Heritage Assessment
Puhipuhi Mercury Mine

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January 2011

newzealand.govt.nz

Department of Conservation
Te Papa Atawbai

Peer Reviewed by: Neville Ritchie

Acknowledgements: Joan Reed, Brian Reed, and Anne Reed, for talking to me about Cyril Reed who worked at the Puhipuhi Mercury Mines, and for providing photographs. The Whangarei Library, for providing photographs. Unless otherwise stated, photos were taken by the author; digital copies of all images held at the Whangarei Area Office.

Image on cover page: two of towers at the processing plant, showing remains of large outlet pipe suspended between them

Site Overview

At Puhipuhi, during the first half of the 20th century, a succession of businessmen attempted to make a profit by producing mercury. They all failed, but not due to a lack of effort and investment. The site today is testimony to that; there remains an opencast quarry, an extensive railway system, a dam, and the impressive remains of the WWII-era plant where mercury was extracted from its ore.

The site is about 10km north-east of Whakapara, and is administered from the Whangarei Area Office. The historic fabric occupies an area of about 5 ha within the 32.5 ha which comprise the Waikiore Conservation Area. The mercury mine is accessible from the northern end of Mine Road, although it is not, at present, a visitor site.

History

Alluvial cinnabar[1] was noticed in the Puhipuhi area in 1892, the discovery prompting a flurry of prospecting to find the source[2]. In 1907, quartz outcrops at the head of the Waikiore Creek were found to contain cinnabar and a Mr Holder began to work the deposits. Three years later, Mr Holder's claim and adjacent ground were taken over by the Whangarei Cinnabar Company, which built a small treatment plant[3].

From 1910 to 1921 a succession of companies attempted under-ground mining operations: the Whangarei Cinnabar Company, the Auckland Cinnabar Mining Company and New Zealand Quicksilver Mines Limited (NZQM)[4]. NZQM continued to produce mercury until 1921 when mining virtually ceased. Ferrar *et. al.* (1925) describe a main adit (passage) and inclined drift totalling 260 feet in length, with passages to the right and left which followed the ore. By 1925, a total of 1558 tons of ore had been processed, yielding more than 15.5 tons of mercury. However, the ore extracted was not enough to keep the treatment plant operating continuously. The loose nature of the ore-body caused problems, and timbering was necessary throughout the workings[5].

The NZQM directors had an on-going squabble with the Mines Department regarding their entitlement to government bonuses and access to loans[6]. In July 1920, the argument came to the attention of the Prime Minister (Mr Massey), who met with Mr Cooke, a director of NZQM. Mr Cooke requested, among other things, that a mining engineer inspect the property[7]. Shortly after, Professor Waters of the Dunedin School of Mines did just that, producing a report of 26 pages. He stated that "the extent of the ore body seems limited and the mine does not show promise of being a big scale mine". However he did go on to say that "the property is a good one, worthy of proper and systematic development ..."[8]

Despite the challenges encountered by NZQM, the Great British Mine took over the property in 1926. The company attempted some open-cut work, and by 1927 had treated

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[1] Cinnabar is mercury sulphide (HgS), the principal ore of mercury.
[2] H. Ferrar *et al.*,1925.
[3] *ibid.*
[4] *ibid.*
[5] Professor Waters to the Under-Secretary for Mines, 1921. Archives NZ Reference: MD1 1466 12/41.
[6] Records relating to the New Zealand Quicksilver Mines, Ltd. Archives NZ Reference: MD1 1466 12/41.
[7] NZ Quicksilver Mine, H. R. Cooke, Puhi Puhi, Whangarei: Interview with the Prime Minister, Wellington, 16th July 1920. Archives NZ Reference: MD1 1466 12/41.
[8] Professor Waters to the Under-Secretary for Mines, 1921, p 20.

400 tons of ore for a yield of 14 ctw of mercury [9]. In 1928 and again in 1931 underground passages were extended, but further ore was not discovered and work ceased[10]. Matters only got worse: in January 1934 a fire started in adjacent scrub, and destroyed all the buildings and the processing plant[11] Later that year, Mercury Mines New Zealand Ltd. invested £5 000 in new processing equipment[12]. Apparently, £5000 was not enough to ensure the safety of the workers at the treatment plant. A year later they were suffering from highly inflamed gums and loose teeth, thought poisoned by escaping mercury fumes[13]. If gingivitis was their only health problem, they were perhaps lucky. Inhaling mercury vapour can have very nasty consequences, such as lung damage, tremors, nausea, emotional upheaval, kidney damage, and even death[14].

The final phase of activity at the Puhipuhi Mercury Mines began in 1939 when Mr W. S. Miller and Mr J. Armstead took over. Their company (New Zealand Mercury Mines Ltd.) built a comprehensive treatment plant with crushers, ore bins, rotary kilns, a condensing plant, auxiliary buildings and workshops. Unlike earlier operations, the mine was completely open-cast in nature. Roads and tramlines were developed, and a dam was built to ensure a water supply[15].

Table 1: mercury produced by New Zealand Mercury Mines Ltd[16]

year	amount of mercury produced	value of mercury produced	number of employees
1939	0	0	0
1940	0	0	20
1941	2.5 tons	£5 043	22
1942	5.1 tons	£11 110	18
1943	3.2 tons	£7 192	18
1944	3.1 tons	£6 840	18
1945	1.0 ton	£2 294	closed early
1946	0	0	0

The mine employed 22 people in its heyday (see table 1). Mr Miller described them as a "tough crew"[17]. Some were manpowered to the site under wartime powers, some were draft-dodgers, and others wanted to keep out of site for their own reasons. However, Mr Miller recalled a core of hardworking miners who kept the plant going through years of shortage[18]. Some of these employees sacrificed their health. One of these men was Cyril Reed, who shovelled ore in the quarry and checked the machines in the processing plant. His daughter remembers her father being very ill, sweating so much in his sleep that the mattress soaked right through[19].

[9] ctw = hundredweight, which is equivalent to approximately 50 kg.
[10] J. Henderson, 1944, p 49.
[11] The fire was reported in *The New Zealand Herald,* 25 January 1934, and *The Auckland Star,* 25 January 1934.
[12] Letter from the Under Secretary, Mines Department, to Mr Downdy, Inspector of Mines, 1935. Records relating to the Great British Mercury Mines. Archives NZ Reference: A92030 M102-A.
[13] Letters, 1935. Records relating to the Great British Mercury Mines. Archives NZ Reference: A92030 M102-A.
[14] J. DeGraff *et. al.* 2007, p 117.
[15] See New Zealand Archaeological Association Site Record Form Q06/170.
[16] Mines Statements, Section C2, Appendix to the Journal of the House of Representatives, 1940 – 1947
[17] R. Scobie,1973, p 23
[18] *ibid.*
[19] Pers. com. Joan Reed, March 2010.

