



MINERAL RESOURCES TASMANIA

**Archaeological Survey Report
1998/03**

**An archaeological survey
of the historic
Mount Bischoff calcining plant**

By Parry Kostoglou





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Acknowledgements

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Introduction

Job brief

This archaeological survey was commissioned by the Department of Mineral Resources in order to record and assess the significance of this historic calcining plant which formed a part of the Mount Bischoff ore processing system. This survey went beyond the requirements of the brief in partially recording the stone remains of three structures located adjacent to the calcining site, but not previously identified by the client.

Methodology

Recording of the calciner site was initially inhibited by the presence of asbestos historically used as rippled roof and wall cladding. Upon the completion of a clean up of this hazardous building fabric, permission was given to undertake this survey. Field work was undertaken over a two-day period between 21 and 22 October 1998. During this period the two calciner furnaces, Glozier's mill and three structures comprising another building complex tentatively identified as the concentrating plant, were recorded and photographed. The resulting scaled plans and colour prints appear throughout this report.

Statement of Significance

The calciner plant installed and successfully employed by the Mount Bischoff Company was by no means a unique piece of technology. Any mining entity confronted with the problem of separating its target mineral (gold, tin etc.) from a sulphide-laden pyritic ore base would have employed a similar furnace type technology to achieve such an end, and certainly other mines at Renison Bell and Beaconsfield employed the same type of Edwards furnace. There is therefore no compelling case for claiming that the technological significance of the Waratah calciner was ever unique, although its ability to reclaim such marginal amounts of tin while remaining commercially viable was probably unprecedented in the industry at that time.

The calciner site is unique today because not only has the structure survived time and subsequent lessees, but it has done this with so little damage to its original components and configuration. Furthermore:

- These remains are now one of the few tangible *in situ* reminders of the Mount Bischoff operation, one of the greatest mines in the world in its day.
- The two calciners are in an excellent state of preservation as are their related plant such as the waste flue.
- No other plant of this type is believed to survive in this state.
- Although modified during its second phase of occupation, Glozier's mill site is well enough preserved to show how ore was dressed using a number of mechanical techniques.
- Collectively these features, in association with the stone walled ruins of the concentrating shed, make a compelling mine-related landscape which should be retained, protected and subsequently interpreted (see **Recommendations** below)

Recommendations

As a result of this survey, it is recommended that:

- The Waratah calcining site, defined here as the two calciner/furnaces, Glozier's mill and the three structures comprising the concentrating plant, be protected from any proposed development or salvage.
- The entire calcining complex be nominated for inclusion on the State Heritage Register of Tasmania.
- The area identified in this report as the concentrating shed, containing the foundation remains of at least three structures, be recorded systematically as a subsequent adjunct to this survey. Further research should also be undertaken to establish the precise identity of the structures comprising this complex.
- Consideration be given to ultimately using the site for public visitation purposes once appropriate security and safety issues have been addressed. This might ultimately involve selectively re-roofing the complex and providing appropriate signage.

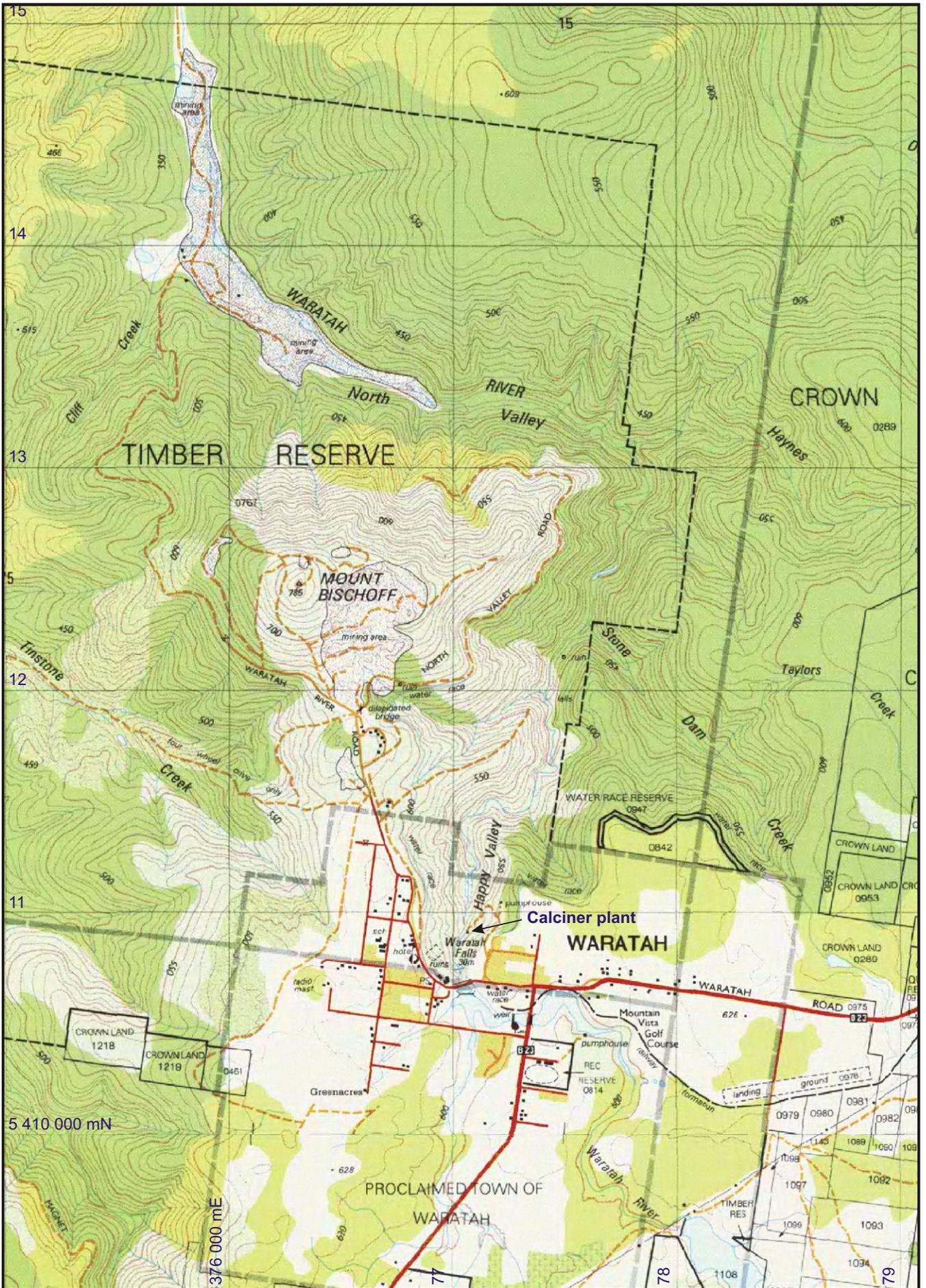


Figure 1

Topographic map of the Waratah township vicinity showing location of the calciner plant.

Historical overview

The Mount Bischoff Company (1871–1947)

Mount Bischoff was named after James Bischoff, the Chairman of the Van Diemens Land Company, in 1828. The tin bonanza beneath his natural namesake was discovered by James ‘Philosopher’ Smith on 4 December 1871. The story of his discovery at Mount Bischoff has all the hallmarks of a good find made badly. The more colourful mine histories tell us that Smith had been prospecting with the aid of an old and inaccurate map and while in the vicinity of what he believed to be the Arthur and Waratah rivers, Smith found cassiterite and traced it to a small water course (Tinstone Creek). After running short of food, Smith returned to civilization and immediately applied to the Minister of Lands and Works for two 80 acre sections of land, at that time the largest possible for mining purposes. Some confusion between the location of his proposed lease and land already owned by the Van Diemens Land Company required a second sortie to Tinstone Creek in May 1872, which clarified the leases in Smith’s favour by a mere 1½ miles.

