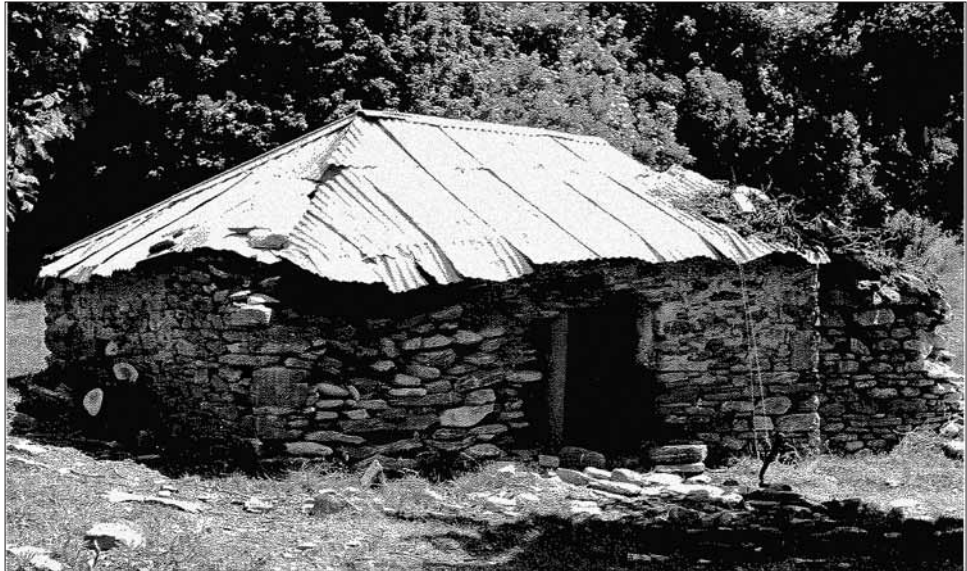


Figure 5. The Bakehouse from the northeast (front), prior to restoration in the late 1970s.

²Photo: L&S records from DOC files.



The building is presently surrounded by artificially smooth lawn-like grass meadow which has obviously been ‘smoothed’ out by a bulldozer or similar machine judging by evidence of such action at the east end of the building and through looking at photographs of what the site looked like in 1979 (Figs 7 and 8).

A large poplar tree stands adjacent to the east end of the building and other exotic deciduous trees, such as sycamore, oak, etc., fill both the foreground and background to this building.

3.3.3 Exterior

Roof

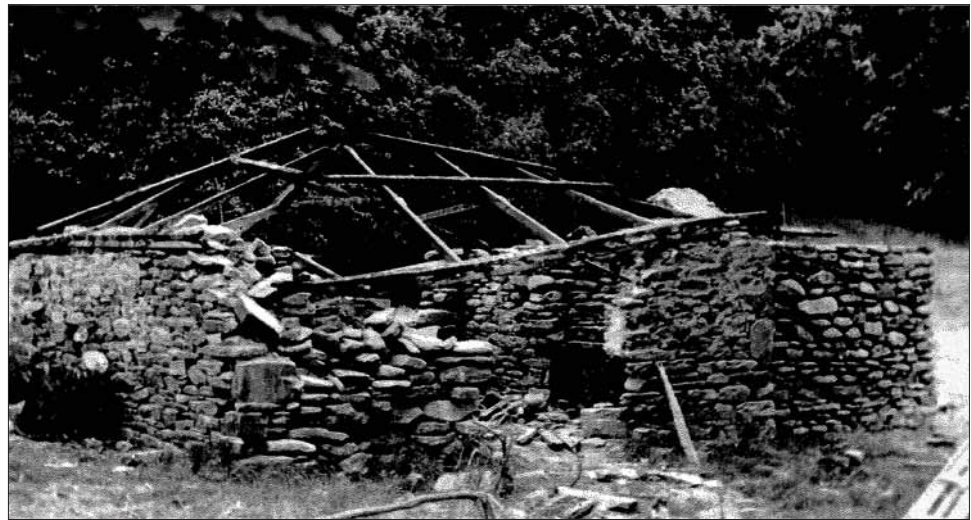
The roof covering is of corrugated iron, with surface rusting on all faces to a greater or lesser extent. The hip and ridge cappings also have surface rusting. Several small holes were evident in the iron and flashings over most of the area. There is no spouting fitted, and would never have been. The roofing iron is lifting in several places, particularly at the hip cappings, ridging, south side and eastern end. The hip capping and roofing sheets at the south-east corner require urgent repair work where the materials are bent and torn. The roofing generally overhangs the walls by 200–300 mm around the perimeter.

The earth mortar has become badly eroded from the stones forming the chimney, to the extent that these are now just sitting in place and in danger of total collapse. This is caused by the smaller stones falling out, leaving large gaps and little support for the larger stones. There are no flashings between the chimney and roofing iron and this situation has probably exacerbated the mortar erosion problem. Photographs of the 1979 rebuilding (Fig. 8) show that the chimney was fully rebuilt and re-pointed at that time. The photographs (Figs 4 and 9) also show that approximately half the roof framing timbers

² **Publisher’s Note:** Restoration work was undertaken by the then Lands & Survey Department during the late 1970s. A photographic record of the work was made. Unfortunately the photos have since been mislaid. Low-resolution scans of these photos are presently all that is available. Given the historical nature of the images, and the possibility that the originals may never be found, we have decided it is better to publish these images, rather than lose the record completely.

Figure 6. The Bakehouse during restoration, late 1970s. The right-hand (west) end of the building has been rebuilt and the front and back walls partially demolished awaiting rebuilding.