Mercury was considered an important resource during World War Two. In 1942, the government prepared a 'denial of resources' (scorched earth) plan, to be put into action if the Japanese invaded[20]. The Mines Department – among others – was required to draw up a top-secret list of things to be destroyed. The mercury workings in North Auckland were specifically identified on this list as a resource likely to be of value to the enemy[21].

Messrs Miller and Armstrong contributed to the war effort, or perhaps they simply tried to take advantage of a business opportunity. If that was their intention, they did not succeed: the right equipment was not available during WWII, when mercury was in great demand. When the war was over, and equipment *was* available, the price of mercury plummeted so that it wasn't worth the effort. An international mercury cartel was apparently to blame[22].

In the end, New Zealand Mercury Mines Ltd. joined the ranks of failed business ventures which characterise the history of the Puhipihi mercury mines. Altogether about 15 tons of mercury was produced, however Mr Miller and Mr Armstead lost about half of their $140000 investment when the mine was forced to close in 1945[23]. Mr Scoble, Inspector of Mines, summarised the situation as follows:

> *Formerly the bulk of the production was sold in Australia, but the market collapsed there about September, and this, together with the difficulty of obtaining suitable gear, led to the closing-down of both mine and treatment plant. The ore is won by opencast methods and it will be necessary to provide a modern bulldozer and carryall to make a success of the venture with the prevailing prices for mercury*[24].

In the 1960s and 1970s a few companies did show some interest in reviving the operation. Exploratory prospecting was carried out, but the experts concluded that there was no money to be made by re-opening the mine. Eventually, all hope of re-opening the mine was extinguished. The lease held by New Zealand Mercury Mines Ltd. expired in 1981 and the land reverted to the Crown.

> *It is to be regretted that the determination of this company to put mercury production on a sound basis in New Zealand and increase supply of an essential war material has not been met with greater success*[25].

[20] P. Cooke, 2000, p 705-706.
[21] *ibid.*
[22] E. Scoble, 1946.
[23] R. Scobie, 1973, p 23. See also the *Northern Advocate*, Wednesday 31 May 1978.
[24] E. Scoble, 1946, p 27.
[25] E. Scoble, 1946.

Figure 1: The quarry in the 1970s. Photo courtesy of the Whangarei Library.

Fabric Description

Contemporary plans exist for the two main phases mine's life, one published in 1925 during the NZQM period[26], and another published in 1944 showing the workings of New Zealand Mercury Mines Ltd. These plans are re-produced in Appendix A. Present on the site today are highly visible components of the NZMM quarry, transport system, water supply system and processing plant. Most of the earlier underground workings were probably subsumed by the opencast quarry, and the same may be said for the processing plant. Figure 3 is a sketch map showing the major components of the NZMM operation.

To state the obvious, the first stage of the process was to extract the mercury ore from the quarry (figure 1). A photo from the *Northern Advocate*[27] shows a digger, a bulldozer, two trucks and a tram in operation. The trucks were used to transport the ore to the processing plant, and the tram was used to transport the overburden to the tip site (see figure 3). The tip area was a natural gully, and the landscape has been altered by tram loads of overburden. The quarry today is more overgrown than it appears in figure 1, although the power poll at the bottom is still visible. The roads on the property are covered in regenerating natives and in gorse, although the benching is clearly apparent. The route of the railway line can be followed as it ran alongside the lake, and to the east of the dam the railway tracks are still in place. Towards the end of the line there are two parallel sets of tracks which connect to each other via a pair of railway switches. This may have been in the vicinity of the engine shed (see figure 3) although no traces of this building were noted.

[26] H. Ferrar *et al.*, pg. 85
[27] *Northern Advocate*, Wednesday May 31, 1978.

Water was of utmost importance for extracting elemental mercury from its ore, as explained below. Messrs Miller and Armstead spent £2 000 constructing a dam in the Waikiore Stream to secure a water supply for their venture[28]. The dam, approximately four metres high on the down stream side, is a constructed of earth and stone. An iron culvert is set into the base of the dam, and through it runs a narrow iron pipe (figure 2). Below the dam the natural stream bed has been altered to form a channel with a regular rectangular cross section.

Most of the historic fabric at the site of the Puhipuhi Mercury Mines in concentrated in the area of the processing plant. To understand the different components, you need a general understanding of how elemental mercury is extracted from its ore. According to DeGraff *et al.,* the process is fairly simple: the ore has to be crushed, and then heated to about 320 °C, to release the elemental mercury from the cinnabar in a vaporised form[29]. The vapour then has to be cooled so that it condenses into liquid mercury; water was commonly used to assist the cooling process[30]. During the earlier stages of the Puhipuhi mining operation, the cooling system comprised parallel sets of V-shaped cast iron pipes. These pipes had open bottoms, set into water-filled wooden troughs[31]. During the NZMM phase, the cooling system was far more sophisticated, involving a complex arrangement of ceramic pipes. Figure 4 is a sketch map of the major components of the processing plant, labelled A – M. Each item is described below, and its function explained (at times, tentatively).

[28] NZ Mercury Mines Ltd. Statement of Accounts for the Year ended March 31st 1945. Archives New Zealand Reference: BAEA S181 2950 26064.
[29] DeGraff *et. al.* 2007, 116.
[30] *ibid.*
[31] H. Ferrar *et. al.*, 1925, p. 84. & Professor Waters to the Under-Secretary for Mines, 1921, p 12-15.

Figure 2: Looking down the channel below the dam, note that the iron pipe continues for some distance down the stream (left); the culvert and pipe set into the bottom of the dam (below).

