

# Archaeological excavations at Big River quartz mine, Victoria Forest Park, West Coast, New Zealand

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Frontispiece. Near vertical aerial view of the poppet head, mullock heap, reconstructed engine shed and the head of the aerial cableway. Note the drain around the flat and the pattern of erosion on the mullock heap.

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# Abstract

The machinery of the Big River mine is the most complete historical assemblage of *in situ* machinery for quartz mining in New Zealand. Excavations were carried out to mitigate the effects of reconstruction of the winding engine house. Comprehensive and extensive drainage of the original working compound between the winding engine, bath house, engineer's workshop and the upper terminal of the aerial cableway to the stamper battery revealed a number of mining artefacts and the foundations and other details of the bath house and the engineer's shop. Excavation of a mullock talus eroding on to the engine house from the time of abandonment of the mine (1942), and before, revealed details of the foundations and layout of the working areas between the engine house and the boiler and flue.

## 1. Introduction

Big River, about 15 km south of Reefton in Victoria Forest Park (Fig. 1), is the site of a small quartz mine which operated between 1882 and 1942 with a break in activity in the period 1927-1932. The site has been recorded as L31/3 in the New Zealand Archaeological Association Site Recording Scheme. A history of the mine recently published by Les Wright (1993) provides much of the detail in this report.

The mine, which worked under several names, produced a total of almost 140 000 ounces of gold from a little over 120 000 tons of quartz extracted. As the mine had a rather extended life, and was at periods very profitable, the site saw a variety of developments and the installation of some very impressive machinery, both imported and New Zealand made.

Work suddenly ceased in 1942, as a result of a relatively minor labour dispute during a period of wartime labour shortage. At that time the mine, though far from profitable, was fully functional, with quartz extraction, gold production, and mine development actively continuing. Although the stoppage was almost certainly intended to be temporary, mining never recommenced.

Salvage work when the company was wound up in the 1960s led to the removal of quantities of building parts and some significant pieces of mining machinery. Vandalism and natural decay in the nearly fifty years since the mine closed have also had an impact on the site. However, the sheer size and solidity of some of the mining equipment, and the mine's remote setting and difficult access, have led to the survival on the site of some very impressive industrial relics.

Major site components still present include adits, winzes and shaft, the poppet head, the winding engine, boiler, parts of the aerial conveyor between the mine and battery (especially toward the top of the system), the pelton wheel

and flume that powered the stamper battery, parts of the battery itself, the cyanide tanks, dams and water races, sawmill, coal mines, tramways, and the remains, sometimes standing, of various buildings including a hotel, a boarding-house, the mine manager's house and other worker accommodation (Fig. 2). In other words, virtually all aspects of the mine's operations are still visibly represented on the site.

The winding engine (Photo 1), boiler (Photo 2), and poppet head (Photo 3) are regarded as being particularly significant (for locations, see Fig. 2). For example, Big River is the only site in New Zealand with both winding engine and poppet head still in position (Les Wright, pers. comm.). All three items are in serious need of protection, and the Department of Conservation has begun to construct a wooden building about 20 x 12 m and more than 6 m high to cover the winding engine and boiler.

As the work of construction will impact on the archaeological remains present on the site, the Department obtained an Authority, 1998/58, from the N.Z. Historic Places Trust to cover this work. Mamaku Archaeological Consultancy was asked to assist in the field and the work was carried out in the week ending 16 July 1999. The present report describes the work undertaken, the results, and interpretation of some of the structural evidence recovered.

## 2. Fieldwork

Obvious threats to the new building were bad drainage and the mullock heap, the lower fringe of which was located immediately uphill of the winding engine and boiler. A plan of the site is shown in Fig. 3.

A six-tonne hydraulic digger was used to excavate two major drains. The first of these was laid out across the slope above the winding engine, so as to intercept water and mullock flowing down the hill. The second drain took water from the bottom end of the first drain, around the perimeter of the flats, and discharged it over the scarp into the gully below the site. The second drain, about one metre deep with a v-shaped profile, is referred to in this report as the "v-drain".

After the v-drain and top drain had been joined, the digger was walked around the rear of the boiler flue, from where much of the scree directly threatening the boiler and winder was removed.

The digger then started to excavate the material covering the rear wall of the engine house, which was clearly marked by the presence of the exposed upper edge of a row of sheets of battered, broken and rusty corrugated iron. Work here started approximately in line with the wall between the boiler room and engine room and proceeded toward the flue.

There were times during the excavation when only trowel work was possible. At these times the digger removed the spoil from the site. The digger was

also used, under Kevin Jones' supervision, to excavate a shallow "scallop" drain parallel to the side of the boiler and feeding into the v-drain.

The builders also had to remove the semi-subterranean steam pipes leading from the boiler to the winding engine. This was done so as to make room for the front wall of the new building, which was to be located slightly forward (south) of the original. The pipes occupied a trench running across the front of the engine foundations and disappeared beneath a pile of loose debris near the engine's eastern edge. When the debris was removed it was found that the pipes led into a corbelled tunnel of fire-bricks at a point about half way between the engine and the boiler (Photos 4, 5).

To return to the major excavation, once we had cleared the north-east corner of the building, the excavation was extended to the north so as to reach the line of the retaining wall behind the building. The digger was then moved around and above the western end. During this work the opportunity was taken to remove the fallen upper section of the boiler chimney stack. Probably felled by the 1929 Murchison earthquake (Wright 1993: 35), this still lay where it had been since the mine reopened in 1932. The chimney was moved (Photo 6) to the other side of the road, where it is to be stored for possible re-erection.