²Photo: L&S records from DOC files.



existed in 1979. It appears these original timbers were re-used wherever possible as part of the rebuilding/restoration process for the roof structure.

The roof is fastened onto a 100 × 50 mm plate, fixed to the top of the stone wall as per the original construction.

Stone walls

The original sections of the exterior walls are of stacked stone work with earthen mortar jointing material. Much of this has eroded away and in many places the stonework has fallen out leaving gaps. It appears that some mortar repair has been carried out in the past, but this was not of a high standard, using inferior materials. The use of Portland cement mortar was also noted.

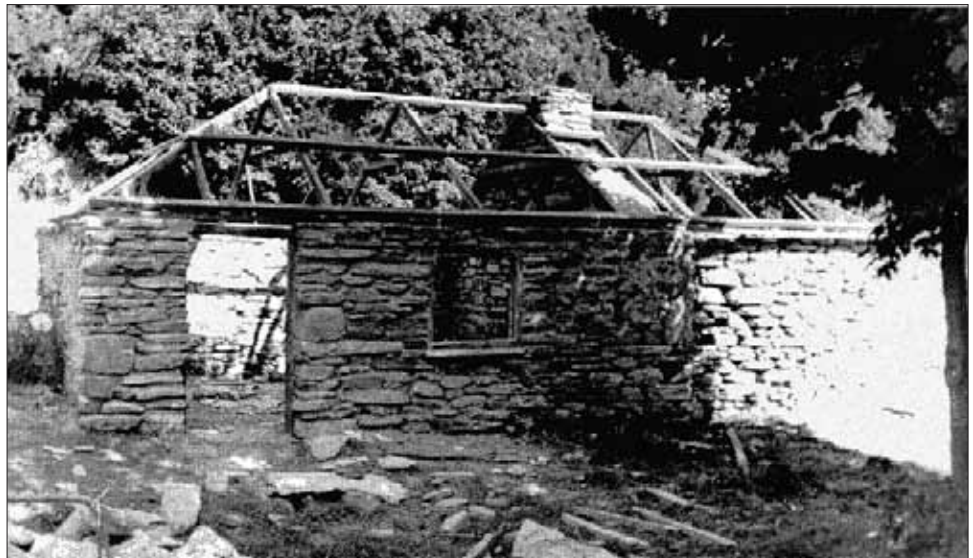
There are a number of loose stones in all wall areas. The mortar pointing of the south wall has eroded very badly. Some inward bulging was noted in this wall, and also in the east wall. Urgent repair work to all exterior wall areas is required to avoid the building suffering further structural instability or, in the worst case, whole sections falling down.

Figure 7. The Bakehouse (from south side) during restoration in the late 1970s. The front and back walls have been rebuilt.

²Photo: L&S records from DOC files.



Figure 8. The Bakehouse from the north (front) with restoration well advanced in the late 1970s. Compare door opening with Fig. 5.
²Photo: L&S records from DOC files.



The ground at the south and east walls has been built up above the floor level, presumably during the site 'smoothing' operation. This has caused moisture seepage through the stonework and further deterioration of the earth mortar pointing.

The west section of the building, which has no external or internal access, appears to be full of stones. This area is assumed to be where the actual oven or ovens were. It may still contain the ovens inside this structure.

The stonework had fallen or been taken away in two areas at the top of the walls of the western section, leaving quite large gaps.

Windows

In the north wall there is a timber-framed sash window divided by astricals into four panes. All the glass is intact. The window lintel is formed by two 100 mm × 50 mm timbers set across the opening with 75 × 25 mm boards running at right angles in the depth of the stone wall. The window is positioned flush with the outer face of the stone work. This window is not an original and the timber frame, which is built into the stone work, is of 100 × 50 mm tanalised wood, checked and housed together. The sill is of a 150 × 25 mm board.

A timber door is located alongside and to the left of the window. This is also not original, and is of vertical boarding with rails on the interior. It is hung in a 100 × 50 mm timber frame. The door lintel is a rough timber beam which, while not the original, is in keeping with the construction.

² **Publisher's Note:** Restoration work was undertaken by the then Lands & Survey Department during the late 1970s. A photographic record of the work was made. Unfortunately the photos have since been mislaid. Low-resolution scans of these photos are presently all that is available. Given the historical nature of the images, and the possibility that the originals may never be found, we have decided it is better to publish these images, rather than lose the record completely.

Figure 9. The Bakehouse (southwest corner) prior to restoration, late 1970s.
²Photo: L&S records from DOC files.



3.3.4 Interior

Roof/ceiling

There is hessian fabric, fixed under the roofing iron and over the timber purlins. The purlins were located at the ridge, mid-rafter length, and at the walls (three in total). Hips and rafters are of 75 × 50 mm timbers with collar ties at half rafter length, also of 75 × 50 mm timbers. Judging by photographs taken during the 1979 rebuilding work, c. 50% of the original roof framing/timbers remained. Presumably some of this timber was reused during the rebuilding work. The rest of the timbers were probably supplied as new timber. They are rough sawn rimu, which is an appropriate species.

The fire in the roof structure of this building sometime following the 1979 rebuilding work resulted in charring of several of the roof timbers. While not structurally unsound, these members should be monitored for any sign of deterioration in the future.

Stonewalls

The stone wall between the east and west sections is constructed the full height of the gable, following the roof line (see Fig. 8). The walls are of exposed stonework and as noted for the exterior, the mortar jointing has eroded away or disappeared to varying degrees.