He now went ahead and formed the Mount Bischoff Tin Mining Company in 1873, which possessed 12,000 shares valued at five pounds each. Within twelve months the company had built its private tin smelters in Launceston, which operated for fifty years and also processed the bulk of the tin ore recovered throughout the rest of the State’s tin mines. The closure of many northeastern tin mines in 1929 as a result of flooding compelled the smelter to close.

Over 100,000 pounds was spent on the mine’s development before the first of many dividends were paid to shareholders in February 1878. That same year, the mine had been connected to Burnie and the sea by a timber tramway which was gradually converted to steel. Other major construction projects involved the progressive erection of milling plants, which were required to crush the tin-bearing rock from the underground mine once the easier won alluvial deposits had been exhausted in the 1880s. Ultimately 115 heads of stampers would be employed on a 24 hour basis by the Mount Bischoff Company.

Both the mine and its attendant milling/treatment plants fostered the growth of Waratah township, which peaked with 2,550 souls in the mid 1880s. The mine ran uninterrupted until 1914–15, when a co operative was trialed briefly to offset company overheads and keep the mine open. The company soon resumed full control of the mine and its plant, but in 1929 another stoppage ended only when the mine was manned by tribute labour, a system which now prevailed until the final demise of Mount Bischoff.

As the easily mined and processed ore lodes gave out in the 1920s, the operation died a protracted death during the Great Depression, although the Second World War saw the Commonwealth Government acquire the mine for strategic supply purposes in 1942. When the mine failed to contribute to the war effort, the State government entered a joint venture with the Commonwealth to stave off closure in 1945. This was only successful until 1947, when the mine and all remaining assets were closed and the company deregistered. Some very small scale private prospecting, ore recovery and treatment has been periodically undertaken to the present day.

Since its closure the Mount Bischoff mine and its plant has been credited during its operational life with processing 5.5 million tons of ore to produce 56,000 tons of tin metal. The company’s financial statistics are equally impressive, given that it paid its shareholders \$5.1 million worth of dividends, and that the tin produced would be worth approximately 800 million contemporary dollars.

The calcining project (1920-1947)

Prior to the installation of the calciner plant, which is the focus of this report, only one fleeting attempt was made by the Mount Bischoff Company to process sulphide or pyritic ore, and this entailed the treatment of sulphide ore from its North Valley mine between 1892 and 1894. After this was deemed a failure, the Mount Bischoff Company ignored the substantial sulphide deposits within their lease, preferring instead to remove and treat the more user friendly alluvial and detrital ores. With neither of the company’s facilities for treating concentrates (the Launceston smelters and a slime/roasting plant at Mount Bischoff) able to economically recover tin associated in this way, the 10 to 15 tons of sulphide ore being stockpiled per day was becoming something of a logistical nuisance.

When prospecting for further alluvial/detrital ore bodies failed ignominiously, Mount Bischoff’s management was finally compelled to come to terms with the treatment of their sulphide ores, or face closure. In an artful act of understatement, the mine manager Millen conceded in July 1919 that “*much laboratory research work is being conducted to obtain data for the improvement of the present methods of treating the admixed sulphides*”.

Experimental work undertaken on a 50 ton stockpiled sample of this pyritic ore within a temporary calcining plant proved the economic value of a more expansive calcination process which could recover a further 2 per cent of tin currently being lost. Ironically, the adjacent mining operation owned by the Mount Bischoff Extended

Company had already been processing their pyritic ore for several years. Belatedly, the Mount Bischoff Company followed their neighbours example, and commissioned the installation of a furnace facility on the western slopes of Happy Valley in 1919. When this furnace stood ready for operation a year later, over 3000 tons of pyritic ore had been stockpiled for treatment. The total cost of this initial calcining plant, including equipment, excavation and erection of buildings, had come to 4022 pounds, although revenues from the additionally salvaged tin were expected to recoup this money within a relatively short period.

The successful inauguration of the first roaster in 1921/22 encouraged the company to add a second furnace in 1925. This increasing treatment of stockpiled pyritic ore proved most timely, as it allowed the mine to show a healthy tin production level even though mining had all but ceased between 1921 and 1923. Succeeding years saw mine production fall even more as hopes of a rich alluvial deposit in the North Valley proved ill founded and international tin prices slumped. This ultimately forced the mine's first closure on 22 October 1929. When work recommenced later that year it was undertaken by tributors, and the Mount Bischoff Company would henceforth limit its activities to the erection and rental of smaller milling plants to each tribute party in addition to ongoing operation of the calcine concentrating plant on a custom basis.

Although the tributors were recovering sufficient ore for the company to survive on the royalties and treatment fees, any destabilisation of the market would destroy the current status quo. Ironically, the company's demise was actually precipitated by a drastic increase in demand for tin as a result of the Japanese occupation of the Dutch Indies and British Malaya. Now bereft of its traditional tin-producing fields, Britain looked to her other dominions to supply essential materials for the prosecution of war. The Mount Bischoff tin deposits and treatment facilities had suddenly become a major priority for the Federal and State governments. When mine productivity fell well short of expectations in 1941, the Federal government purchased the mine and its plant from the Mount Bischoff Tin Mining Company Registered on 28 November 1942 for the sum of 10,358 pounds.

During the period of its control of the mine and plant between 1942 and 1947, the Federal government undertook a major re-evaluation of the resident milling technology while considerably improving the rate of ore recovery at the mine. However when it became apparent that such improvements would not be made sufficiently quickly to aid the immediate war effort, the Commonwealth's interest in the mine became somewhat lacklustre to say the least. Only State Government intervention and the establishment of a joint venture between the two levels of government induced the Commonwealth to continue bankrolling the operation. This continued support was contingent on the successful outcome of further exploration work at the mine and a simpler pyritic ore refining process based on floatation rather than calcining.. When both strategies failed to improve productivity, the Federal Government closed Mount Bischoff for the final time in August 1947.

Some prospecting/mining on a very minor scale has occurred since this time, and the establishment of a concentrating/roasting plant by Mr Glozier between 1948 and c.1980 may be seen as the final, although greatly overshadowed chapter in the story of the great mine and its calciner plant.

Site Reports

This section provides historic summaries and descriptions of individual structures comprising the calcining complex such as the furnaces, waste flue, and concentrating sheds. Reference should be made to Figure 2 which shows a scaled plan of the entire site and as such indicates the locations and scale of all constituent building features.

Low grade ore roasters (furnaces, calciners)

LOCATION

The calcining facility has been erected on the eastern slope of Happy Valley (formerly Ring Tail Valley) some 350 metres north of the Waratah Falls. The pair of ore roasters described below have been erected at the eastern end of the site immediately beside a recent bulldozed track linking the calciner site to the town water pump house.

HISTORY

Also referred to by various sources as furnaces, calciners and roasting furnaces, the Mount Bischoff ore roasters were ultimately a product of the ever changing composition of the mine's geology. For the first forty years of the mine's operation between 1873 and 1913, the presence of easily accessed surface deposits of tin allowed the mine management the luxury of rudimentary ore treatment technology. By 1919 all easily treatable ore had been won from the Mount Bischoff mine, leaving only a more complex pyritic/sulphidic ore which would require a new treatment regime to liberate its tin. Experimental work conducted during that same year recommended the introduction of new customised roasting equipment, and a 100 foot long Edwards roaster was obtained from the Tasmania Gold Mine Ltd's Beaconsfield mine, where it had been used to process old tailings⁽¹⁾. The reconditioned plant was accordingly installed in 1920 and had been commissioned by 1921. During its inaugural nine months, the roaster treated 2,472 tons of pyritic concentrate which assayed 2.5% tin and ultimately yielded a calcine containing 55 tons of metallic tin⁽²⁾. With tin assays falling as low as 1.88%, the Secretary of Mines could quite justifiably boast that the Mount Bischoff material was the "lowest grade pyritic concentrate being profitably treated in the world today"⁽³⁾.