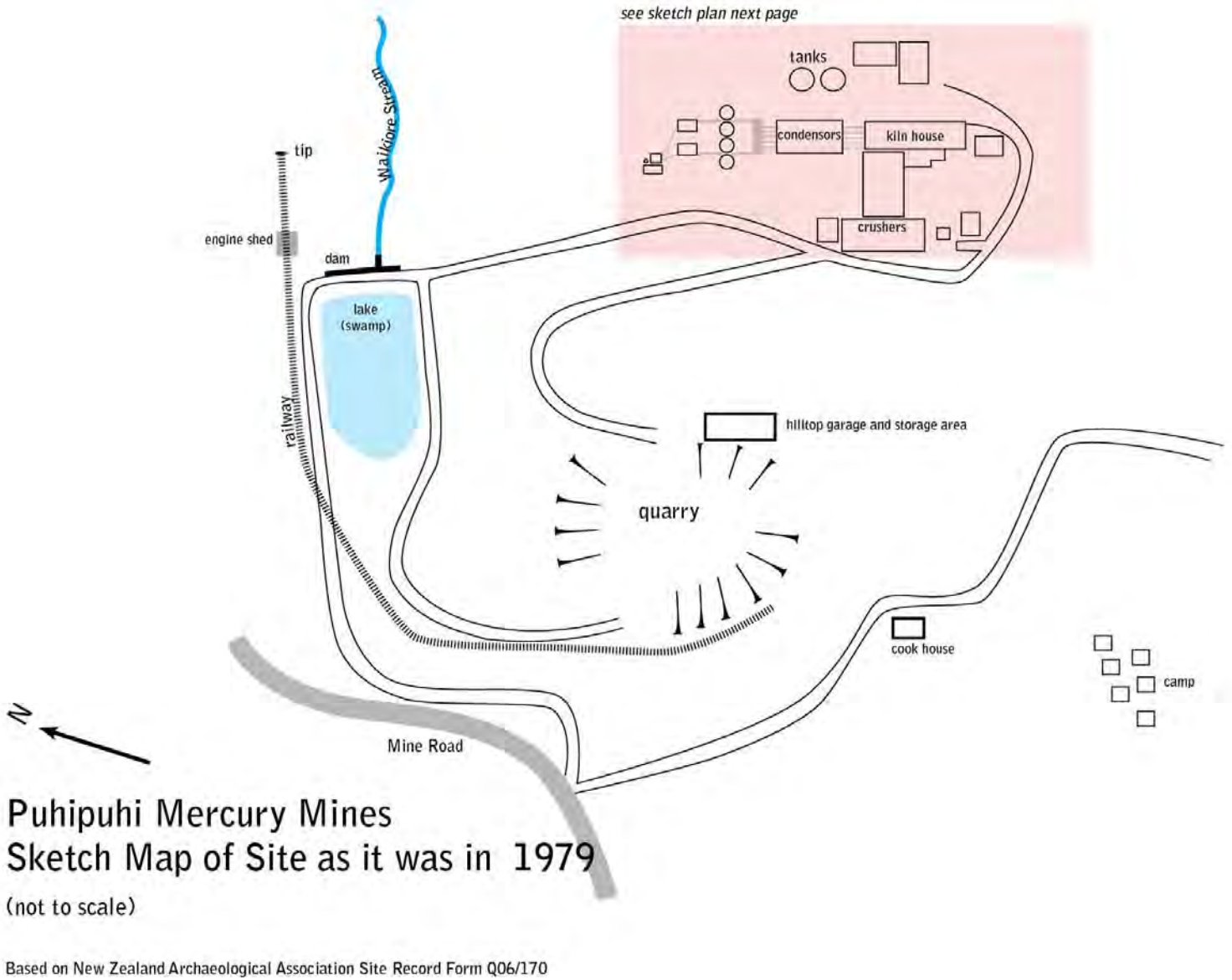


Figure 3: Sketch map of site, showing the components of the NZMM operation.

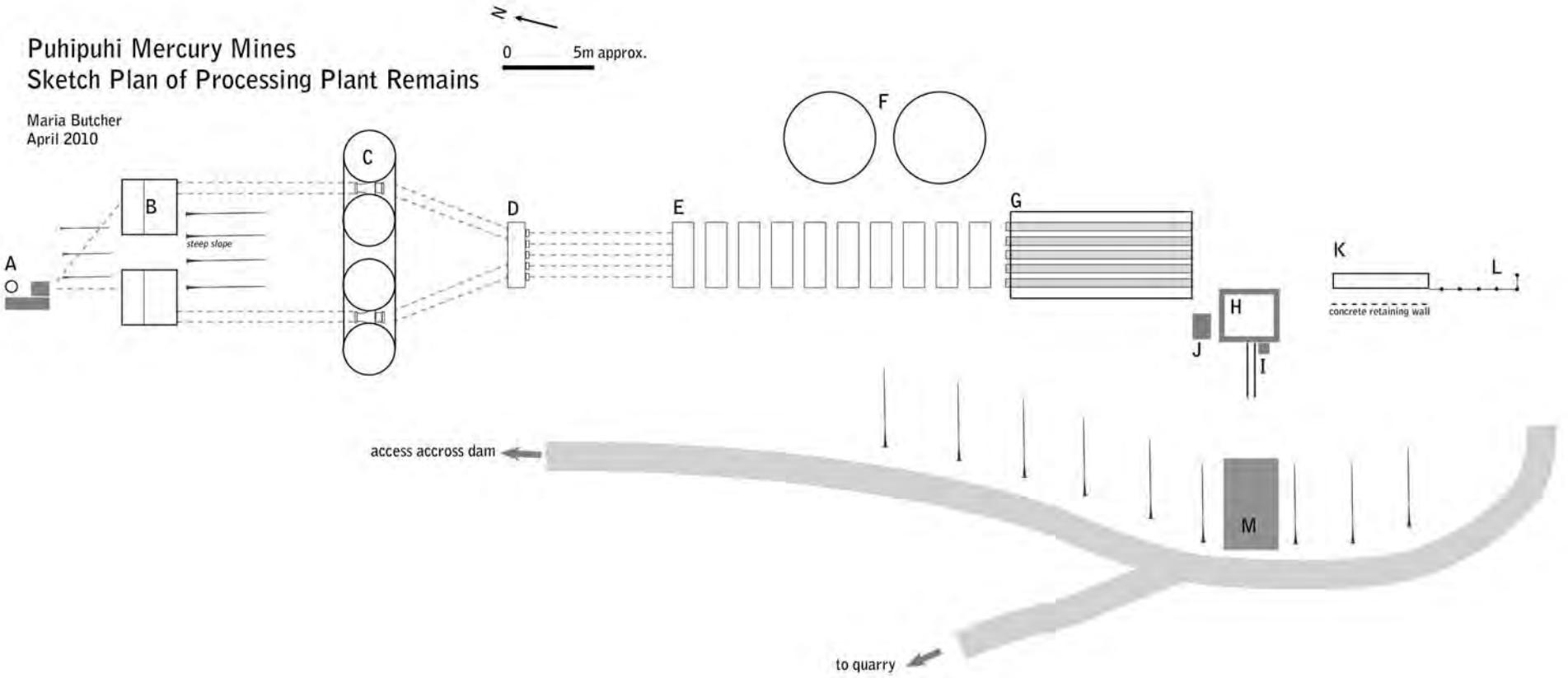


Figure 4: Sketch map of main components of processing plant, as at April 2010

Figure 5: cast iron Sturtevant fan under rough corrugated iron roof. "Monogram" model, manufactured in the 1920s – 1940s. A large volume fan, adapted for exhausting smoke fumes and gasses from engine-rooms, laboratories and kitchens (see B. F. Sturtevant, n.d., and also www.sturtevantfan.com).

