation of buildings and structures on the mining lease areas.

The mining lease areas contain a great deal of physical evidence of the large scale mining operations which took place at this site, and the other social infrastructure such as housing, churches and schools which went along with these operations. Conservation of this aspect of the State's development must involve something more than can be presented through a museum experience. The site itself contains the physical evidence which explains historical developments and through its conservation and presentation visitors to this area will be able to achieve a personal and tangible understanding of the importance of this site.

The report sets out a series of proposals for the conservation and presentation of the site including a proposal for the upgrading of the present museum complex at the Moonta Mines Model School. This later proposal has been endorsed and supported by the History Trust of South Australia.

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At this stage the report has been considered by officers of the History Trust of South Australia and of this Branch. In its preparation, discussions have also taken place with the National Trust of South Australia (Moonta Branch), the Department of Tourism and the Department of Mines and Energy. The support of several organisations is patently crucial to the success of this proposal, since no one organisation has either the resources or authority to unilaterally undertake all the initiatives required.

The Heritage Conservation Branch is prepared to work closely with these other organisations and to provide a focus for the overall coordination of the project. The report suggests that in relation to the key organisations, this might be accomplished through the establishment of a Moonta Mines Area Steering Committee. The 'Copper Triangle' has the potential to become one of the State's and Australia's premier tourist destinations through the wise and careful management of its rich heritage resources. The local communities have strong ties with their Cornish ancestry and already celebrate these links through the biennial Kernewek Lowender Festival. This project proposal will support and build upon these existing activities to the benefit of all.

I strongly recommend this proposal for your consideration.

Yours sincerely,

(J.C. Womersley)
MANAGER
HERITAGE CONSERVATION BRANCH.

JCW:ct

HISTORY TRUST
OF SOUTH AUSTRALIA
Institute Building
North Terrace Adelaide 5000
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14 March 1983.

Mr. K. Bonython,
Chairman,
Jubilee 150 Board,
G.P.O. Box 1986,
ADELAIDE. S.A. 5001.

Dear Mr. Bonython,

Re: Moonta Mines Conservation and Interpretation Plan

I am writing to endorse the proposal contained in the Moonta Mines Conservation Area Interpretive Concept Plan drawn up by the Heritage Conservation Branch of the Department of Environment and Planning.

The History Trust recognises the Moonta Mines site as one of the most significant sites in the industrial and social history of South Australia. The Trust therefore strongly supports the view of the Heritage Conservation Branch that the conservation and interpretation of this extensive precinct is one of those projects to which the Jubilee 150 Board should give priority for major funding.

The History Trust's own brief is not with the built environment but with the State's portable heritage and with the general interpretation of South Australia's history. In this context, when consulted by officers of the Heritage Conservation Branch in the course of the concept plan's preparation, the Trust advised that the role of the National Trust's Moonta Mine Museum would have to be recognised as crucial to the development of a truly comprehensive interpretation programme.

The Museum has a very significant collection of local relics and it is both geographically and conceptually central to any site interpretation programme. Furthermore, as the Concept Plan accepts, on-site interpretation of the technological processes involved in copper mining needs to be complemented by broader social and economic historical approaches. The vitality and colourfulness of the local mining community in its heyday cannot be captured adequately in the planned site-based metalphoto panels.

The best place for a visitor to be introduced to the human history of this site is in the excellent and popular National Trust Museum. The Museum, which already draws some of the highest attendances of any local museum in South Australia, is located in an attractive building of great significance to the State's educational history. It already provides a pleasant, all-weather destination for a tourist wishing to find out more about the history of the Moonta Mines and copper triangle society.

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However, the Museum's displays at the moment are not designed to provide a sufficiently systematic and self-explanatory overview of their theme to do justice to the aims of the Concept Plan. What is required is a major upgrading of the Museum's displays so that it can become the effective interpretive or visitor centre for the whole site. The provision of interpretive centres is common overseas at historic sites but has yet to be undertaken in South Australia. A development of such a centre based on the Moonta National Trust Museum would be in line with the recommendations of the Interpretive Centre Policy Co-ordination Committee Report commissioned jointly by the Department of Tourism and the History Trust and completed in 1982. This report recommended Moonta as the site for the main interpretive centre for tourists visiting Yorke Peninsula. It is highly likely that the Department of Tourism could therefore provide some additional support to this project.

The redevelopment of the Museum as a major Jubilee 150 project could only be carried out successfully through the deployment of professional staff working closely with the various organisations interested in this exciting project. The Trust suggests simply that one person with appropriate professional qualifications and personal skills be appointed to get on with the job and to be allotted a budget which that person can deploy as circumstances dictate. It is too big a job for one person but multi-faceted, well-trained persons can be found who can carry out most tasks required in tandem with local volunteers.

The support of the National Trust and its Moonta branch is patently crucial to this whole scheme. The History Trust is willing to work closely with the Heritage Conservation Branch and the National Trust (at both its head office and Moonta branch levels) the Department of Tourism and the Kadina District Council. As the agency charged not only with advising the State Government on general museum policy but also with running 3 museums and developing several more by 1986, the History Trust can provide general museum expertise and is willing to act as the main support body for the curator/manager.

One thing remains to be said. The Trust has suggested that one person be appointed for 2 years and be given a budget of $90,000 to complete this task. This is a modest proposal indeed and it is likely that parts of the Moonta Museum will remain basically untouched. What can be achieved is a series of attractive and informative displays evoking the atmosphere of life in the Copper Triangle when it was at its peak. When the work is done, the Moonta Mines Museum will continue to attract thousands of visitors at little or no on-going cost to the State.

I wholeheartedly recommend the project to the Jubilee 150 Board.

Yours faithfully,

P. J. Cahalan

Dr. P.J. Cahalan,
per B. Samuel.
DIRECTOR.

INDEX

COVER PHOTO: PRANKHERD'S ENGINE HOUSE ALONG ELDER'S LODE, circa 1899

1. GOAL STATEMENT

The goal of the Moonta Mines Conservation Area Interpretive Concept Plan is to design an interpretive programme in order to relate visitors to area themes at different target points, and to propose programme and media solutions for developing these relationships.

2. CONSTRAINTS

2.1 Area Definition

Much has been written about the historic significance of the Moonta Mines, and since the establishment of the National Trust Museum in 1968 (in what was formerly the Moonta Mines Model School) area visitors have been treated to informative displays that reinforce this significance. The National Trust of South Australia has, through prolonged effort, had reserves designated and acquired mining leases in order to preserve the area's most distinctive heritage resources.

The Moonta Mines Area Study (Urban and Environmental Planning Group, Nov. 1981) was the first planning exercise aimed at defining boundaries and zoning for the heritage area. It also represented the first attempt to study the resources of social and industrial history as a whole, though from the standpoint of the retention of "character", not with any fundamental attention to the historical morphology of the area. The Department of Environment & Planning is presently involved in designating a State Heritage Area, under the South Australian Heritage Act, for Moonta Mines. The proposed area is a modified and slightly enlarged version of that outlined by the Area Study. Ideally, the proposed Heritage Area will be recognized in the Supplementary Development Plan for the District Council of Kadina, presently being drafted. (See Diagram I, which follows.)

2.2 Area Character

In a State famous for its government township planning, the rectilinear geometry of which is strikingly apparent in the layout of Moonta township (1863), it is an anomaly to find an ad hoc industrial migrant settlement such as that which existed at Moonta Mines. The extant built environment is seemingly devoid of areal meaning for the visitor. The scattering of pug

2.2 CONSTRAINTS (Area Character cont.)

cottages, public buildings and mining structures is difficult to understand collectively, situated as they are on a perfectly flat plain, and connected by a maze of dirt tracks. The main bitumen road (Verran Terrace, surveyed 1881) which dissects the Mines Area and leads to the museum has traditionally served as the linear focal point for visitors. Visitor orientation and comprehension can only be increased by establishing an area flow pattern that highlights the key developments of social and industrial history, and explains sequentially their interrelationship.

2.3 Present Mining Status

At present mineral exploration is allowed in the Mines Area, under the control of the Department of Mines & Energy. Inter-departmental discussions are now taking place to ensure that possible future mining operations do not interfere with the preservation and presentation of the Heritage Area.

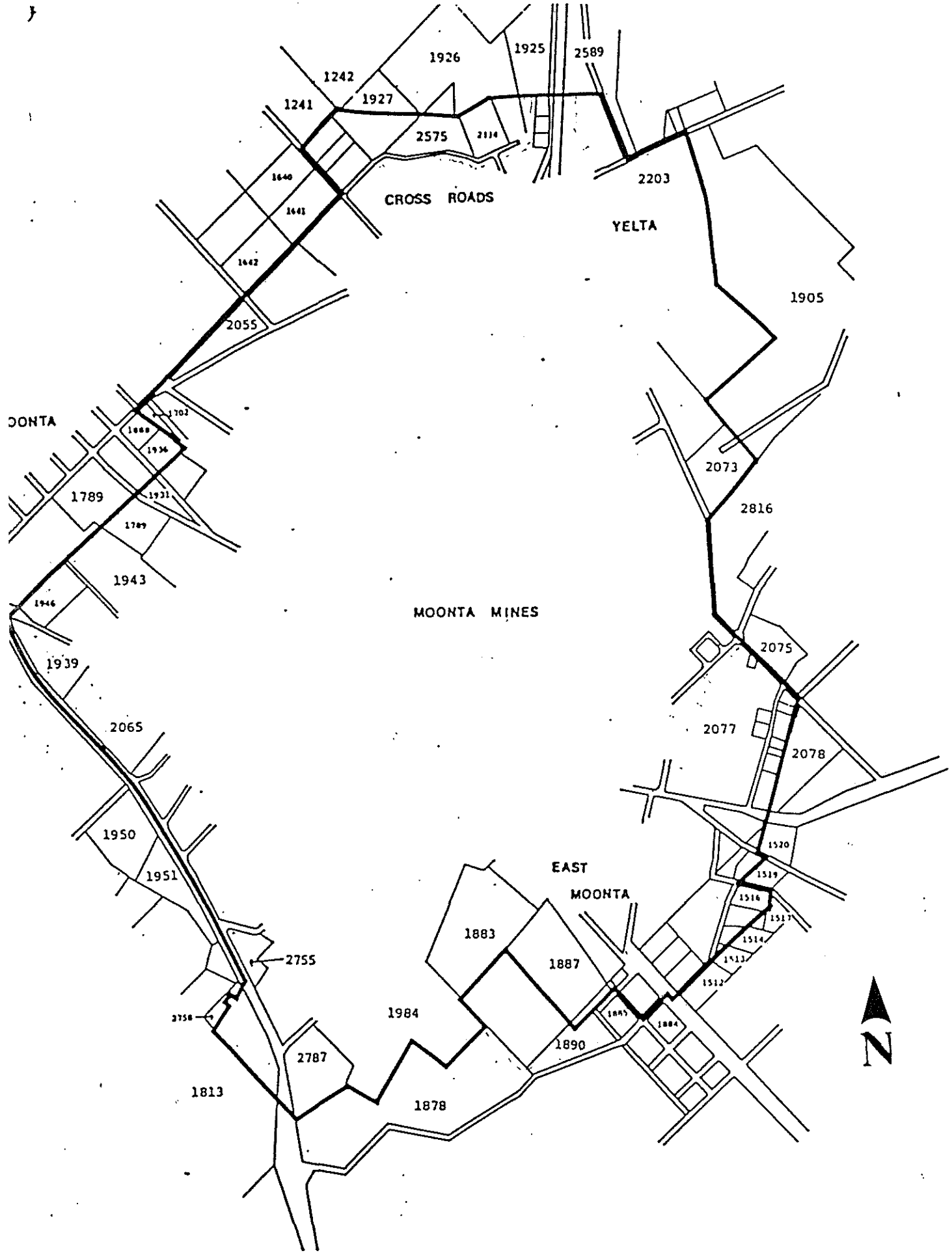


DIAGRAM I:

MOONTA MINES AREA

3. STATE INTERPRETATION MASTER PLAN

Mining has been identified as a Key Theme in the draft Site Interpretation Master Plan (scheduled for completion, August 1983). The following excerpt may serve to place Moonta Mines within an overall historical framework:

The development of mines during the 1840s, largely by Cornish migrants, was critically important for the early economic well-being of the struggling colony. Copper mining, initially at Kapunda (1842), then Burra (1845), predominated over all other forms of mineral extraction and created clusters of isolated settlement within the Wakefieldian agricultural colony, prompting the early development of transportation systems. The proximity of the sea, the richness of the copper ores, and the presence of a colonial establishment with capital, ensured that mining would flourish early in South Australia. As late as 1868 copper exports still surpassed wheat and flour, and the Copper Triangle of Kadina, Moonta and Wallaroo on the Yorke Peninsula further assured South Australia's reputation of being the primary producer of copper ore in the British Empire.

The period from 1890 to 1918 was one of consolidation and modernization, best exemplified by the Wallaroo and Moonta Mining and Smelting Company, whose improvements sustained Copper Triangle operations until 1923. Though South Australia was pre-eminent in copper, it is important to realize that the State is not a richly mineralized area: by 1936 it had yielded only 4% of Australia's total mineral wealth.

3.1 Site Assessment: Copper Mining

The following copper mining sites have been identified as having the best combination of accessible, historically significant in-situ resources for intensive interpretation:

3.1.1 Moonta Mines Site

3.1.2 Burra Mine (including Bon Accord) and Smelter Site

3.1.3 Blinman Mine and Smelter Site

3.1.4 Bolla Bollana Smelter Site

3.1.5 Kitticoola Mine and Smelter Site

3.1.6 Preamimma Mine Site

3.1.7 Sliding Rock Mine and Smelter Site

3.2 Systems Approach: Copper Triangle

Though the resource-base of the Wallaroo Smelter Site, and the Wallaroo Mines (Kadina), is not sufficient to warrant intensive interpretation, there are extant items at these sites that warrant individual attention. A full understanding of the heritage resources of the Copper Triangle can only be expressed by integrated site planning. This approach would view the Copper Triangle as it was historically: a social and industrial totality comprised of interdependent components. The Kadina, Moonta, Wallaroo Conservation Studies (Kinhill Planners, 1979-80), address individually the built environment of the three townships. Further survey research is required, particularly with regard to industrial archaeology, so that all important resources in the Copper Triangle are properly identified. Systems planning would then give priority to conservation and interpretive developments for the district as a whole. This is particularly important for the Copper Triangle, which can be very confusing to the visitor. How will visitors become orientated in future to the fact that the Wallaroo Mines were at Kadina,(not Wallaroo) and have a history directly analagous to that of the Moonta Mines? Why are the railroad stations at Wallaroo and Moonta identical? The National Trust Museums, by virtue of their local collections, serve to thematically differentiate the towns, but no attempt is made to present the integrated or organic nature of the district's industrial and urban development.

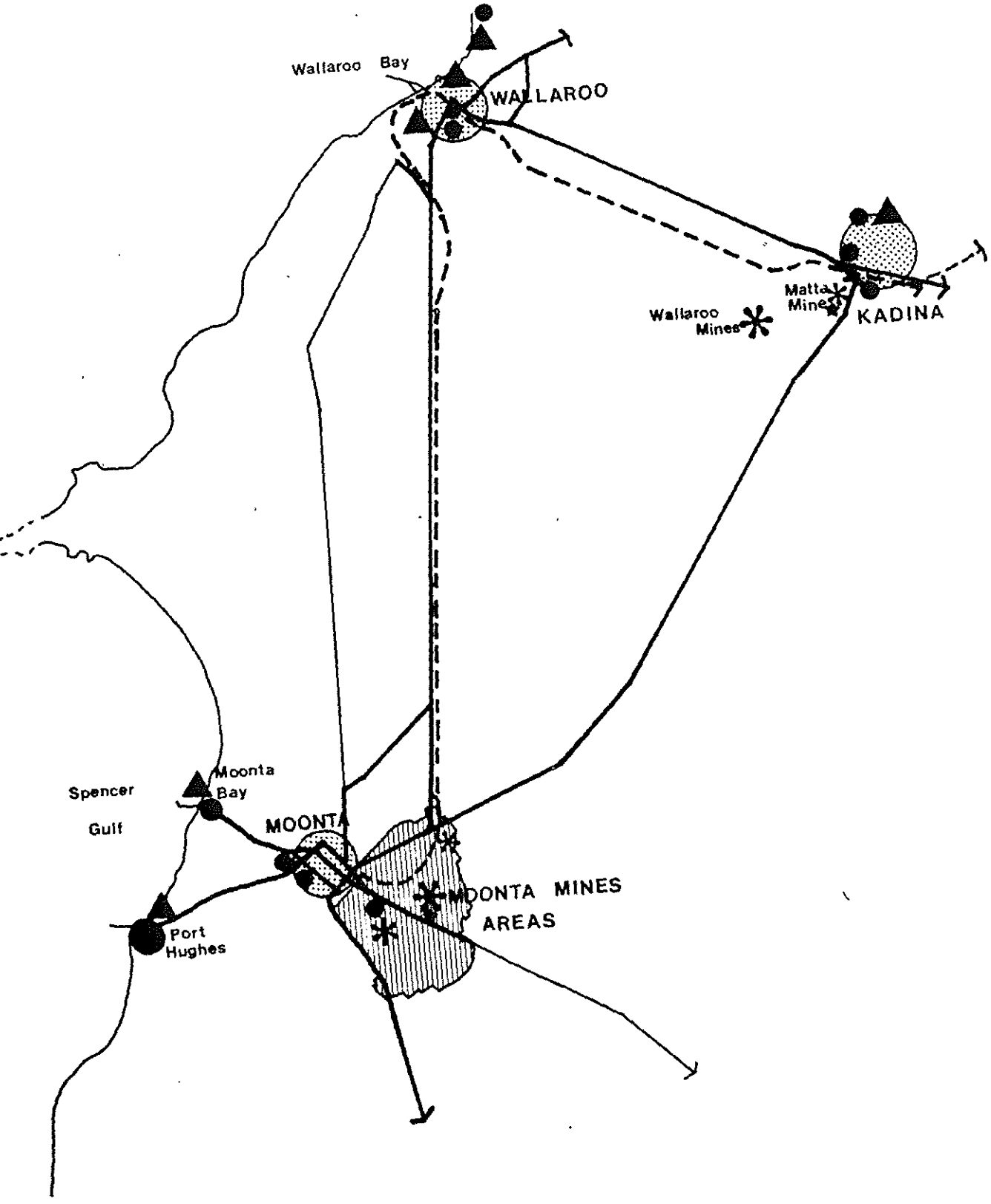


DIAGRAM II: COPPER TRIANGLE

4. THEMATIC FRAMEWORK

For convenience and understanding the historical themes of the Moonta Mines Conservation Area can be delineated under two categories: Social History and Industrial History.

SOCIAL HISTORY

4.1 Cornish Demography

Conditions in Cornwall, mining company inducements and government immigration policies meant that by 1865, 65% of the migrants to South Australia were Cornish. In terms of number and longevity the greater Moonta area was the most significant Cornish settlement in Australia. By the mid-1870s as many as 6,000 Cornish people were living on the Moonta mining leases, and the greater Moonta area was the largest urban settlement outside of Adelaide. Though much of the mining population had shifted to the Wallaroo Mines by the turn of the century, substantial decline of the Moonta Mines settlement did not occur until after the 1923 closure of the mines. In the ensuing decade 3,000 people migrated from the Copper Triangle, 85% of them from mining lease settlements.