The next focus was on the retaining wall. Once that had been cleared the northern wall of the engine house was examined, the excavation coming down to the level of the main wall-plate. The digger then removed material from above the retaining wall. It also removed the spoil from the excavations on the northern side of the building, (Fig. 4) then proceeded to scrape off the surface layer from along its western side. The debris from these operations was pushed down the western side of the gully immediately below the main flat. In the meantime RN had recorded the section along the lower part of the v-drain. Finally, we collected various artefact samples from around the site and tidied up.

## 3. Results of the excavations

### 3.1 TOP DRAIN

The top drain was dug down to bedrock, removing loose mullock and superficial *in situ* deposits. The only find was a length of miniature tram-line, sticking out of the bank at a point toward the bottom (eastern) end of the cut. The significance of this find was unclear before Les Wright's visit, when he worked out that the line was probably a relic of the old No 1 adit. Les suggested that the adit entrance was very close to the surface here, though up to the time we left, the adit itself had not been precisely located.

### 3.2 SCALLOP DRAIN

The scallop drain mainly cut through a layer of peat that had developed on the old ground surface. Probably the most significant find was a series of 12 inch piles, which probably once supported part of the bath house. These piles took the form of very neat cylinders in a very pale timber.

The trench also encountered a few artefacts, including hooks for drying clothes, most of a light switch (copper on a round white ceramic base), and a group of three glass tubes. These tubes are:

- 51 mm long, 24.5 mm outside diameter, wall 2.6 mm thick, in clear glass;
- 41 mm long, 15.6 mm outside diam, wall 2.3 mm thick, in pale green aqua glass;
- 71 mm maximum length but irregularly broken at one end, 18.4 mm outside diameter, wall 3 mm thick, in green aqua glass.

All three tubes appear to have been hand-made from longer tubes by means of a scratch-and-snap technique. The purpose of these tubes is unknown but there are some possibilities that might be suggested. Perhaps they were used as insulators of some kind; perhaps they were to be turned into heavy-weight fuses by adding suitable metal-work (something like a medium-sized nail and some solder); they may have had some cunning use in blasting; or they may have been parts of a still. Ken McMahon (pers. comm.), who worked on the site around 1940, also reports that glass tubes of similar diameters were used to show the depth of water in the boiler tubes.

### 3.3 V-DRAIN

Running for a total length of about 65 m, the v-drain was by far the most substantial of the three drains. The trench cut through a variety of deposits including peat, ash, mullock and the natural clay substrate. The section on the eastern side of the lower 50 m of the v-drain is drawn in Fig. 4.

#### **Structures in area of v-drain**

Wright 's (1993: 63) schematic diagram of the site shows the tram-line to the ore loading system nearest the scarp, with a store, the smithy, and the manager's office lined up in order of increasing distance. Across a gap is the bath-house, which is aligned with the boiler room.

Though the route of the drain kept very much to the edge of the flats, it was almost inevitable that the trench would encounter material associated with several of the structures present on the small and rather congested area of flat ground on the site.

Figure 4 shows that the 50 metres of trench studied cross five distinct zones of approximately equal size. Taking them in order from the downhill (southern) end, these are:

*Zone 1*, about 9 m long, has a number of clay and ashy deposits, incorporating quantities of iron and rust, resting on a thick mullock layer. The depth of the mullock layer means that no trace of the natural base can be seen. The irregular form of the deposits in this area suggests that this area was not occupied by buildings, though the abundance of iron and rust, and especially the abundance of worn-out iron tools (see below), indicates that the smithy was close by. The light tram-line seen on the surface in this area (see Fig. 3) is presumably one of the pair serving the ore bin.

*Zone 2*, about 10 m long, has a couple of thin horizontally bedded ash-rich layers, resting on a thick layer of mullock. Within this zone are four horizontal timbers, which appear to represent three phases of construction. The lowest is marked by the two northernmost timbers, which rest on the interface between a brown ashy clay layer and the surface layer of black ash. Next was the timber wholly contained within the black ash layer. And last was the timber resting on what looks like a deliberately excavated flat and level surface about 4 m wide, which has now been smothered by a growth of peat. This area was probably occupied by the store and smithy, though exactly how the timbers relate to those structures is unclear.

*Zone 3*, about 9 m long, has a variety of horizontally bedded deposits, resting on a natural base of grey clay, with a thick layer of black ash on the surface. This area was probably occupied by the manager's office. It is likely that pieces of a telephone battery jar found in spoil from this part of the trench (see below) came from the office, and that two wooden piles visible in the section once supported the building itself. It appears that the ground surface here has been raised slightly, possibly to improve drainage.

*Zone 4*, about 11 m long, has a variety of deposits, some with artefact fragments, again on a grey clay base and with black ash on the surface. Wright's map of the latter site layout indicates that the area occupied by this zone had no structures. Most of the buried deposits were probably dumped as fill, i.e. they were merely intended to raise the ground level. The thick deposit of black ash on the surface was probably aimed at improving drainage.

*Zone 5*, about 12 m long, has a very simple stratigraphy, with mullock dumped in a sizeable depression (presumably a stream gully), on which a natural mound of peat has developed. This part of the section produced quantities of boots and bottle-glass (see below). The concrete shower base and the row of piles in alignment make it possible to place the bath-house on the ground immediately to the west of this portion of the section, and Zone 5 can be confidently interpreted as a dumping area behind the bath-house building.