In his 1923 report, Reid described both the size and configuration of the furnace at Mount Bischoff. He identified it as an Edwards furnace consisting of "two 60-foot roasting plants set end to end on a uniform grade of 2 per cent. The rabbles, 27 in all, are arranged in series, and are driven from one line of shafting. The furnace is encased in ordinary red brick, and the archway and fire-boxes are constructed of fire-brick. Broken rubble, capped with 2 inches of lime mortar, forms the base upon which a 12-inch layer of low-grade concentrate rests. Over this the rabbles move and form their own bed. Water-jacket rabbles of the plough type are in general use here"⁽⁴⁾.

Of the motive power for the rabbles, Reid wrote: "The rabbles are driven at the rate of one and a half revolutions per minute by a geared 15-horsepower motor"⁽⁵⁾. The scale of the furnace was likewise justified because: "A furnace of this length is required in order to allow the ore to remain in contact with the hot gases until it is thoroughly dry before passing it to the calcining section. The wet concentrate may, in consequence, be introduced in that condition without in any way affecting the efficiency of the furnace. Owing largely to the length and depth of the bed sufficient heat is generated in the combustion of the sulphur component of the pyrite to render the process of roasting complete without the aid of external fires"⁽⁶⁾.

The same author also subsequently noted how the ore was differentially heated as gravity compelled it downhill towards the end of the furnace.

"In the operation of roasting the pyrite concentrate delivered to an adjustable automatic feeder from which it falls through the arched feed-hole to No. 1 rabble. It is then carried forward and downward from one rabble to another over the three fire-boxes to the discharge orifice. The fire-boxes are so adjusted that the heat applied to the pyrite is increased as the material approaches the end of the furnace"⁽⁷⁾.

Token pollution control measures at the plant included a flue dust chamber for catching larger combustion particles. Reid described it as "a chamber 12 ft. x 12 ft. x 12 ft. is provided at the end of the furnace to arrest flue dust before it can reach the smoke-stack"⁽⁸⁾. When this measure failed to mollify Mount Bischoff's concerned citizenry, a more comprehensive waste containment system was added uphill (see below). Initially the furnaces were continually fed with firewood as a fuel for the combustion process. However after a few months of operation, the furnace operators realised that the calcination process could be achieved without fuel, because the sulphur content in the ore was sufficient to make it self burning. One source suggests that this discovery was somewhat more accidental.

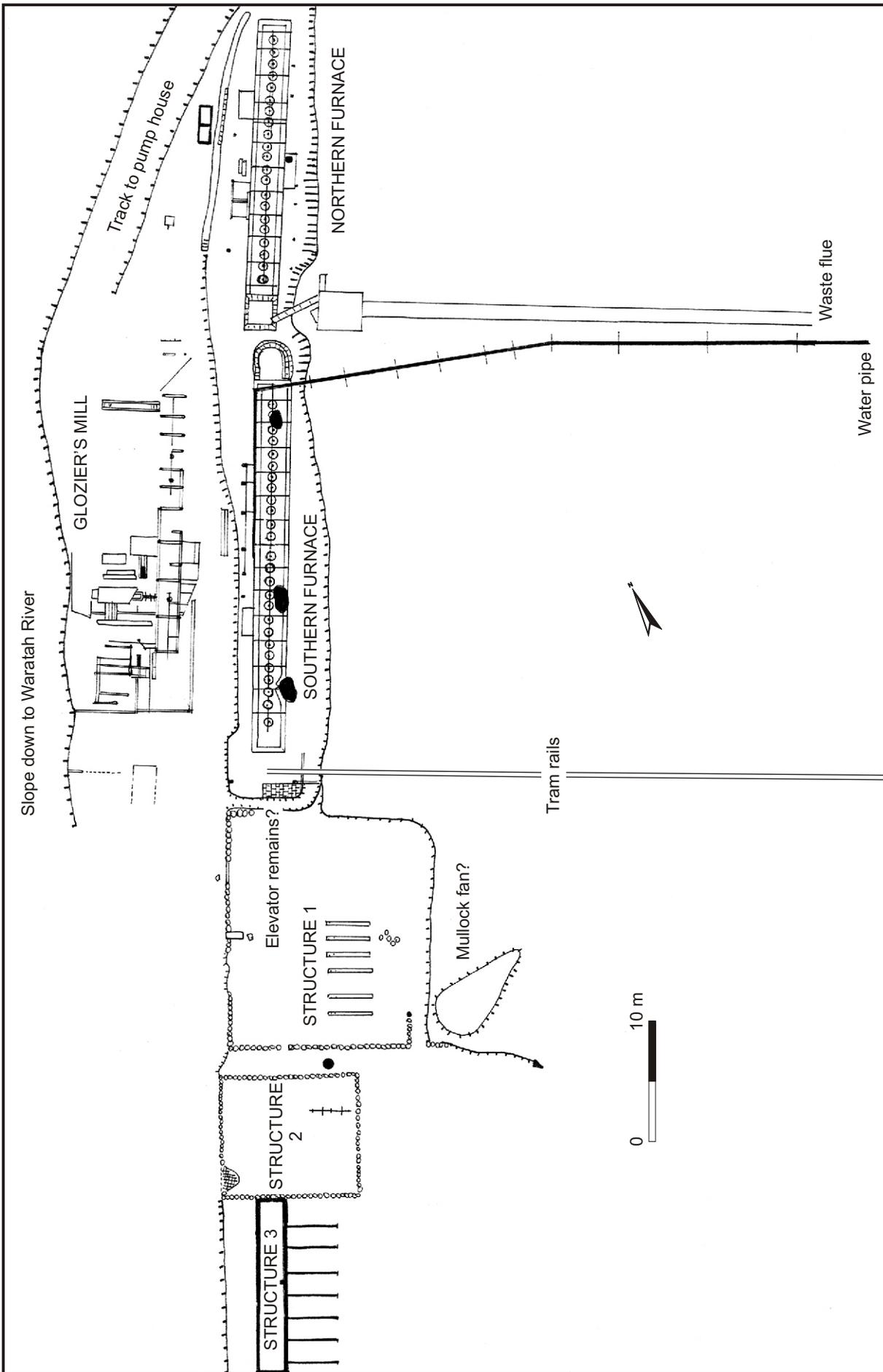


Figure 2
Scaled plan of the calciner complex showing location and disposition of all recorded features

“The furnaces had to have a stoker to fire them with wood cut to 5 feet lengths. The story goes that one time the stoker went to sleep. When he woke the fire was still burning. This was how they discovered that the high percentage of sulphur was feeding the fire and so it would keep burning”⁽⁹⁾.

By 1925 the success of the new furnace technology was being handicapped by its limited capacity. Having treated 3,500 tons of pyritic concentrate in its first year, mine management anticipated an increased capacity of 8,000 tons if a second but slightly larger furnace was added. A larger furnace was accordingly obtained and installed next to the original plant in 1925. It was soon belatedly realised that this additional furnace further lowered the minimal tin assay to a remarkable 0.5%. In 1928 the roasting plant processed a record 8,322 tons of ore, before it was compelled to shut down as part of the Mount Bischoff Co. mine closure on 22 October 1929. When mining resumed and recovery concentrated on alluvial deposits for the next two years, the roasters probably remained idle⁽¹⁰⁾.

In 1933, the roasters were re-awakened to treat ore from non-alluvial sources which was now being mined by tributers. Although these independent tributers erected their own milling plants, they were still dependent on the company calciner/roasters to treat their pyritic ore, and this plant was therefore granted an extended life. Under the tribute system, the roasters were treating no more than 10 tons of ore every 24 hour period. In 1933, the furnace building was damaged by fire and repairs were required to both the shed and the furnaces themselves. A spate of internal company reports soon identified more substantial structural repairs which would be required if the calcining plant was to see out another decade of operation. One report stated that the calciner would need to be relocated, and that the larger calciner/furnace needed major repairs⁽¹¹⁾. In the vain hope that new floatation technology would make the calciner plant redundant, the major repairs were not effected.