A. Exhauster/fan. An electric belt-driven exhaust fan, manufactured by B. F. Sturtevant Co. of Boston, "America's first and most innovative fan company[32]". The fan is mounted on a concrete platform, with a roughly constructed wooden and corrugated iron roof. It connects to a vertical "chimney" c. 0.6m diameter and c. 5 metres high. A canvas belt (8 cm wide) is present. The fan connected to the pair of tanks below (B), apparently to vent gaseous bi-products of the mercury extraction process (?).

B. Tanks. A pair of drum-shaped metal tanks, mounted on their sides; 3 m diameter and 3 m long. Footed on wooden sleepers. Internal baffle made of bricks with small "window". Intake pipes (c. 60 cm diameter) connected to the towers (C), and outlets connected to exhauster (A). Apparently used for containing gaseous bi-products of mercury extraction process.

C. Towers. Four metal "towers" approximately 12 metres high, with round cross-sections, approx. 3m diameter. Each tower has an internal "funnel" structure. The funnels feed into a system of narrow pipes at the bottom of the tower structures. The towers are paired, each pair connected with a shared input pipe and shared output pipe (c. 60 – 80 cm diameter). Due to the sloping topography, the output pipes are at the same level as the input pipes of the tanks above (B). The pipes which fed the towers were connected with the cooling system by way of a concrete structure (D) described below. Function: final stage of separating the liquid mercury from waste gasses (?)

[32] www.sturtevantfan.com, accessed 10 April 2010.

Exchange. A hollow concrete structure 3.6 m x 0.8 m, 1.5 m high. It directed the flow from the five pipes of the cooling system into the two large pipes which feed into the tower structure.

Figure 6: Above: Looking east across the lake in 1968; the dam is in the middle ground, and the roads flanking the lake are clearly visible (see figure 3). Below: Looking north at the towers (bottom right), the tanks, and the building which housed the fan/exhauster.

Figure 7: Towers. Above: Southern aspect of towers in 1968. Note handrail around the top and large inlet pipes connected to the "exchange" by way of terracotta pipes. Photo from the collection of Anne and Brian Reed. Below: Northern aspect of towers inn April 2010. Note the large "outlet" pipe.

Figure 8a: Pipe Battery. Above: the stamp on the side of a fragment of pipe remaining on the site today. Below: The pipe battery in 1968. The structure is evidence today by a series of low concrete troughs, visible below.

Figure 8b: The Pipe Battery in 1968. Evidenced today by a series of low concrete troughs, visible at the bottom of this photo. This photo was taken facing the south, looking back at the corrugated iron building which housed the furnace. The "cooling trough" (G) is visible behind the ladder.

E. Pipe battery (remains). Ten low concrete troughs, each 1.2 x 3.6 m, and 0.7 m apart. Height: 0.5 m. The base of the "pipe battery", a complex vertical arrangement of terracotta pipes set into cooling troughs of water. Broken terracotta pipes present on the site, some stamped with the name of the manufacturer (figure 8a and 8b).

F. Water tanks. Two open-topped water tanks, 5 m diameter, approx. 1 m high

G. Cooling trough and pipes. Re-enforced metal trough, rectangular, 5.4 m wide by about 10 m long. Supported underneath by substantial concrete and timber structure. Trough contains five horizontal metal pipes, which fed directly into terracotta pipes of the pipe battery. Sturdy nature of trough and evidence of pluming underneath indicates it was filled with water. The initial stage of the cooling process, whereby the mercury vapour passed though the horizontal pipes set in water and fed into the pipe battery.

H. Furnace (part of). Brick furnace, approx. 3 m x 2.5 m x 4 m high. Façade shown in figure 9b is missing.

I. Conveyor belt system. For lifting crushed ore to the top of the furnace. Steeply angled wooden tracks, and wide canvas belt with metal scoops attached (see figure 10).

J. Mechanical structure. Complex metal structure attached to back of furnace (figure 9a). (Part of machinery to rotate inner chamber of furnace?)

K. Channel. Concrete channel set into ground, c. 1 m wide and 6 m long. Based upon a historic photograph, the channel accommodated the wheels relating to the rotating function of the furnace.

L. Handrail. Metal handrail, related to concrete channel (K.).

M. Chute. A concrete chute, about 3 m wide, at a right-angle to road which led to the quarry. Angled at about 45° and leading down towards the furnace. For dumping truckloads of ore, to be dried, crushed and roasted.

Figure 9a: Left: rear view of the furnace and associated metal structures. Right: front of furnace as it appeared in the 1970s; the façade and associated building no longer exist. Photo courtesy of the Whangarei Library.

Figure 9b: Interior of furnace building in 1968; handrail visible in foreground present at the site today; photo shows that the function of the concrete channel (K) was to accommodate the wheels which rotated the furnace. Photo: courtesy of Anne and Brian Reed.

Figure 10: Above: debris in the vicinity of the furnace including canvas conveyor belt with metal scoops attached, for lifting ore to top of furnace. Left: plaque attached to electrical component in the same vicinity.

Figure 11: Photo of the processing plant taken in the 1968, with main components labelled. Letters relate to sketch plan of site (figure 4). None of the buildings are still standing. No trace of the building marked with an asterisk is evident at the site today. Photo from the collection of Brian and Anne Reed.

Assessment of Completeness

NZMM Ltd did a poor job of cleaning up the site when it was finally abandoned. Therefore, the fabric of the processing plant is more complete than one might expect. The ore-crushing equipment is notably absent, but it is clear that it was positioned between the chute (M.) and the conveyor belt (I.). The crusher may have been worth salvaging, since, unlike the bulk of the equipment, it would be of use for other applications. It is clear from historic photos that the furnace and all the associated equipment was housed in a large shed, which would have accommodated the crushing and drying of the ore. Rubble from this structure, including corrugated iron and timber, is present. The same is true of the other buildings, seen standing in figure 11.

Most of the mercury extraction process is evidenced by the historic fabric present at the site today. The final stage of the process – the collection and bottling of the liquid mercury product – is not. According to Brian Reed, this was a manual process: the liquid mercury was collected in a bucket from a series of valves at the base of the pipe battery, and taken to the building marked with an asterisk in figure 11. The bottling process is evidenced by a photograph which appeared in the *Northern Advocate* in 1979 (figure 12). The newspaper identifies the man as Dusty Miller, filling cast iron mercury flasks. It is interesting to note the complete absence of protective clothing.

As well as the major components of the processing plant described above, there are many interesting smaller items. These include items relating to the plant's electricity supply (figure 9). A few decades ago, cast iron mercury flasks were present at the site[33], but it seems that all have been removed in the meantime.