### **Artefacts from v-drain**

Several iron artefacts seen during the monitoring, including drill-bits, long, thin cold-chisels and a pickhead, are very probably debris from the blacksmith's shop, where equipment of this kind was taken for sharpening (Wright 1993:64). These items were presumably discarded because they had become completely worn out; certainly the drill bits had been pretty thoroughly reduced to stubs. The source of some bolts about 800 mm long with nuts and large square washers found in the same area is unknown. The drill-bits, cold chisels, and pickhead were retained by DOC staff.

A little further from the edge of the scarp were fragments of a green-aqua glass battery jar, probably relating to a telephone serving the mine manager's office. This area also produced an unmarked "coffee and chicory" bottle in clear glass (identifiable because of its characteristic shape), and a small and delicate if rather bulbous bottle with a funnel-shaped neck, also in clear glass. The glass battery jar fragments were retained but the coffee and chicory bottle was left on the site. The other bottle was mislaid during the excavation.

Adjacent to the bath-house was virtually the only assemblage of "occupation debris" seen on the site. The artefacts included the remains of a large white enamel mug (internal diameter c. 110 mm) with a pale blue line on the rolled rim. The pottery included two white china cup handles, a couple of anonymous, plain white sherds, and a piece of a small plate in "Asiatic pheasant" design. Numbers of broken bottles are presumably debris from social gatherings after work. And there was a major concentration of boots and boot parts, including the sole of a gumboot, together with some scraps of cloth, probably originally blue, which are no doubt worn-out and discarded work-wear. This area also produced a small horse-shoe, though there were no pit ponies as such, horses had several uses at the mine. The final item was a small triangular file 18 mm wide and 7 mm deep, which has a badly bent blade and has had much of its "keel" ground away. Such damage would be almost impossible in a good quality tool, so it seems that either the file has been re-tempered (perhaps by friction during the grinding), or it was originally of inferior quality.

The boots posed something of a problem because of possible complications involving their conservation. After several discussions we decided on the following approach. Two of the boots were retained and returned to Picton. There they were washed and slowly dried, to see how they responded to this rather basic treatment. The remainder of the collection was bagged up and reburied in the bottom of one of the drains (see Fig. 3), from where they can be retrieved if this should at some later time be thought desirable.

In the event the boot leather appears to be reasonably good (Photo 7), though almost all trace of the thread they were sewn with has disappeared. It may be that a number of boots could be prepared for display, if required, without a major investment in their conservation being necessary.

One of the boots retained, about a size 8, has the whole toe moulded in one piece, paired sides, and a reinforcing strip up the back of the heel. There is no lace. The boot has a sturdy U-shaped iron heel plate secured by four nails, with an additional triangular insert of 15 hob-nails arranged like the reds in a frame of snooker. The rest of the sole is missing. The other boot, about size 10, has the toe-cap formed separately but the upper is otherwise the same. The lace is a leather thong. No heel or toe plate survives, though there are traces of hob-nails toward the rear of the ball of the foot. Both boots have eight lace-holes, each with a copper eyelet.

Most of the diagnostic bottle fragments were taken to Picton, where the material was washed and dried so that it could be examined more closely. The assemblage will be described by colour, starting with *green glass*:



- one neck, a collar skirt applied top in yellowish-green glass.

The remainder of the green glass involved at least base parts. All were broken, but colour and shape allow a couple of matches between bases and necks. In order of decreasing base diameter, bottles identified were:

- dark green ring-seal quarts with deep dew-drop punts, base diameters 88, 89, 90, 91, 91, 91, 91 mm. This was by far the most common style of bottle in the assemblage. Including three obvious duplicates, left behind at the site, there were at least ten of these bottles. There were two separate necks, four bases, five missing only their necks, and one was complete.
- dark green ring-seal quart with a flat-topped punt, base diameter 85 mm (base only);
- apple-green quart, flat bottom, side branded "14", base diameter 80 mm (base only);
- very pale olive green, nearly flat bottomed, base branded "N ?3 / 2 / L", base diameter 77 mm (base only);
- apple green, very shallow punt, brand "261 / L", base diameter 77 mm (base only);
- yellowish green, nearly flat bottomed, base branded "N B / 6 / + ", base diameter 76 mm (base only);
- yellowish green tall ?whiskey quart, hoop collar skirt neck with trace of seal, nearly flat bottomed, base branded "NB 15 / + // 11 ", base diam. 76 mm (most of bottle);
- dark green tall quart, very bubbly glass, very shallow punt with central pimple, base branded "2", base diameter 74 mm (base only);
- pale olive green, very shallow punt with central pimple, diam. 74 mm (base only);
- dark green ring-seal pint, deep dew-drop punt, base diameter 71 mm (intact);
- dark green ring-seal pint, shallow dew-drop punt, base diameter 71 mm (base only).

There were three pieces of "black glass", which are from two bottles:

- black beer (actually dark brownish olive green), tapering, very shallow punt with central pimple, base diameter 75 mm (part base only);
- black beer (actually rich reddish brown), collar skirt applied top, traces of a red seal on neck, base branded "Q", base diameter 74 mm (base, neck/shoulder).