At the east wall, the mortar has disappeared to create gaps that go through to the exterior. The inward bulge (noted under the notes for the exterior of the south wall) is quite pronounced on the inner face. This does not show up as any sign of cracking of the wall or other deterioration, apart from the deterioration of the mortar jointing. However, unless remedied, pressure from the moist ground against the exterior of this wall, will only increase the bulging and result in significant damage over time.

At the west wall of the accessible areas, there is a small fireplace at the north side, formed with an iron arch lintel bar and stone firebox. The chimney from this has been incorporated within the stone gable wall, built on angle, across to where the chimney passes through the roof, at the apex of the roof. The

stonework hearth at the bottom of the firebox has begun to fall away, and requires tidying up.

At the centre of this wall down at floor level is another opening, which is totally lined with stones and has no chimney opening. Its construction appears original and its purpose is unclear. The stonework around both the firebox and the above mentioned opening require re-pointing.

Window/door

The window reveal has been bagwashed to some extent. The timbers of the head/lintel can be clearly seen.

The door, as mentioned above, is not original. It has rails at top, middle, and bottom, and diagonal braces. It is fitted with a rim night latch, knob furniture, and a tower bolt on the exterior side.

Floor

The floor appears to have originally been of flagstones, many of which are lying loose over the floor area. Careful removal of these is required, followed by the laying of a new base course and the relaying of stones into a suitable sand/lime mortar.

3.4 ANDERSON'S BATTERY

The site is reasonably open, slightly sloping from front to back, with grassed area to the front and right side and a crumbling gravel bank to the left and behind. The bank areas are covered in briar bushes and other shrub growth.

This stamping battery structure is in reasonable condition considering its age. It has been exposed to the weather for the past 33 years, since its enclosing corrugated iron shed was demolished because of its unsafe condition. The iron sections of the structure and mechanism have survived well in the relatively dry and non-corrosive air of Central Otago. However, the timber work has suffered the inevitable rot and subsequent semi-collapse of some members. Some timber members have been replaced, probably during the rebuilding programme of the late 1970s.

3.4.1 Main battery stand

This consists of a large steel framed structure in two banks of five stampers joined by two c. 200 × 100 mm timber cross-members, bolted together and drilled as a guide rail for the top of the stamper rods to pass through. There are five steel stamper rods in the right-hand bay only, with twelve other rods lying alongside the battery stand. It was not clear whether the left hand bay of five rods had ever been used at this site, as there was no gold saving table at the front. The stamper box areas at the bottom of the stand are also of steel. The structure is braced with c. 60 mm diameter steel rods angled out from both the front and back faces. A plan and photographs of Anderson's Battery were published in Petchey (2002: figs 22, 23, and 24) and a photograph in Hamel (2001: 168).

A water supply pipe in cast iron, runs along the front of the stamper with water feed holes on the right-hand side only (as viewed from the front). This is consistent with only five stamps being used. A 60 mm-diameter cast iron supply pipe feeds the 150 mm main pipe. The battery was originally water-driven from a pelton wheel, which was presumably supplied by water via overhead flume from a water race running down the valley behind the battery. The pelton wheel drive pulley was originally connected to a timber pulley wheel on a side shaft mounted on a stand on the right-hand side of the battery by a long drive belt. The timber drive pulley mounted on the shaft has now rotted and collapsed onto the ground and will need replacing using the original pieces and the left-hand timber pulley as patterns.

The driven shaft mentioned above has a small toothed gear on its left-hand end, which meshes with a large spoked toothed gear wheel mounted on the right-hand end of the main cam shaft.

As this cam shaft turns, the cams act against a large steel collet fixed to each stamper shaft, thereby lifting each stamper and dropping it as the cam leaves contact. The action of the cams is spaced around the 360° rotation to reduce the load on the shaft.

On the left-hand end of the main cam shaft is another wooden pulley wheel. A drive belt from this pulley was attached to the pulley on the one grinding berdan which was mounted in a frame, directly in front of the left-hand pulley wheel. The berdan consists of a large round steel tub, like a mixing bowl with an inner steel grinding bulb which revolves via a steel shaft and gear set mounted on the frame above and driven by the steel pulley wheel. The revolving bulb grinds the crushed quartz ore to a fine paste to release the gold.

The berdan, driveshaft, and gears are supported on a timber stand of c. 150 × 150 mm angled timber uprights, 250 × 100 mm cross top rail, and 150 × 150 mm base bearers. The frame timbers are weathered and split to some extent, but show little sign of decay except for one of the small bracing members. The base timbers, however, are quite badly broken away and, on the left-hand side, are largely non-existent where these timbers are buried in the ground. The left-hand timber pulley wheel was formed from three layers of timber pieces, bolted together in opposing orientations over steel frame base plates. These timbers are badly split and showing signs of rot and decay.

A large toothed and spoked drive gear along with a smaller cog gear are at the right-hand end of the stamper frame and are driven by a shaft connected to the cog wheel which was originally connected by a belt to a pelton wheel.

The timber work of the main stand is generally in sound condition considering its age. The top right-hand guide member is split at the left-hand end (may not be original). Timbers are joined to the steel structure by large steel bolts and plates.

The steelwork, while showing signs of surface rusting, appears to be in sound condition. The cams on the left-hand side section of the cam shaft are all grouped toward the right side of this section of the shaft, and some are badly worn or broken. As mentioned previously, this left-hand bank of stamps may not have been used at this site. These batteries were often dismantled and moved to another location as one lode petered out and another one was

located. Because of the difficulty of transporting the heavy ore (often by hand, barrow, or trolley) in inaccessible locations, the stampers were required to be as close as possible to the ore source. This battery was definitely relocated to this site in 1907, but it is not known from where.