4.2 Mining Settlement Pattern

The most striking feature of settlement in the Moonta Mines Area today is the lack of geometry apparent in the residual arrangement of housing and public buildings. Several elements of this theme should be brought to light. First, early settlement evolved in a sudden, ad hoc form as temporary dwellings were constructed on mining leases, in clusters adjacent to mine workings. The proximity of a defined commercial core in the nearby government township, Moonta, ensured that after 1863 there would be no urban planning superimposed on settlement at the mines. The placement of public buildings, mine officers' housing, and occupation blocks often reveals a belated attempt by the mining companies to give some rational order to Mines Area settlement. The role of the mining companies in controlling an adaptive settlement for poor migrant workers is critical to the understanding of this theme.

4.3 Material Culture

This theme can be divided into three basic elements--shelter, food and dress--all strongly reflective of Cornish ethnicity and poor migrant conditions. The Mines Area is characterized by low profile pug cottages, adaptive habitations which in form and construction hark back to Cornwall. Originally two-room dwellings with earth floors, the long life of the mines ensured that each cottage was improved, often with skillion rooms annexed behind to provide kitchen facilities. As most of the cottages were situated on mining leases controlled by large mining companies, they were not developed with permanence, rather with a uniformity suggestive of a Cornish mining class. The dwellings of the mine officers, a high proportion of which have survived, represent a more middle class material culture.

4.4 Organization of Work

Cornish work customs, such as "tribute", "tutwork", Survey Day and the contractual work pattern are important aspects of this theme. The wage-based employment of surface workers and company officers should also be understood in terms of the social hierarchy implicit in the corporate structuring of work. Despite that Moonta Mines were developed wholly by Cornish miners, engineers and "captains", the exploitative nature of company control has much to do with nineteenth-century British industrialism in general.

4.5 Labour Conditions

This theme concerns the day-to-day working conditions, with particular emphasis on physical conditions for the underground miners. An 1864 strike led to the dismissal of the two original managers of the Moonta Mines; and the 1874 "brushing" strike reveals the ethnic, non-unionized nature of labour unrest. The practice of letting by contract was to the company's advantage in later years, when Moonta workers were paid the lowest wages in South Australia, but even so were disinclined to support the secular Amalgamated Miners Association.

4.6 Methodism

The spiritual quality of the Cornish people, epitomized by the religious revival in the Mines Area in 1875, is the most significant element of this theme. By 1899 there were 11 Wesleyan chapels on the mining leases, representing the diverse denominations and social groups within the Cornish settlement context--Primitive Methodists, Bible Christians, and so forth, each with their own spiritual style. No other heritage area in Australia has a stronger Methodist tradition.

4.7 Health and Welfare

The closest hospital to the Mines Area was at Port Wallaroo. The living conditions in the Mines Area were among the worst in nineteenth-century Australia. Typhoid epidemics were common (110 died in one week) in the Mines Area before 1890 because of the lack of drinking water. The ad hoc settlement was not compatible with community health, as no organized sanitation services could be devised.

4.8 Education

The South Australian colonial government was particularly lax in bringing public education to the mining population. Prior to the Compulsory Education Act of 1875 education was denominational (the Wesleyan Sunday School), and illiteracy was the norm. The Act meant that young workers required an education certificate before they could work, and it led to the construction of the Moonta Mines Model School in 1878 (the most impressive public building in the Mines Area, which is now the National Trust Museum). In 1879 1,030 pupils attended this school, a measure of its cultural importance.

4.9 Domesticity

Women's role within the framework of an industrialized Cornish migrant society is the main feature of this theme. The family remained the primary social institution in the Mines Area (which was not the case with gold rush society). The 1874 "brushing" strike, when the miners called upon their women to humiliate the company officers, suggests some matriarchal bias to Cornish culture. On a functional level, the relationship between material culture and domestic chores should be developed.

4.10 Art and Recreation

Two traditions are apparent as features of this theme. First, Cornish pagan tradition involves occasions such as the celebration of Midsummer's Night, and a love of cockfights and wrestling. Carol singing is perhaps the most obvious expression of Cornish spirituality. The second tradition is not ethnic, but rather pertains to the regional development of sport and pastimes that are typically Australian. The appearance of an Exhibition Ground, a Rotunda Square and tennis courts within the ironical context of the Mines Area are part of this latter tradition.

INDUSTRIAL HISTORY

4.11 Resource Discovery and Exploration

By 1861 there were 650 mineral claims on Yorke Peninsula, and the story of how Captain Hughes seized control of the ore body discovered by shepherd, Patrick Ryan, is now legendary in Australian mining history. The excitement of the speculative copper boom initiated by the development of the Wallaroo Mines, and the subsequent discovery of 5 rich lodes in the Moonta Mines Area must be presented before any understanding of the region can be attained. Early methods of mineral exploration, the processing of mining leases, all these should be detailed as a basis for understanding the morphology of area land use.

4.12 Ore Recovery

By 1862 six shafts had been sunk at Moonta Mines, and 4,865 tons of ore raised. By 1879 more than 50 shafts existed, and the Mines Area was producing the greatest quantity of 20-30% copper ore in Australia. The technical aspects of this theme--underground shafts, drives and "wallows" developed to depths exceeding 2,500 feet--must be presented. The specific manner of working the Moonta lodes, with its geological implications, should be developed. Also, the mechanics of moving men and ore underground are integral to this theme, and expressive of period mining in general.

4.13 Ore Sorting and Movement

Sorting floors, adjacent to shafts, are today a major extant feature of the Mines Area. The ore was sorted "at grass", and young men worked at "pickey tables" in the crushing plant, culling high-grade ore which would go directly to the smelters. By 1906 only 5.3% was culled, 88.5% going directly to the concentrator house, and 6.2 % was returned underground for mullocking. See Appendix A, pp. 2-2C, for a discussion of sorting and crushing in the Mines Area.

4.14 Concentration Processes

See Appendix A, pp. 3-4B, for an explanation of this processing at Moonta Mines.

4.15 Slimes and Cementation Processing

See Appendix A, pp. 5-6B, for an explanation of these processes at Moonta Mines. A personal note to this theme pertains to the importance of Antonio Delgado in developing modern practises for the recycling of waste tailing dumps.

4.16 Industrial Engineering and Construction

This is a multifarious theme, embracing those aspects of the operating "plant" which involved the importation of mining technology and the development of indigenous engineering and construction methods. Hancock's Jig might be the focus for a discussion of adaptive inventiveness. Also, the machine shops at Moonta Mines were the most significant in South Australia. The expression of Cornish traditions in construction methods and design is of paramount importance.

4.17 Water Supply and Control

This theme concerns both the industrial and public uses of water, and associated waterworks. Hughes' Pump House, the most well-known heritage item extant, must be viewed for its historic role of extracting brackish water from the ground so that a lowered water table would facilitate shaft mining. The development of pumping methods is important, particularly where it relates to the pumping of salt water from Moonta Bay to the Mines Area for slimes and cementation processing. The Mines Area is characterized by a total lack of surface drinking water. The early use of run-off wells should be discussed, and the company's distillation plant, as well as the later development of a reservoir system.

4.18 Transportation Systems

Lode mining depends on rail transportation to move machinery to a mine, and to move ore around a mine site and eventually to a smelter. The industrial transportation network at the Moonta Mines is especially difficult to comprehend, except in terms of its linkage to the smelters at Wallaroo. The areal transportation pattern must be explained in terms of lode lines and the movement of ore to the Moonta-Wallaroo mainline. Tramcar lines which bisected the Mines Area, and led to settlements and associated public buildings, should be viewed as the link to the commercial township of Moonta.

4.19 Company Administration

The nature of colonial corporate organization is important to to any discussion of the Moonta Mining Company, which operated privately for 28 years after the discovery of ore. In 1889 the amalgamated Wallaroo and Moonta Mining and Smelting Company was formed, for many years the largest corporation in South Australia, and it survived fluctuating economic conditions until 1923. The management style of Henry Richard Hancock, and his son, Henry Lipson Hancock, are important factors explaining company administration. Of equal importance to the above is the interrelationship of different mining companies in the Mines Area, and their overall relationship to the Kadina and Wallaroo Railway & Pier Co.

5. VISITOR TARGET POINTS

At present visitors are given little sequential site orientation, though the Moonta guidebook's "Tour 1" does attempt to guide vehicles along a convoluted path touching upon a large array of sites. Area signs are confusing, but most visitors are induced to veer off the bitumen road along tracks leading to the most visually impressive sites: Moonta Mines Model School (museum), Ryan's Tailing Heap, Ryan's Shaft, Richman's Concentrating Plant and Tailing Heaps, Hughes' Pumping House, and the National Trust Miner's Cottage. Any selection of target points from which to develop the interpretation of the Mines Area must take into account the pre-existent stops-of-interest. It follows that intensive interpretation should only occur where resources of sufficient interest exist, so that at all times the visitor is entertained by the scene while being informed. Target points should also be selected to treat different area themes in a rational, sequential manner, so that a broad thematic coverage is achieved. Lastly, the selection of target points should not interfere with the conservation of the Mines Area, but rather lead to a controlled visitor use which decreases the impact on more fragile resources. The following is a prospective list of Mines Area target points:

5.1 Moonta Railway Station
5.2 National Trust Miner's Cottage
5.3 National Trust Museum (former Moonta Mines Model School)
5.4 Moonta Mines Methodist Church
5.5 Hughes' Pumping House
5.6 Taylor's Shaft
5.7 Richman's Concentrating Plant and Tailing Heaps
5.8 Ryan's Tailing Heap

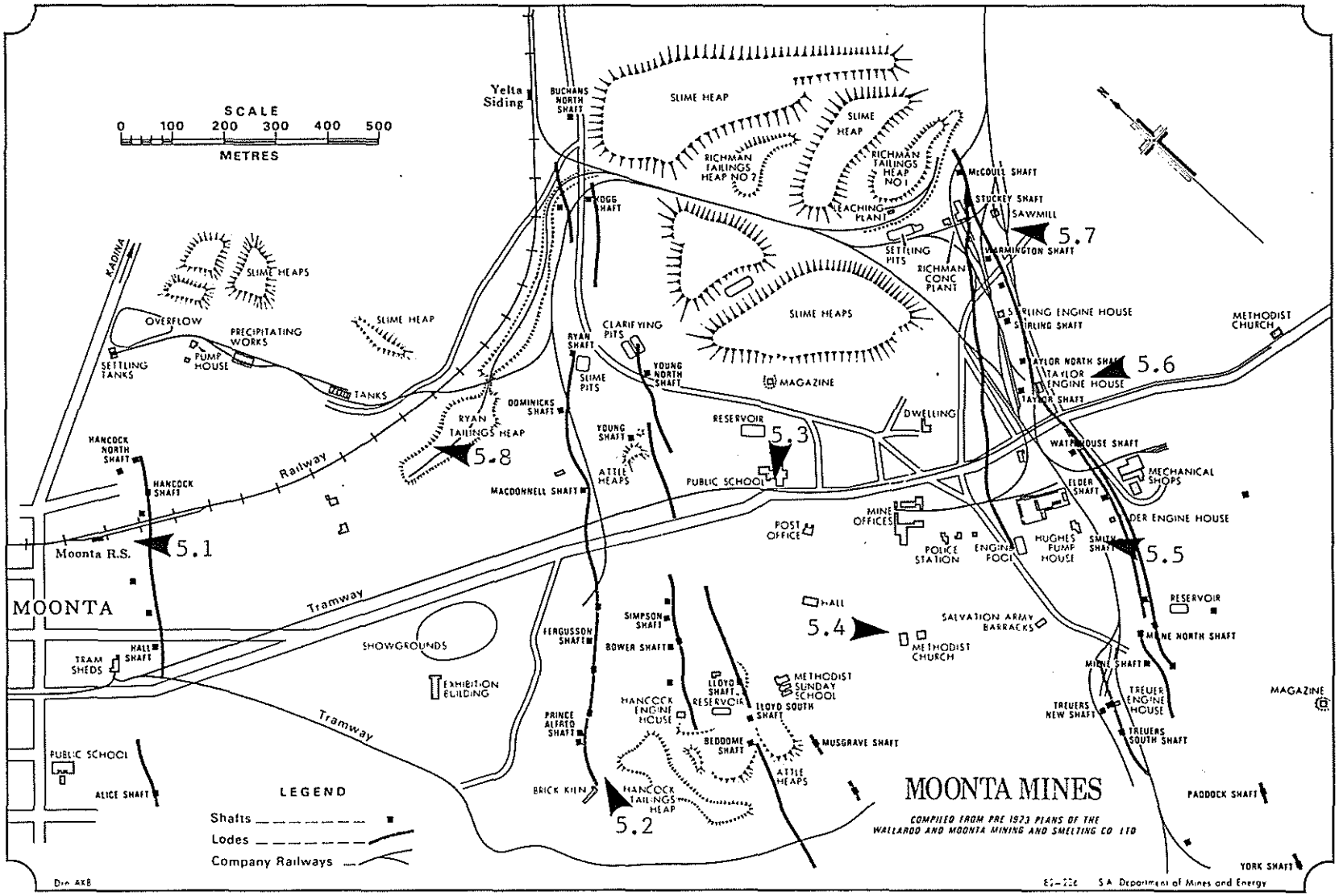


DIAGRAM III: TARGET POINTS

(marked within historic framework)

6. CONTROL PATTERN

The Control Pattern, depicted on Diagram IV which follows, takes into account prospective visitor movement, interpretation, conservation and security needs. It is a practical solution to immediate site management problems, and as such may be seen as Phase I development for this site.

6.1 Vehicular Movement

For the most part, traffic flow delineated in the Control Pattern is guided along the major roads and tracks presently used by visitors. The construction of a defined road between Richman's Plant and Ryan's Tailing Heap would help to preserve the slimes which are now being overrun by vehicles travelling aimlessly between these two points. A defined road here would also delimit the use of Ryans Road to local traffic. Given that most visitors are inclined to use their vehicles to reach sites (walking is arduous and hazardous in this expansive, often hot environment), the Control Pattern seeks to minimize vehicular intrusion on the major structural resources and living areas. The construction of shaded parking areas is integrally important to this system, for little protection from the sun exists now. Such parking areas will, ideally, help to put the visitor in a more liesurely frame of mind as they are all immediately adjacent to sites and short walks of interest. Movement will be controlled by fencing and directional signs, and it is felt that visitors will readily adhere to this system, given the present confusion of tracks, and the overriding desire of the visitors to see and understand the major resources of the Mines Area.

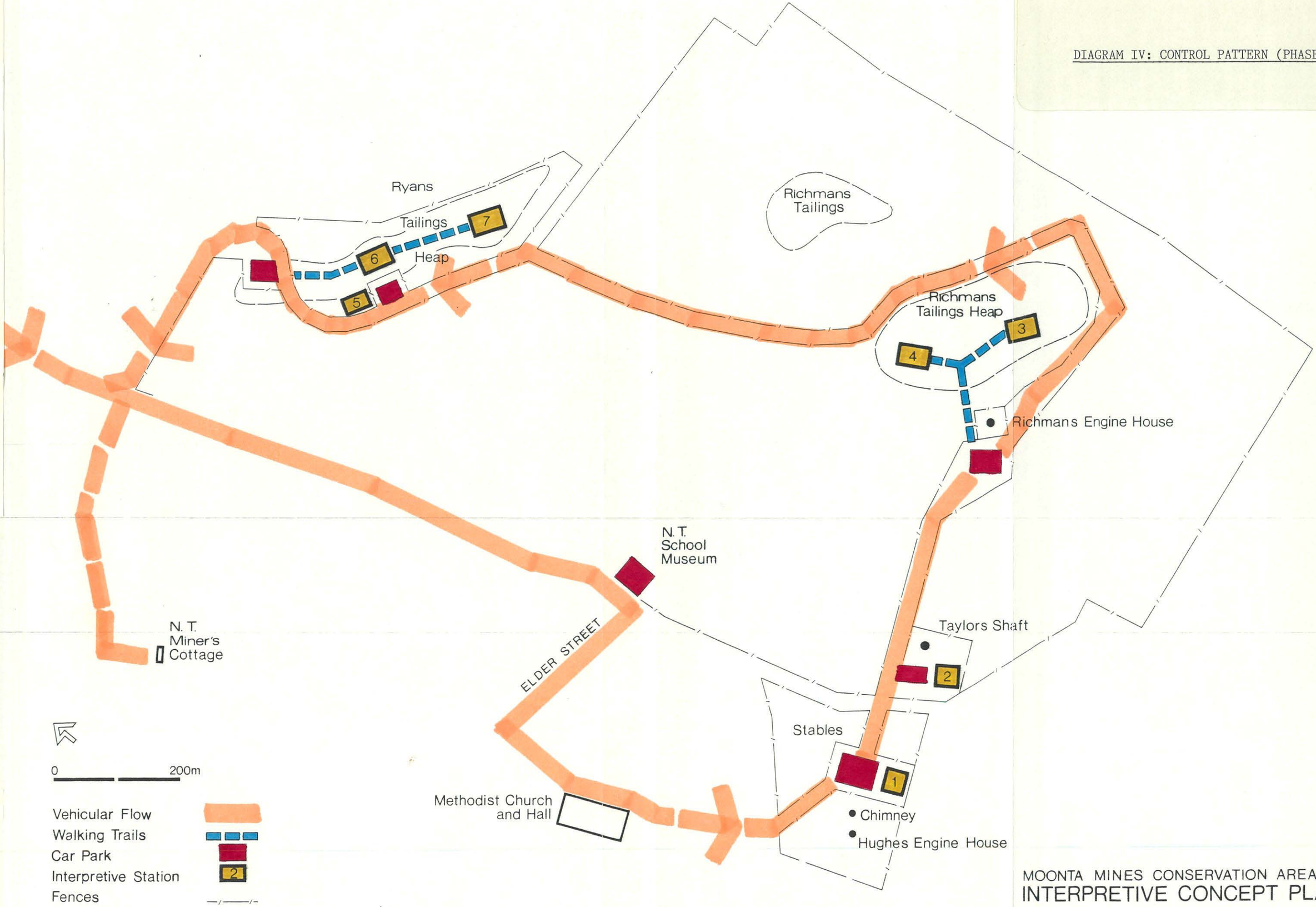
6.2 Interpretation and the Control Pattern

Sites and target points related to Industrial History are presented in the logical sequence of mining operations, i.e., ore recovery is dealt with at Taylor's Shaft before concentration processes are treated at Richman's Plant. The flow pattern also stresses areal orientation, with visitors ending up at high vantage points from where they can gain a final overview of the Mines Area. As interpretation depends on having the audience in a receptive frame of mind, the Control Pattern is designed to maximize the time visitors spend outside of their vehicles, by guiding them along a mostly one-way route past a succession of stops. Defined walking paths and interpretive stations are essential to guide visitors to passive media, interpretive signs.

6.3 Conservation and Security

The Control Pattern is designed to minimize the destabilizing impact of visitors on major sites. It outlines only the essential control requirements for Phase I of development, which would protect major resources from misuse, and secure visitors from the obvious hazards of open shafts and unstable ruins. The construction of walking paths is deemed essential for the survival of Richman's Tailing Heaps and Ryan's Tailing Heap, as only the surface crust of these industrial landforms sustains their underlying terraced form. Areal fencing on the Control Pattern is designed for the greatest security need, namely to stop motorcyclists from sporting on the heaps and slimes. Though Hancock's Tailing Heap and the Hamley Mine are significant features of the Mines Area, as with many other sites they are better left alone in Phase I of development. However, the fencing of Hancock's Tailing Heap is critically important for its stabilization, as the heap is about to collapse, having been undermined by the Highways Dept. road-fill excavations and eroded by the Pony Club (who have a hitching post on the surface). Also, vehicles using Bower Street to reach Hancock's Heap are driving directly over ore floors. Archaeological investigations are required for many zones before any interpretation should be devised.