There were four pieces of *aqua glass*, all from separate bottles:

- small crown cap, pale green aqua (lip fragment);
- tall quart, very pale green, very shallow punt with central pimple, plain base, base diameter 76 mm (base only);
- tall quart, pale green very bubbly aqua glass, very shallow punt with central pimple, base branded "A / I\*\* / IS", base diameter 73 mm (base only);
- small but very solid mineral water bottle, green aqua, very shallow punt with tiny central pimple, base branded "JWD / B", base diameter 63 mm (base only).

There were two pieces of *clear glass*:

- long-necked quart crown cap soft drink bottle, marked "Blackmores Grey-mouth" on shoulder (neck/shoulder);
- rather tubular one-piece collar skirt neck, probably having a plunger stopper in a cork ring (neck only). This has a small scratch at the base of the neck.

There was one piece of *amber glass*:

- wide tubular neck, neck about 32 mm high, 32 mm inside diameter, on bottle about 70 mm diameter, looking rather like a reagent bottle (neck/shoulder).

Finally, there was one piece of *stoneware*:

- cream stoneware bottle or jar, c. 110 mm diam, glazed inside and out (body sherd).

Most of this material is obviously derived from liquor bottles, especially beer and whiskey; there is one soft-drink bottle; and one probable chemical reagent bottle. With regard to dating, much of the assemblage is obviously rather late, probably from the 1930s and 40s, though the black glass and possibly the stoneware might be earlier. As previously indicated, the liquor bottles probably relate to after-work socialising at the bath-house. However, the engine-driver's but was located just up the slope (Wright 1993:65), and some part of the assemblage might be derived from what was effectively a domestic situation.

There is a marked disparity in the numbers of necks and bases within the assemblage as a whole. As the material was hand-picked from the spoil-heap and section, there may be nothing to explain here. In addition, the three glass tubes found were clearly not derived from bottle necks. Nevertheless, it is possible that the relative rarity of necks does relate to their use as raw material for glass tube manufacture, whatever the tubes were for. All but one of the necks present are more bulbous than tubular. Furthermore, as stated, the

one tubular neck in the assemblage has a small scratch just above the shoulder, as though someone had briefly contemplated turning this into a tube. This issue could probably be clarified somewhat if the purpose behind the tubes was sorted out, and someone from the site must know what they were for.

#### 3.4 SCREE ABOVE RETAINING WALL

The mullock scree contained four interesting items. The hub of a large iron wheel with the spokes all broken off very short, mounted on a c. 1 m length of iron rod, is probably one of a series from the system carrying the wire rope from the winding engine to the poppet head. An almost complete window sill and a piece of timber with an ogee-profile bracket for guttering are probably parts of the main building. A piece of c. 75 x 50 mm timber about 2 m long with neat notches cut into it at regular intervals may have been part of a ladder-way for the mine (Ken McMahon pers. comm). All four items were retained by DOC staff.

#### 3.5 WESTERN SIDE OF ENGINE HOUSE

Surface scraping in this area produced nothing more notable than a few scraps of decayed timber. These were probably debris left over from the demolition of the building.

#### 3.6 AERIAL ROPEWAY UPPER TERMINAL

When we visited this structure in company with Les Wright he pointed out the spindle from the whim used as an auxiliary power source for the aerial during its early years, i.e. in the period immediately after 1882. He reported that this had been dug out of the encroaching mullock a few years ago, using labour provided by Task Force Green workers. In the meantime, however, it had again been almost overwhelmed. With the massive new spoil-heap now poised almost directly above it, it seemed that the spindle was about to disappear for good, so we decided that it should once more be dug out and moved to a safer location.

As well as uncovering the whim spindle we found a wooden bullock yoke or swingle-tree (Photo 8). Les Wright commented that he knew of no references to bullocks anywhere on the Inangahua. Ken McMahon (pers. comm) reports that he never saw a bullock, nor does he remember anyone ever speaking of one. The yoke is therefore an interesting find.

The spindle was then lifted from the gully using the digger (Photos 9 & 10). It proved to be a massive piece of jarrah about 2.2 m long, faceted and with mortise and tenon hub for the spokes of the drive wheel, with an iron collar and axle. A number of Roman numerals had been carved into its surface.

These probably relate to its assembly and suggest that the whim arrived on the site as a kitset of some kind.

The spindle was taken to Reefton. Though the timber appeared to be in very good order, especially given its age, it is intended that it should undergo conservation work before being returned to the site.

As a more immediate problem, other portions of the ore-loading apparatus, including the loading hopper, the loading monorail, and the return wheel and its supporting structure, are still at risk below the spoil-heap, while the ore bin has almost completely collapsed. If any of this equipment is to be rescued the work needs to be carried out in the near future.

### 3.7 ENGINE HOUSE/BOILER ROOM

The main objective of our visit to the site was preparation for the construction of a building to house the remains of the winding engine and boiler.

When I started work on the excavation of the rear (northern) wall of the building its position was reasonably clearly marked by remnants of its corrugated iron cladding. All that was necessary was to remove the pulverised mullock from the inside of the iron so as to expose any surviving timbers. The first timbers to appear were two vertical beams that turned out to be those marking the northern end of the wall between the engine room and boiler room. These were in extremely poor condition, but with care it was possible to establish their original dimensions. It was notable that the major beams supporting the wall differed somewhat. In fact, apart from some regular 100 x 50 mm beams, and the t-g-v moulding lining the building, almost every piece of wood in the structure was a one-off. After the two timbers were excavated down to the wall-plate I then worked eastward along the wall, exposing the rear of the buried corrugated iron.