Figure 12: Dusty Miller filling cast-iron mercury flask.

[33] Pers. com. A. Gardiner, April 2010.

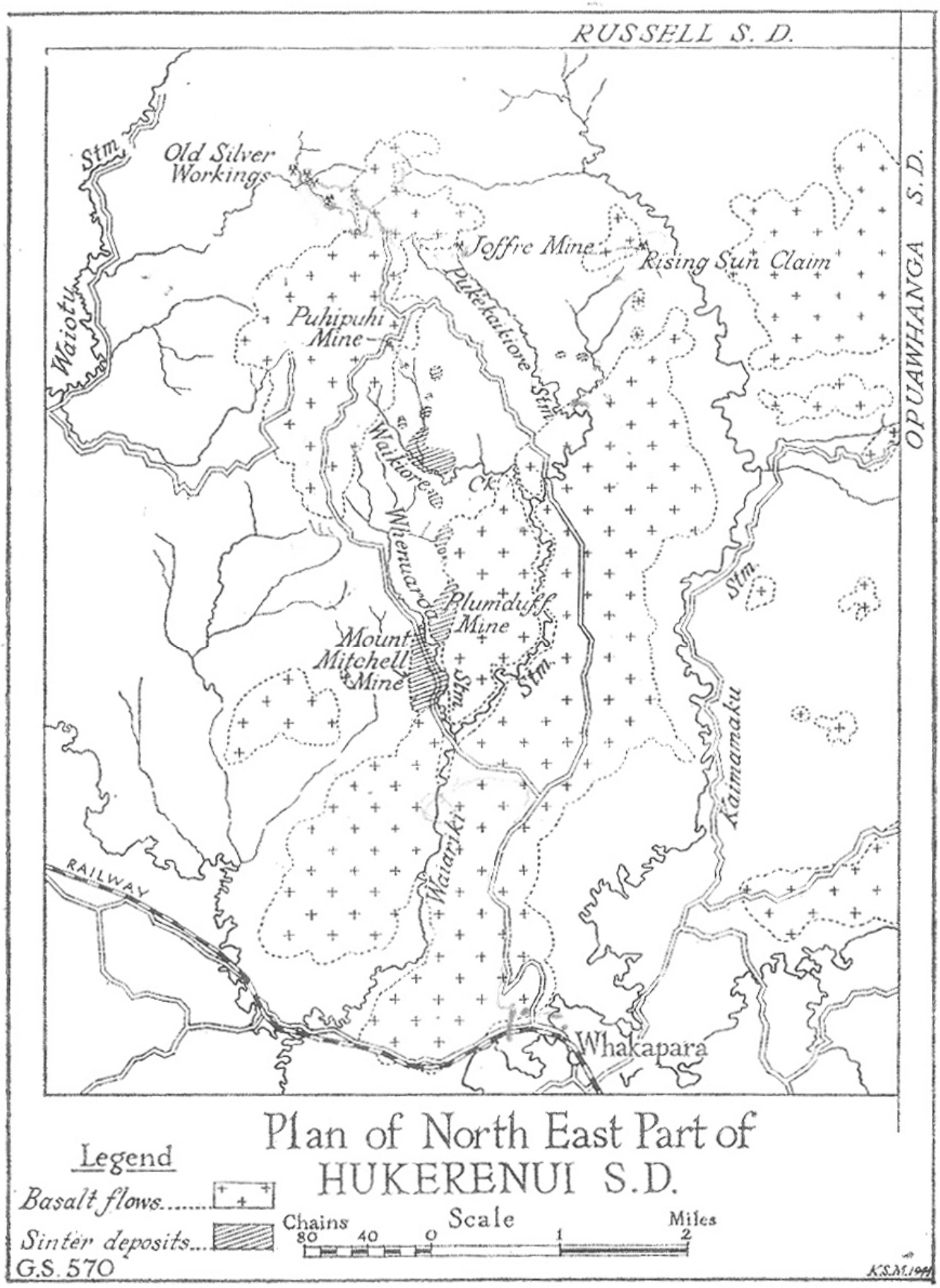


Figure 13: Map showing mining activities in Puhipuhi area in 1944. From Henderson 1944.

National Context

Mercury has only ever been produced from three places in New Zealand: Puhipuhi and Ngawha in Northland, and Mackaytown on the Coromandel Peninsula[34]. Although cinnabar has been noted in various geological settings across the country, the main deposits are associated with active and extinct hot springs in Northland and on the Coromandel[35].

Figure 13 is a map published in 1944 of the mercury workings in the Puhipuhi area at that time. The workings in the Waikiore Conservation Area (labelled "Puhipuhi Mine") were the most extensive. A small amount of ore from the Rising Sun claim was treated in the early 1920s, however by the time J. Henderson visited the site in the 1940s the adits had collapsed[36]. The Mount Mitchell mine, which possessed a small processing plant built in 1922, was on a much smaller scale than that in the Waikiore Conservation Area.

Mercury was encountered at Ngawha (near Lake Omapere) in the late 19th century, and by 1895 the property boasted processing plant, described in great detail by Mr Andre Griffiths[37]. Extracting the mercury proved rather more difficult than expected, however, and the works were no longer operating in 1897[38]. In 1929 the Kaikohe Development Company – unwisely, in retrospect – invested £75 000 to build a spectacular setup involving giant scoop suspended on a wire between two towers. The scoop slid down the wire, scooping up mercury-bearing mud, tipped its contents into a hopper, which transferred to an aerial tram, which finally off-loaded the material into the interior of the plant[39]. The high-tech delivery system did not guarantee success. Again, there were problems with extraction; the Ngawha mud did not yield clean mercury vapour[40]. The plant operated at full capacity for less than a year, and produced a mere 18 tons 15ctw of mercury[41]

There is not much information available regarding the mercury mining operation on the Coromandel. The Ascot Cinnabar Mine is recorded in the New Zealand Archaeological Association Site Record Scheme as T13/319. The site, located on private property, is not accessible, and the processing plant machinery is no longer present[42].

Significance

The significance of historic places can be assessed against criteria set out in Section 23(2) of the Historic Places Act (1993). The criteria, of which there are eleven, fall roughly into three categories: history significance, fabric significance, and cultural significance. The latter is not of particular relevance to the Puhipuhi site.

Historic Significance

The history of mercury mining in New Zealand is characterised by a series of short-lived ventures, by high expectations, considerable investment, and finally, by disappointment. Letters written by NZQM staff, with the requisite courteous veneer, convey a growing sense a frustration, and perhaps even desperation. There exists a mountain of scientific and technical reports, business documents, maps, plans and correspondence regarding the

[34] L. Jones, 1974, p 10; T. Christie & B.raithwaite, n.d. p. 2.
[35] T. Christie & B. Braithwaite, n.d. p. 2; G. Williams, 1974, p 191.
[36] J. Henderson, 1944, p. 54.
[37] A. Griffiths,1898, p. 48.
[38] K. Boese,1977, p. 369.
[39] *ibid.*, p. 370.
[40] *ibid.*
[41] J. Henderson, 1944, p 59.
[42] Pers. com. Neville Ritchie, April 2010.