On 28 November 1942 the Federal government acquired the Mount Bischoff mine and all its plant in an attempt to increase tin production as part of the war effort. As output failed to reach federal targets, the State government supplemented the mine fund in order to keep the mine open and the Waratah workforce employed. By 1947, the mine's destiny rested on new mine prospects and a modified ore recovery process mooted previously, which saw calcination replaced by floatation technology. When both the prospects and the new recovery loop failed, the mine and its plant were closed in August 1947. A smaller and modified calcining plant was established beside the old roasters by a Mr H. C. L. Glozier in 1948. He treated Mount Bischoff ore carted here by a narrow gauge tramway until c.1980, when the calciner site was abandoned for the final time.

DESCRIPTION

This complex consists of two banks of low grade ore roasting furnaces (calciners), a brick-lined drain and related concrete vat, and a metal water tank. The furnaces themselves are further comprised of a stone/rubble foundation supporting a rectangular sequence of furnaces and fireboxes, which in turn is capped by a sequence of mixing rabbles and motive wheel assemblies.

Northern Furnace

The northernmost of the two furnaces, this plant stands adjacent to the pumphouse track. Measuring 26.5 m in length, 2.6 m in width and up to 3.5 m in height, this furnace is slightly smaller than its southerly neighbour. Originally boasting a compliment of twenty-two agitators or rabbles, the northernmost pair have been removed leaving a current total of twenty rabbles *in situ*. The rabbles are articulated by a series of connected drive shafts which are in turn connected to a pair of gear/drive wheels located beneath the fifth pair of rabbles. These were in turn powered electrically from a nearby power source. Water used to cool the rabbles was conveyed along a two inch water pipe beside the entire length of the furnace. The water pipe for this furnace is no longer to be found on the site.

The northern furnace possesses two fireboxes which heated the charge ore. The central and slightly larger firebox still retains its tubular iron chimney measuring approximately four metres in height. In contrast to its southern twin, the northern furnace has a square 3 x 3 metre flue dust chamber at its southern end. Presumably due to its slightly smaller size, the main dust flue connecting the furnace flue dust chamber to the hillside concrete chamber is narrower than its southern equivalent, measuring half a metre in diameter. A number of milled timber posts standing at 2.5 m intervals on both sides of the furnace indicate that it was enclosed within a shed standing at least three metres in height.

As the smaller furnace, it seems probable that this northern furnace was the second piece of plant installed in 1925, while the larger northern furnace had been erected in 1921.

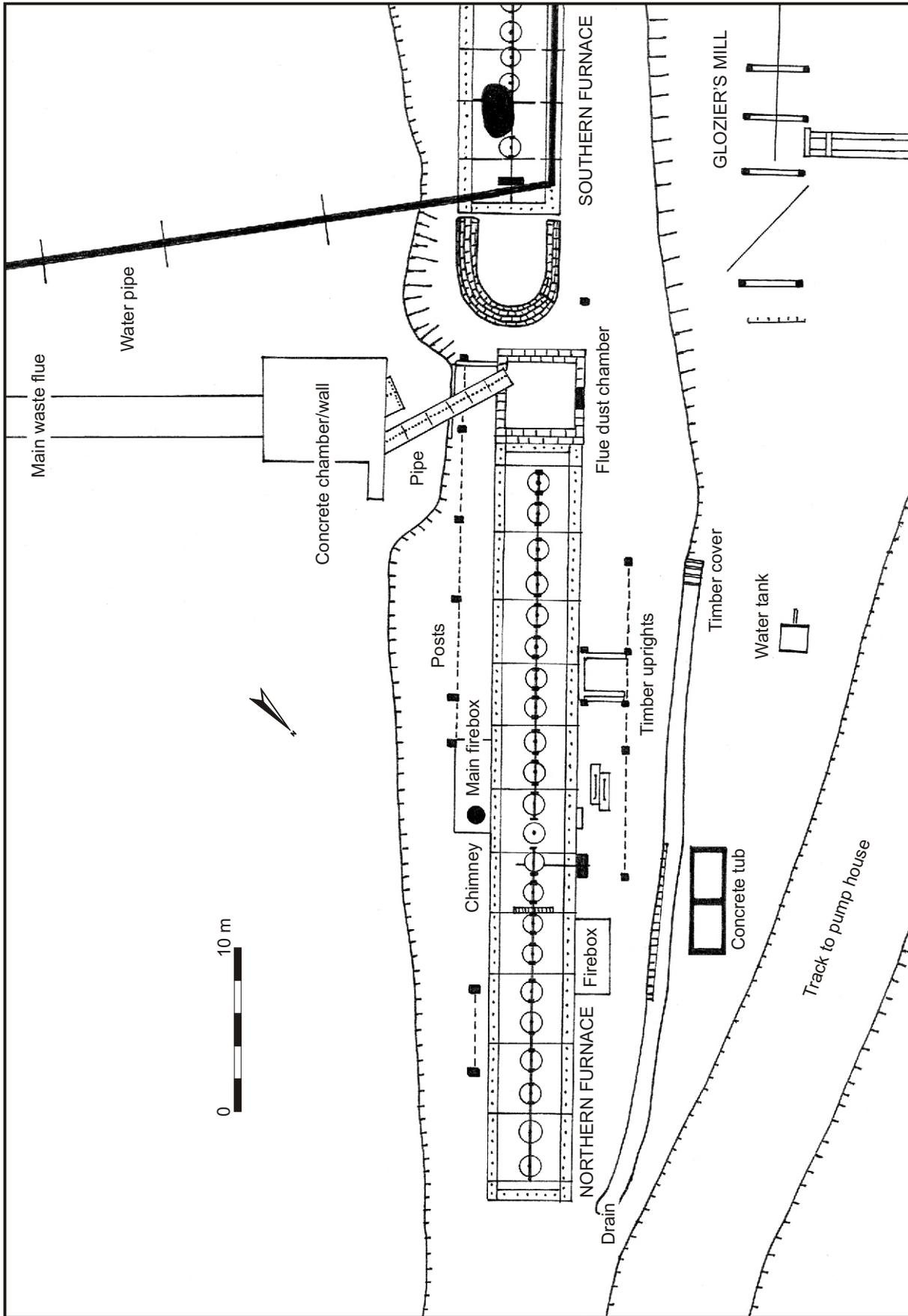


Figure 3

Scaled plan of the northern furnace

Southern furnace

The southern furnace, erected only a metre away from its smaller northern twin, is nearly identical in its specification and configuration. There are however some noteworthy differences. For example, this southern plant is larger, measuring 35 m in length and 3 m in width. Its compliment of rabbles is also larger, boasting five additional rabbles totalling 27 in all. In contrast to the northern furnace's square-shaped flue dust chamber, the southern furnace has a snub nosed U-shaped chamber. Likewise the diameter of the main dust flue is larger here, measuring a metre in diameter. Because all of the combined treated ore from both furnaces was emptied from the southern end of the southern furnace, there is a cast iron door here which allowed the manual removal of the waste pulp. The southern furnace also still retains its two inch water pipe to cool the rabbles. This pipe is in turn connected to the larger water pipe proceeding up the hill to the east adjacent to the main waste flue (see below).

This southern furnace is most probably the original 1921 plant, given that its dimensions and rabble configuration match the written and illustrated specifications for the original installation (see Figure 7).

Drain

Immediately west of and running the entire length of the northern furnace is an excavated drain. Measuring 21 m in length, half a metre in width and 0.3 m in depth, this feature has a five metre section of brick lining on one side and a one metre long timber cover at its terminal southern end. This feature appears to have drained the work space centred around the concrete tub described below.

Concrete tub

Immediately west of the brick-lined section of drain stands a form concrete tub measuring 3.5 x 0.5 x 0.4 metres in height. The tub is divided into two equal compartments and was made to hold high temperature liquids. Its precise function in the calcining process remains unknown.

Water tank

Standing three metres northwest of the timber drain terminus is a steel water tank. Measuring one metre squared, the tank has a simple sleeve where a spigot may have once been inserted. Welded edges indicate that this feature post-dates the calciner period and was probably employed by Mr Glozier after 1948.