Immediately beyond the next wall joist the iron disappeared. At this point a dressed plank was nailed outside of the iron and partly overlapping the gap. About 1200 mm further east the iron reappeared, again with a dressed plank nailed on its outside. This looked like a doorway. Excavating down to the floor in search of a doorstep I uncovered the surface of a layer of concrete. This was quite rough, badly cracked, and sloped down toward the front of the building.

Though the gap in the iron extended down to the floor, two timbers on the outside of the "doorway" blocked the gap to a height of about 215 mm above the concrete floor.

Extending the excavation beyond the gap in the iron exposed some artefacts in the loose mullock. The first was a section of 50 mm water-pipe. Next was a curved length of sturdy iron rod, with a neat slot near one end into which a triangular brass "pin" had been wedged. Both these were standing on end. When this area was later cleared (see below) and the whole of the iron rod was exposed, it proved to be broken, but a distinct kink in the rod hinted that it had formed a swivelling suspension handle perhaps it came from one of the

buckets on the quartz aerial. Next was a sturdy wooden box, found near the wall but a long way from the floor (Photo 11).

As matters here were getting rather complicated I decided to expand the hole west and south, following the concrete, before examining this area further. With the help of the digger this was quite quickly done. A double wall plate, with 150 x 68 mm and 150 x 75 mm timbers, both on edge, were found in alignment with the first joists seen. A long piece of 75 x 75 mm timber was lying on the concrete just to the east of the wall. A heavy galvanised bolt secured a robust pulley to the northern end of this timber. The pulley, designed to accommodate heavy wire rope, was a derrick, which must have been used when lifting and moving heavy equipment in and around the boiler room.

Beyond the internal wall we found a tangle of pieces of white-painted 150 mm t-g-v wall-lining, lying face down. It would seem that sizeable portions of the engine-room wall were felled and stripped during salvage, this being the unwanted residue.

Among the mullock beneath the lining debris we found some short lengths of white wax candles about 21 mm diameter. A little further west the excavation uncovered the edge of the cement pit below the winding engine. A piece of sound 100 x 75 mm timber beside the pit had clearly been put in place before the cement was faced.

Extending the hole toward the south from the doorway, a sound piece of 100 x 50 had been laid flat across our path about two metres from the tin. Toward the east, this converged slightly with the northern wall. At that end it was found to rest on a low brick wall beside the flue. There was a marked alignment between the end of the 100 x 50 and the brick it rested on, which had been detached from the rest of the wall. Another isolated brick was found below the beam's western end, but the connection there was less clear. The beam looked rather like a step.

The strongest argument for this related to the beams outside the door that blocked the bottom of the doorway itself. These beams show that a layer of mullock had accumulated behind the building, presumably during the break in operations in the period 1927-1932, and the beams were intended to keep the mullock outside. On the basis that a layer of compact mullock might have been useful inside the building, as a way of helping to bolster the flue, it might be possible to interpret the suspected step as having kept mullock away from the doorway, enabling it to open.

However, there are three reasons why the piece of 100 x 50 is not a step. First, the beam can only have been placed where it was found after the brick wall beside the flue had been largely removed. As that would have happened during salvage, during the 1960s, the beam cannot have been part of any structural development during the life of the mine. It may have been deliberately placed, as it certainly appeared, but if so it must have been involved in some plan on the part of the people salvaging building materials. Second, the "step" is placed rather a long way back from the door, so if mullock was retained on its southern side, it would have been prevented from bolstering most of the flue, where it might have done some good, and would have been largely re-

stricted to bolstering the brick cladding of the boiler, which is much higher, where it would have been almost completely irrelevant. And third, having a layer of mullock covering most of the floor of the boiler room would have greatly offended George Black, the engine driver at the time the mine was reopened in 1932, who is reported as being extremely fastidious about his equipment (Wright 1993). Consequently, the idea of a step can almost certainly be set aside.

Additional excavation showed that the brick wall ran parallel to the side of the flue but about 280 mm from it (Photo 12). In effect the brick wall filled the little alcove between the rear of the boiler and the north wall of the boiler house. Between the flue and the bricks was a slab of a tough grey deposit that was rather like a cemented coarse silt. This had a number of artefacts visible within it, including a coil of twined iron wire, a coil of thin copper wire, some rust fragments, and some bricks and brick fragments. While the wall was nowhere more than five bricks high (300 mm) the silt slab was about 650 mm high. Its top surface comprised a thin layer of very fine laminated silt, which must have been formed in a completely enclosed space. The obvious interpretation of these features is that the brick wall was originally higher, probably about a metre. It is probable that most of the bricks were removed during salvage, but the filling was solid enough to survive unsupported, probably because the mixture included cement.

The brick wall rested on a quantity of white fibrous material, identified by Dave Hawes as being asbestos sheeting. As this is potentially very hazardous material it is given some emphasis here.

The wooden box previously found east of the doorway, could not be given very much attention, but the box, with long bolts as reinforcing, was quite robust. Probing its inside produced a large paintbrush with a wooden handle. Its bloated bristles were possibly oil-soaked. The box and contents were retained by DOC staff.

Beneath the box was an object, rather like a basket, in a very black timber (Photo 13). It fell to bits when it was dug out, but records made previously allow it to be drawn reasonably accurately (Fig. 5). Perhaps this was a container of some kind, as at first suspected. Or possibly it is illustrated upside down, in which case it might have been a cover for moving machinery.

