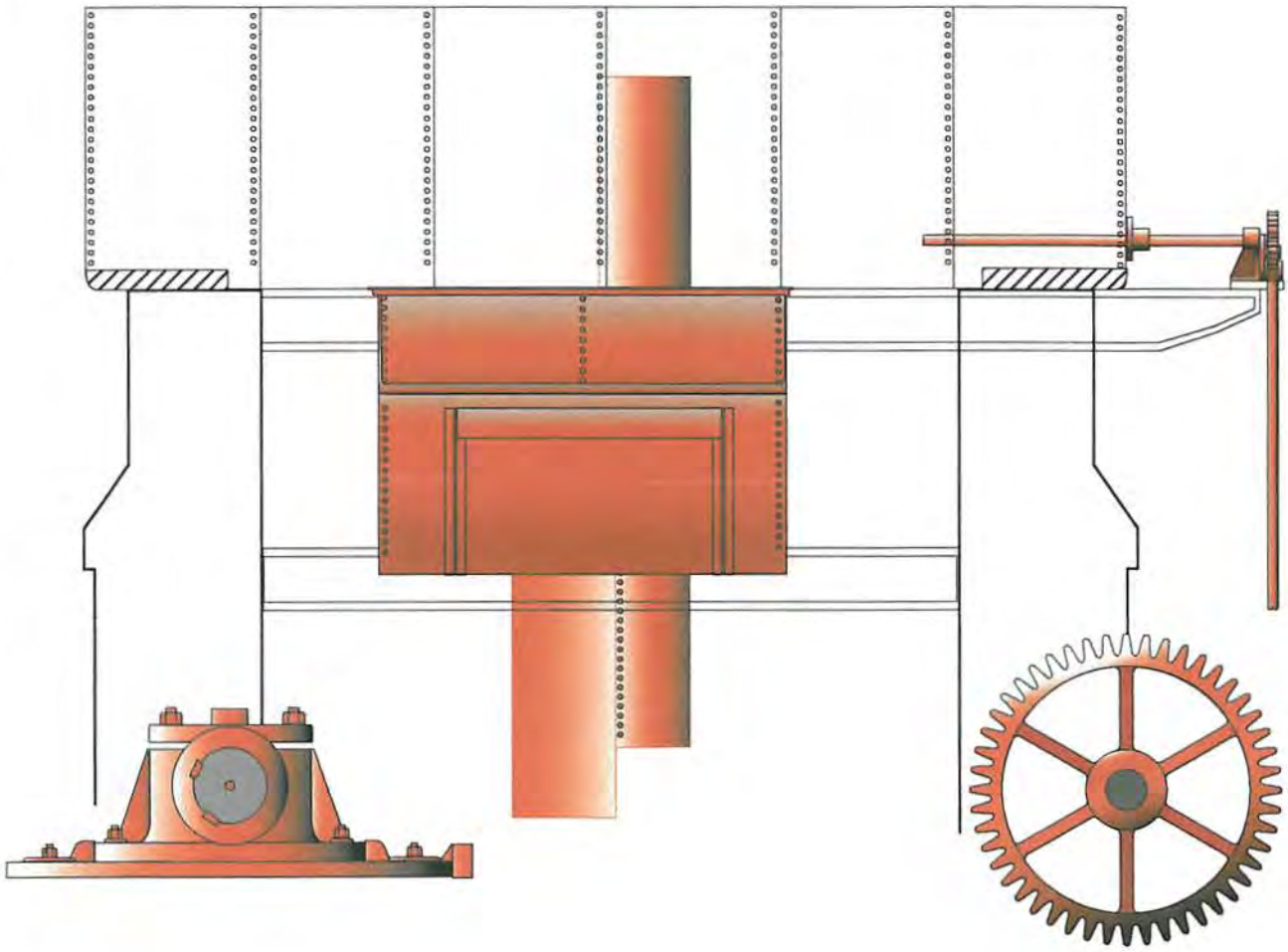
Restoration of Waterwheel, Header Tank and Rising Main at Gilfach Ddu, Llanberis.



Archaeological Recording Interim Report

Ymddiriedolaeth Archaeolegol Gwynedd Archaeological Trust

POSFORD DUVIVIER

Restoration of Waterwheel, Header Tank and Rising Main at Gilfach Ddu.