Projecting forward at the front of the right-hand section of stamps, a timber sluice box is positioned. It is constructed from 300 × 75 mm stringers with 200 × 50 mm decking with old bolt connections showing positions of original metalwork, brackets, and braces, etc., no longer connected and not evident on site. Timbers of this section are quite weathered and split, but again there is no obvious sign of decay.

The primary drive shaft is supported on its right-hand end by a timber support structure constructed of 250 × 250 mm side, top and base members, which is braced by two steel rods facing back towards the main structure and attached to ground bearers. This support structure is in poor condition with a moderate lean towards the right and suffering badly from rot and decay. Vegetation is growing around and over the base sections and requires to be cleared away.

A pelton-wheel housing is located approximately 10 m in front of the battery stamper stand, with the actual pelton wheel no longer in the housing. The timber base frame of the pelton wheel is badly decayed and is almost non-existent, but the old holding-down bolts are still in place. The pelton wheel case, while showing surface rust, is in sound condition. The pelton wheel lines-up with the former wooden pulley wheel on the primary drive shaft. The final drive of the stamper battery was achieved by moving the primary shaft to the left and engaging a drive dog on the shaft with a matching dog inside the primary drive gear.

The following maker's information was noted from the items on site. Steel Water Wheel Manufacturers—'Pelton's Patent Wheel, Sole Makers, A and C Price, Thames, New Zealand, No. 105.' Metal Battery Stand Manufacturers—'R.S. Sparrow & Co., Engineers, Dunedin.'

3.5 OTHER STRUCTURES

3.5.1 General

A number of other stone ruins exist throughout the Macetown Reserve. These ruins vary from a four-walled stone structure which is almost complete, to stone chimneys, stone building wall remnants, stone foundations and the remains of various stone garden, boundary and retaining walls. Each ruin portrays part of the overall picture of how these gold-mining settlers lived in the environment of Macetown. These ruins are mainly located within three distinct clusters throughout the reserve.

Southern entrance cluster

The first group is around the un-named timber building, near the southern entrance to the reserve. The most distinct of these is the windowless stone ruin, located c. 50 m past the timber building, 5 m above the left-hand side of the road.

Although this structure has nearly complete walls, there is evidence that much of the front wall and the front sections of the side walls were probably rebuilt during the 1979 rebuilding work within the reserve.

The low wall-height of this former lean-to-roofed structure, together with the lack of fireplace, indicates it was probably used as some sort of storage facility as opposed to a dwelling. It is in very good condition and would require very little work or cost to re-roof and re-point the stonework, which would secure its existence for many years to come.

There are also the remains of several stone fences surrounding the flat area in front of the timber building. Their purpose would probably have been to exclude animals from what was possibly a garden area.

On various flattish areas on the small hillside above the timber building are the remains of several other buildings. These ruins vary from almost complete stone chimneys, which were possibly associated with either cob house structures or possibly partial cob or stone walls with calico or iron roofs above, to low-level stone walls and several garden or boundary stone fences.

Central cluster

The second group is near the centre of the reserve, around the site of Needham's Cottage. They consists of a few stone foundation remains above the road and just before Needham's, but are not very significant.

Northern cluster

The third and predominant group of ruins is at the site of the main settlement at the north end of the Macetown Reserve. These remnants are very common on both sides of the road, accurately locating the positions of many of the original buildings shown in the early photographs of Macetown. They consist of stone foundations, partial walls of former stone buildings, chimney bases, garden walls, and retaining walls.

There are a series of very unusual stone retaining walls and associated excavations on the bank in the trees directly behind the Bakehouse building. Their purpose is unclear and further investigation could be warranted.

The significance, and visitor experience of the openness of the ruins, of the original Macetown settlement is being greatly diminished by the proliferation of wilding sycamores in this area. (This issue is discussed below in section 6.)

4. Work required

4.1 GENERAL REPAIRS, AND SITE RESTORATION

All damaged or defective original fabric or elements should be repaired with the minimum amount of intrusion possible. All details and standards of workmanship should match those of the original.

A record of all repair work should be kept. This should include a description of all work carried out, including the names of those who did the work, and the date. Photos should be included of any significant work, including a record of the existing fabric before alteration.

All restoration work undertaken should use materials and timbers, etc. to closely match the adjoining surfaces with regard to material, profile, colour, texture, hardness, and finish. All work should be undertaken by craftsmen skilled and experienced in this type of work.

A fundamental dilemma exists with regard to trees surrounding several of the buildings at Macetown. While these trees provide part of the historic setting of the town, they also pose a real danger to the well-being of adjacent buildings, should they fall or be blown down by high winds.

Consideration should, therefore, be given to trimming or pruning these trees to prevent them destroying the historic buildings within the reserve. An arborist should check on the health of all trees adjacent to buildings and should any be found to be reaching the end of their life and therefore be in danger of falling, they should be felled as a preventative measure.

4.1.1 Long-term maintenance

Once restoration is complete, the buildings should be regularly maintained so that they remain structurally sound and weatherproof and continue to fulfil functional requirements. Maintenance records should be kept. A maintenance plan is included as section 5 of this report.

4.1.2 Maintenance and repair work required

The following is an outline of work required to the three remaining main structures to repair or replace deteriorated or missing elements and to increase weather-proof qualities and appearance. Once the initial work has been undertaken, it is important that future defective items are rectified as they are discovered.

This is not a full specification, but a list of items requiring attention to prevent further deterioration and to replace lost heritage significance. It is important to note that the work described here must be carried out in accordance with accepted conservation methods and techniques. Accordingly, a Conservation Architect skilled in this work should be consulted to carry out appropriate tests, prepare detailed specifications for the work involved, and observe and administer the work as it is carried out.