Other artefacts recovered from this corner of the building included some small pieces of 2 mm window glass, a piece of 7 mm plate glass (which may have been broken by a bullet), a piece of a small octagonal bottle, about 65 mm high excluding the neck, in very clear glass (a semi-ornamental item?). There was also an unusual firebrick looking rather like a fancy paver, stamped with the marks "No 1", "4", "W", and "H" (Photo 14). This was originally a support/spacer associated with the boiler tubes.

Rather more interesting, there was also a greatly damaged portion of a royal blue enamel vessel about 110 mm wide and 75 mm high, which looked rather like a beaker (Photo 15). It is probably the lid of a billy, very like that shown on the cover photo of Les Wright's (1993) book.

The excavation could now deal with the eastern extension to the north wall of the building. Digging toward the flue, an additional 100 x 50 mm wall joist appeared about 800 mm beyond the gap. A 160 x 60 timber rested on the floor between the two, and a dwang spanned the gap about 375 mm above the floor. A sturdy metal bracket attached to the upper surface of the dwang was hooked around the middle of an iron rod arranged diagonally to the floor. The lower end of this rod, which was about 28 mm diameter, rested between the roughly split halves of the floor-plate. Its upper end passed outside the 100 x 50 joist, where the corrugated iron cladding could be seen to Fig 5 have been bent around the end of the rod. This arrangement was clearly aimed at reinforcing the wall in the corner of the building, though just why was not immediately clear.

The northern wall of the boiler room is shown in Fig. 6, while features on the northern side of the building as a whole are shown in Fig. 7.

We then started work outside the doorway. Here the digger was given the primary role in clearing the mullock, and a red-painted doorstep some 1630 mm long was soon uncovered. At its western end this was attached to an apparently very sound wooden pile (Fig. 7).

By that time a good deal of the retaining wall opposite the doorway had been exposed. Excavation then focused on clearing the mullock from the western face of the chimney base. This uncovered a rather irregular stack of substantial baulks of timber. These had been piled around the south-west corner of the chimney base (Photo 16), no doubt to bolster the brick-work.

Once the work around the rear door of the boiler room was completed, our next major effort was directed at clearing the remainder of the northern and western walls of the engine house. We had to deal with the retaining wall to the north of the building as a necessary preliminary (see below).

As time was now pressing, removing the mullock overburden from the foundations of the engine room was done very rapidly, and we excavated down to the level of the wall plate without making any effort to recover details of the wall construction. However, two groups of nail-points emerging from the upper surface of the wall plate were 620 mm apart. These marked the locations of wall joists and indicate that the joists were at very close to "two foot centres".

Once the wall plate was exposed it was reasonably easy to identify the locations of the piles. These proved to be still very sound. It was obvious that most were slabs, markedly rectangular in plan, cut from relatively large-diameter stems of a reddish timber. These were placed with their long axes under the wall plate. However, two of the piles proved to be almost identical to the 12 inch diameter round piles in a pale timber that were uncovered by the scallop drain to the east of the boiler house. The only difference was that the tops of the two piles used on the engine house had been cut down to form something like tubular "tenons". This modification was presumably to prevent the piles interfering with the wall's cladding and/or lining.

The layout of piles on the northern side of the engine room is shown in Fig. 7.

### 3.8 RETAINING WALL

Portions of the trusses supporting the western end of the retaining wall were clearly visible protruding from the mullock above the winding engine house when we arrived at the site (Photo 17). Excavation immediately to the west of the flue uncovered the tops of some smaller and shorter piles which appeared to be slightly closer to the rear of the engine house. At first these smaller timbers seemed to form part of a separate structure, but as excavation proceeded it became clear that they were a continuation of the main retaining wall. A plan of the retaining wall as finally reconstructed is shown in Fig. 7.

The use of smaller timbers in the eastern part of the wall, where the risk of mullock-flows appears to be greater, was probably because of the converging angle between the rear wall of the building and the face of the retaining wall.

When the western end of the wall was removed, as a preliminary to clearing the site for the new building, it was found that several of the piles had large diagonal props tending to hold them upright, and almost all of the verticals were also matched by a large horizontal timber. However, it was rather surprising to find that each vertical was standing on top of the northern end of its matching horizontal.

Most of the buried woodwork was in very poor condition, so that few of the timbers were able to provide exact measurements. Fortunately, some details could be obtained from one of the trusses on the west and later from one of the smaller trusses to the east. The results showed that there was an important difference in the design of trusses at either end of the row.

On the larger (westerly) truss the southern end of the horizontal timber had been adzed so as to form a kind of ramp, and the diagonal brace rested on the adzed surface. The diagonal was held in place by means of a short but stout vertical post driven into the ground at its lower (southern) end. The vertical timber rested in a rebate adzed into the northern end of the horizontal beam. The junction between the vertical and diagonal timbers did not survive, but it seems likely that the upper end of the diagonal was accommodated in a rebate in the vertical. An additional detail is visible in photographs of the site, specifically photo 17. This shows that a beam was fixed to the face of the vertical timber immediately above the point of contact, no doubt to help to lock the top of the diagonal into place.

In the case of the smaller truss the lower end of the diagonal rested in an adzed rebate in the horizontal timber, where it was secured by at least three large nails. The rest of the truss construction is obscure, due to a combination of decay and incomplete excavation, but other details probably generally match those in the large truss. A reconstruction of the two designs is shown in Fig. 8.