Puhipuhi mercury ventures. The paper-trail is evidence of considerable official interest, right up to the level of the Prime Minister. That the Honourable Mr. Massey actually had a meeting with a director of NZQM shows that mercury mining was not a matter to be taken lightly.

The documents, collectively, are a litany of woes. There were landslides, a fire, and mineshafts collapsing. The ore body was not as extensive as supposed. Workers were being poisoned by mercury vapour, and the processing plant wasn't quite working as it should. No, the Mines Department would not pay the company a bonus. There was too much over-burden. The weather was so terrible that operations were postponed.

In an earlier guise, the Puhipuhi Mercury Mines were connected, albeit briefly, with an important person (the Prime Minister). The later development of the site was associated with an important event, namely World War Two. However, mercury was never important to the New Zealand economy. Nobody ever made a fortune (although several people lost one). Nor did the mines ever employ very many people. For these reasons, the mercury mines at Puhipuhi (and at Ngawha) are best viewed as a notable failed experiment in New Zealand's industrial history.

Fabric Significance

The site in the Waikiore Conservation Area, and possibly a second, smaller site in the nearby Puhipuhi Conservation Area are the only mercury mining sites situated on the DOC estate.

The historic fabric of the Puhipuhi Mercury Mines is unique. Any historic mine site will have mineshafts or a quarry, and a system to transport the ore and the overburden. However, the processing plant and the water transport system were especially designed with mercury in mind. The only site directly comparable is the mercury mining site at Ngawha, where the system for extracting mercury was not the same. The Ngawha site is on private land, and although the current owner appreciates its heritage value[43], its future cannot be guaranteed.

Management Recommendation

The Puhipuhi Mercury Mines are not accessible for visitors at present. The location of the site is not common knowledge, and there is no sign at the entrance. There are many hazards, including unstable built structures, steep slopes, rusted metal items hidden in the undergrowth, and structures dug into the ground which could lead to a nasty fall. Furthermore, the Puhipuhi Mercury Mines are listed as a "contaminated site" in the Whangarei Distinct Plan. No evidence that the site has ever been tested for contamination could be found[44]. However, the site should certainly be approached with caution. DeGraff *et al.* examine the problem of contamination at mercury processing sites in the USA. They summarise:

> *The mill facility at a mercury mine may have varying forms and elevated concentrations of mercury present in a number of locations. A primary location is the on-the-ground disposal area(s) where accumulated calcines [mine wastes] and, sometimes, the condenser soot was placed. […] A second location would be near the stack where emission deposition may be present in the near-surface soil. Emission deposition may also be found of porous structures near the stack. Finally, processing equipment such as retorts, furnaces, condenser structures,*

[43] Pers. com. Mrs Beadle-Taylor, January 2010.
[44] Pers. com. J. Mitchell, Northland Regional Council, March 2010.

tanks, and associated piping systems represent a forth location where mercury concentrations may be elevated[45].

The following management steps are recommended:

(1) Establish a safety plan for working at the site. Visitors to the site must be accompanied by a DOC staff member, and briefed about the hazards prior to entry.

(2) Establish and maintain an access ways from the road to the various components of the site. This will allow DOC staff to access the historic fabric with ease, to carry out assessments and monitoring, and possibly vegetation clearance and maintenance. The access should not be visible from the road, as the site is not safe for visitors at present.

(3) Add monitoring and track maintenance tasks to the AMIS system.

(4) Clear the undergrowth around the processing plant, to assist with (5). Safety issues must be assessed before this work in undertaken.

(5) Create a comprehensive inventory of the historic fabric, and assess the condition of each item. Produce accurate maps (to replace the sketch maps presented in this document).

(6) Assess whether any conservation work is required to preserve historic fabric.

(7) Produce a conservation plan by the end of 2011.

(8) Assess the options for a visitor experience and produce report by the end of 2011.

Puhipuhi's Potential

There are stories to be told about the Puhipuhi Mercury Mines. Some of those stories are about people: the determination (or folly?) of a succession of owners, the suffering of workers like Cyril Reed. Another story is about the WWII era technology, how the machinery at the processing plant actually functioned to separate the mercury from the ore. The historic fabric at the Puhiphui Mercury Mines is complicated and highly visible. It is unique, and would capture the imagination of people who are interested in industrial history, railways, and machinery.

[45] J. DeGraff *et al.*, 2007, p 121.

Sources Consulted

(1) Records held at Archives New Zealand

Great British Mercury Mines. Reference: BBDO 18634 A902/30 M102-A

Great British Mercury Mines. Reference: BBDO 18635 A902/30 M102-B

Mercury Mines (NZ) Ltd. Reference: BADZ 5181 709 4648 1943/106

New Zealand Mercury Mines Ltd. Reference: BAEA 5181/2950 26064

New Zealand Mercury Mines Ltd. Reference: BAEA 5181/2950 26064 1939/21

New Zealand Quicksilver Mines Ltd, 08 July 1916 – 24 March 1938. Reference: MD1 1466 12/41

Puhipuhi Mercury Mines Ltd. Reference: BADZ 5181 402 2271 1992/11

Whangarei Cinnabar Company. Reference: BBDO 18634 A902/29 M100

(2) Published Sources

Mines Statements, section C2 of the *Appendix to the Journals of the of the House of Representatives*, for the years 1940 – 1947.

Bell, J. & C. Clarke. 1909. *The Geology of the Whangaroa Subdivision, Hokianga Division.* Government Printer, Wellington.

Bell. J. & C. Fraser. 1912. *The Geology of the Waihi-Tairua Subdivision. Hauraki Division.* Government Printer, Wellington.

Boese, K. 1977. *Tides of History: Bay of Islands County.* Bay of Islands County Council.

Cook, P. 2000. *Defending New Zealand: Ramparts on the Sea 1840-1950s.* Part 2. Defence of New Zealand Study Group, Wellington.

Craw, D. 2005. Potential Anthropogenic Mobilisation of Mercury and Arsenic from Soils on Mineralised Rocks, Northland, New Zealand. *Journal of Environmental Management* 74:283-292.

DeGraff *et al.* 2007. Approaches to Contamination at Mercury mill Sites: Examples from California and Idaho. Pages 115 – 134 in DeGraff (ed.) *Understanding and Responding to Hazardous Substances at Mine Sites in the Western United States.* The Geological Society of America, Colorado.