4.1.3 Loss of the un-named timber building

Unfortunately this building was lost to fire in late 2004 when a visitor who was sheltering in it accidentally set it on fire. It was burnt to the ground and only the foundations remain. The original report (Gray 2004) contains a section on work required on this building, but with the total loss of the structure, this information was deemed no longer relevant, and has been omitted from this publication.

4.2 NEEDHAM'S COTTAGE

4.2.1 Exterior

(The front of the cottage is the north side.)

Site

Prune and trim all sycamore trees to the south of the cottage. Thin out trees and remove all branches which could possibly fall onto the cottage. Have an arborist check the health of the poplar tree to the west of the cottage to make sure it is not in danger of falling on the building.

Excavate ground on north, east, and south sides of the building, to c. 100 mm below floor level and at least 600 mm back from edge of walls. Taper back the highpoint of the excavation. Excavate a 200 mm wide trench c. 300 mm deep, a minimum of 300 mm out from the exterior walls. Excavate to falls in both directions around building and install 200 mm high perforated plastic strip drain wrapped with permeable geotextile fabric.

Backfill with clean gravel, maximum 25 mm size, to within 100 mm of surface. Cover trench with further strip of geotextile fabric (full width) and complete backfilling with gravel to level with surface. Run drain away from building to a free-draining soak pit.

Vegetation growing adjacent to the perimeter walls should be removed. Spray around building next to walls with weed killer to inhibit plant growth. Dig out any larger woody plants or stumps, roots, etc., being very careful not to damage the stonework during excavation.

Roof

Where possible remove all spring-head nails and replace with lead-head nails. Re-fix all loose (or replace all missing) nails to roofing iron or flashings with lead-head nails, as required. Patch all holes in roofing iron and flashings with small squares of canvas dipped in pitch.

Replace all bargeboards and barge capping boards with new tanalised rough-sawn timber boards of same sizes as existing (barge cappings 200 × 30 mm, and bargeboards 150 × 25 mm). The tanalised boards should be painted with oxalic acid prior to erection to instantly age them and remove the green coloration of the tanalith.

Replace the horizontal iron flashing on the south side of chimney with another aged galvanised flashing of similar size to those on north side. Reposition all

flashings at chimney so that they are better sealed into the stone mortar joints and tucked under the timber barge cappings, etc. Consideration should be given to providing 100 mm wide strips of lead flashings which could be set into each pointing joint at the chimneys and over-flashed to existing flashings.

The corrugated iron at the lean-to roof should be repositioned further up the roof, so that it better waterproofs against the gable end of the cottage. Re-fix as required with lead-head nails. Provide a capping flashing constructed of bent over flattened corrugated iron or similar aged sheet, at each end of lean-to roof top end, beyond the line of the gable end. Provide a lead flashing at the junction of the lean-to roof and west gable end. The lead shall be set into the stone work mortar joints and the joints re-mortared to seal. Fix all new flashings with lead-head nails.

Walls

Check all stonework to walls for loose or missing mortar, or loose or missing stones. Assess the condition of all mud mortar. Any areas of pointing which are missing, excessively recessed, or soft, should be raked out at least an equal depth to the thickness of the mortar, in readiness for re-mortaring.

Select a suitable local site—preferably outside the reserve and in consultation with DOC staff—for the excavation of earth material for the re-pointing. This material should be a mixture of clay, silt, and fine sand with all stones larger than 6 mm sieved out. The earth material should not contain any top soil, but be approximately 70% sand and 30% clay/silt. Should a suitable clay material be found which is lacking in the sand content, it can be batched up to the 70% sand content by adding fine river sand for this purpose.

This selected earth/sand material should be mixed with sufficient water and c. 1 part of slaked (burnt) lime putty to 8-10 parts of the earth mixture, to form a stiff plaster mix. After spraying the stonework with a fine mist of water to enhance adhesion, the mix should be forced into the mortar joints. The work surface should be kept damp during the installation of all mortar. The joints should be slightly overfilled and initially allowed to dry to the point where the excess mortar can be brushed back with a stiff nylon or bristle brush to the required level to finish just below the stone surface.

The Conservation Architect will offer guidance and show photos of the finish required. Remove all excess mortar from the stonework with a stiff bristle brush to allow the maximum amount of stone face to be shown. Immediately upon completion of an area of re-mortaring (to a maximum of 1 m²) the area should be sprayed with a knapsack sprayer to thoroughly wet it, and fully wetted hessian sheets should be hung over the area to prevent excessively quick drying. The hessian and wall behind should be sprayed with water every 1-2 hours, to keep it damp. This procedure should continue for at least 2 days or until the back mortar can thoroughly dry. This process prevents excessive cracking of the earth mortar and provides a more durable product.

There are three areas of collapsed and/or bulging stone wall at the south side. These must be repaired immediately. The damage towards the eastern end and at the right of the south-side window has probably been caused by dampness and water accumulating as run-off from the bank behind. A smaller section of

bulged wall occurs at the top western end of the south side of the main cottage wall.

Following the excavation of the earth adjacent to the wall (as recommended above), carefully remove all bulging stonework. Apply support props to the upper stonework or support needles through the stonework, immediately above the removed area. The reinstallation of the wall stones should be undertaken immediately after dismantling the bulging section of the wall. To build the wall back up and to provide full support, install small support stone wedges between the stones as they are rebuilt. Apply mud mortar between the stones, as specified in the previous paragraph.

All stones should be placed in a similar order and configuration to the existing layout. Refer to photographs of the original appearance. Should some of the original stones not fit back into the available space (because of prior slumping, etc.), select other suitable stones from the area to complete the work. All areas of new mortar work should be adequately cured by slow drying of the new mortar, as previously mentioned.