DIAGRAM IV: CONTROL PATTERN (PHASE I)



MOONTA MINES CONSERVATION AREA

INTERPRETIVE CONCEPT PLAN

7. INTERPRETIVE EXPERIENCE

This section proposes programme and media solutions for developing interpretation at the target points chosen in section 5. As the Heritage Conservation Branch has a role in the interpretation of in-situ heritage resources, but no mandate to develop museums (the domain of the History Trust), programme recommendations for the National Trust Museum and the National Trust Miner's Cottage are made in the light of their thematic relevance as heritage resources to the Mines Area as a whole.

7.1 MOONTA RAILWAY STATION

7.1.1 Themes

Transportation Systems (4.18)

7.1.2 Programme

The Moonta Railway Station is strategically located to intercept vehicular traffic coming from Kadina, and to serve as an Orientation Centre for the township of Moonta and the Mines Area. Though it was constructed in a Federation style in 1908 (see Figure I) on the site of the original Moonta railway station, it remains as the only substantial item associated with the above theme. Its situation makes it ideal for the distribution of literature and general information about the geography of the greater Moonta area. Adaptive reuse of this structure is recommended as part of Phase II development.

7.2 MOONTA MINES MODEL SCHOOL (NATIONAL TRUST MUSEUM)

7.2.1 Themes

Education (4.8)
Water Supply and Control (4.17)

7.2.2 Programme

The role of the museum needs to be redefined to suit its central position in the Mines Area. At present the Moonta Branch of the National Trust seeks to expand its outdoor exhibits collectively known as the "Wheal Munta", and generate more tourist interest through active, participatory programmes that are loosely representative of copper mining in South Australia. The interpretation of the Moonta Mines Model School as an educational institution for Mines Area settlement is inadequate at this time, and there is no interpretation of the Water Supply and Control theme inherent in the substantial ruin of the reservoir adjacent to the schoolyard. Until such time as the Moonta Railway Station is developed as an Orientation Centre, the visitor will be introduced to the Mines Area at the museum. It is recommended that basic information regarding the interpretive tour outlined in the Control Pattern be made available at this target point, which for Phase I of development is identified as the start of the tour. It is also recommended that the interpretation of the above themes at this target point not be attempted until a Development Plan has been completed for the redevelopment of a defined museum precinct. Development options must be considered which take into account the full significance of the school in the social history of the Mines Area. Of equal importance is the need to have the museum provide active interpretation which supplements the passive interpretation of in-situ resources. Also, certain themes delineated in section 4 have no correlative extant resources and can only be interpreted in a museum context. The prospective role of the museum as an Interpretation Centre for the Mines Area is discussed in section 8.

7.2.3 Photo: Moonta Mines Model School (National Trust Museum)

7.3 NATIONAL TRUST MINER'S COTTAGE

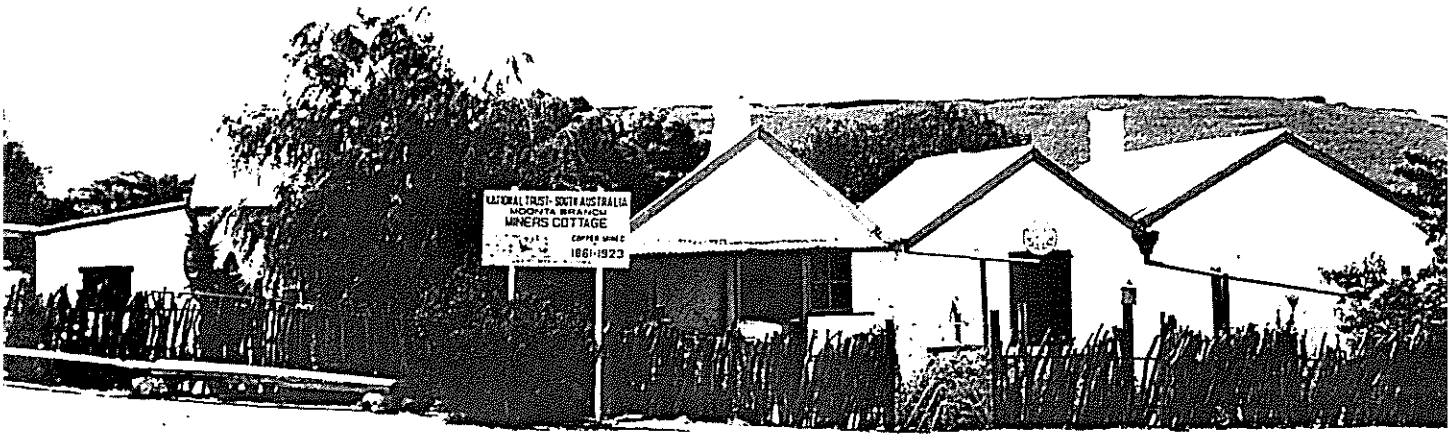
7.3.1 Themes

Extractive Settlement Pattern (4.2)
Material Culture (4.3)
Health and Welfare (4.7)
Domesticity (4.9)

7.3.2 Programme

The proximity of this cottage to Hancock's Tailing Heap, which looms directly behind, makes it ideal for explaining how temporary dwellings were constructed on mining leases. However, its isolation from the more concentrated clusters of settlement means that it is not suggestive of any communal pattern. Though it presently purports to depict "the typical home of a Cornish miner", its general atmosphere is not typical of Material Culture or Health and Welfare conditions during the mining period, 1861-1923. In view of the fact that this target point provides the only "environmental" depiction of the above themes, it is recommended that the cottage be redeveloped so that greater representative verisimilitude can be achieved. Character animation (role-playing) that interprets period domestic activities should be integrated into any redevelopment plans as part of Phase II development of the Mines Area.

7.3.3. Photo: National Trust Miner's Cottage



7.4 MOONTA MINES METHODIST CHURCH (UNITING CHURCH in AUSTRALIA)

7.4.1 Themes

Methodism (4.6)

7.4.2 Programme

As this is the only public building in the Mines Area still being used for its historical purpose, interpretation of the above theme would seem a matter of adaptation rather than reconstruction. This historic church, constructed in 1865, has a major role to play in Phase II of Mines Area development. A display concerning Methodism within the Mines Area should be established inside the hall adjacent to the church. Once visitation warrants it, special church services should be established for Mines Area visitors, which involve some characterization of Wesleyan sermonizing and ceremonial practices.

7.5 HUGHES' PUMPING HOUSE

7.5.1 Themes

Water Supply and Control (4.17)

7.5.2 Programme

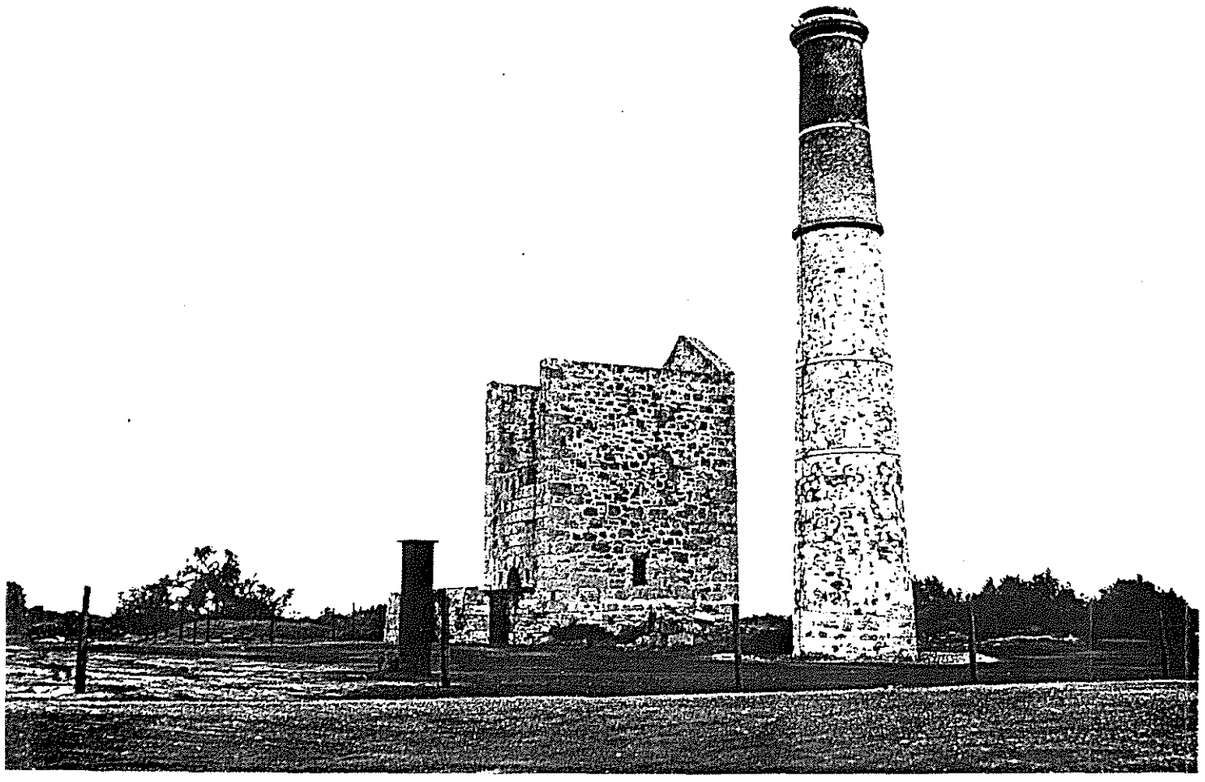
This pumping house and its chimney have become icons of Australia's industrial heritage. Construction of these items, using fossilized limestone from Boor's Plains, began in 1864. For nearly 60 years the pumping engine operated to drain the underground workings, the water table not being very deep at Moonta. At present these restored items are misunderstood by most visitors, for the rear of the pumping house (where the National Trust plaque is situated) appears now to be the front, and the items are usually seen as symbolic of shaft ore recovery, not drainage. As drainage was the necessary initial step in mining operations, it is recommended that site-based interpretation of copper mining in the Moonta Mines Area commence at this target point.

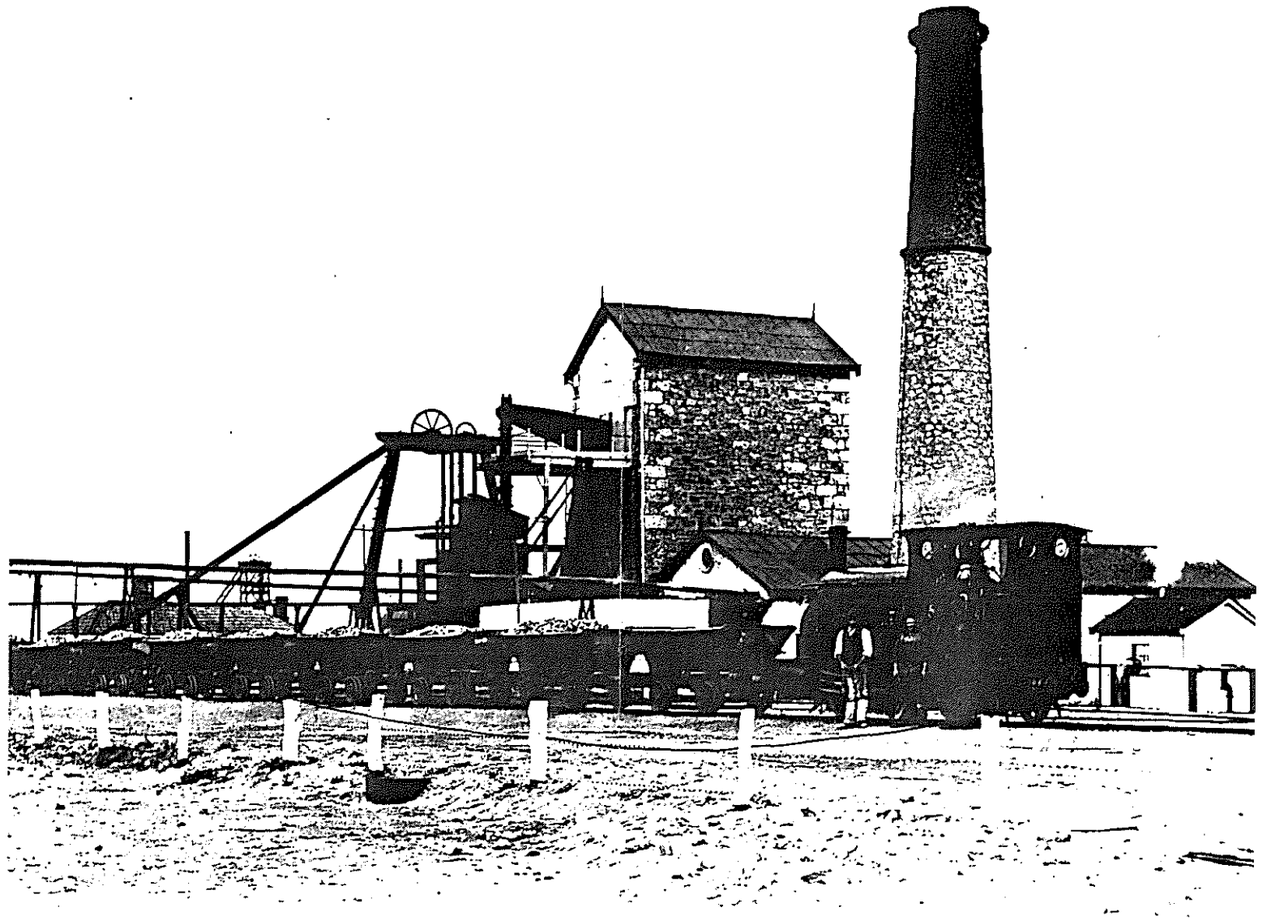
7.5.3 Interpretive Station #1

As several historic photographs of Hughes' Pumping House are extant, and we understand in detail its operation and engineering qualities, it is an ideal location for a metalphoto display of the site's past character. Information would cover theme 4.17 in general, then deal with the documentary specifics of Hughes' Pumping House, relating the surface items to underground drainage. As most of the historic photos were taken from the angle apparent in photos that follow, there should be some interpretation of how the site was improved and altered over the years.

INTERPRETIVE STATION #1

HUGHES' PUMPING HOUSE





7.6 TAYLOR'S SHAFT

7.6.1 Themes

Ore Recovery (4.12)
Ore Sorting and Movement (4.13)

7.6.2 Programme

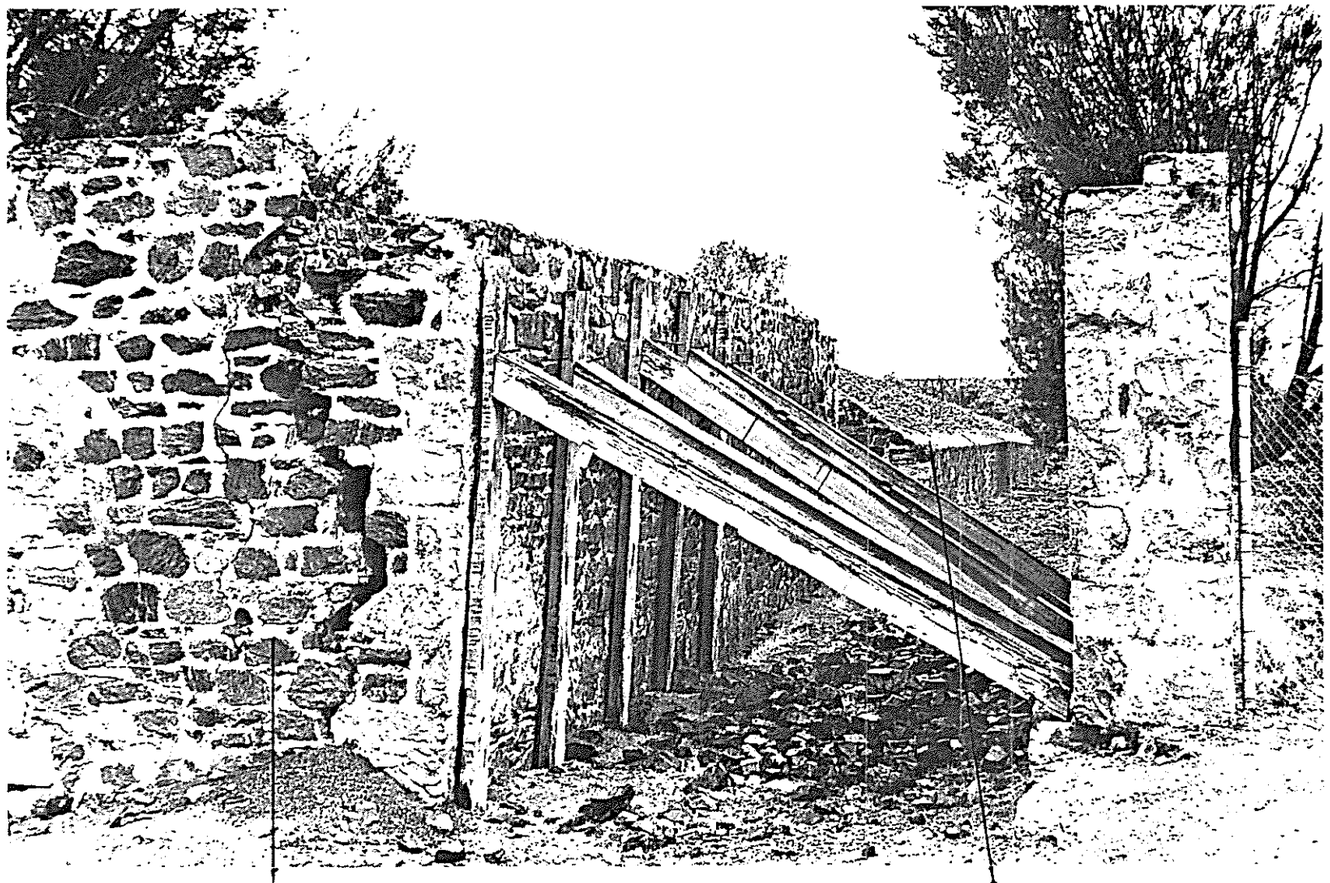
Situated in Elder's Main Lode, Taylor's Shaft was more than 2,520 feet in depth and was worked continuously from 1862-1923. Taylor's Crushing and Sorting Plant was the largest in the Mines Area, and was the major terminus for ore movement. At present, substantial ruins are clustered amid the best examples of ore floors extant in the Mines Area (see the photos which follow). A steel fence encloses Taylor's Shaft. This is the most difficult target point in terms of orientative comprehension for the visitor, yet it is perhaps the most significant, thematically speaking. Some clearing of vegetation is required before the complex of heritage items will cohere visually. Important subthemes here: the operation of a hauling shaft with a Cornish Winding Engine (Prankherd's until 1900) or Horizontal Winding Engine (installed at Taylor's after 1900); ore dressing, crushing and sorting; and the movement of ore to Richman's Concentrating Plant.