REFERENCES

1. Secretary for Mines Annual Report for 1918, p. 13.
2. Groves *et al.*, 1972, p. 109.
3. Acting Secretary for Mines Annual Report for 1921, pp. 24-25.
4. Reid, 1923, p.77.
5. Reid, 1923, p.78.
6. Reid, 1923, p.77.
7. Reid, 1923, pp.77-78.
8. Reid, 1923, p.77.
9. Paine, H. 1994, p.91.
10. Groves *et al.*, 1972, p.113.
11. Groves *et al.*, 1972, p.117.

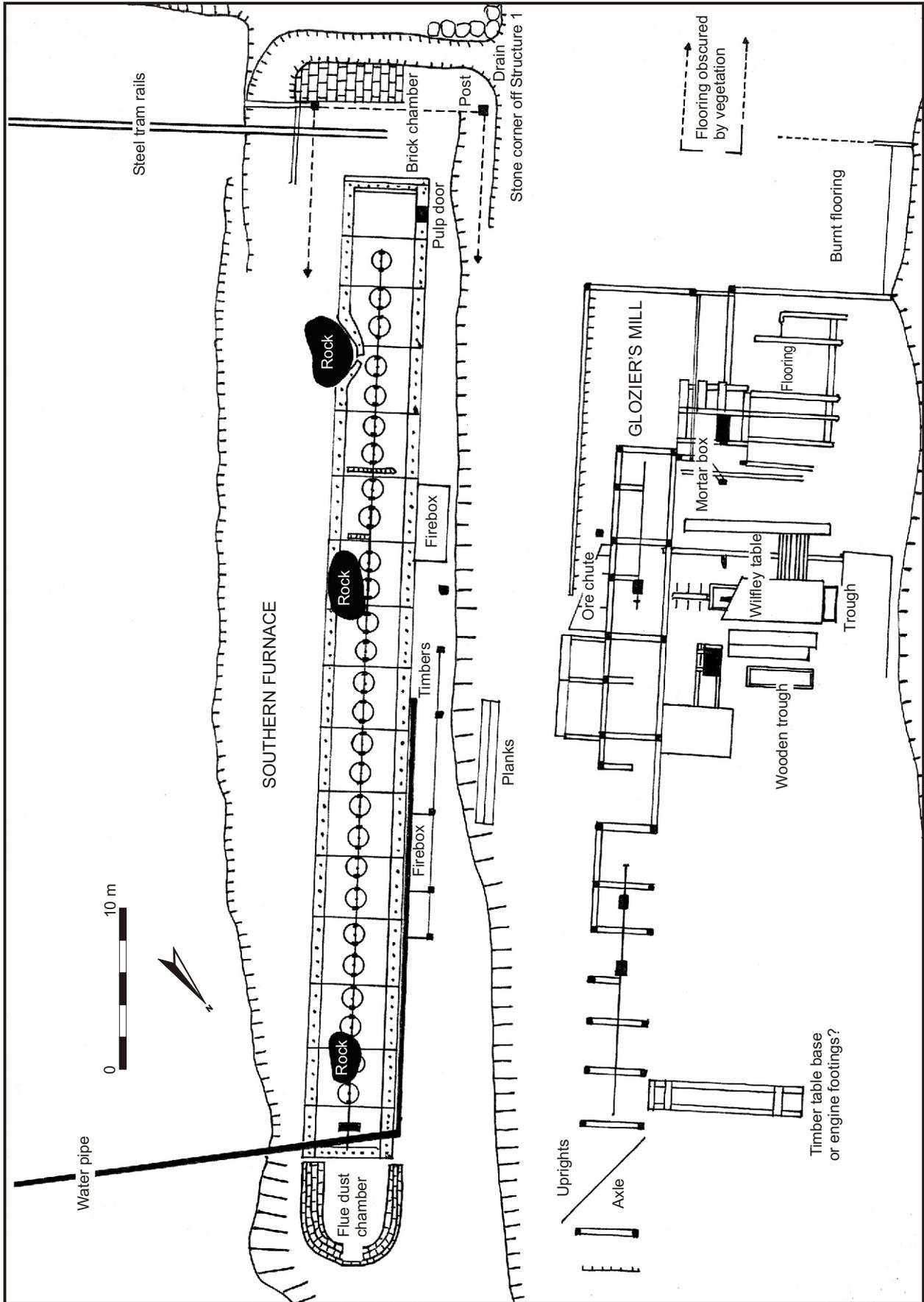


Figure 4

Scaled plan of the southern furnace and Glozier's mill.

■ **Waste flue system**

LOCATION

This feature proceeds up the hillside immediately southeast of the furnaces.

HISTORY

As soon as the first calcining roaster/furnace came on line in 1921, it became evident that the resulting noxious emissions would rankle Waratah's citizenry. One source remembered that "*The sulphur smoke was very powerful, killing all the trees and fernery in Ringtail Valley and beyond*"⁽¹⁾. Vociferous complaints to the mine management culminated in the installation of "*a water blast for the killing and removal of the sulphur fumes from the township and machinery site areas*"⁽²⁾. In his 1923 report, Reid described the process whereby noxious fumes were dampened.

"The fumes discharge into an enclosed concrete chamber, and are met and propelled forward by a series of water-jet sprays into a covered flume. Another series of water-sprays operates in the flume maintaining a regular flow of vapour, and an even furnace draught. The now thoroughly saturated vapour is discharged into Waratah River and carried away"⁽³⁾.

Reid also noted the water blast eliminator's other beneficial effects.

"This water-blast has not only eliminated the sulphurous acid fumes from the furnace buildings and the township, but has brought about an appreciable reduction in the quantity of fuel required in the operation of roasting"⁽⁴⁾.

This pollution control equipment was presumably utilised until the calciner's final closure in 1947.

DESCRIPTION

This system is most eloquently described in drawn form as part of the c.1920 schematics for the first calciner (see Figure 7). This diagram shows a main flue conducting sulphide pollutants from the flue dust chamber at the calciner uphill for a distance of 85 feet to a concrete chamber. At this juncture the pollution entered an enclosed flume and was bombarded with water jets, before being conveyed down the remainder of a wooden flume for discharge into the Waratah River.

A brief inspection of this plant in the vicinity of the calciner furnaces indicates a slight modification from the original blue print in that each of the two furnace flue dust chambers was connected to the main uphill flue by means of two separate sections of aerial pipeway measuring some 4.5 m in length. The original and larger southern calciner required a larger gauge piece of pipe than its neighbour.

The nature of the grade above the calciners further required that the two uptake pipes from the calciner flue dust chambers be cemented into a small stone/cement rampart built on the hillside above the calciners. Measuring 3.5 x 4 .x 4 metres in height, the rampart links these two uptake pipes with the main flue which conveyed the unwanted pollution to the flume further up the hill. Unfortunately time constraints prevented any inspection of the system above the rampart.

REFERENCES

1. Payne, H., 1994, p.91.
2. Report of the Secretary for Mines for 1922, p.25.
3. Reid, 1923, p.77.
4. Reid, 1923, p.77.

■ **Rabble coolant water pipe**

LOCATION

A continuous length of cast water pipe runs uphill/southeasterly from the vicinity of the calciner flue dust chambers towards the summit of the low hill overlooking the calciner and Happy Valley.

HISTORY

Given this pipelines exclusive dedication to the calciners, it is assumed that both plants were contemporaneous. The pipeline was therefore operational between 1921 and 1947.

DESCRIPTION

This continuous section of two inch water pipe runs alongside the main waste flue. Although its ultimate source on the hill summit was not inspected, it is assumed that a dam held water on the heights which was conveyed

down the pipe to the calciners for use in cooling the numerous agitators/rabbles. Indeed the pipeline still connects onto the cooling/water pipes on the southern furnace/calciner.

■ **Pulp elevator**

LOCATION

The hydraulic syphon elevator, built to convey calcined pulp from the calciners to the concentrating plant, was presumably located adjacent to the southern end of the original (southern) calciner furnace.