Archaeological Recording Interim Report : number 2

Introduction.

Essential archaeological monitoring and recording of the above restoration works at the Welsh Slate Museum has been carried out in conjunction with the various main phases of work that have directly affected either the appearance or existing structural integrity of the monument.

In addition to recording any physical changes made to the wheel during the works a number of outstanding questions posed during the initial recording of the monument were subsequently addressed.

The majority of the recording work carried out to date occurred between March and June, when the wheel itself underwent restoration. Refurbishment and repairs to the header tank and riser have been deferred until the autumn, although specific areas requiring restoration work have been identified and approved.

History.

It was apparent from an early stage that a number of the existing components of the wheel were non - original. Indeed there are references to the removal of specific components in the form of quotes for materials and labour dated 1972 and 1980. Although both documents refer to the provision of new buckets, the former quote specifically mentions the removal and replacement of all the sole plates at this time. In addition to that of the prefabricated elements the gauges of all nuts and bolts are also itemised, and the descaling and application of Red Oxide Primer is mentioned.

Recording.

1. The Wheel

Prior inspection showed that the dimension of the long axis of the sole plates varied around the circumference of the rim and that it was essential to record the unique position of each *in-situ*, to assist in the reconstruction process. Consequently each was recorded and its location incorporated into the drawings of the monument that had been prepared previously.
Each was allocated a number and tagged for reference prior to removal.

The methodology required to dismantle the waterwheel, that is removing components at 180° to each other by turn, meant that the numbering system used on site by the contractor becomes non - consecutive when the wheel is viewed as a whole. To assist in the retrospective identification of particular elements the archaeological recording identified each component consecutively from a common point of reference. Viewed from the west (entrance) side of the wheelpit there is a single shroud casting, segment 1, bearing the maker's name and a date, DE WINTON & C° CARNARVON 1870. The reference point is the left hand (leading) edge of the casting, where it would butt against segment 20. Hence, bucket number one (B1) is the first entire bucket held within the internal flanges of that segment. Sequential numbering runs in an anti-clockwise direction (the direction that the wheel turns). It should be noted that a similar casting within the opposite shroud bears the date 186 (presumably originally 1869?) although the 9 appears to have been deliberately removed. Is this some indication that the project was in any way delayed or that some considerable time elapsed between the casting of each rim segment?

The sole plates, of which there are presently 30, are similarly numbered in an anti-clockwise direction. Plate number one (S1) is wholly located between the emblazoned shroud casting (see accompanying A3 fig \Gilfach_06).

The contractor responsible for the removal of the sole plates and buckets, Dorothea Restoration (DR), was notified of the preferred numbering strategy, thereby utilising a common point of reference and making it possible to correlate both sets of records more easily.

All components were stamped or metal tagged and their location within the shroud castings correspondingly marked.

It was the opinion of DR staff that the existing replacement sole plates were non-original in size, appearance and to some extent, function. The manner in which the wheel is constructed allows overflow from the buckets to run between the back of the bucket and the sole plates to ensure that lower buckets remained filled. The replacement sole plates did not fulfil this function being butt jointed and consequently leaky. It is most probable, given the symmetry and overall integrity of the rest of the wheel, that the originals consisted of a regular series of smaller lapped plates.

This feature was incorporated into the restoration process by the addition of a narrow external-lapping strip, to be fitted before being reassembled.

The above work confirmed a methodology for the continued restoration of the wheel, as it was apparent upon removal of the sole plates that the condition of the buckets was better than anticipated, and that entire replacement buckets would be unnecessary. The buckets are made up of three principal components riveted together, and as such are suited to partial repair. A total of 15 defective buckets were identified and subsequently removed off site for renovation, a number of which were modern replacements. The location of these particular buckets was accordingly noted. The main failing of all buckets was the corrosion of the angle iron bracket that formed the lap joint at the rear of the bucket.