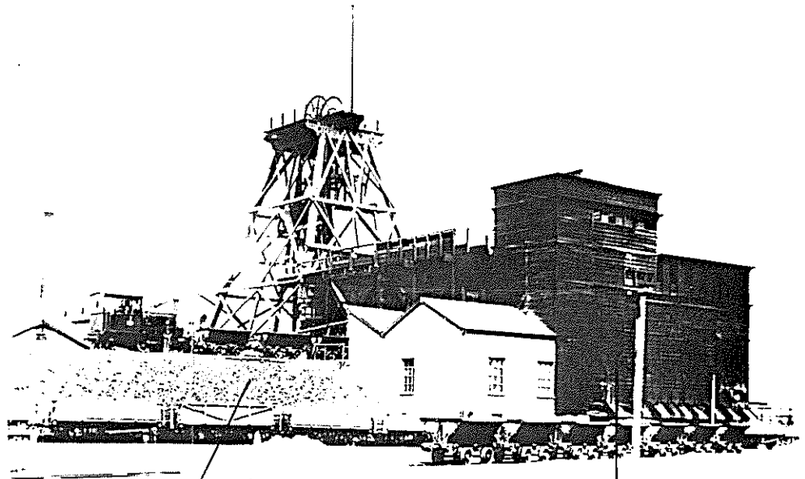
7.6.3 Interpretive Station #2

It is recommended that a metalphoto display introduce the visitor to the complex of items by the use of historic photos. It should also diagrammatically suggest the scale and depth of underground workings in relation to the scale of historic surface items. Clearing and marking will help to orientate the visitor to surface ruins, but this should not be attempted before there is more archaeological documentation of items. A study of this particular target point zone should also address security and conservation needs, before detailing a walking tour.

INTERPRETIVE STATION #2

TAYLOR'S SHAFT



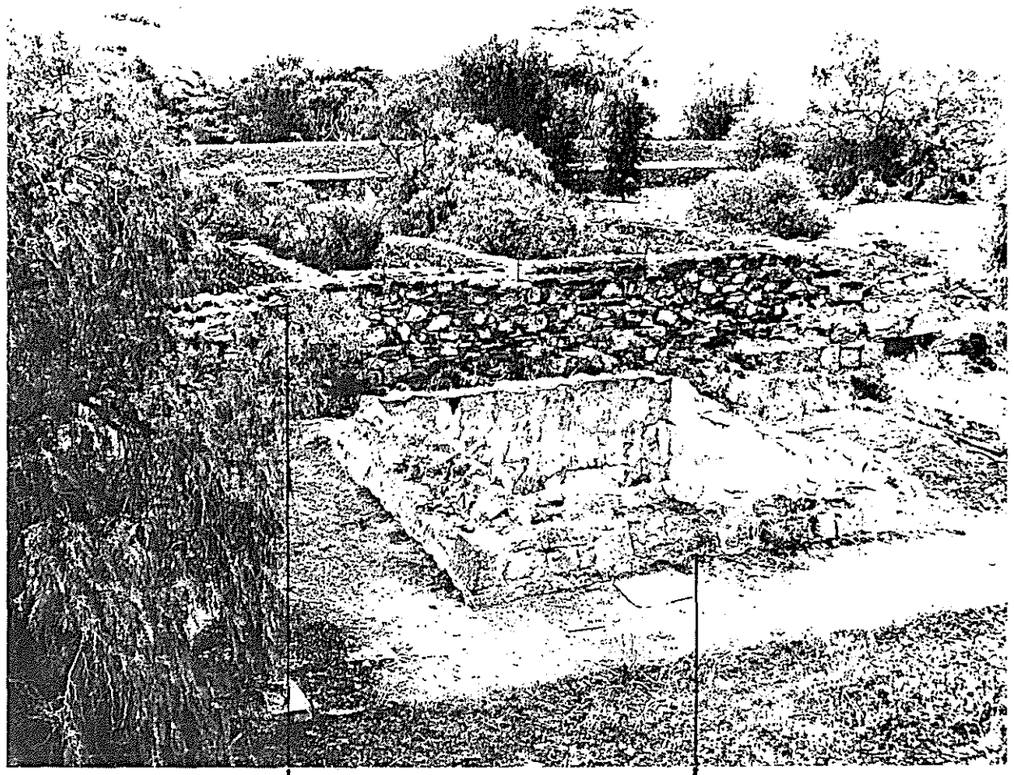


RAILWAY GRADE

CRUSHING AND SORTING PLANT

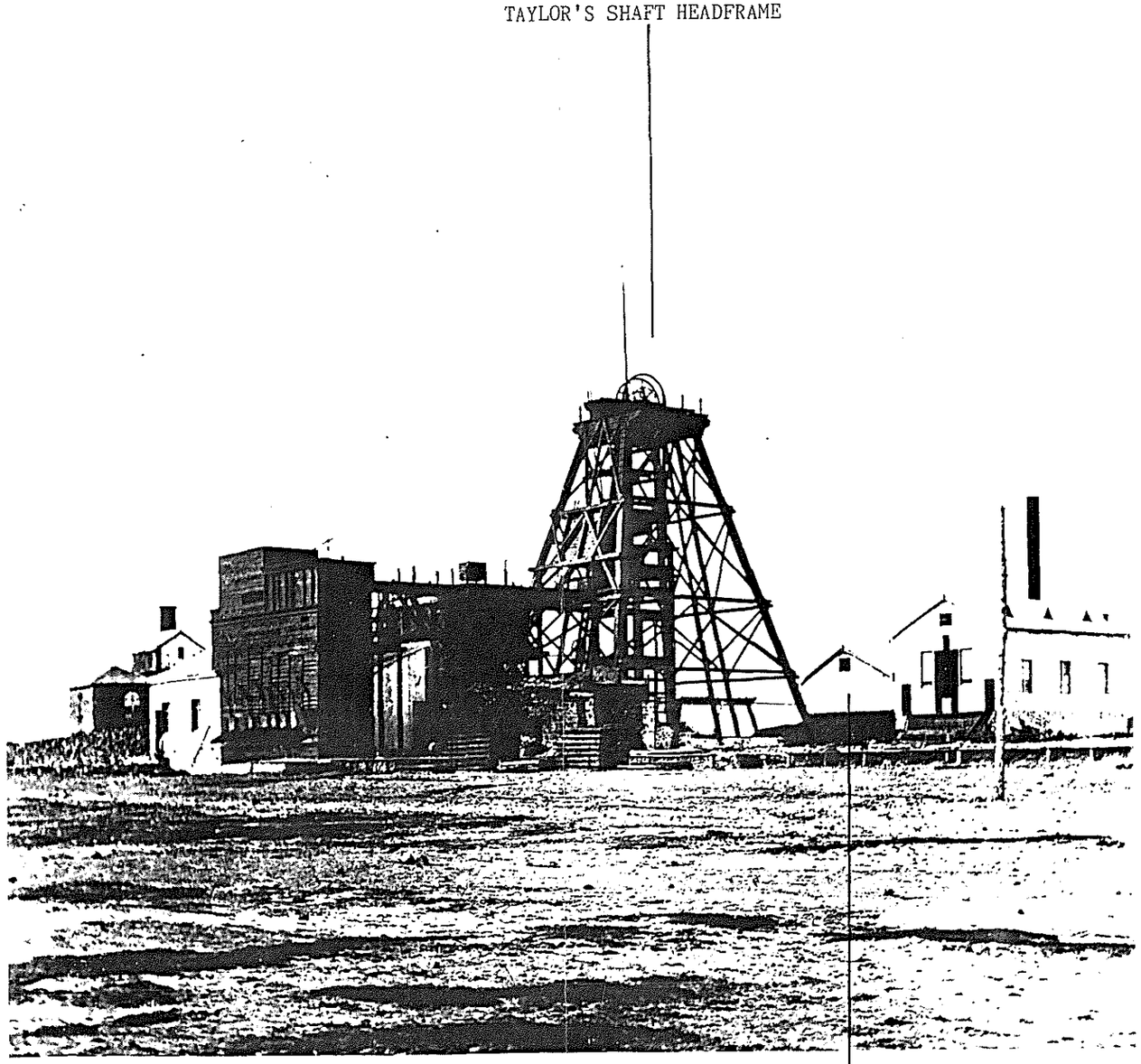
INTERPRETIVE STATION #2

TAYLOR'S SHAFT



CHIMNEY FOUNDATION

TAYLOR'S SHAFT HEADFRAME



BOILER HOUSE

7.7 RICHMAN'S CONCENTRATING PLANT AND TAILING HEAPS

7.7.1 Themes

Concentration Processes (4.14)
Slimes and Cementation Processing (4.15)

7.7.2 Programme

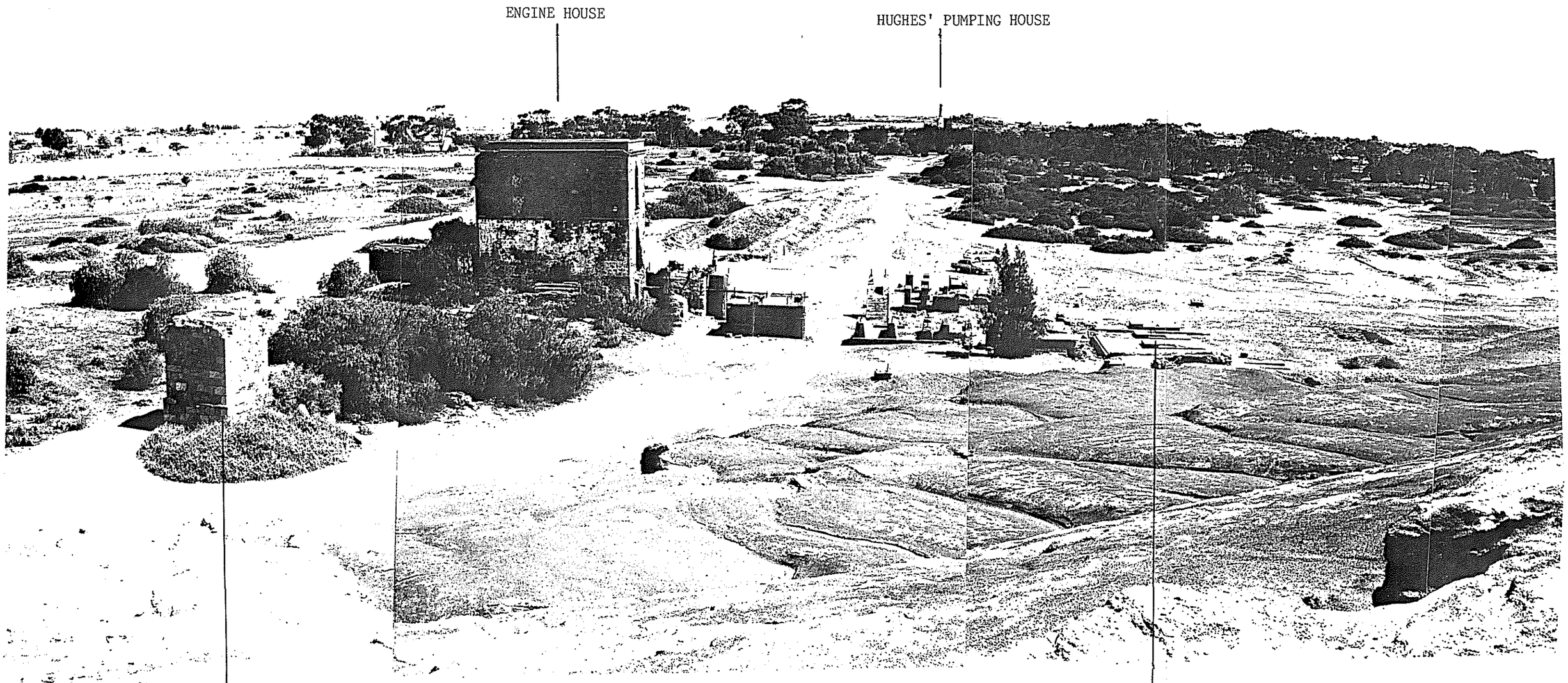
At ground level the visitor should be provided with information concerning the imposing Engine House (constructed in 1869), still largely intact and arguably the most impressive ruin in the Mines Area. Ore from the various shafts along Elder's Main Lode was concentrated here before being transported to the Wallaroo Smelters. It is critically important to fence off the visitor from the Engine House, until such time as it is stabilized or restored. Information must also be imparted on the walkway up the terraced side of the skimping heap, which would discuss the terraces and the practice of depositing tailings that created this, the largest heap among Moonta's once famous "Himalayas". It is recommended that two interpretive stations be situated atop this heap.

7.7.3 Interpretive Station #3

From this high vantage point the visitor will view Elder's Main Lode, the line of which is marked by Hughes' Pumping House in the distance (see the photos which follow). The lode itself will be discussed, with a view to reinforcing the sequence of mining operations already experienced. A metalphoto display will reveal the industrial built environment that historically existed along this lode line (see cover photo), with particular reference to the buddles concentrating area associated with Richman's Plant.