HISTORY

Appearing on the schematics for the original calciner, this system was presumably operational in 1921 and remained in service until 1947. One source described the elevator's components:

“The last rabble discharges the roasted material into an inclined trough along which it is borne to an enclosed chamber. It is now dampened to pulp, then passed through screens to a water-jet elevator, and, by that agent, returned to the concentrating plant.

The discharge pit in which the elevator operates is constructed of concrete, and has a storage capacity of 40 tons. The capacity of this elevator is 15 tons per day, operating under a static head of 40 lbs. per sq. inch”⁽¹⁾.

DESCRIPTION

A hollow 3.5 x 1.2 x 0.4 metre high brick chamber and a drain appear to be the only physical vestiges of the elevator system. The 1 x 8 metre long drain separates the brick chamber from the first of the concentrating shed foundations.

REFERENCES

1. Reid, 1923, p.78.

■ **Original tramway**

LOCATION

A timber tramway appears to have run from the northern end of the northern calciner furnace around the eastern slope of Happy Valley to an undetermined point.

HISTORY

The only known evidence for the existence of this tramway is a photograph dated c.1922 (see Plate 3)⁽¹⁾. As this tramway appears to access the northern vicinity of the calciner plant, it is assumed that the two complexes are contemporary (i.e. 1921–1947). The precise function of the tramway also remains unknown, although it seems most likely that it was used to convey pyritic ore from a large stockpile south to the calciners for treatment. That the tramway is conspicuously absent in photos taken during the 1970s (see Plates 1 & 4) indicates that it had been salvaged during the intervening three decades.

DESCRIPTION

The c.1922 photograph shows a continuous sleeper progression or tram ‘road’ supporting a pair of parallel unsquared timber spar rails. The line appears to be a standard narrow gauge of 3 ft. 6 in. which would have accommodated standard ore skips of the day.

REFERENCES

1. Groves et al., 1972, p.305.

■ **Later (Glozier's?) tramline**

LOCATION

A second tramline of sorts ran down the hillside overlooking the calciner plant to the southern end of Glozier's concentrating shed.

HISTORY

There are no known written references to this tramline, although it is discernible in photos of the calciner precinct dating from the 1970s (see Plate 4). It is conspicuously absent in descriptions and photos of the calciner plant dating from the formative years of its operation. It is therefore considered most likely that this line was built by Mr Glozier after 1948, and used by him to convey mine product down to his concentrating plant at the now derelict calciner facility. The tramline had also become derelict by c.1980.

DESCRIPTION

Photographs taken during the 1970s show the tramline as a well constructed sheathed steel tramline supported by an elevated timber incline. Contemporary remains today are limited to parallel sections of the two steel rails in the vicinity of the southern calciner/hydraulic elevator.

■ **Glozier's mill**

LOCATION

The remains of the building known as Glozier's mill or shed stand on a levelled clearing immediately northwest of the southern calciner plant.

HISTORY

The shed ultimately chosen by Mr Glozier as the site of his own ore processing plant had originally been erected as part of the Mount Bischoff Company's calcining operation in c.1920, although specific references to this part of the plant are fleeting. One later reference to a fire which damaged the furnace building in 1933 also tells us that "Four card tables were made operational in the calcine plant"⁽¹⁾. This building may also have housed the calciner's electrical power plant, which Reid referred to in 1923.

"Electricity, at a pressure of 550 volts, provides the motive power for the plant. The rabbles are driven at a rate of one and a half revolutions per minute by a geared 15-horsepower motor. The motor is housed in a small dust-proof room in the main building"⁽²⁾.

The calcining shed remained unaltered and to all intents and purposes unremarked upon until after the final closure of the mine by the Federal Government in 1947.

In his 1948 annual report, the Director of Mines noted that a Mr H. C. L. Glozier was undertaking tin processing activities in the vicinity of Tinstone Creek. More specifically:

"Towards the latter end of the year, this person was engaged in the construction of a concentrating and roasting plant. His outfit consists of a screen, 3 head of stamps, Wilfley concentrating table and roaster. Motive power is supplied by a water wheel assembled by Mr Glozier on the job"⁽³⁾.

Mr Glozier's new concentrating and roasting facility presumably remained in operation until his final departure in c.1980. The surviving fabric and plant at this site today (described below) are deemed to be the remnants of Mr Glozier's occupation.

DESCRIPTION

This site consisted until recently of an asbestos-clad shed housing several remnant pieces of milling and concentrating machinery. A works crew contracted by the Department of Mineral Resources recently removed all the hazardous asbestos cladding while leaving all uprights and internal fixtures *in situ*. The site therefore is now an open one, although all posts and fixtures have been judiciously avoided during the clean up.

The surviving timber uprights indicate that the former shed was 31 m long, 9.5 m wide and nearly four metres in height. The asbestos skin was undoubtedly added during Mr Glozier's tenancy (1948 onwards), as photos of the site dating from the 1920s clearly show the structure clad in corrugated iron. Surviving *in situ* fixtures imply three differing activity areas within the shed.

Overhead belting/power plant

Running almost the entire eastern length of the shed is an overhead belting system used to power the various ore agitating apparatus below. Measuring 26 x 2 x 3.7 metres in height, the timber framework once supported a continuous sequence of six belt drive shafts, although only four now remain on the frame.

Concentrating plant

The remains of one Wilfley table and surrounding timber troughs indicate where ore was washed and sorted. The location of three pulley wheels on the overhead belt driven shafts imply that there were at least another two tables to the north of the surviving table.

Milling plant

A small ball mill and a mortar box embossed with a manufacturers plate 'Johnson & Sons' sit *in situ* immediately north and south of the Wilfley table respectively.

Ore chute

A tapering timber ore chute, measuring 3 x 1 x 1 metres in height, stands erected on the slope against the eastern wall of the shed. It appears that ore was tipped down through the device to sorting tables on the shed floor below. A wheelbarrow lying beside the ball mill plant may have been used to cart ore from the tramway to the ore chute.

Other features

A rectangular timber frame at the northern end of the shed may have served as a machine footing or sorting table base. The burnt flooring/decking surrounding the south side of the former building indicates that some activity occurred beyond the southern edge of the shed. Historic photos fail to tell us what this may have been.

REFERENCES

1. Groves et al., 1972, p.113.
2. Reid, 1923, p.78.
3. Director of Mines Annual Report for 1948.

Concentrating sheds

LOCATION

The extensive but well concealed remains of some type of concentrating plant were located and partially recorded over an 80 m expanse immediately south of the southern calciner plant.

HISTORY

The identity and genesis of this three-building complex remains for the moment uncertain. A small number of clues imply that this complex served as some form of concentrating plant for the product from the adjacent calciners. The first reference from 1923 for example describes how: "A large Edwards furnace was erected close to the slime plant, and so placed that the main tramway would serve as the line of transport from the slime plant, and also from the stack of pyrite concentrate to the hopper of the furnace"⁽¹⁾. The slime plant may have possibly formed part of the complex described here.

A subsequent reference in 1925 alludes to "a new treatment plant consisting of a grinding pan and seven tables to treat the calcine"⁽²⁾. Another makes reference to the concentrating of calcined ore undertaken in c.1942. More specifically this source alludes to "the pyritic concentrate which was roasted at the company calciners and then tabled to produce a final concentrate in the adjoining plant which contained five tables on which 91% of the tin was recovered"⁽³⁾. This may actually refer to the shed which would soon become Mr Glozier's concentrating plant (described previously), although it could equally apply to this building complex immediately south of the furnaces.

DESCRIPTION

The ruinous foundations of least three separate but adjacent structures lie in the bramble-ridden area between the southern calciner and a track to the bottom of the Waratah Falls.