It should be noted that many of the details recorded in Fig. 7 are interpolations from relatively small numbers of observations. Where the position or size of a timber was recorded specifically, it is marked by a solid line. Dotted lines indicate an approximate size or position only. It will be seen that only



two of the trusses are plotted in detail (those illustrated in Fig. 8), and that the rest of the sequence are dotted in as more-or-less duplicating one or other of the two measured specimens.

Incidentally, it will be seen that the most westerly of the trusses is shown in Fig. 7 as being a duplicate of the large truss shown in Fig. 8A. This accords with notes taken at the site, which record that the vertical timber at the end of the row was about the same size as the example illustrated in detail. This is clearly in conflict with a photo of the truss (Wright 1993: 35), which shows that the vertical was formed from a pair of relatively skimpy timbers. However, as the photo dates from 1932, and we recorded the situation as existing in 1942, it may be that, in the interim, the pair of small timbers was replaced by the large timber recorded during fieldwork.

The face of the retaining wall between the main timbers comprised a series of light planks. These seem remarkably flimsy given the impressive supporting structure, but this style of timbering may be routine for quartz mining.

As previously indicated, not all the trusses had the full set of triangulating timbers. At first it appeared that gaps in the structure were regularly distributed and actually part of the design. Once the excavation was complete, however, it could be seen that the missing elements were less common and were apparently distributed in a random fashion. The implications are that the original structure comprised a series of complete triangles, and that decay is adequate to explain the missing elements.

When a short section of the retaining wall outside the door from the boiler room was excavated it was found that a sturdy iron pipe 125 mm in diameter was resting in the angle between the horizontal and vertical timbers. As more of the retaining wall was uncovered, this pipe was found to emerge from behind the chimney base and to extend as far as the western side of the building. The pipe was in sections which were joined via collars. As the pipes were heavily corroded it was not possible to be certain if the collars were of a piece with the pipes or if they were separate fittings. The sections of pipe looked about the same length but only one was measured, at about 2660 mm.

These pipes probably carried the compressed air supply for the mine, as they came from the direction of the compressor, beyond the boiler house, and led in the direction of the No. 1 adit..

### **Artefacts associated with retaining wall**

During the excavation of the platform between the building and the retaining wall, a considerable number and variety of artefacts were uncovered. Most of the assemblage was found in the area immediately to the west of the door from the rear of the boiler room. Minor items present included some additional candle fragments, several bricks, pieces of twined wire, two heavy bolts, a ?gear lever, the rear end of a boot sole and heel, a small piece of iron plate that had apparently been cut by means of an oxy-acetylene torch, and a very sturdy flanged truck wheel.

Several other items in the assemblage appear to have greater importance, often because of their possible structural significance:

- a small turn-buckle (possibly from one of the wire braces of the boiler chimney);
- a white ceramic insulator about 80 mm wide and 85 mm high (Photo 18), with a short length of 2.2 mm diameter copper wire attached; two fragments of a second similar; and a very large dry-cell battery;
- a short section of fascia, with an ogee-profile bracket for the gutter it once supported;
- a battered enamel light-shade, white below and royal blue above, conical in profile and c. 250 mm diameter;
- many (perhaps 40) large fire irons, which appeared to have been dumped in a heap quite close to the doorway; as all were warped and many were broken these must be gratings from the boiler's fire box that had been discarded after becoming damaged (Photo 19);
- a sturdy iron lock with a rather delicate keyhole, with part of a copper door-knob attached, and a thin brass disk 28 mm in diameter fixed to the lock face by a central rivet; the disk is marked "W.H. & T. VAUGHAN / MANUFACTURER", around a rather fancy design with an open-work Star of David surrounded by four more similar but miniature stars and two crescent moons (Photo 20);
- some short fragments of a reddish rubber hose c. 25 mm outside diameter; these had traces of wire windings impressed on their surfaces and a complicated wall structure, comprising two concentric layers of rubber separated by at least three layers of fabric in a rubber matrix; and
- several wheel bearings and a flanged collar from a c.100 mm diameter iron pipe, which were threaded on to two lengths of wire rope and secured by means of U-bolts on the rope ends.

After the retaining wall had been unearthed, additional excavation further up the slope uncovered a basic wooden platform about a metre above the level of its base. This was formed from a series of timbers resting on a thick layer of mullock, but the details of the structure were not closely investigated. The platform may have been formed as a kind of pavement. Alternatively, it may have been intended as a storage area, though no artefacts were found when the area was cleared.

## 4. Structural history of the building

First, the two round piles with "tenons" located near the north-west corner of the engine house (Fig. 7) should be noted as they are quite unlike the slab-like piles supporting most of the northern wall of the building. These round piles were probably later replacements, added when the building was refurbished when the mine reopened in 1932.

As those piles are apparently identical to piles exposed in the scallop drain that supported one side of the bath-house, it may be that the bath-house was also in need of substantial repairs at that time. This would not be especially surprising, as the wet conditions to be expected in the building might well have led to a considerable amount of decay in its foundations.

Most of the points raised below relate to features excavated in the vicinity of the door at the rear of the boiler room. With regard to the door itself, no sign of hinges were seen on either side of the opening, but it seems very likely that the hinges were on the left looking out. Assuming the lock found below the retaining wall was originally attached to the door in question, and the keyhole upright, then the lock, which was clearly designed for use inside the building, must have been attached to the right-hand edge of the door. So the door must have been hinged on the left and it would have swung back against the engine house wall.