Due to the integrated nature of the wheel components considerable difficulty was encountered in removing a number of the buckets. In some instances this required that individual buckets had to be cut or have rivets burnt out whilst still in place. It became apparent that the installation of the existing replacement buckets in the 1970's had been problematic. These were not as wide as the originals and consequently not completely held by the shroud castings but by the bolts around the inner circumference of the casting only, which also held the sole plates in place. This anomaly was manifest after the removal of the sole plates as these buckets were clearly not flush with the surviving originals.

The specified buckets were dismantled on site prior to being removed for grit blasting and renovation. The remaining wheel components were grit blasted on site and *in-situ*.

Prior to the entire structure being cleaned to bare metal a paint sample was taken for chemical analysis to enable the original coating to be identified, if possible. It is assumed that this would have been red lead oxide. A proposal to use this same agent as a sealant in the re-assembled buckets was subsequently approved.

Following grit blasting it was apparent that only a single spoke clamp of the ten originally fitted needed to be replaced. Dorothea Restorations provided a replacement clamp cast from a surviving pattern provided by the Museum, and this was duly fitted.

2. The Pinion Shaft

It was recognised at an early stage that there was excessive wear in the bearing of the pinion wheel shaft. This is evidenced by uneven wear in the teeth of the gear wheel reflected in the serrated rack castings mounted onto the shroud of the waterwheel itself. The extent of the wear suggests that this process has been ongoing for some considerable length of time.

The removal of the safety cage and railings around the wheelpit allowed access to the bearing and it was subsequently inspected and stripped by DR staff. As might be expected, the lower bearing liner was heavily worn whilst the upper liner was still in good condition. The liners were made of brass and steel respectively and it was decided to reverse their respective positions. There was also some settling of the bearing mounting and this is likely to have created the problem with the bearing in the first instance. Inserting a spacer of plate steel below the mounting rectified this problem and in combination with reversing the bearing liners re-aligned the shaft.

3. Header Tank and Riser

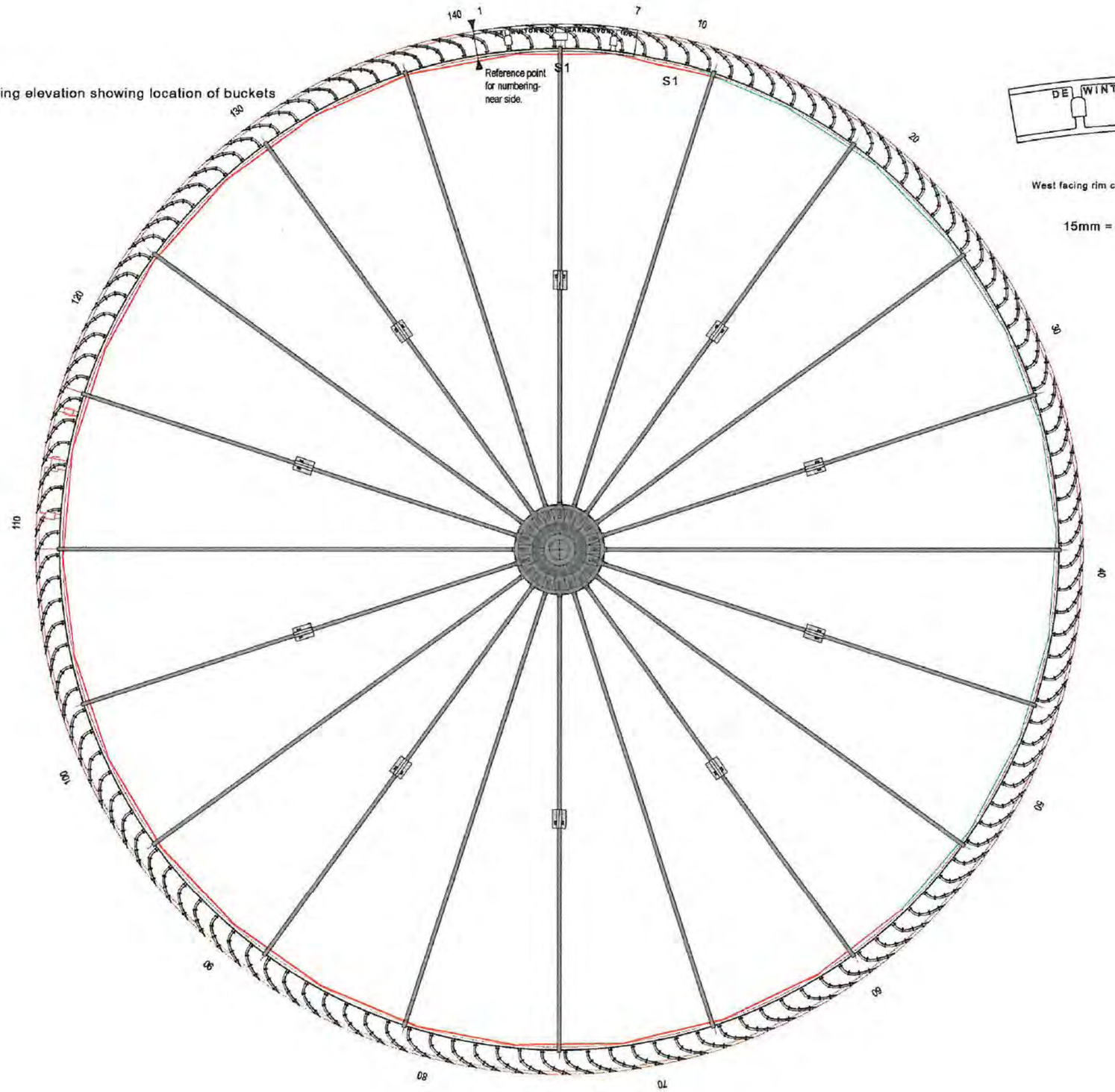
From the outset SMC had allowed for the removal of all or parts of these features within the scope of the restoration process. Detailed structural analysis, however, showed both header tank and riser to be in a substantially worse state of preservation than was appreciated. This state of affairs effectively precluded any reasonable option to remove these features whole. An alternative methodology was subsequently proposed by DR that would permit both tank and riser to be repaired *in-situ*, with no need for lifting or jacking at any time. This proposal was accepted by Cadw and the scheduled work on the header tank will commence in August with the riser being tackled during the following two months.