Ferrar, H. *et al.* 1925. *The Geology of the Whangarei – Bay of Islands Subdivision, Kaipara Division.* Government Printer, Wellington.

Griffiths, A. 1898. The Ohaewai Quicksilver Deposits. *Transactions of the New Zealand Institute of Mining Engineers*, Vol. II.

Henderson, J. 1944. Cinnabar at Puhipuhi and Ngawha, North Auckland. *New Zealand Journal of Science and Technology* 26:47-60.

Jones, L. 1974. Chapter 2 in G. Williams (ed.) *Economic Geology of New Zealand.* The Australian Institute of Mining and Metallurgy.

Scobie, R. 1973. There's Mercury in them thar CInnibar Hills (sic.). *Better Business*, August 1973.

Scoble, E. 1946. Summary of Reports by Inspectors of Mines, Northland District. Appendix to the Journal of the House of Representatives, II, C-G, p 27.

Sturtevant, B. F., n. d. *The Heating and Ventilating of Buildings*, Hyde Park, Boston. Available at www.arcchive.org.

White, G. 1986. Puhipuhi Mercury Deposit. *Monograph Series on Mineral Deposits* 26: 193-198, Gebruder Borntraeger, Berlin-Stuttgart.

Williams, G. 1974. Economic Geology of New Zealand. *The Australian Institute of Mining and Metallurgy.*

(3) Unpublished Sources

Christie, T. & B. Braithwaite, n.d. Mineral Commodity Report 8 – Mercury. Institute of Geological and Nuclear Sciences Ltd.

New Zealand Archaeological Association Site Record Form: Q06/170

(4) Newspapers

Auckland Star, 25 January 1934

New Zealand Herald, 25 January 1934

Northern Advocate, 31 May 1978

(5) Oral Sources

Reed, Brian. Personal Communication, March 2010. (Son of Cyril Reed who worked at Puhipuhi Mercury Mines)

Reed, Joan. Personal Communication, March 2010. (Daughter of Cyril Reed).

Beadle-Taylor, Mrs. Personal Communication, January 2010. (Owner of property with mercury mining remains at Ngawha)

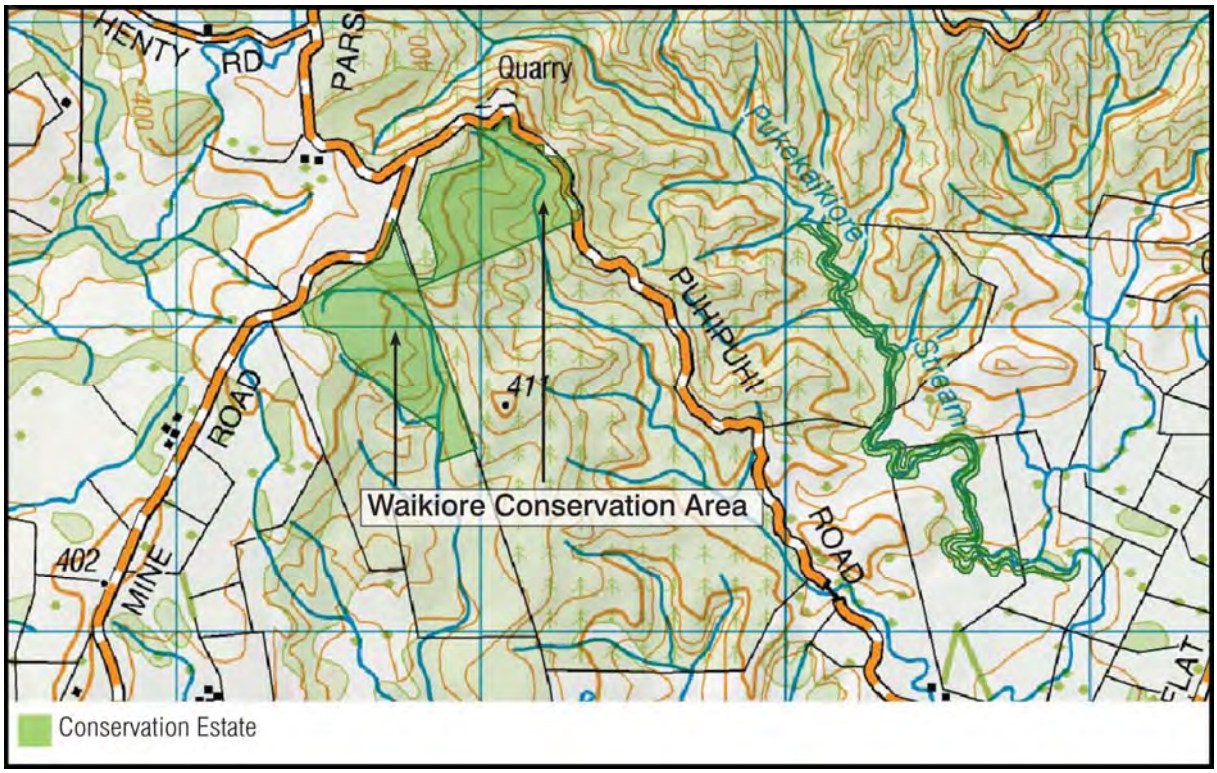
Gardiner, A. Personal Communication, April 2010.

(6) Historic Images

Photographs of the Puhipuhi Mercury Mines. Held in the Whangarei Library, New Zealand Room.

Photographs (taken from slides) from private collection of Anne and Brian Reed.