It is obvious that the timber baulks by the chimney base, the brick wall by the flue, and the cast slab formed behind the brick wall, represent attempts to strengthen and protect the brickwork of the flue. It is possible that the iron bar strengthening the wall of the boiler room between the doorway and the flue may be related: adding the iron rod may have been done to help resist pressure from the baulks of timber piled around the chimney base.

The state of the flue was a major concern for the mine management, because, just as the Murchison earthquake (1929) was probably responsible for the top of the chimney stack falling (Wright 1993: 35), it seems very likely that the earthquake also had a significant impact on brick structures such as the flue and boiler. Besides the direct effects of the shaking, disturbance to their foundations could undermine the structures. As almost the whole site is built on a layer of fill, slumping could have happened anywhere (or everywhere) on the area of the flats. This might have been the reason for the cracked and quite steeply sloping (1 in 12.6) concrete floor in the boiler room, the sloping (1 in 14.8) upper surface of the flue, and the cracks visible in the sides of the flue itself.

There was one further attempt to strengthen the flue, though its date is somewhat more problematic. This involved the use of two pairs of light tramlines placed vertically on either side of the flue and clamped together across its top by iron tie-rods. Some details of the design of this reinforcing are illustrated in Fig. 9. As these braces are covered by the brick wall and its infill

(Photo 21) they were obviously installed first, although probably at very much the same time as the rest of the reinforcing work was done, for the following reasons.

About 500 mm from the top of the flue wall, an iron bar takes the place of one of the courses of bricks. The bar was clearly part of the original reinforcing of the flue, but it is not connected to the vertical tramlines, which it would be if the two were part of a single design. In addition, reinforcing has also been applied to the brick cladding of the boiler itself, in a style very similar in design to the arrangement of tramlines clamping the flue but this time involving the use of lengths of full-sized railway line (Photo 22). The boiler's brickwork bulges out rather alarmingly, particularly toward the top of the wall. Large RSJs built into the boiler's brickwork at front and rear are obviously part of the original design, but the railway line appears to have been added later. This suggests that the tramlines reinforcing the flue were also an afterthought.

However, the brick flue, and the boiler cladding, would always have been vulnerable structures, and it is just possible that the clamps on both structures, though not part of the original design, were added at the time of construction. Unfortunately, the tie-rods across the top of the flue are concealed as they have now been plastered over, and it is not clear whether this happened during the original construction or during refurbishing. The plaster also prevents examination of the relationship between the tie-rods and the original brickwork. If it was thought desirable this question can still be tested archaeologically. If tramline braces on the sides of the flue were part of the original design, the tension in the tie-rods across the top of the flue should be matched by similar rods beneath the flue. These could be sought by removing part of the cemented fill and following the tramlines down the wall of the flue. Alternatively, bits of the plaster on top of the flue could be removed, and as the plaster is now rather decrepit it might be possible to do this without causing any significant damage.

As to the date of the strengthening work, it seems likely that the developments took place at the time the mine was reopened in 1932. At that time many years of natural deterioration, lack of maintenance for the previous four years or so, and the recent impact of the 1929 Murchison earthquake, might have combined to leave the brick structures looking rather fragile. It would have been obvious that some kind of strengthening was desirable, and our excavations uncovered a number of efforts to that end, including the addition of the baulks of timber, construction of the brick wall with cemented silt infill, and probably the tramline braces.

## 5. Acknowledgements

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## 6. References

Wright, Les 1993. *Big River quartz mine*. Published by Friends of Waiuta Inc.

## Appendix 1

### Artefacts recovered during excavations

As described in the body of this report, artefacts from the Big River excavations went to several different destinations. Some wooden material was stored in wet conditions on site, in a hole in the bottom of the scallop drain. This material comprised:

- two bathhouse window sills;
- one engine house window sill;
- one engine house window frame upright;
- one engine house door sill;
- one piece of engine house fascia with gutter bracket;
- one piece of c. 125 x 50 mm notched timber c. 2 m long;
- one piece of engine house T&G flooring;
- an ox yoke;
- 20 odd boots.

The whim spindle from the early quartz aerial was taken to DOC's Reefton workshop.

Of the bolts and pipe work only the zinc pipe from the long v-section was retained and the rest of the material was left on site. Other artefacts were transported to the DOC workshop. This material is shown in Photo 23. The photo is accompanied by a key to the items illustrated, which are numbered as follows:

1. unknown;
2. axle with wheel hub and broken spokes, possibly from cable supports between winding engine and poppet head;
3. bronze bearing;
4. hinged flue or inspection plate cover;
5. pick;
6. rock drills;
7. rock drills;

8. unknown;
9. bearing bracket;
10. cold chisels;
11. fire bar;
12. unknown;
13. wheel bearing from ore truck;
15. part of swivelling bar with brass key;
16. unknown;
17. unknown;
18. fire bar;
19. instrument dial;
20. handle from ore bucket;
21. clothes hanger.

Material which will be returned to Reefton shortly includes the following:

- two boots;
- ?gear lever;
- lock;
- ceramic insulator;
- fragment of plate glass;
- fragment of window glass;
- fragment of octagonal bottle;
- lid of blue enamel billy;
- blue & white enamel lampshade;
- several fragments of red rubber hose;
- several fragments of white wax candle;
- firebrick spacer/support from boiler;

- three glass tubes;
- two fragments of glass battery jar;
- one piece of stoneware bottle;
- many bottles and fragments from beside bathhouse, as described in detail above.