Exterior woodwork

Borer-treat all exposed exterior woodwork with a suitable spray or brush-on borer treatment. Recoat all exposed exterior woodwork with a mixture of boiled linseed oil, turpentine, and teribin to provide protection to the timber. Coat the window sashes, frames, sills, lintels, doors, and frames, top plates, rafter ends, etc. Check all window glazing putty and if defective remove and re-glaze as required.

4.2.2 Interior

Roof structure

Remove any bird's nests or other material from behind scrim and re-fix all loose or torn scrim back to existing by sewing with hessian thread. Where possible, repair holes in scrim by sewing in patches using new scrim sheeting and scrim thread. Spray or brush borer treatment onto all exposed timber frame members. Remove all loose or hanging string, etc., from ceiling area.

Interior walls

Check all stonework to all interior walls for loose or missing stones. Allow the lower wall areas to dry out after the earth has been removed from the outside of the walls (down below floor level as previously mentioned). After drying, carefully re-point all joints between the stones where required, so that all mortar joints have the pointing to a maximum of 10 mm back from the adjacent face surfaces of the stones. Re-point interior vertical joint between main cottage and lean-to on north side. Re-pointing mortar shall be of a similar mix to that specified for the exterior re-pointing. Specific areas requiring re-pointing include the lower wall areas on all sides, the upper walls at the west gable, and east gable and above the fireplace. Similarly check the lean-to interior, and carry out all re-pointing work as required.

Replace flat stones which are missing at the top of the walls at the south side of both the cottage and lean-to and above the north-side east-end window of the

main cottage and at tops of walls in the lean-to. Replace the missing stones at the east-end gable top of main cottage and east end of north wall of lean-to and to the tops of the east wall of the lean-to at both sides of the main cottage gable. Rebuild stones and apply mortar around window opening at west side of lean-to.

Apply the boiled linseed oil mix (as per the exterior) to the interior window frames and sashes and interior of the doors and frames. Spray or brush all interior timber with a suitable and effective residual borer treatment and in addition consider tenting the building and treating the complete structure with a gas type borer treatment, similar to that undertaken at Ah Lum's store in Arrowtown (see photo in Hamel 2001: 186).

4.3 THE BAKEHOUSE

(The front of the building is the north side.)

4.3.1 Exterior

Site

Prune or trim the poplar tree to the east of the Bakehouse. Remove all branches which could possibly fall on the Bakehouse. Excavate the ground surrounding this building on the north, east, and south sides to approximately 100 mm below floor level, and at least 600 mm back from the edge of the walls. Excavate a 200 mm-wide trench c. 300 mm-deep, a minimum of 300 mm out from the exterior walls on all four sides. Excavate to falls in both directions around building and install 200 mm-high perforated plastic strip drain wrapped with permeable geotextile fabric. Backfill with clean gravel, maximum 25 mm size to within 100 mm of surface. Cover trench with further strip of geotextile fabric, full width, and complete backfilling with gravel to level with surface. Run drain away from building to a free draining soak pit.

Vegetation growing adjacent to the perimeter walls should be removed. Spray around building next to walls with weed killer to inhibit plant growth. Dig out any larger woody plants or stumps, etc., being careful not to damage the stonework during excavation.

Roof

Where possible remove all spring-head nails and replace with lead-head nails. Re-fix all loose or replace all missing nails to the roofing iron or flashings with lead-head nails. Patch all holes in roofing iron and flashings with small squares of canvas dipped in pitch.

Rebuild chimney above the roof as required including re-pointing all mortar joints with earth mortar (as per notes above for walls). Replace missing stones with others from around the site. Finish chimney with flat capping stones.

Straighten out or replace the hip flashing at the southeast corner with a suitably aged hip flashing. Consideration should also be given to replacing the bent roofing iron sheets adjacent to this southeast corner.

Walls

Check all stonework to walls for loose or missing mortar or loose or missing stones. Assess the condition of all mud mortar. Any areas of pointing which are missing, excessively recessed, or soft should be raked out at least an equal depth to the thickness of the mortar in readiness for re-mortaring.

Prepare mud mortar, apply, and finish off in the same manner as described for Needham's cottage in section 4.2.1 'Walls' (above). Replace the stones missing from the north wall of the oven area with new selected stones from around the site. Treat all areas of re-mortaring in the same manner as described above, to prevent excessively quick drying. The hessian and wall behind should be sprayed with water every 1-2 hours or so, to keep it damp. Carry out this procedure for at least 2 days or until the back mortar can thoroughly dry. This process prevents excessive cracking of the earth mortar and provides a more durable product.

Exterior woodwork

Borer treat all exposed exterior woodwork with a suitable spray or brush on borer treatment. Recoat all exposed exterior woodwork with a mixture of boiled linseed oil, turpentine, and teribin to provide protection to the timber. Coat the window sashes, frames, sills, lintels, doors, and frames, top plates, rafter ends, etc. Check all window glazing putty and, if defective, remove and re-glaze as required.

4.3.2 Interior

Roof structure

The interior of the roof structure of the Bakehouse should be treated in the same manner and for the same problems as detailed above for Needham's cottage, see section 4.2.2 'Roof structure'.

Interior walls

Check all stonework to all interior walls for loose or missing stones. Allow the lower wall areas to dry out after the earth has been removed from the outside of the walls down to below floor level. After drying, carefully re-point all joints between the stones where required so that all mortar joints have the pointing to a maximum of 10 mm back from the adjacent face surfaces of the stones. Re-pointing should be done with a similar mix to that specified for the exterior re-pointing. Specific areas requiring re-pointing include the lower sections of the walls, the upper gable at the west end, the east-end wall, and around the fireplace at the west end. Rebuild the raised stone hearth to the fireplace, using the stones in this area and suitable mortar.