INTERPRETIVE STATION #3

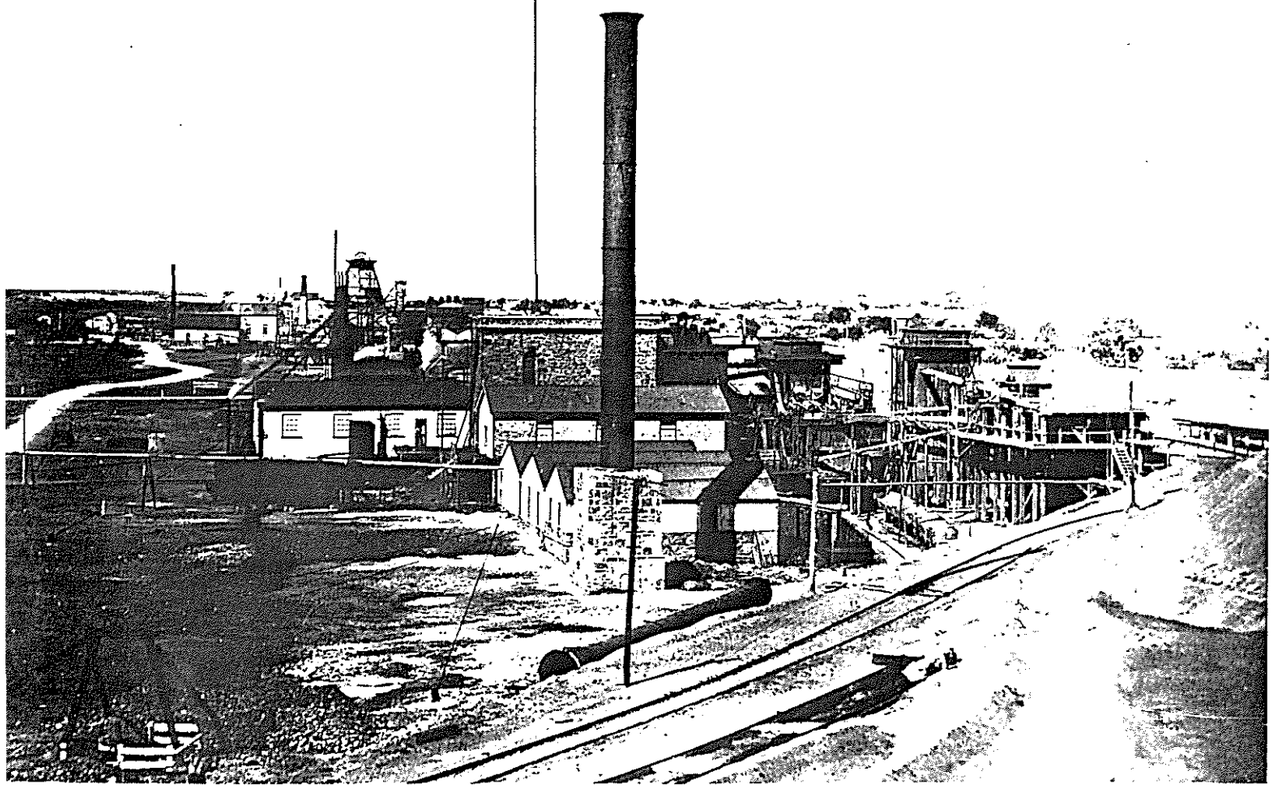
RICHMAN'S CONCENTRATING PLANT



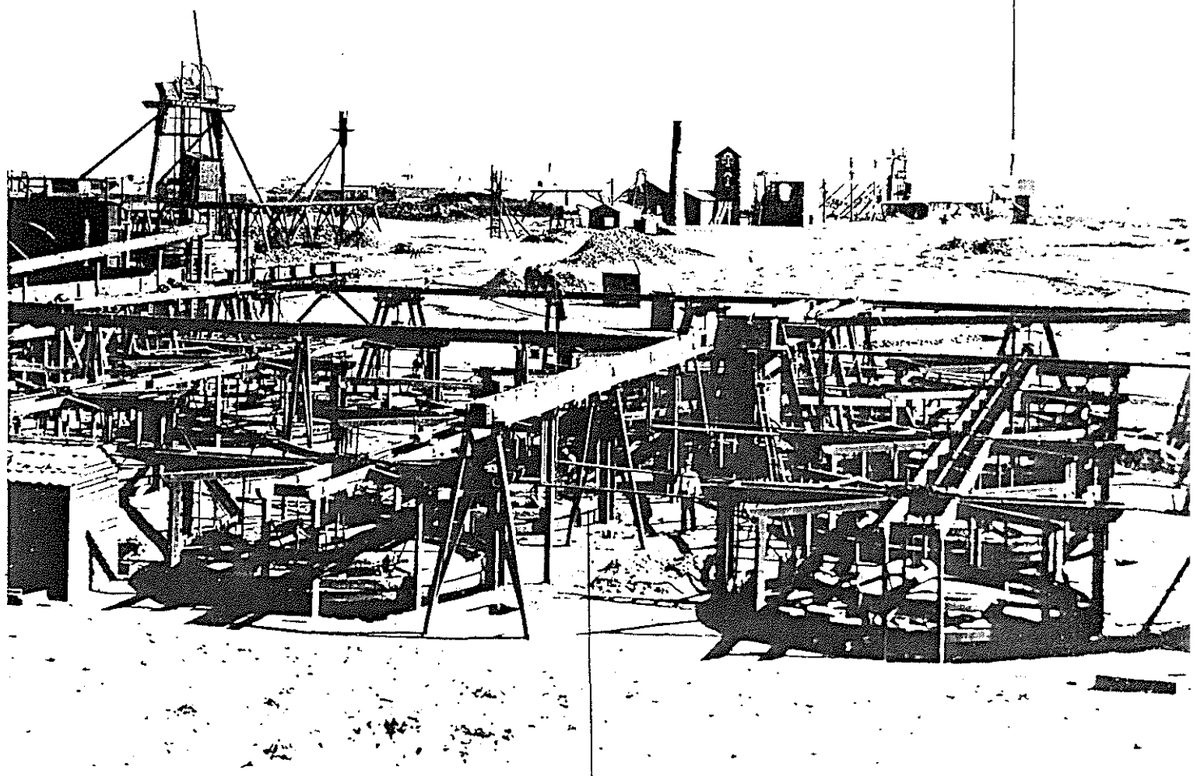
INTERPRETIVE STATION #3

RICHMAN'S CONCENTRATING PLANT

ENGINE HOUSE



HUGHES' PUMPING HOUSE



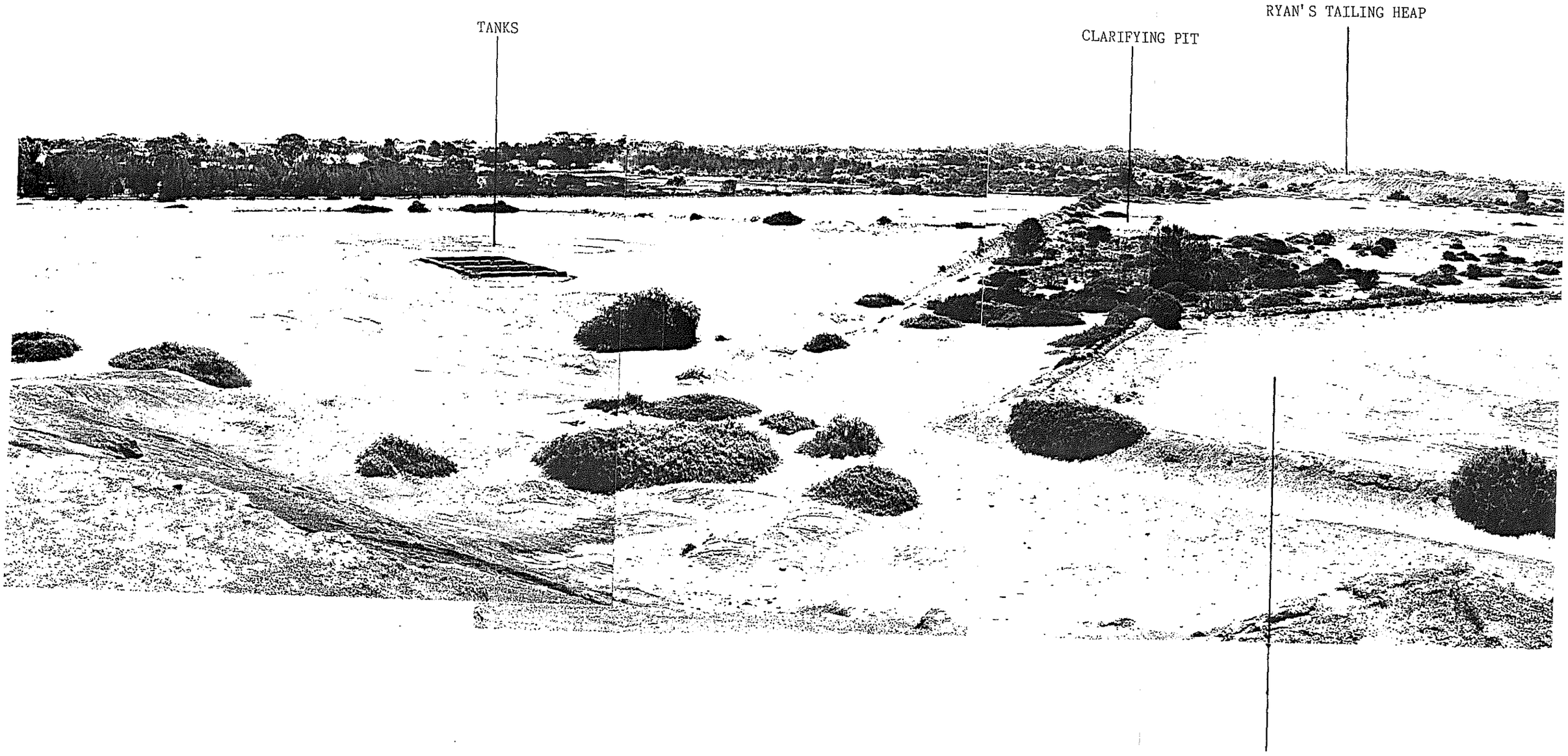
BUDDLES AREA

7.7.4 Interpretive Station #4

From this elevated station a spectacular westerly panorama of the Mines Area reveals a flat plain denuded of vegetation, and and the second tailing heap associated with Richman's Plant. It is recommended that a metalphoto display of the present scene identify landscape items. Information concerning slimes processing, which created this industrial desert, should be imparted. The analogous cementation process, whereby water was percolated down through heaps so that a copper solution could be leached out of the tailings will be introduced here, with diagrammatic reference to Richman's second heap and the residual grid-pattern of waterworks still apparent atop both heaps.

INTERPRETIVE STATION #4

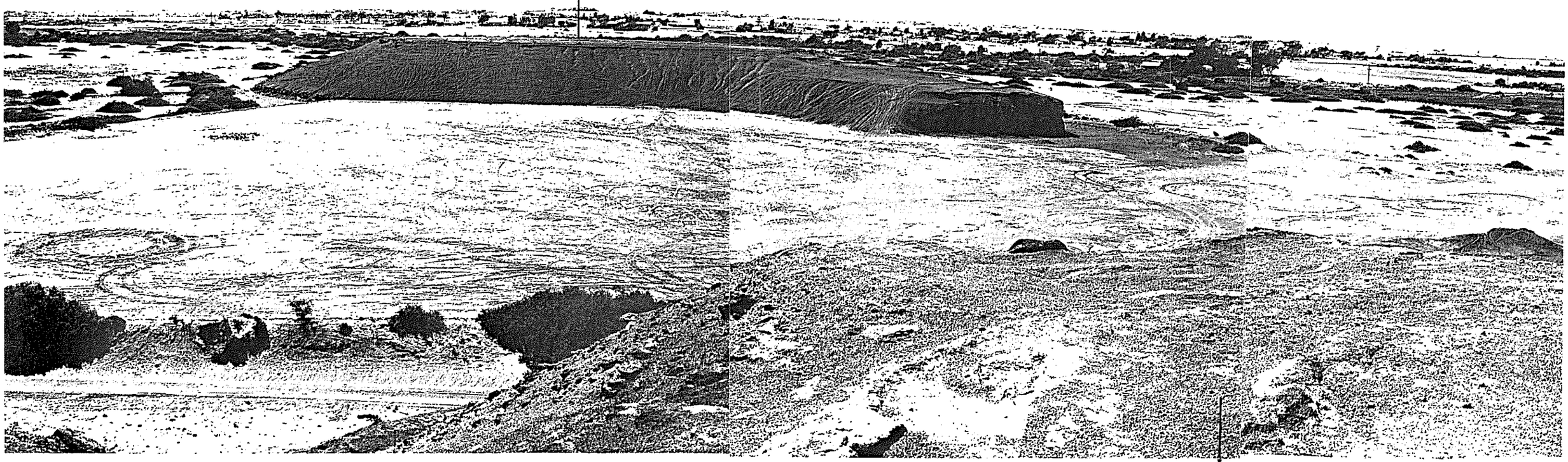
RICHMAN'S TAILING HEAPS



INTERPRETIVE STATION #4

RICHMAN'S TAILING HEAPS

CEMENTATION (LEACHING) PLATEAU



CEMENTATION (LEACHING) PLATEAU

7.8 RYAN'S TAILING HEAP

7.8.1 Themes

Resource Discovery and Exploration (4.11)
Slimes and Cementation Processing (4.15)
Water Supply and Control (4.17)
Transportation Systems (4.19)

7.8.2 Programme

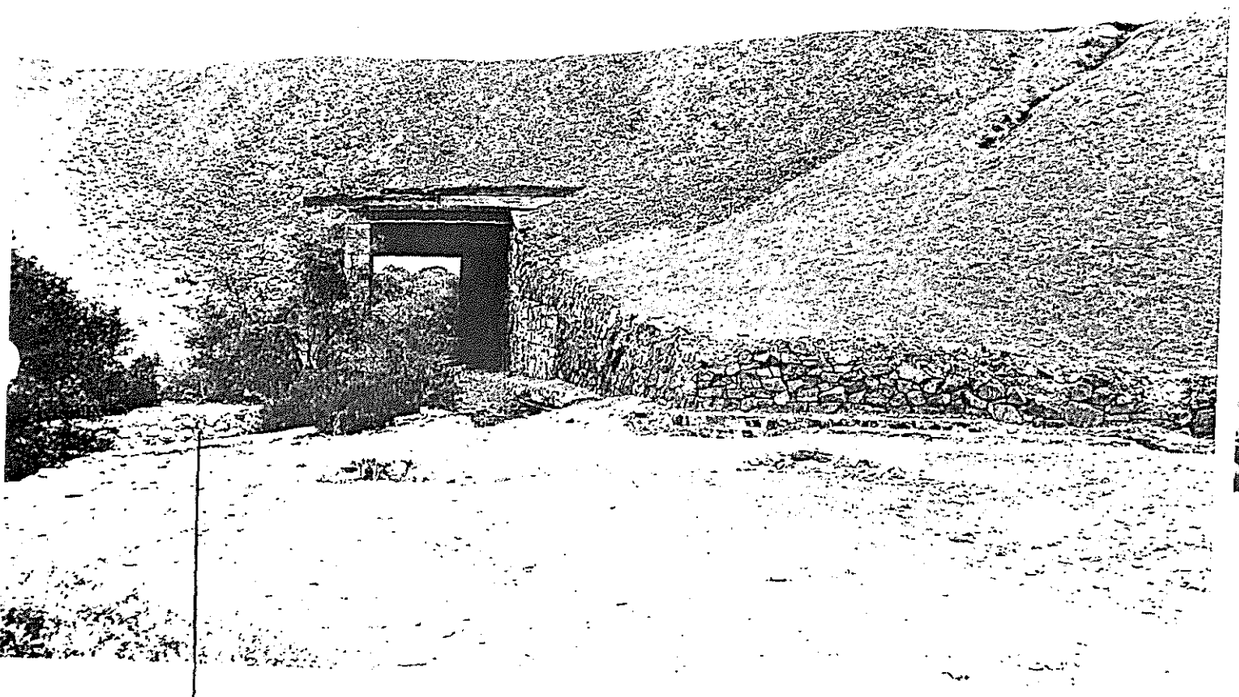
Three interpretive stations at this target point will serve to complete the visitors' sequential interpretive experience of historic mining operations at Moonta Mines. The visitor is brought forward in historical time as well, to the Cementation Plant ruins, which represent the final "modernized" stage in processing at Moonta Mines, developed around 1900 by Antonio Delgado for the collective reworking of Mines Area tailing heaps.

7.8.3 Interpretive Station #5

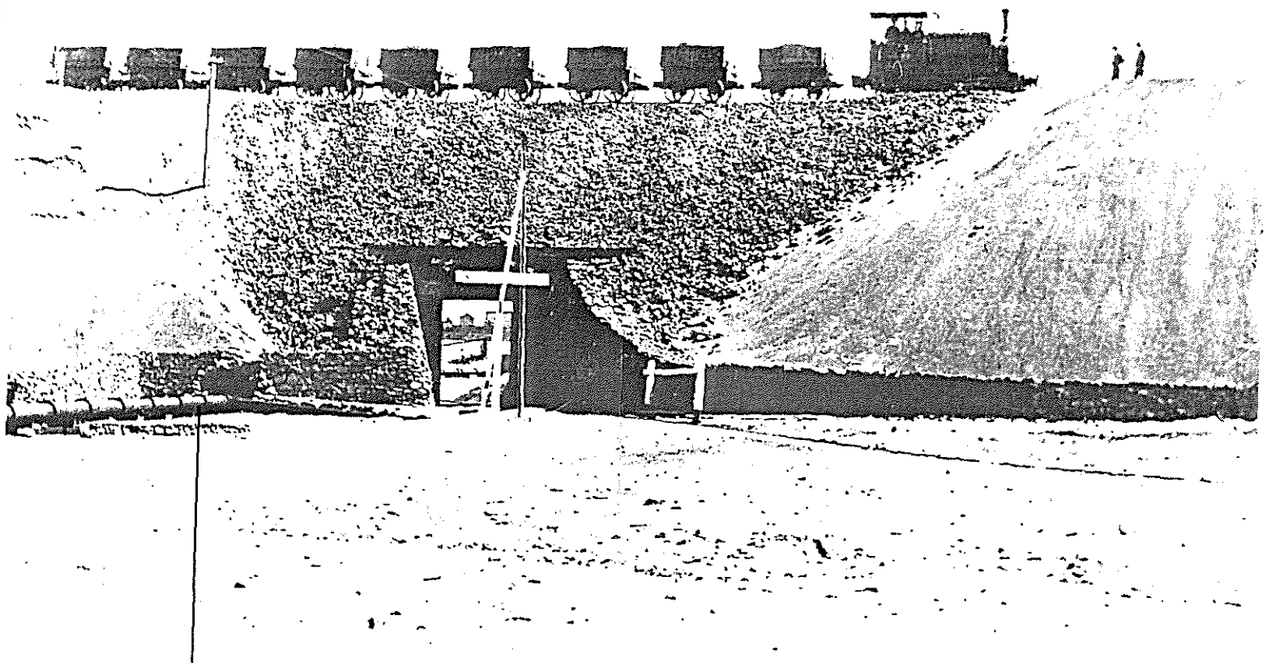
At this location the visitor, at ground level (see the photo which follows), will be introduced to Ryan's Tailing Heap, which was originally two heaps that were conjoined over the tunnel. The tunnel is strong focal point for discussing the movement of tailings, precipitation solution and laundering water. A metalphoto display will image the historic scene and diagrammatically reveal the Mines Area system for moving water and solutions. Some clearing of vegetation and archeaological work is required before visitors may fully understand the extant resources of the movement network.

INTERPRETIVE STATION #5

RYAN'S TAILING HEAP



OPEN LAUNDER



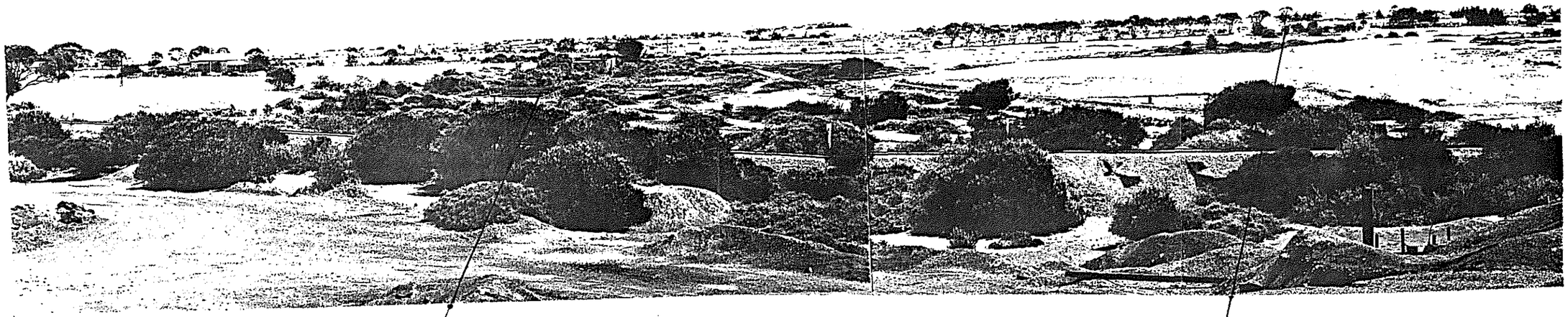
PRECIPITATION SOLUTION PIPELINE

7.8.4 Interpretive Station #6

A metalphoto of a historic panorama will reveal how little the landscape has changed since 1900, and may be used to indicate the present position of the Precipitation Plant, the disused railway to Wallaroo, and the Cross Roads settlement (see the photos which follow). General reference only should be made to the Precipitation Plant. (It is recommended that Phase II development include a walking tour of this site, after archaeological investigations suggest a control pattern that will not interfere with this fragile resource.) Reference to the significance of the Yelta siding, where ore and copper precipitates were transferred to the mainline, which was opened by South Australian Railways in 1878, will be made.

7.8.5 Interpretive Station #7

The lack of historic photos from this vantage point may preclude their use on a metalphoto display (see the only photo of this scene, which follows). Still Ryan's Shaft serves as a focal point for discussing the discovery of ore in the Mines Area (it is reputedly the first shaft), and relating that to the total development of the Mines Area. As a final orientation to the Mines Area it is recommended that a diagram of the entire Mines Area appear at this station (refer to the Target Point diagram). It is particularly important here to provide information pertaining to the western lode lines, the enormity of operations in the Mines Area, and perhaps some final remarks about the industrial desecration of the original environment.



INTERPRETIVE STATION #6

PRECIPITATION WORKS

PUMPING STATION

PRECIPITATING TANKS AND CANAL

CROSS ROADS: BLOCK 2606

CHIMNEY

PRECIPITATION SOLUTION PIPELINE

RAILWAY TO WALLAROO SMELTER

INTERPRETIVE STATION #6

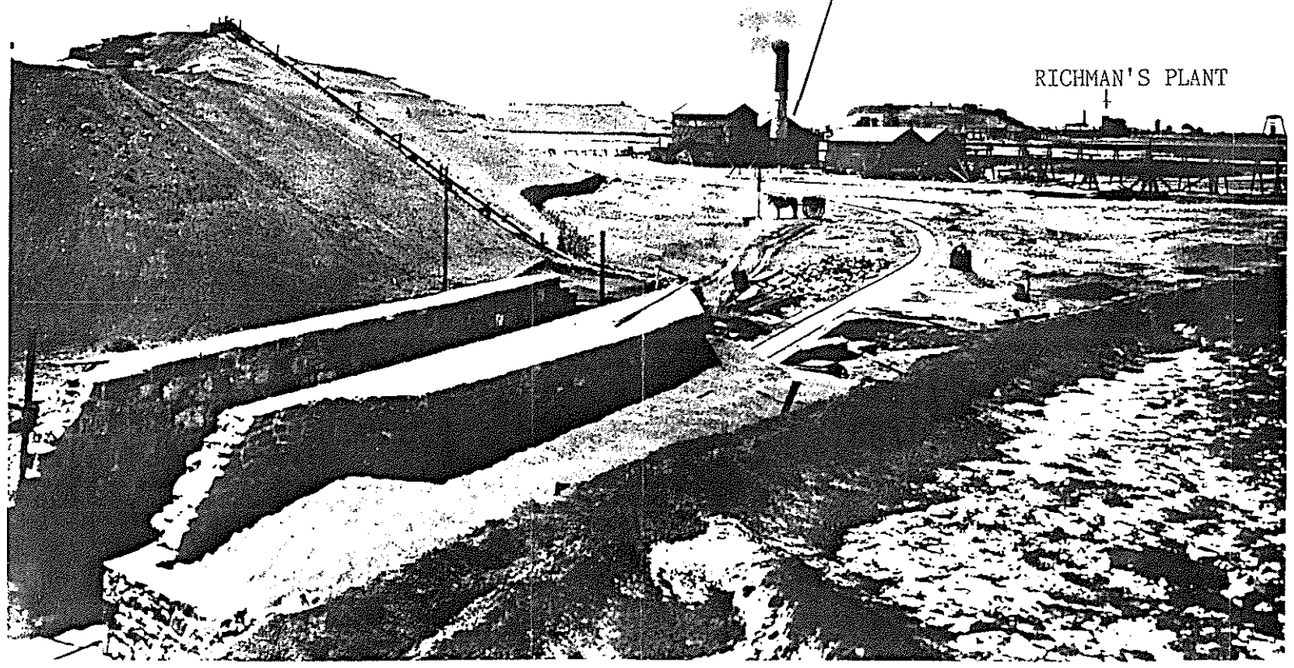
PRECIPITATION WORKS

DRAIN WALL

RYAN'S TAILING HEAP

RICHMAN'S PLANT

RYAN'S CRUSHING HOUSE AND SHAFT



INTERPRETIVE STATION #7

RYAN'S SHAFT

8. PHASE II EXPERIENCE PACKAGE

Phase I development, conceptualized by the Control Pattern (section 6) and the Interpretive Experience (7), would result in a passive system for the interpretation of the major industrial resources in the Mines Area. The thematic coverage implied by this system is limited both in extent and intensity. A second development phase will be required before the themes of Social History are adequately represented. Some Industrial History themes require interpretation to balance out visitor understanding of the Mines Area. As many of the theme gaps cannot be filled by the interpretation of in-situ heritage resources, it follows that balanced interpretation of the Mines Area can only be achieved with the supplement of an Interpretation Centre. Moonta Mines Model School (7.2) is strategic to this need.