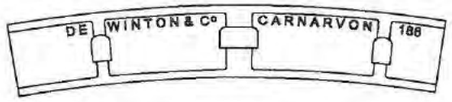
In brief, the structure will be scaffolded out to provide a safe working space. Restoration work will involve thorough cleaning of the corroded surfaces by appropriate means prior to cutting out defective areas and welding in new items or patches of wrought iron or coreten steel, to be date stamped '2000'. All accessible surfaces will be painted with specified materials.

The accompanying drawings, figs \Gilfach 03 - 05, highlight proposed areas for replacement or patching. The precise areas affected will be recorded during the forthcoming restoration process, as will any hitherto unrecorded features or aspects of construction.

GAT August 2000

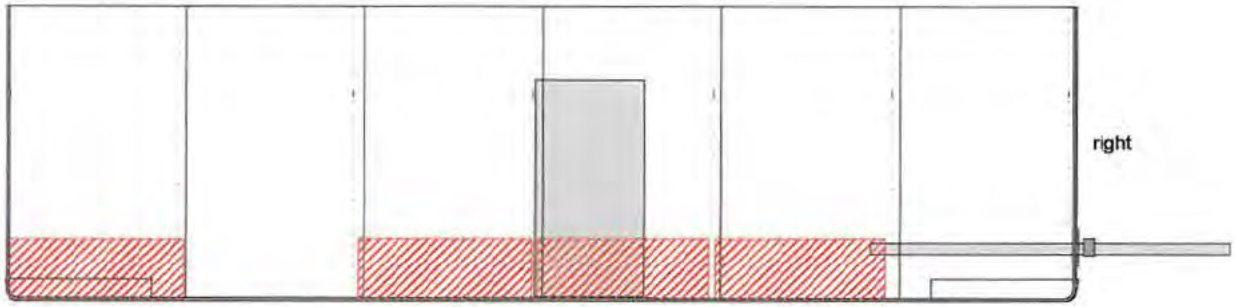
West facing elevation showing location of buckets