Apply the boiled linseed oil mix (as for the exterior) to the interior window frames and sashes and interior of the doors and frames. Spray or brush all interior timber with a suitable and effective residual borer treatment and in addition consider tenting the building and treating the complete structure with a gas type borer treatment similar to that undertaken at Ah Lum's Store (Arrowtown).

Floor

Carefully clean off and remove all earth, rubble, leaves, etc., to expose the flagstones on the floor.

Fireplace

Carefully clean away the stones around the fireplace to ascertain the original form of the hearth structure. Rebuild the hearth structure to a similar form to original, using earth mortar with a 1:6 burnt lime/earth mix. Remove all redundant stone, etc., from the interior.

4.4 ANDERSON'S BATTERY

4.4.1 Site

Consideration should be given to digging out and removing all gravel from the east end and from behind the main frame of the battery structure to remove pressure on the frame. Once the gravel has been removed a timber crib or similar retaining wall should be built around the eastern side to retain the gravel bank and prevent further encroachment of this material on the structure.

Spray around the base of the stamper battery, berdans, and pelton wheel structures with weed killer to kill foliage. Remove all larger plants such as gooseberry, matagouri, briar, etc.

4.4.2 Stamper battery structure

Dismantle the right-hand top timber stamper rod-guide block, which is constructed in two halves, and reconstruct to match the left-hand top block. Re-fix into position, replacing all missing nuts, etc. Replace the missing bolt and nut at the left-hand end of the upper tie strap across the front of the main frame. Reconstruct the two timber belt-drive flywheels—one on the left-hand end of the main shaft and one on the primary driveshaft—using the existing timberwork as a pattern. Screw and bolt together to same construction as existing.

Remove the handrail to the former walkway adjacent to the water supply pipe, together with the centre stanchion. Straighten handrail and centre stanchion and replace both in same position.

Replace all four timber members supporting the western end bearing block including the sill plate, vertical supports, and horizontal plate, with new timber members of similar size and of Australian hardwood timber. Re-use all metalwork, tie rods, bolts, braces, etc., to construct new timber frame. Straighten the two steel braces as required, and construct new hardwood timber base bearer foundations set onto concrete foundation below new bearers and bolt fix braces to base bearers and to vertical supports. Set up the bearing support structure in a vertical position and in an orientation that positions the drive shaft 'in gear', with the drive dog on the toothed gear.

The timber gold-saving table at the base of the right-hand mortar box should be moved back, hard up against the steel mortar box, and levelled up across its width, on the existing timber support blocks.

Coat all steelwork with metal preservative to preserve the steel and prevent further rusting. Coat all timberwork with clear zinc naphthanate timber preservative.

4.4.3 Berdan

Dig away the gravel, which has accumulated against the base bearer on the eastern side of the support frame, to the level of the lower side of the bearer. Support the main frame of the berdan while the east-side base bearer is replaced (in Australian hardwood) with a new member of similar size. Remove surplus lightweight timber braces from main frame.

Coat all steelwork metal preservative to preserve the steel and prevent further rusting. Coat all timberwork with clear zinc naphthanate timber preservative.

4.4.4 Pelton wheel structure

Once the timber flywheel has been replaced on the west end of the primary drive shaft of the battery, the pelton wheel is to be repositioned on new timber base bearers, so that the pelton flywheel will align with the flywheel on the shaft. Provide two new timber base bearers and joining blocks, etc., of similar size to existing, constructed of Australian hardwood. Bolt pelton wheel structure to base bearers with existing bolts, if possible.

Coat steel work of pelton wheel with preservative to preserve the steel and prevent further rusting. Treat timber base bearers with zinc naphthanate timber preservative.

5. Maintenance plan

Needham's Cottage, the Bakehouse, and Anderson's Battery (as noted) are in need of maintenance, restoration, and repair. Once this current repair and restoration work has been carried out, it is recommended that a formal and regular programme of maintenance be adopted for the buildings.

Such a programme of regular inspection and maintenance means that minor faults are identified early, avoiding the need for major repairs in the future. A well-maintained historic structure is likely to be better used and enjoyed than one that is neglected. It is also likely to survive longer, and suffer less damage in the event of a major storm or earthquake. An outline programme for the above structures is set out below.

As required

- Carry out general 'housekeeping' jobs
- Clean the structures, buildings and windows, etc., both inside and out
- Remove any debris from the interiors and sweep out as necessary
- Attend to maintenance items as they show up

Annually

- Check the whole of the fabric of the structures and buildings and carry out any necessary repairs.
- Check the roofs for loose fixings, sheet iron roofing or flashings, etc., and re-fix as necessary.
- Check for holes, rust holes, etc., in roofs and patch as necessary.
- Check stone walls for cracks, and pointing for loose or eroding material. Repair or re-point as necessary with pointing to match existing.
- Check the exterior weatherboard fabric of the timber building for rot, cracked or split boards, and repair or replace as necessary.
- Check exterior windows and doors and other timber and joinery for rot or cracking, repair as necessary.
- Check window glazing for cracks, breaks, or loose putty, and replace as necessary.
- Inspect for any plant growth on or around the exterior perimeter of buildings. Remove and spray as necessary for moss and algae growth, and spray for weeds around base.
- Wash the exterior woodwork items of the buildings as able to.
- Treat exterior woodwork joinery and structural items which are not painted with clear wood preservative as required.
- Check for borer infestation in all timbers, both inside and out, and treat if required.
- Oil catches, door hinges, and locks. Ease opening doors and windows so they operate easily.