8.1 Moonta Mines Interpretation Centre

It is recommended that in consultation with the History Trust a Development Plan for the existing museum precinct be completed with a view to its redevelopment as an Interpretation Centre. Such a Centre would have three thematic roles to satisfy. First, the themes (4.8 and 4.17) intrinsic to the school building and the reservoir should be interpreted in-situ. Second, the Centre must supplement the in-situ interpretation of Mines Area resources by specifically interpreting theme gaps, and by making collective sense of the Social History themes. Third, in relation to a prospective Systems Approach (3.2) for the Copper Triangle, the Centre can be identified as the best target point for the interpretation of copper mining and mining settlement in the Copper Triangle.

8.2 Interpretation Centre and Mines Area Management

The Development Plan must address the problem of management. At present the National Trust Museum is operated on a volunteer basis. Funding is insufficient, and museological standards are low, if not non-existent. The abscence of a collections policy has resulted in an overburden of irrelevant artefacts, which in turn have provided the only rationale for many of the displays. A great many artefacts do have a direct relationship to the greater Moonta area, but they are suffering from a lack of conservation. It is recommended that in anticipation of a Development Plan a Curator/Site Manager should be installed for two years. This should be seen as a supervisory position. The Curator/Site Manager will implement and oversee Interpretation Centre and Mines Area development. Ideally, the Curator/Site Manager will be responsible to a Mines Area Steering Committee comprised of representatives from the National Trust, the History Trust of South Australia, the Heritage Conservation Branch of the Department of Environment & Planning, and the Kadina District Council. The establishment of the Curator/Site Manager position is seen as an essential first step in the orderly development of the Moonta Mines Heritage Area, which has the long-range potential of becoming one of the major heritage developments in Australia.

9. COST PROJECTIONS: PHASE I CONTROL PATTERN

Until Project Plans are drawn up it will be not be possible to project precisely the cost of Phase I development. This table serves to generalize anticipated costs, and allocate them to component projects.

9.1 Basic Information Programme

This will involve the production of a tour brochure, Mines Area information signs, roadside directional signs, and site markers.
Cost: $25,000

9.2 Fencing

This will involve fencing the areas marked on the Control Pattern (6), fencing Hancock's Tailing Heap, and providing security fences around shafts.
Cost: $22,000

9.3 Roadwork (including Parking Areas)

The greatest expense here will be the construction of a new road from Richman's Plant to the parking area at Interpretive Station #6, at the western end of Ryan's Heap. The slimes are impassable when wet, except for 4-wheel drive vehicles, which are destroying the industrial form of the landscape.
Cost: $30,000

9.4 Walking Paths

This will include platforms at interpretive stations located on the heaps, boardwalks with control railings, and non-erosive walkways.
Cost: $15,000

9.5 Outdoor Interpretive Displays

The production and placement of a uniform series of metalphoto displays, minimum of six.
Cost: $8,000

9.6 Interim Stabilization

This will include stabilizing Richman's Engine House, and is considered the minimum expense to secure the resource from imminent collapse. It will also involve some reconstructive infilling of Ryan's Heap, which is about to collapse in the area of Interpretive Station #6.
Cost: $50,000

9.7 Project Planning

Though Project Plans could be drawn up by government engineers and architects, it is useful here to estimate what this would cost if it were contracted privately.
Cost: $10,000

9.8 Total Cost

$160,000

10. COST PROJECTIONS: PHASE I INTERPRETATION CENTRE MANAGEMENT

The complete redevelopment of the Moonta National Trust Museum as an Interpretation Centre will require professional direction. Therefore it is recommended that a Curator/Site Manager (projects manager) be appointed to liaise with the Moonta Branch of the National Trust to ensure that the Museum becomes an effective interpretive centre linked to the site-wide interpretive programme. Precedents exist interstate and overseas for the appointment of museum professionals linked to State museum bodies but based locally and working with local voluntary museum organisations to improve the operation of their museums. These persons generally have degrees or diplomas in museum studies and have an all-round knowledge of museum matters such as interpretation, registration, conservation, design and administration.

10.1 Curator/Site Manager (for 2 years at $25,000 p.a.)

Cost: $50,000

10.2 Position Establishment

This would entail advertising costs and relocation expenses, among other establishment costs.
Cost: $3,000

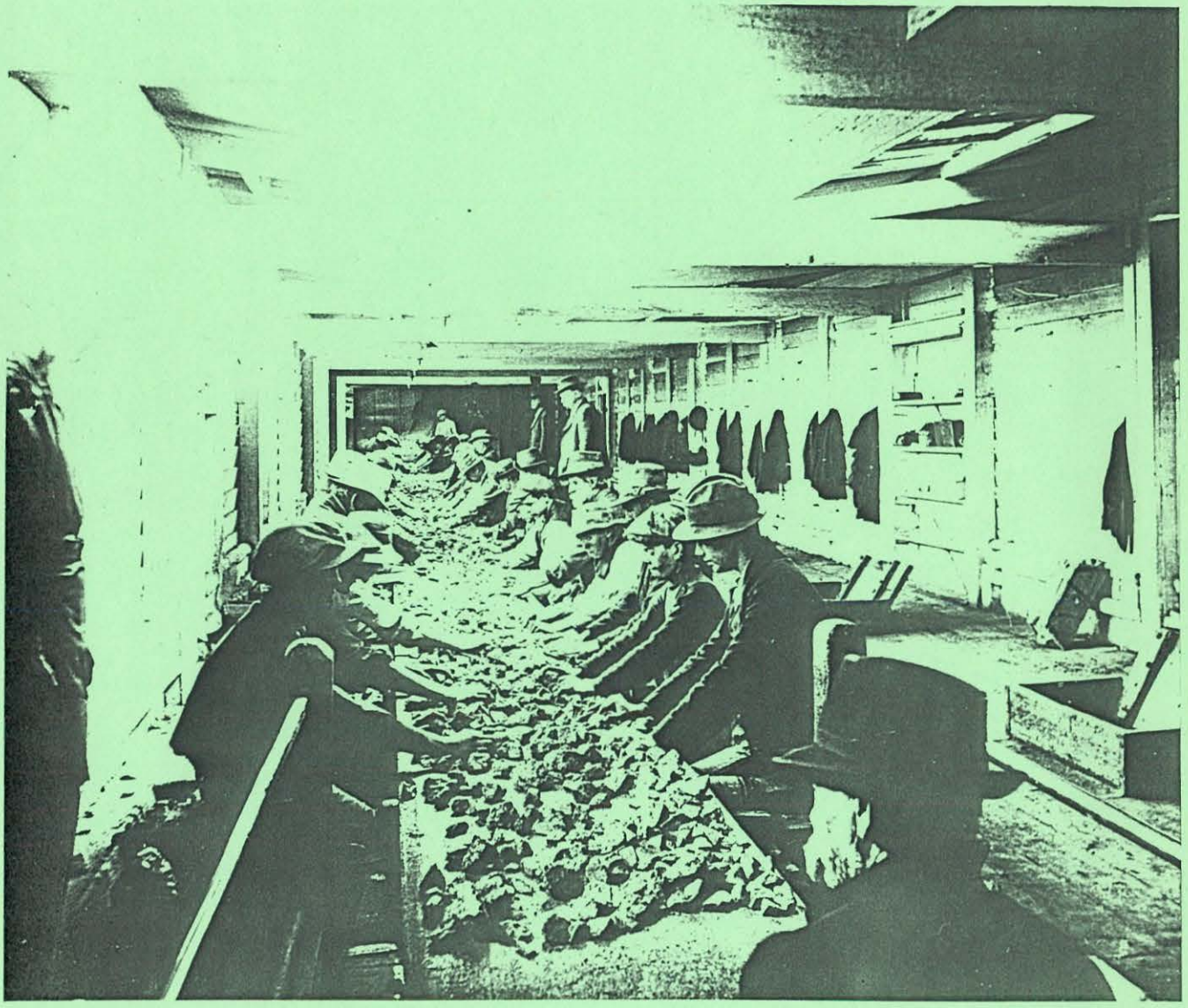
10.3 General Budget

This would be deployed as the Steering Committee decides, on the basis of the appointee's particular aptitudes. Budget items will pertain to the following: design assistance, special consultancies, conservation work, travel and accomodation expenses, materials, artisan labour, part-time clerical assistance and general administrative expenses. Secretarial assistance from the local Council would, of course, reduce some costs.
Cost: $90,000

10.4 Total Cost

$143,000

APPENDIX A: MINING PROCESSES AT MOONTA AND WALLAROO MINES



Moonta-Wallaroo Mines Area Study

Ore Recovery and Concentrating Processes

Introduction

Refer to the Diagrammatic Representation of the above processes, which follows.

The representation depicted on this drawing is derived, mainly, from the Booklet -

> "The Wallaroo and Moonta Mines, their History, Nature and Methods together with an account of the Concentrating and Smelting operations".

Printed by Hussey & Gillingham Ltd., 1914.
Reprinted by Gillingham Printers, 1980.
And from "Australia's Little Cornwall"
O. Pryor. Rigby Limited.

The production of commercial copper from an established mine can be divided into three distinct divisions:

1. Extracting ore from the earth and raising it to the surface (grass). - Mining

2. The division of the ore into useless rock and classifications of payable ore and the initial separation of metal from bulk ore - Concentrating

3. The treatment of rough metal by smelting and electrolytic refining to produce 99+% pure copper - Smelting

Item 2 is the work covered by this review of ore recovery and concentrating processes.

Preface

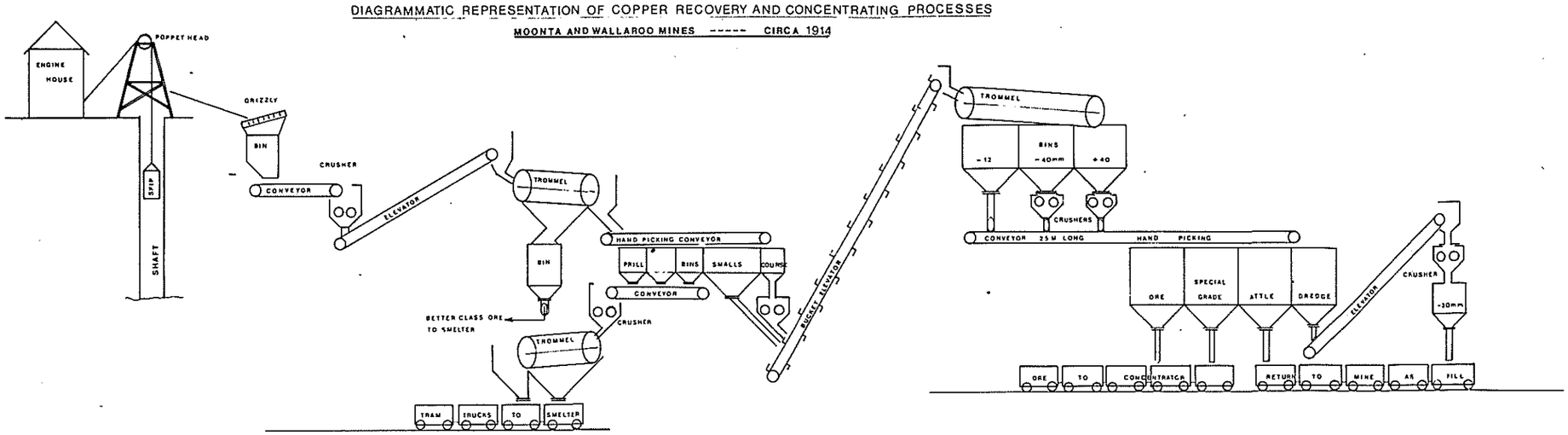
The ore from different mines may vary widely and require very specific treatment, indeed, ore from different parts of the same field may vary considerably.

The Moonta field was very different from that at Wallaroo Mines both as to the nature of the ground and the method of extracting the ore.

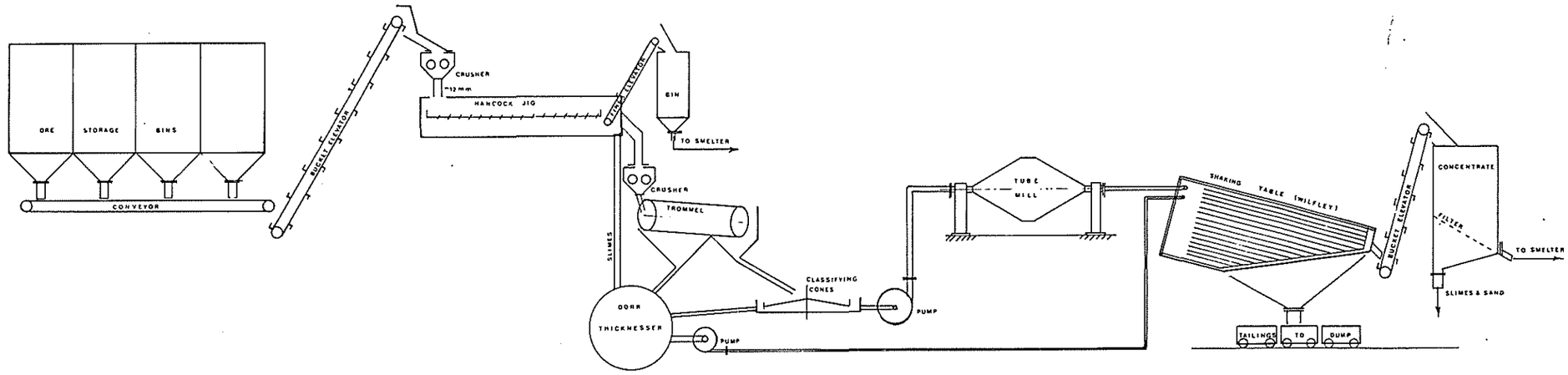
Under these circumstances any treatment plant represents a compromise of all the ideals which would apply for each type of ore. The plant would be subject to perpetual change as new equipment was devised to improve processes and as mining progressively produced new types of ore from new lodes.

DIAGRAMMATIC REPRESENTATION OF COPPER RECOVERY AND CONCENTRATING PROCESSES

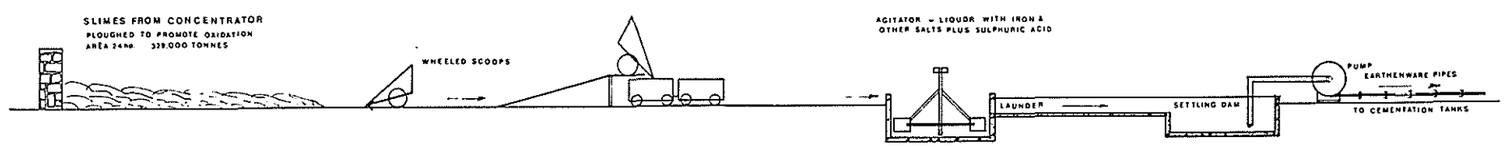
MOONTA AND WALLAROO MINES ----- CIRCA 1914



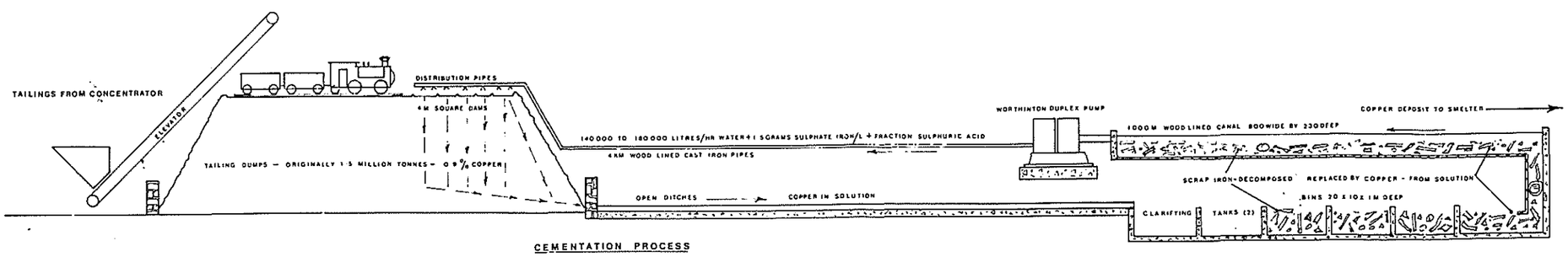
SURFACE WORKING AT MINE



CONCENTRATING PLANT



SLIMES PROCESSING



CEMENTATION PROCESS

HERITAGE CONSERVATION BRANCH
Department of Environment & Planning
Kent Town S.A.

DEVISED AND DRAWN J.E.Connell June 1981

The Diagrammatic Representation of the Concentrating Processes is drawn around the 1914 plant so far as we can understand it today.

The 1914 equipment was an amalgam of all of that since 1863 with its additions and changes. The following chapter attempts to describe many changes made to the plant before and after 1914 as we can identify.

Recovery and Concentration

The ore excavated underground is broken up enough to be handled and trammed underground, but as most miners were paid by results they would not break it up any more than necessary.

Surface work therefore was primarily a series of sorting and crushing operations, fig. 1.
See "Surface working at Mine"

The content of copper could vary from "rocks" of almost pure metal - "Native Copper" to some ores containing 4½%, others up to 30% copper. Occasional very rich pockets of ore ("bonanzas" or "wallows") were found, but for the most part it was a matter of sorting by hand the rich ore from the useless (attle). In 1883 some ores raised contained 40% and some 30% copper.

The selected very high grade ore (Prill) could be sent direct to the smelter after waste rock (attle) was removed.

Hand picking was by "Picky boys" or old men standing beside a conveyor belt on which the ore travelled, fig. 2.

Further grading, crushing and sorting produced ore of various grades for further processing and attle which was returned to the mine to fill the empty spaces (Gunnis). The selected ores were moved to the concentrating plant for further crushing and separation.

While progressive improvement was made over the years on this section of the plant the processes did not vary much. The main developments were in the handling by conveyors rather than by barrow and the sorting on conveyor belts where previously the ore had been spread out on a large floor or table for hand picking and, of course, the use of mechanical crushers, fig. 4, rather than the breaking of rock by hand with bucking hammers, (in England wielded by "Bal Maidens", not, so far as we know, in Australia). See fig. 5.

Sorting and grading plants became very large, see fig. 3.