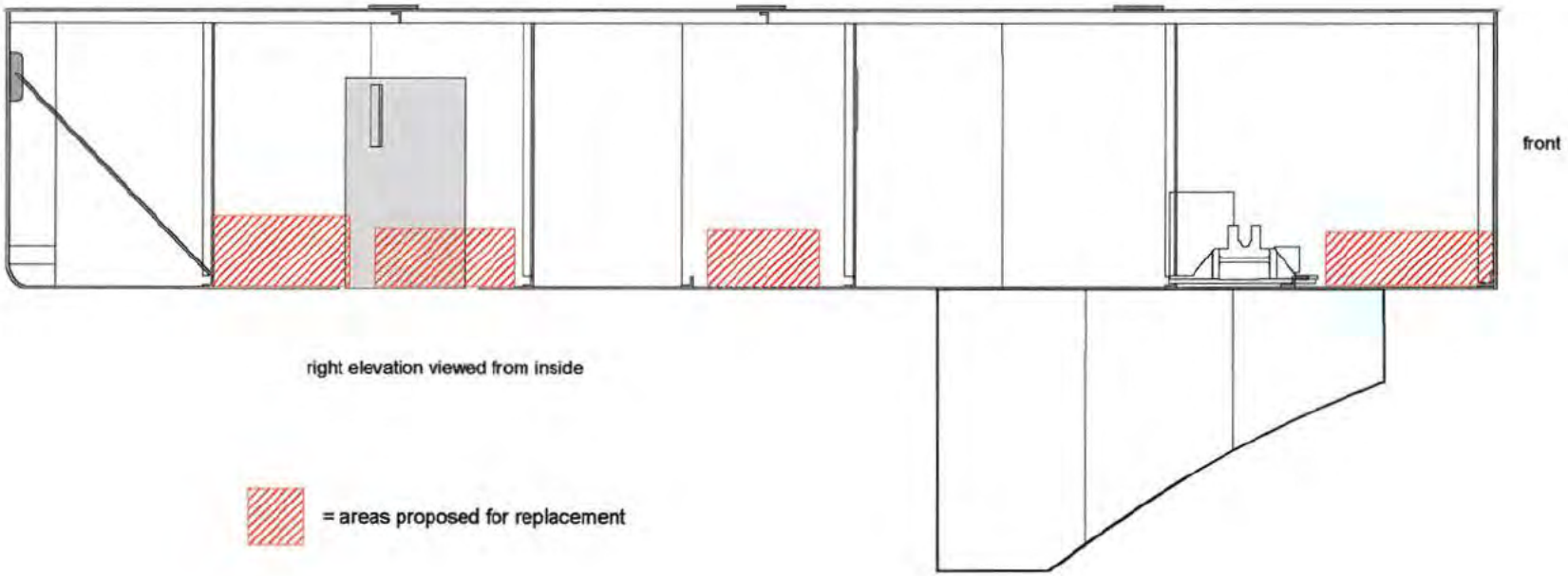


West facing rim casting displaying partially erased early date.