Appendix 1: Location Map



Appendix 2: Contemporary Plans of the Mine Workings

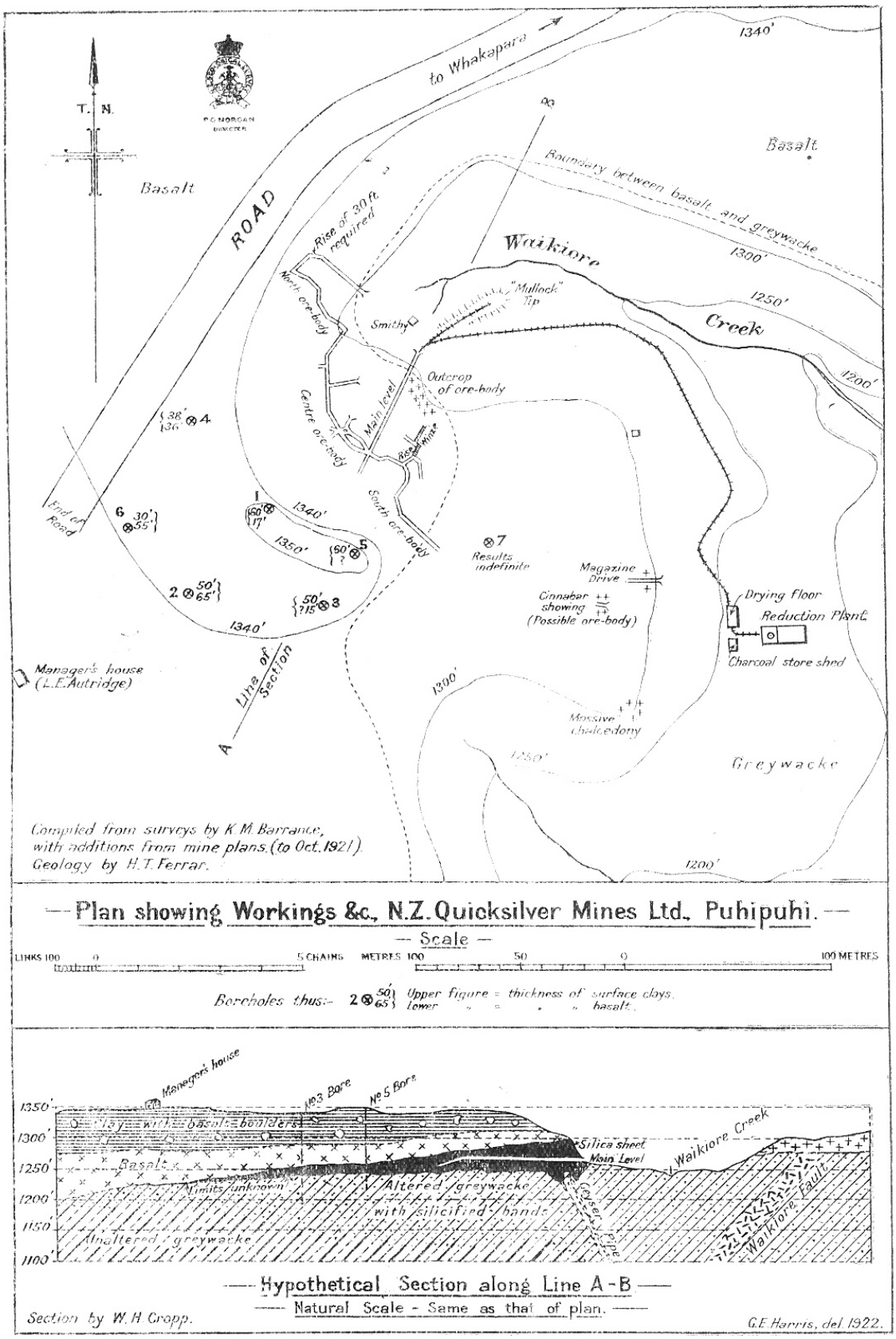


Figure A1: Earlier stage of the Puhipuhi workings, from H. Ferrar *et al.* 1925, p 85.

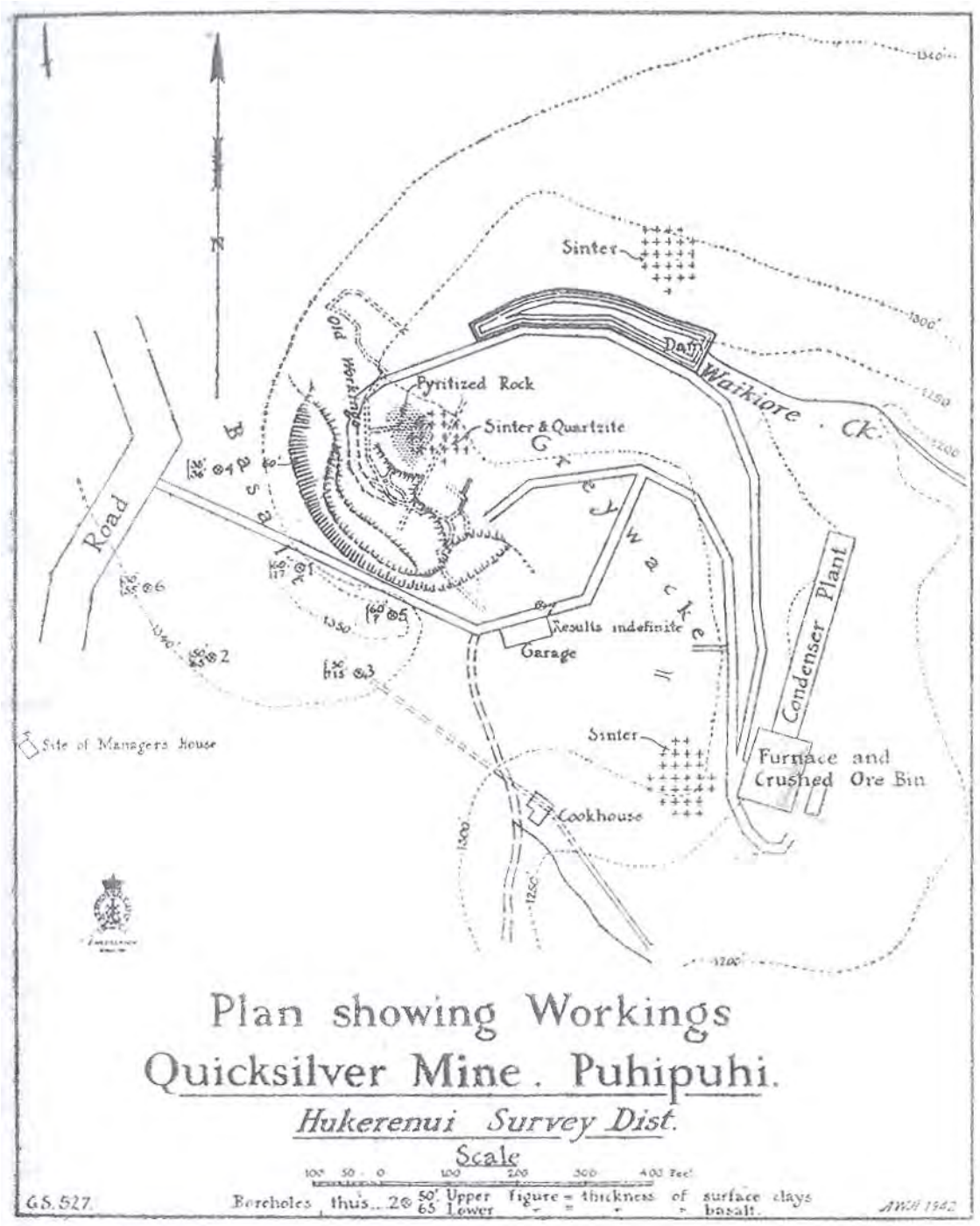


Figure A2: Map of mine workings from J. Henderson, 1944, p. 53.