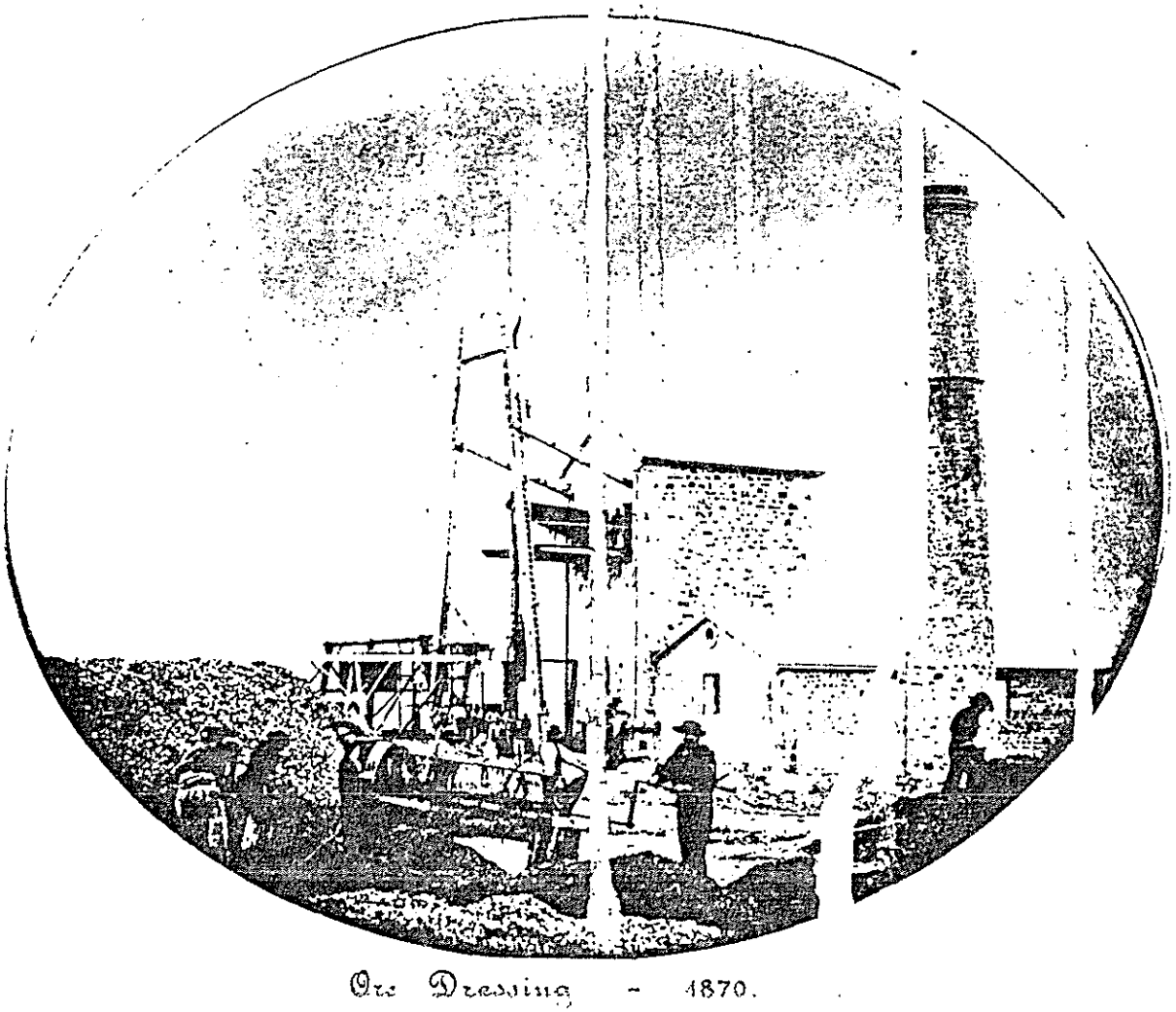


Figure 1. Very early sorting and crushing at Elder's Shaft, Moonta Mines. The photograph shows Hughes' beam engine pump in the background.
Elder's winding engine and shaft would be roughly behind the photographer.

Figure 2. "Pickey Boys" beside the sorting conveyor at Moonta Mines, about 1913. The boys sorted the ore from the attle. The Trommel (rotary screen) at the rear sieved off fines before the larger pieces fed to the conveyor belt.

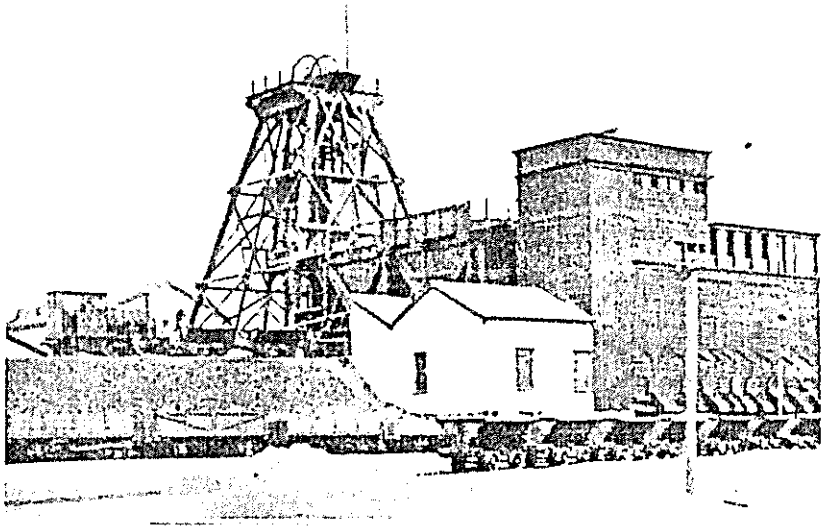


Figure 3. Taylor's Headframe, Moonta Mines. The buildings housed the winding engine. Crushing and sorting plant and storage before the ore went to the Concentrating Plant.

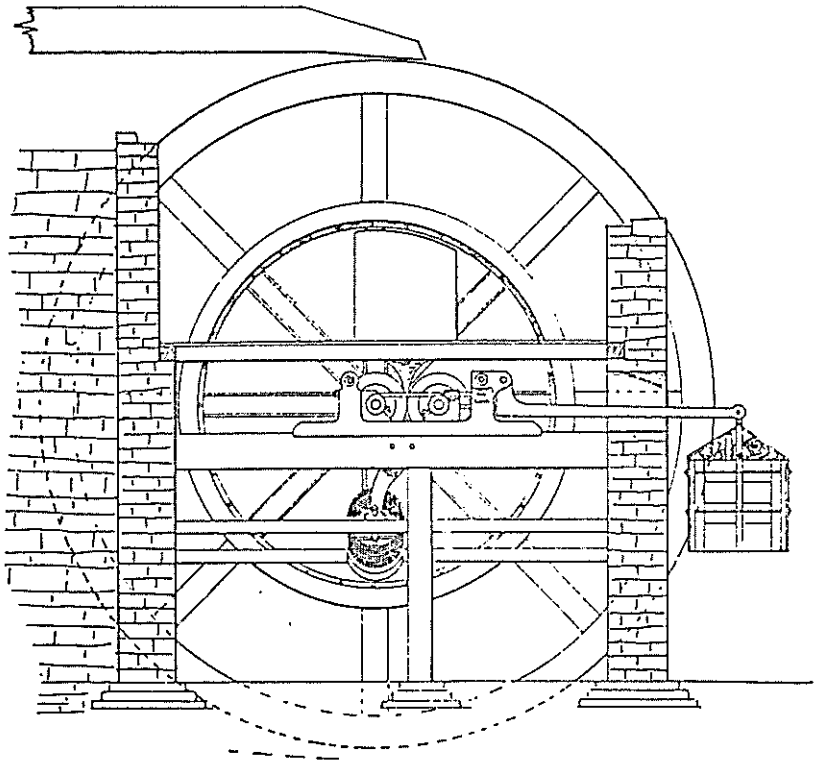


Figure 4. Crushing rolls, in this case driven by a water wheel. The counterweight on the right provided constant load on the rolls. The water wheel was frequently driven by water pumped up from a mine.

Concentrating Plant

The object of this section was to reduce the volume of material to go to the smelter by removing much of the unwanted "dirt" or gangue and produce a rich "concentrate".

The process comprised a series of complex machines which were improved tremendously over the years. Figures 6 & 7.

From the storage the ore, generally less than 12 mm grading, was passed through a crusher to ensure uniformity of size before going to a jig. Fig. 8.

Our drawing represents a Hancock mechanised jig which was the invention of H.R. Hancock, manager of Moonta Mines and which with a series of improvements was later widely used in America. The purpose of the jig was to separate grains of metalic copper from waste material.

The Hancock jig comprised a tank 8 metres long in which a large horizontal screen or sieve was supported. A combined vertical and horizontal (or jigging) motion lifted and traversed the ore, stratifying it so that the longitudinal motion carried the lighter waste along the top to pass it over the tail of the machine while the richer, heavier material made its way down through the 6 mm square screen. This could separate five grades of concentrates and "middles".

The Hancock jig could handle 800 tonnes of material per 24 hours. Fig. 8.

Prior to Hancock's mechanised jig the work was done on a hand jig, much smaller and not continuous which was worked by four women or boys, who, standing at each corner of the tank and leaning almost double over the side operated the screen with a "jigging" action to effect a separation of the waste from the metalics . . This manual jigging produced only one grade of material and of course the daily output was considerably less. Later a lever operated jig was introduced in which one woman could operate the machine. (Fig. 9.)

The highest grade of ore from the jig could go straight to the smelter. Lower grades were processed further in rolls, fig. 4, trommels, fig. 8, and a classifying cone to produce a fine sand size for the final separation. Some very fine material, known as slimes, was treated in a Dorr thickener to a suitable consistency.

All of this equipment was improved considerably over a period of time, the equipment being changed to adopt improved processes or to suit new types of ores.

The Dorr thicknesser was a tank 10 metres in diameter which fed a liquid mixture to the final separator. Coarser material was pumped from the classifier cone to the tube mill. This was a large rotating drum in which scrap iron tumbled. The liquid mixture was fed through one hollow trunnion and as this mixed and tumbled with the scrap iron the particles were further crushed before discharge from the opposite trunnion. Fig. 10

Figure 5. "Bal Maidens" cobbing or bucking ore, breaking up the large lumps for sorting. Mid 19th Century Cornish.

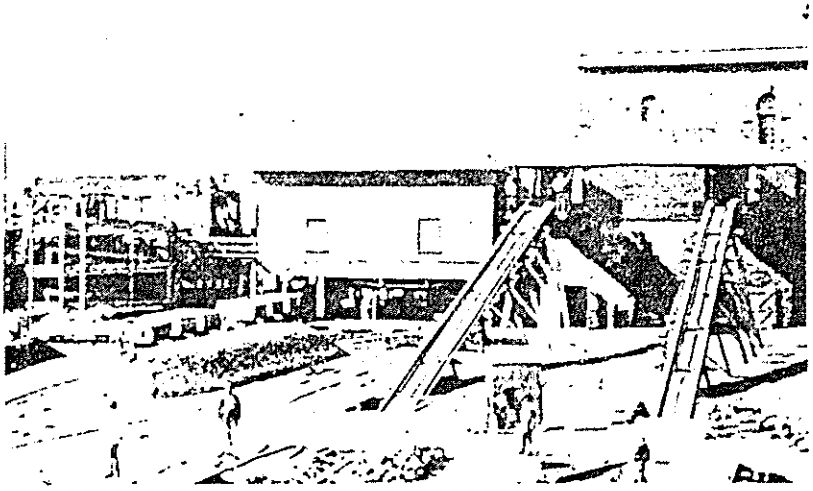


Figure 6. Richman's Processing Plant, Moonta Mines, 1898

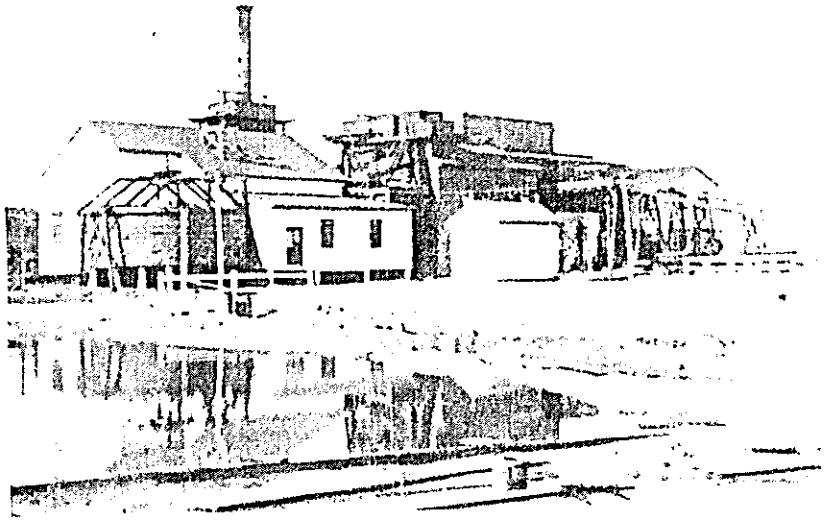


Figure 7. Richman's Processing Plant, Moonta Mines. C.1914. The large and high steel chimney replaced the old stone one in 1908.

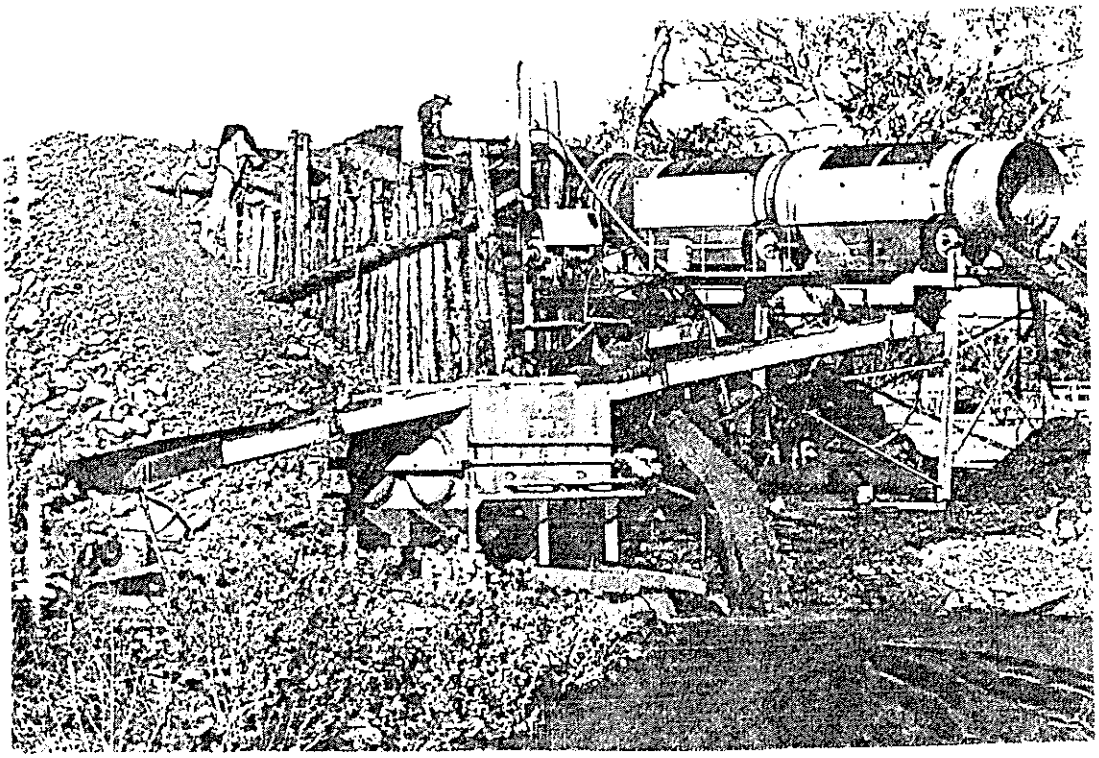


Figure 8. A Trommel (rotary screen) and a jig (shaking sieve) in use at Sapphire Mine. Wellingrove Creek. N.S.W. Recent.

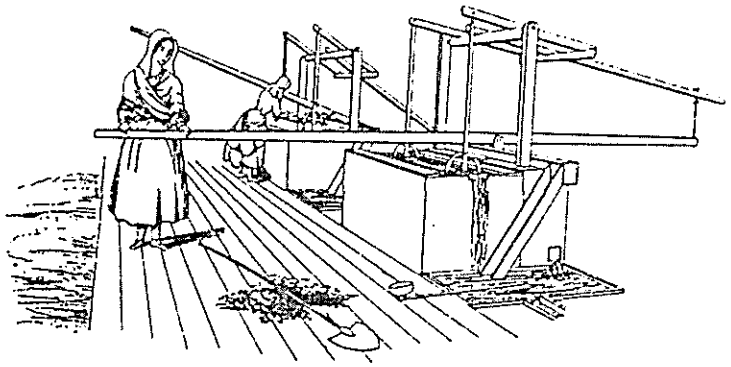


Figure 9. The advanced manual jig, preceding the power driven Hancock jig and superceding the old 4 operator manual rig.

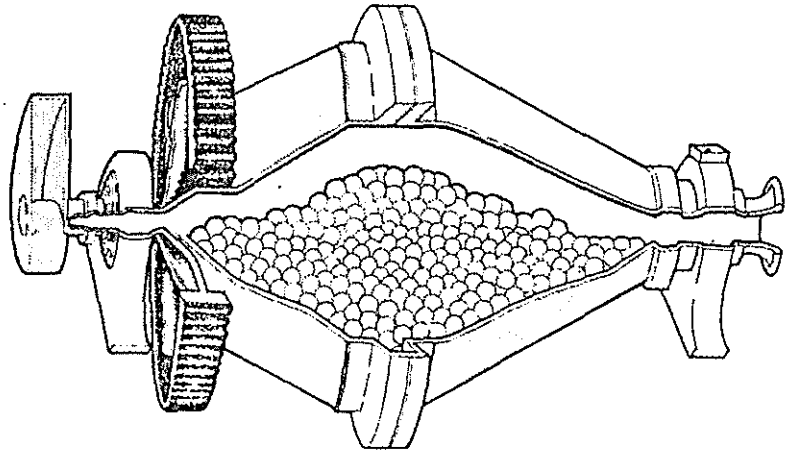


Figure 10. A modern ball mill, in this case operating dry. This was similar in principle to the tube mill but the latter was loaded with scrap iron.

Figure 11. Vanning Shovel used to separate metal from the gangue material much as a gold miner uses a gold pan. This process formed the basis of the buddle separator.

Final Separation or Concentration

This process changed considerably over the years. The original method was hand vanning, in which a skilled operator using a special vanning shovel could separate the metal from the ore by deft manipulation such as a miner uses a pan for gold, fig. 11. This was satisfactory for valuable tin in low capacity mining but was not viable for copper.

The mechanical adaptation was buddling. Buddles took a number of forms, the early one was a tank or pit with a ridged, sloping board on which the crushed ore was fed with water flowing over it. The water washed the light material away leaving the "heavies" caked onto the ridged surfaces. This was dug off periodically. Generally the material was subjected to several such processes to concentrate it further. This was very labour intensive, fig. 12.

Copper content of this concentrate was about 12% but was still only 70% of the total copper, the rest having been carried off with the slimes.

The buddles at Richman's were revolving wooden tables 8 metres diameter with a slope of 60 cm on its conical top from the centre to its rim. Slime, containing about 3½% copper was fed to the centre of the table as it rotated slowly, a trickle of water carrying the light stuff over the edge to a gutter, thence to a settling pit. The heavier material with about 12% copper, having settled on the table was washed off once each revolution by a strong jet of water to be caught in an ore pit.

The Company had sixty buddles in their plant including single and triple deckers. The buddles gave way to the more efficient shaking or Wilfley table in the late 1890s. The process was invented by Rittinger in 1844 and later developed by others including Wilfley after whom it is generally known, figures 13 and 14.

The shaking table is a plane surface with riffles or ridges, slightly inclined and given a mechanical shaking or jolting action in its long direction. The ore pulp is fed onto the table at one end and as it washes down the slope the heavy particles are caught in the riffles and progress along the table as it shakes. The light material washes sideways to waste or further processing.

Our diagram shows the shaking table as the last operation in the concentrating plant.

The Wilfley table later gave way to the ultimate system of ore concentration, the flotation process although shaking tables are still used in many processes.