15mm = 1m



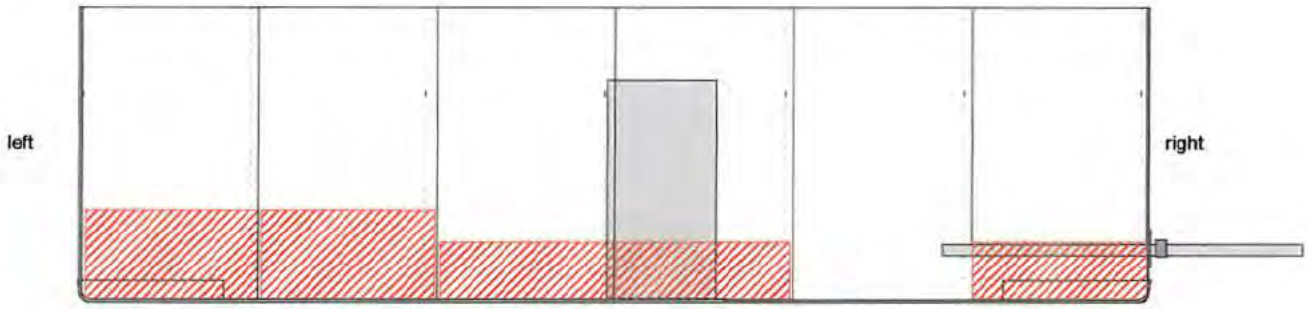
frontelevation viewed from outside



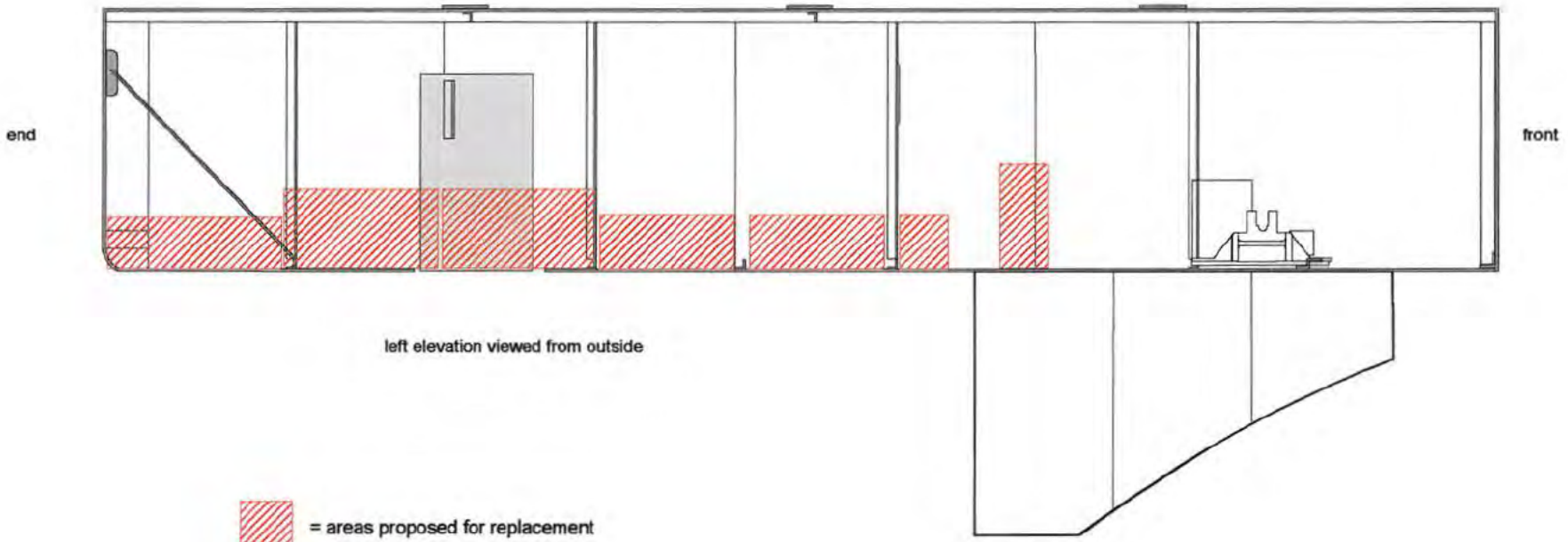
right elevation viewed from inside

= areas proposed for replacement

Ymddiriedolaeth Archaeolegol Gwynedd Gwynedd Archaeological Trust ☎ 01248 352535 01248 370925 email : gat@heneb.co.uk Craig Beuno : Ffordd y Garth : Bangor : LL57 2RT	Client: POSFORD DUVIVIER	Scales: 1:40 15/08/00 Andrew Dutton Drawing number C:\G1625/Gilfachtank03.ai 1of2	Title: Elevation of surviving elements of water wheel header tank, rising main and distributer valve at Gilfach Ddu, Llanberis.