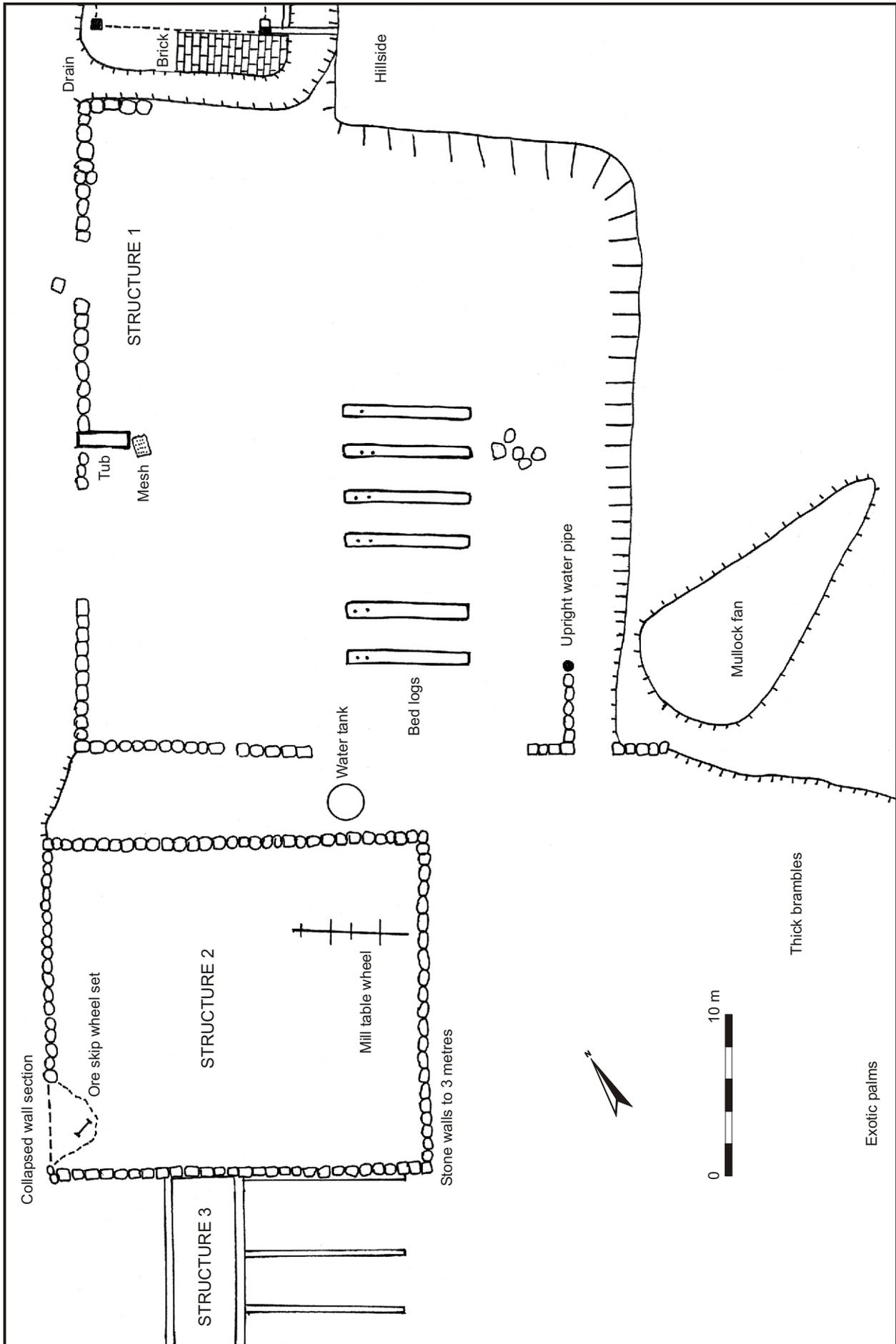


Figure 5
Scaled plan of the three structures thought to comprise the concentrating plant.

Due to the tenets of the brief and time constraints, this complex of buildings was only fleetingly explored and recorded.

Structure 1

The northernmost structure adjacent to the southern calciner measures 20 x 17 metres in extent. The external wall footings are composed of mortared local stone, and the hillside in the northeastern corner of the building has been cut away to a height of six metres in order to accommodate the structure. A sequence of six parallel bed logs and their fasteners within these walls marks the location of some former item of plant. An ore washing tub and section of mesh against the western wall attests to the building's use as a concentrating facility.

Structure 2

The second and medial structure in this complex consists again of a square 10 x 12 x 1 metre high stone wall. The only obvious internal feature was the 3.5 m long shaft of a double round mill table.

Structure 3

The third and final structure hurriedly noted here was a 16 x 2 metre wide form concrete water or slurry tank with several (?) concrete walls acting as channels above it. This structure was barely clambered over let alone recorded. As such its form and function both remain unclarified.

REFERENCES

1. Reid, 1923, p.77.
2. Groves *et al.*, 1972, p.109.
3. Groves *et al.*, 1972, p.115.

Site interpretation

Figure 6 shows a diagrammatic reconstruction of the calciner facility covering the two principal periods of the site's operation.

- First phase — Mount Bischoff Company/ Commonwealth Government (1919–1947).
- Second phase — Mr H. Glozier (1948–c.1980).

The principal features to survive from the plant's inception to the present day are:

- The two calcining furnaces
- Hillside waste flue
- Glozier's mill
- Concentrating shed foundations

Features added or destroyed over time include:

- Water jet discharge pipe
- Original tramway
- Later (Glozier's?) tramline
- Chimneyed shed adjacent to northern calciner

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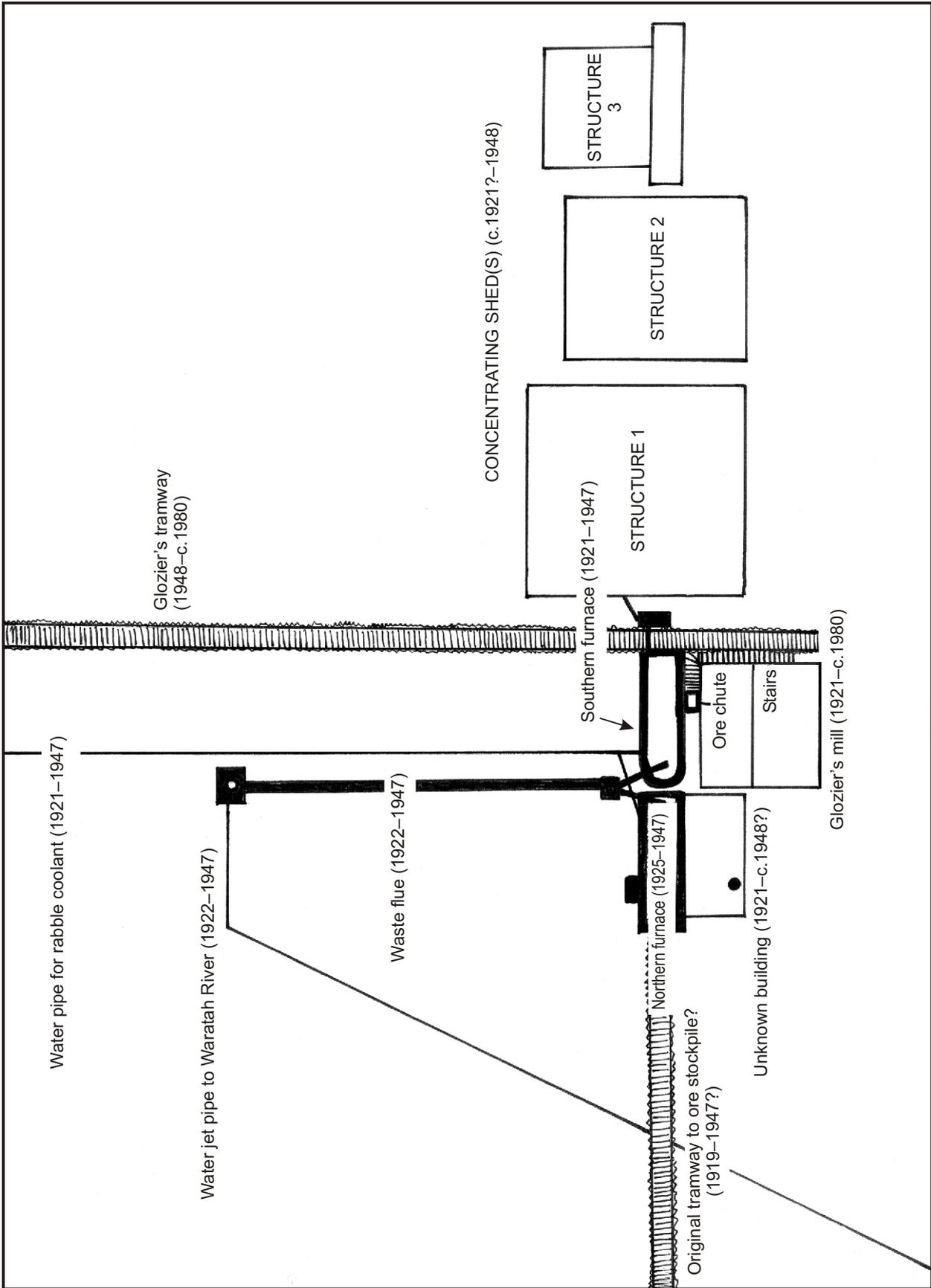