- Check perimeter water drainage system and soak pits for adequate operation.
- Check all iron metalwork items on all structures and buildings for rust and treat as required with rust-inhibiting oil.

Bi-annually

- Take general photographs of buildings and structures and any noticeable deterioration and compare with previous photos. Label, date and file photos in building records file. Notify Conservation Architect or engineer to investigate if structural deterioration is noticed.

Every six years

- Have a Conservation Architect inspect the structures and general building fabric of the buildings for any deterioration and a full assessment of their condition compared with that immediately following the restoration and repair work.
- Clean down and stain or oil, as appropriate, only the previously stained or oiled exterior fabric, etc. according to the requirements of *NZS 7703:1985 The Painting of Buildings*. Retain some stain or oil for the purpose of touching up.
- The interior of the buildings will probably only require a good dusting down and washing off of any bird or vermin droppings, etc. because of the need to preserve the desirable heritage patina.
- Check all visible timbers for borer and treat all timbers with a brushed or sprayed-on insecticide.

After a major storm or earthquake

- Carry out an inspection of all structures including the roofs, flashings, and all structural walls. Repair as necessary.

5.1 BUILDING MAINTENANCE RECORD LOG

A building or structure Maintenance Record Log should be started for each building and structure, to record a schedule of when all jobs were carried out, what was done, by whom, and the cost.

A maintenance schedule Checklist Sheet should also be kept and ticked off as items are completed.

Photos should be taken to record significant work, and they should be labelled and filed within the appropriate file for each structure.

6. Peripheral issues for the reserve

Three important peripheral issues associated with the reserve arose as a result of the site survey. They need to be addressed by DOC in consultation with the Queenstown Lakes District Council, and perhaps with the wider public. These issues were:

- Wilding trees
- Public damage to the structure and ruins
- Damage to the physical environment and setting of the reserve by four wheel drive vehicles

The most distinctive feature of the original Macetown settlement area in the reserve is the proliferation of wilding sycamore trees, which are predominantly located on the line of former stone fences and ruins. The seeds of this plant, (which has been declared a noxious plant in many parts of the country) accumulate within the stones of the ruins and, nurtured within this protected environment, quickly develop into substantial trees. Tree growth hastens the premature destruction of the stone fences and ruins, and needs to be urgently addressed. Groupings of these trees are becoming so thick, that they are forming a sheltered canopy above, enhancing the growth opportunity of the thousands of sycamore seedlings beneath.

The visitor experience and significance of this part of the reserve is becoming greatly diminished, in that it is already difficult to envisage what the Macetown settlement was originally like. It is assumed that, unless the growth of this noxious plant is drastically curtailed within the reserve, the whole area will become severely overgrown with this species within the next 20 years.

The author recommends the removal of all sycamores within the vicinity of the flat and the near-area of the original Macetown settlement, but the retention of all non-sycamore exotic trees. The stumps of all the felled trees and all the seedlings will require poisoning or spraying with a strong herbicide for at least 2-3 years, to prevent regrowth.

Another important issue is the damage to structures and ruins within the reserve by both uncontrolled animal grazing and human visitors. There is clear evidence that groups of campers have removed stones from ruins in several locations within the reserve to form camp fireplaces, and for other unknown purposes. Other damage may be unintentional, but is happening, nonetheless.

During the time of our survey of the buildings, a large group of primary school pupils from Queenstown were camped within the old Macetown settlement area. It was noticed that several stones had just been removed from an original chimney-base ruin adjacent to the campsite, possibly by some of the children. This damage was pointed out to one of the head teachers, who was horrified that her pupils may have been involved. She informed us she would discuss this further with the pupils.

The damage to structures by grazing animals, does not appear to be too significant within the reserve at present, but cattle have the potential to cause considerable damage to stone structures already weakened through erosion. Cattle like to rub against the stones, and can easily push the weakened walls over. There is also evidence (from their droppings) that sheep have entered all the buildings at some stage in the past. There is a real danger of sheep closing the door on themselves once inside the building and being unable to escape. If the incident occurs at a time of year when not many people are about, this can result in a slow and unpleasant death for the animal, as witnessed at an historic building near Macraes. While sheep do not do a great amount of physical damage, the smell and appearance of their droppings, or worse, a dead animal inside a building, does nothing to enhance the visitor experience. Consideration may, therefore, have to be given to fencing the reserve off from the surrounding farmland at some stage.

The most significant damage to the physical environment and setting of the reserve is caused by the thoughtless use of four-wheel-drive vehicles which are used to transport visitors to the reserve from Arrowtown. The amount of damage caused to banks and natural watercourses within the reserve by the drivers of some of these visiting vehicles is astonishing. Vehicles have been repeatedly driven up banks over a period of time, forming deep cuts which, in places, are up to 1 m deep. One such cut has recently been formed on a steep bank at the junction of a natural watercourse and the road, just to the north of Needham's Cottage. Other considerable damage has been caused to almost every natural watercourse within the reserve, where vehicles have repeatedly been driven through these soft spots, turning them into large mud-holes. This damage is very unsightly and detracts from the visitor experience. Careful consideration needs to be made of methods which could reduce the amount of damage caused to the reserve by thoughtless vehicle use, without restricting the access of the many visitors who act responsibly.

A balance is required between the needs and desires for open public access to allow the enjoyment of the recreational opportunities, when compared with the damage and destruction to the built and natural features which results from the thoughtless actions of a few users.

7. Acknowledgements

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