endelevation viewed from inside



left elevation viewed from outside

= areas proposed for replacement

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Client: POSFORD DUVIVIER

Scales: 1:40

15/08/00
Andrew Dutton

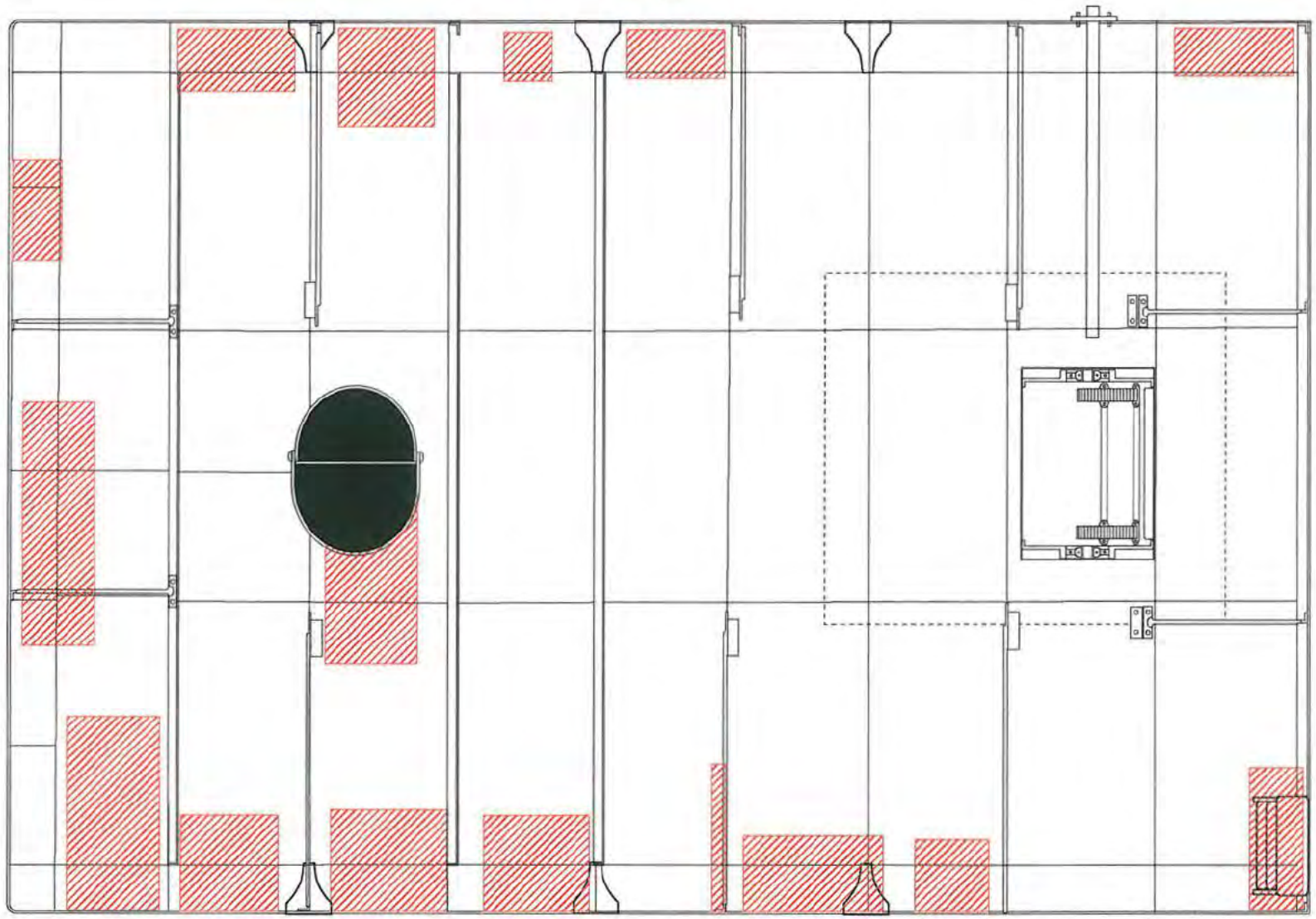
Drawing number
C:\G1625/Gilfachtank03.ai

2of2

Title:
Elevation of surviving elements of water wheel header tank, rising main and distributer valve at Gilfach Ddu, Llanberis.

= areas proposed for replacement

right



end

front

left

Ymddiriedolaeth Archaeolegol Gwynedd Gwynedd Archaeological Trust ☎ 01248 352535 01248 370925 email : gat@heneb.co.uk Craig Beuno : Ffordd y Garth : Bangor : LL57 2RT	Client: POSFORD DUVIVIER	Scales: 1:40 15/07/00 Andrew Dutton Drawing number C:\G1625/Gilfach_05.ai 1of1	Title: Plan of surviving elements of water wheel header tank, rising main and distributer valve at Gilfach Ddu, Llanberis.