Figure 6

Unscaled reconstruction of the calciner plant over time between 1921 and 1980.

APPENDIX I

Historic photographs



Plate 1

Northeasterly view of Happy (Ringtail) Valley in 1976, showing partially intact calciner complex and footings of concentrating plant in right foreground.



Plate 2

Similar view twenty years later (1996) showing substantial collapse of calciner and Glozier's mill roof sections. A new road has also been graded down to Waratah Falls (right background).



Plate 3

Southwesterly view of Happy (Ringtail) Valley looking towards the falls. The calciner is the building cluster on the left hand side. Note the wooden tramway on extreme left. Photo dated c.1922 in Groves et al. (1972).



Plate 4

A more detailed view of the calciner plant in c.1972 showing Glozier's tramline running downhill to his mill shed in the lower right hand corner. (From Groves et al., 1972).

APPENDIX 2

Contemporary site photographs



Plate 5

*Southwesterly view of calciner showing the northern furnace with its chimney still intact.
Note auxiliary firebox on right hand side of the furnace.*



Plate 6

Detail view of rabbles and their drive assembly on the northern furnace.



Plate 7

*Easterly view of southern furnace showing a small part of its brick-lined interior.
Note also the brick pedestal upon which the furnace has been lowered.*



Plate 8

View of the southern furnace showing water pipe used to provide coolant for the rabbles.



Plate 10

Detail of main firebox and chimney on northern furnace.



Plate 9

Detail of auxiliary firebox feed doors on northern furnace.



Plate 11

Square-shaped flue dust chamber on northern furnace.



Plate 12

Rough U-shaped flue dust chamber on southern furnace.



Plate 13

Detail of rabble head.



Plate 14

Detail of furnace deck showing a rabble foot protruding. A rabble head would have been bolted onto this.



Plate 15

A rabble foot found lying beside the furnace. Note the weighted end used as an agitator to mix the heating ore.



Plate 16

Square mild steel water tank lying near the northern furnace.



Plate 17

Pipes connecting the two furnace flue dust chambers to the main waste flue which proceeds uphill behind the stone wall.



Plate 18

Southwesterly view of Glozier's mill showing overhead pulley system.



Plate 19

View of interior of Glozier's mill showing Wilfley table locations and a ball mill.



Plate 20

Detail of the overhead pulley drive assembly in Glozier's mill. Note the timber ore chute at rear possibly used to offload ore from tramway into the mill.



Plate 21

Detail shot of the overhead pulley assembly



Plate 22

Detail shot of the small ball mill in Glozier's mill.



Plate 23

Small timber machine footings in Glozier's mill.



Plate 25

Johnson and Sons three-head mortar box in Glozier's mill.



Plate 24

*Timber ore washing tub adjacent to Wilfley table in Glozier's mill.
Note crude hammered spigot.*



Plate 26

Shaft from a double round mill table lying in Structure 2, concentrating sheds.



Plate 27

Stone dam wall comprising part of Structure 3, concentrating sheds.

APPENDIX 3

Historic plans

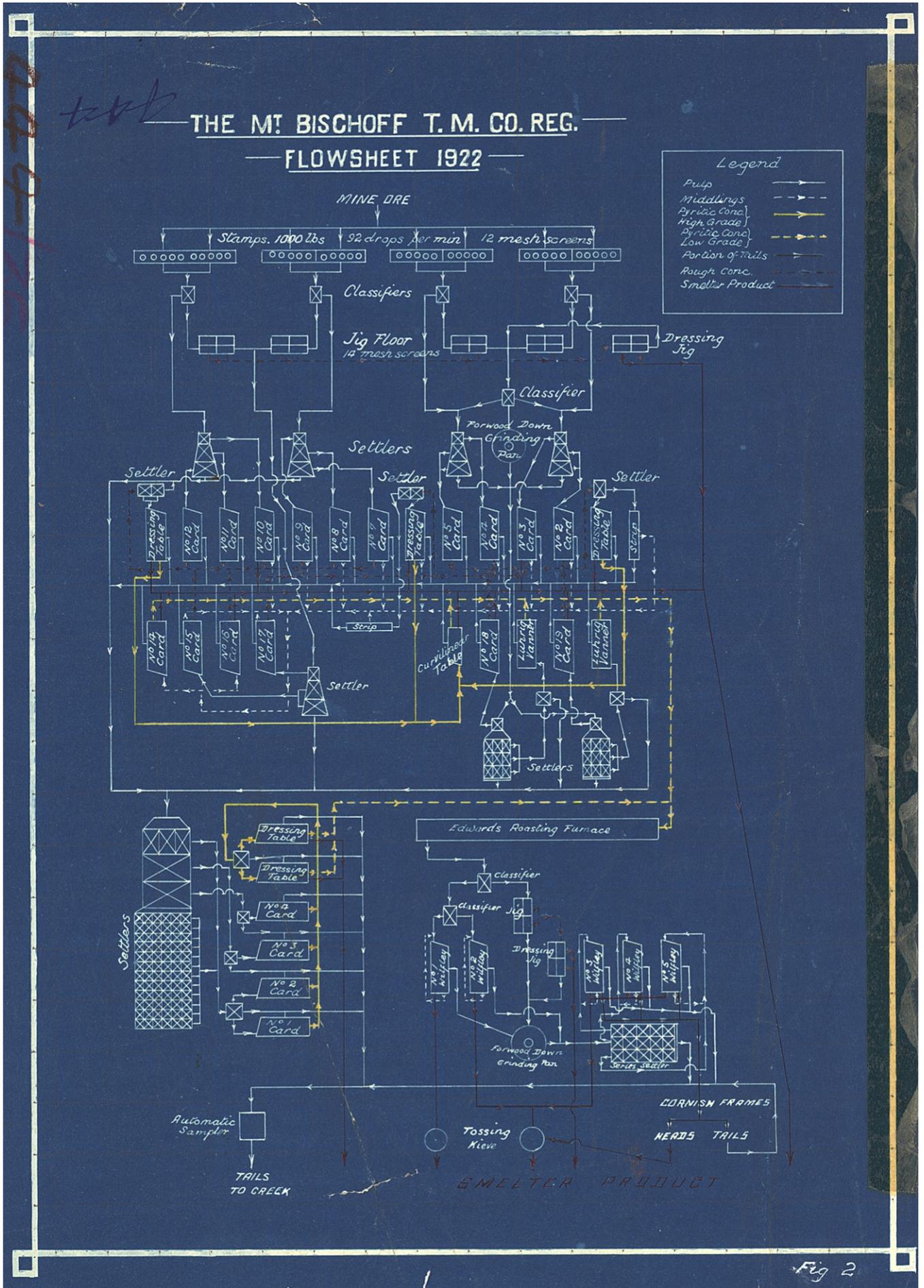


Figure 8