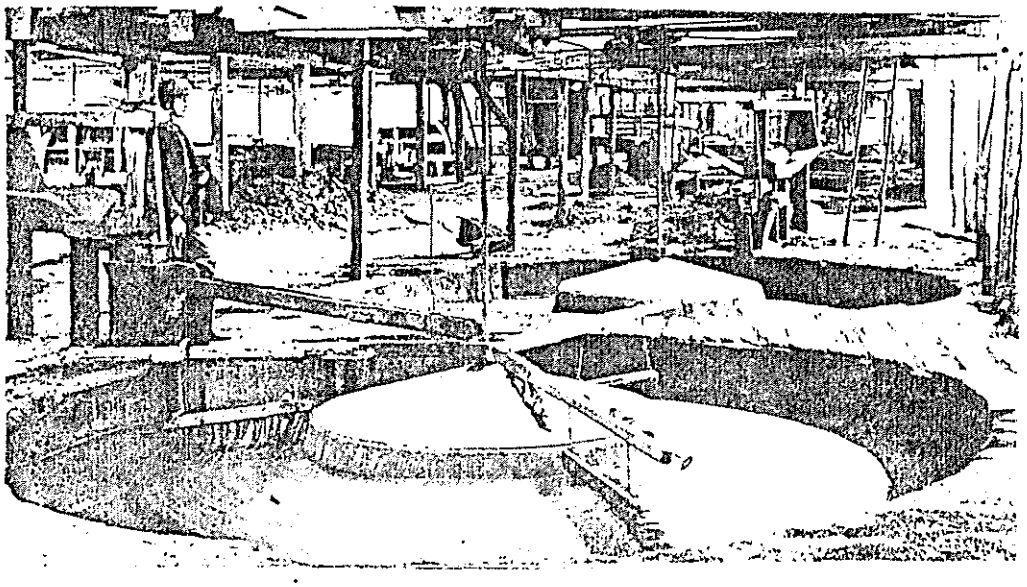


Figure 12. A round buddle, convex type. The ore pulp pours onto the middle of the cone and down to the pit. The bushes, slowly sweeping over the surface promote an even deposit. The "heavies" settle out near the cone, the water and slimes overflow and leave the pit. The concentrate is dug out periodically.

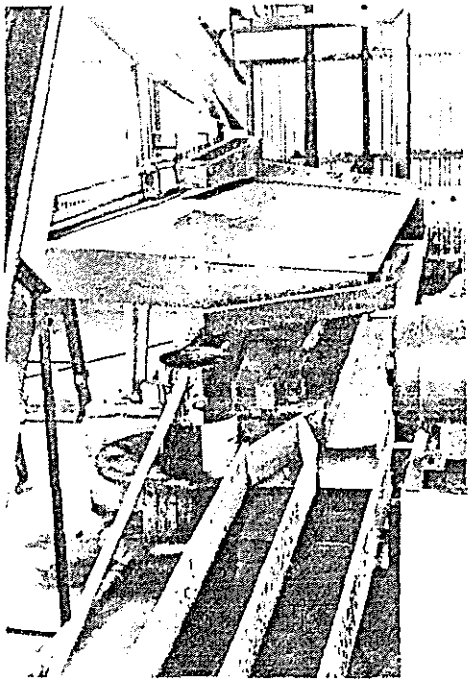


Figure 13. Shaking table and corduroy stakes. This unit was at Kitticoola Copper Mine, S.A.

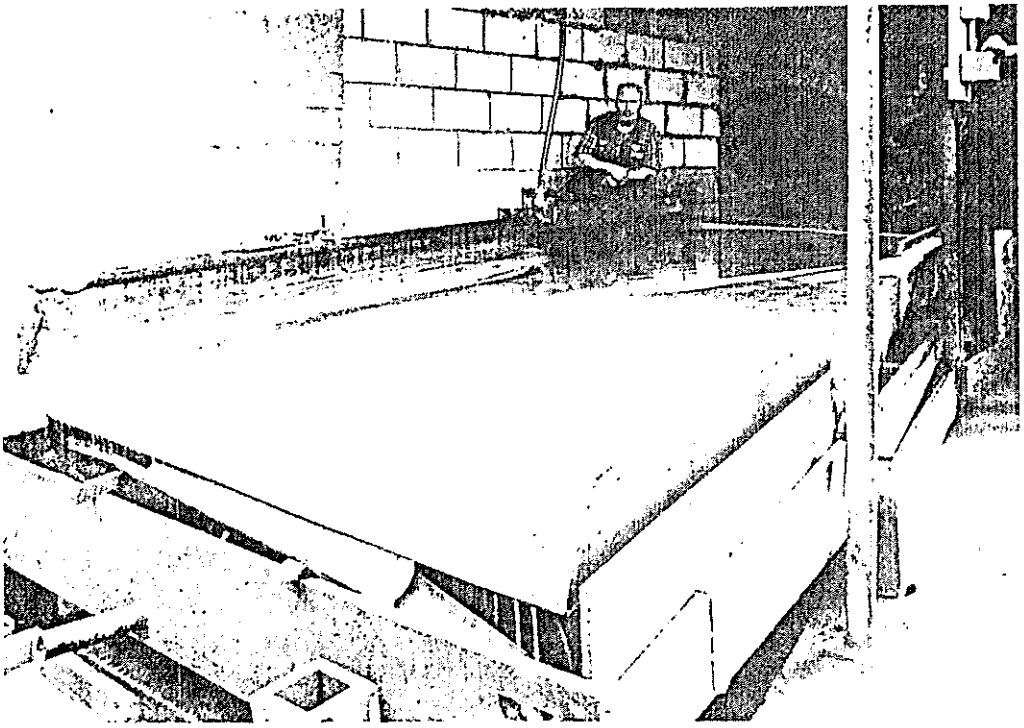


Figure 14. Shaking Table. The ore pulp is fed to the "shaking deck" from a distribution box under the operators arm. Water flows in from the perforated pipe on the left. The deck slopes slightly down to the bottom right hand edge. The light streak is the line where the heavy ore are separated from the waste which washes off to the right.

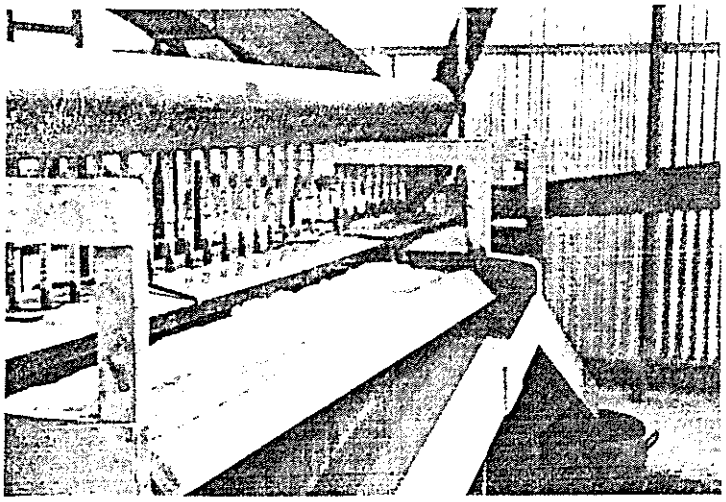


Figure 15. Flotation Process. The fine ore mixture is carried with the fluid, the froth of which lifts and carries off the heavy metal particles.

The Flotation Process

The flotation process was discovered by a Welshman named Haynes in 1860 when he noticed that if mineral ore was surface coated with oil the sulphides repelled water. He could not put this process to a useful purpose.

In 1898 a mining engineer named Elmore used this in a practical way by submitting a pulp of finely ground ore to a layer of oil in a foam. The metal particles were held by the oil and floated off with it while the gangue or waste submerged. This was one of the greatest mineral processing discoveries and enabled economic production of many otherwise unviable ores. It is still widely used today.

The method has been further developed such that by varying the coating and the use of depressants, the bubbles of the froth become selective of the minerals to which they will adhere, and it is possible to separate different minerals from each other. See Fig. 15.

Slimes Processing

About 330,000 tonnes of slimes containing 3½% copper had accumulated over the years and this was treated in conjunction with the Cementation Process.

Oxidation of the material was accelerated by spreading over an area of 24 hectares and ploughing the surface, figures 16-17. The oxidised material was gathered by wheeled scoops, horse drawn to a tipping platform from which it was loaded into tram trucks, fig. 18, and taken to a treatment plant beside the tailings heap.

The material passed through agitators with liquors containing iron and other salts plus sulphuric acid to produce a very thin pulp, with the copper in solution. The pulp was conveyed in long launders to settling dams where the slimes were deposited. The liquors passed to clarifying reservoirs thence to the precipitating tanks and canals of the Cementation Process.

Cementation Process

Large accumulations of jig tailings totalling 1.5 million tonnes covering 8 hectares at Moonta and 10 to 20 metres high contained nearly 1% of Copper, fig. 19.

Time demonstrated that moisture and exposure decomposed the sulphides to soluble sulphates resulting in a bluestone or copper sulphate solution which seeped from these mounds.

The copper content was 1.7 to 3.5 grams per litre. This liquid was directed into vats and canals containing scrap iron which decomposed

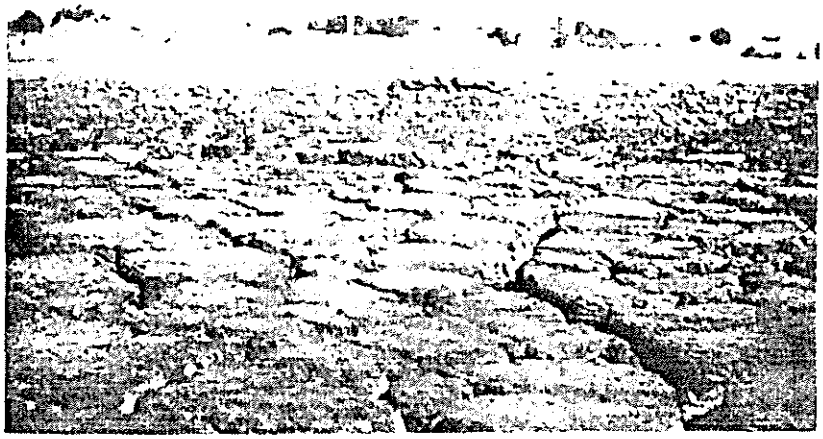


Figure 16. Slimes from concentrator spread over an area of 24 hectares at Moonta Mines oxidising in preparation for recovery process.

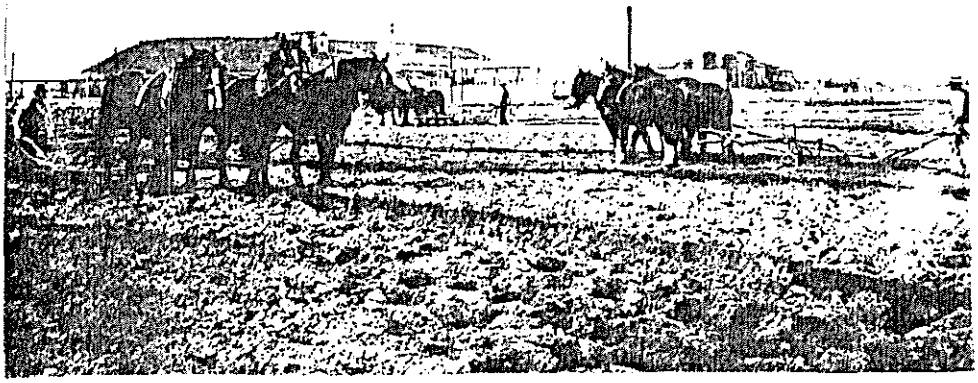


Figure 17. Ploughing slimes to promote oxidation.

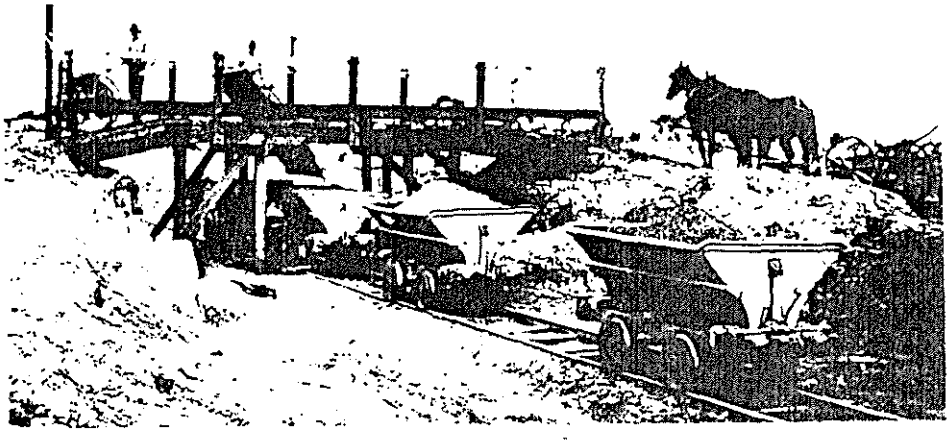


Figure 18. Wheeled scoops collecting slimes and delivering to tram trucks for movement to slimes processing plant.

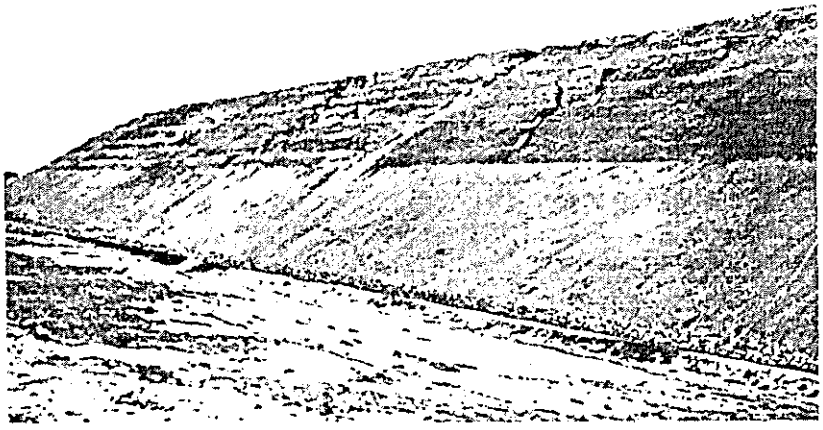


Figure 19. Tailings heaps up to 20m high under treatment be leaching to recover much of nearly 1% copper content.

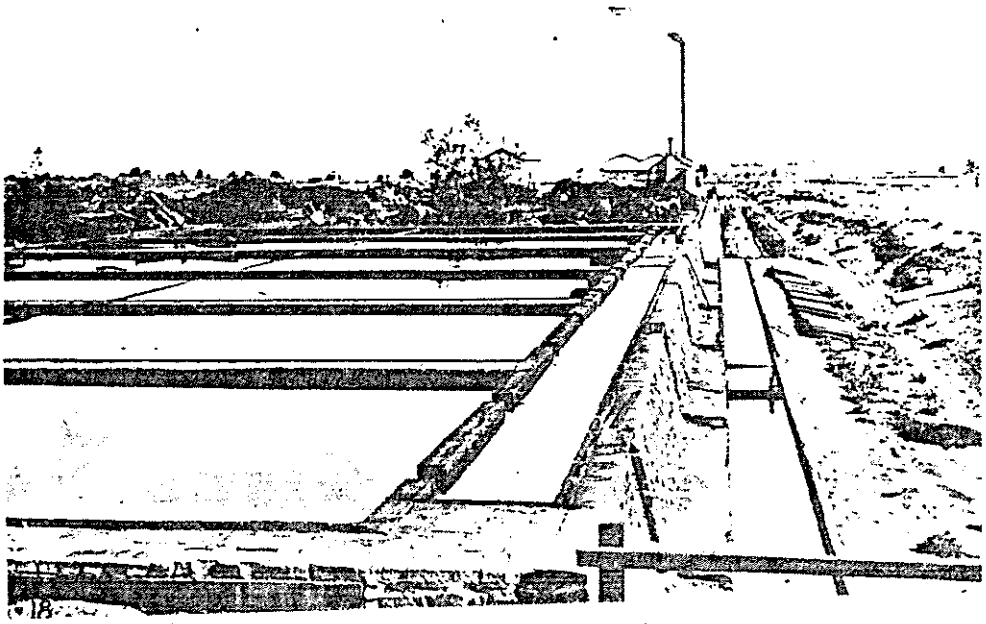


Figure 20. Cementation Plant, Moonta Mines. Six bins 20 x 10 x 1 metres. The first 2 bins, wood lined clarified the other 4 bins plus 1000m of canals contained scrap iron which was decomposed and replaced by copper precipitate. The pump house for the circulating liquor is in the background.

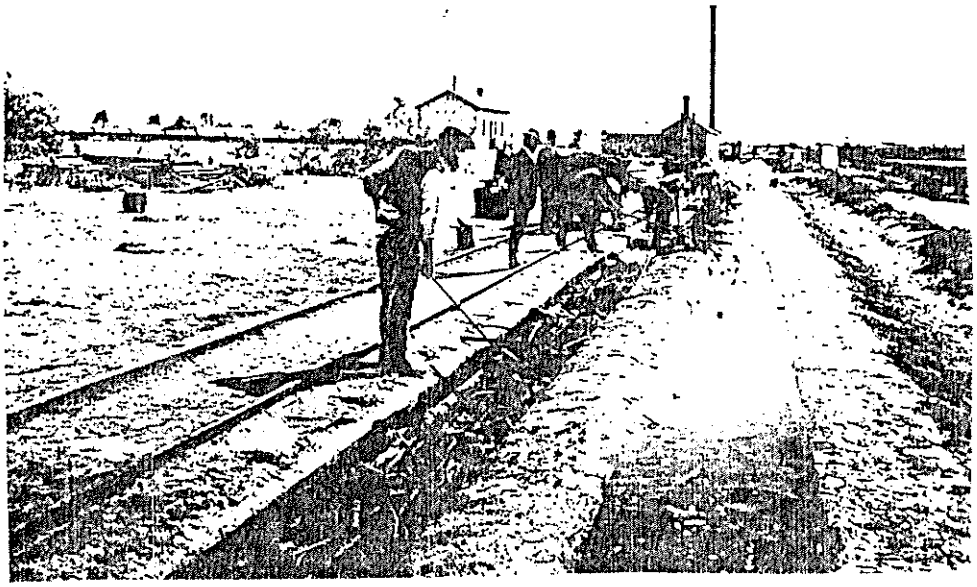


Figure 21. Charging the canals of Figure 20 with scrap iron.

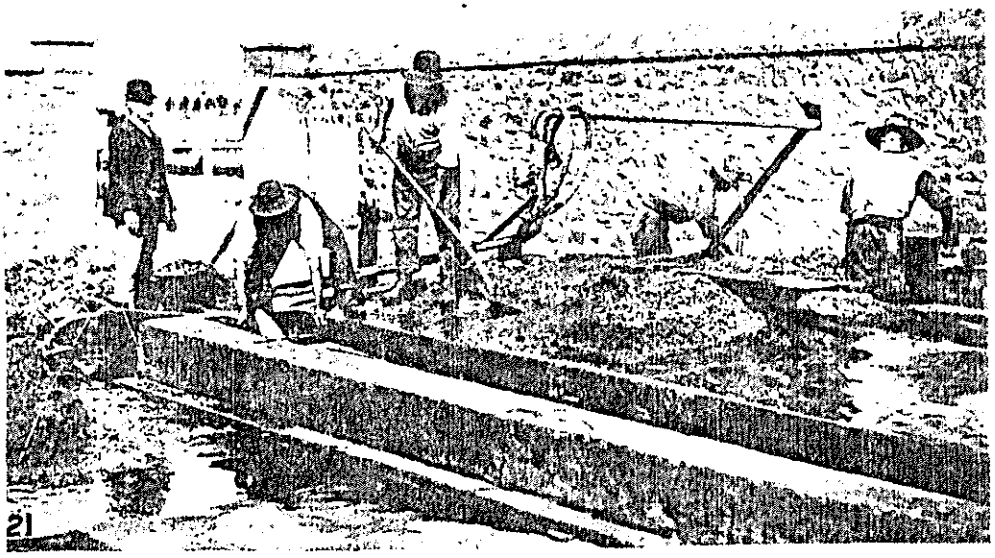


Figure 22. Removing the copper precipitate (about 76% pure copper) from the canals of figures 20 and 21.
The canals were filled with "scrap iron at 30 shillings ($3) per tonne which 'turned into' copper worth £70 ($140) per ton.