Report No: 2015R029

St Agnes mine buildings, Cornwall

Archaeological monitoring during repair and consolidation works 2014

Cornwall Archaeological Unit

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Report authors	Nigel Thomas (CAU), Adam Sharpe (CAU)
Checked by	Dr Andy Jones
Approved by	Andrew Young

Cornwall Archaeological Unit
Cornwall Council
Fal Building, County Hall, Treyew Road, Truro, Cornwall, TR1 3AY
Tel: (01872) 323603
Email: cau@cornwall.gov.uk Web: www.cornwall.gov.uk/archaeology

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The building conservation works were sensitively carried out by KPK Builders (Burncoose, Redruth).

Help with interpretation and conservation suggestions for some of the structures was provided by Adam Sharpe of CAU, who co-authored this report.

The views and recommendations expressed in this report are those of Cornwall Archaeological Unit and are presented in good faith on the basis of professional judgement and on information currently available.

Freedom of Information Act

As Cornwall Council is a public authority it is subject to the terms of the Freedom of Information Act 2000, which came into effect from 1st January 2005.

Cornwall Archaeological Unit is a Registered Organisation with the Chartered Institute for Archaeologists

Cover picture: Charlotte United engine house, with the Old Century Works in the far distance down the valley.

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Abbreviations

CAU	Cornwall Archaeological Unit
CIfA	Chartered Institute for Archaeologists
CRO	Cornwall Record Office
EH	English Heritage
HBSMR	(National Trust) Historic Buildings Sites and Monuments Record
NT	National Trust
OS	Ordnance Survey

1 Summary

Land owned and managed by the National Trust was entered into Natural England's Higher Level Stewardship scheme in order to produce a comprehensive Management Plan which summarised and prioritised the management needs of the various structures and habitats. These sites were found to be subject to weathering from their exposed coastal locations, some also being significantly affected by visitor footfall despite conservation programmes undertaken in the 1970s and 1990s.

On the basis of a brief produced by Historic Environment, Cornwall Council, Natural England awarded the tender for undertaking programme of conservation works to PDP Green Consulting Limited, with archaeological input from Historic Environment Projects (now Cornwall Archaeological Unit). Stage 1 of the project saw the production of an options appraisal with associated costings, and on this basis a shortlist of works was drawn up. The programme included scrub clearance, survey, repointing, limited rebuilding where buildings or features were structurally compromised, and the replacement of failing structural timbers. This work was successfully carried out in 2014.

This report incorporates the text of the building and site surveys carried out in 2010, the specifications for the works on a structure by structure basis, before and after photographs illustrating the range of works undertaken, and copies of the record survey drawings as amended by the Cornwall Archaeological Unit building surveyor.

Fig 1. Location map showing Wheal Coates, Old Century Works and Charlotte United.

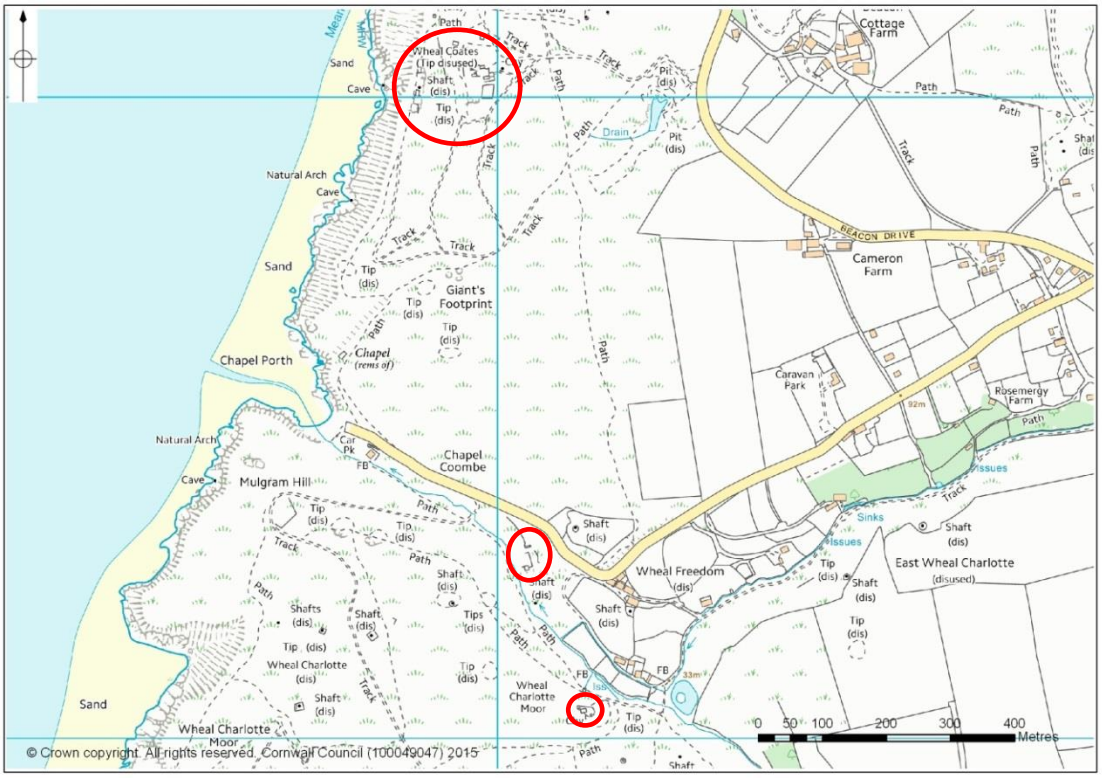

Fig 2. The extents of Wheal Coates (top), Charlotte United (centre) and Old Century Works (bottom).

2 Introduction

2.1 Project background

The National Trust holdings at St Agnes include St Agnes Beacon and a large area of coastal property from St Agnes Head to just east of Porthtowan. The land has been entered into Natural England's Higher Level Stewardship scheme (St Agnes Coast and Beacon, HLS agreement No. AG00438963).

The site was initially entered into a one year HLS agreement to produce a comprehensive Management Plan (Kirkham and Sharpe with Spaldings Associates 2010) which summarised and prioritised the management needs of the various structures and habitats.

Sites in this area are subject to weathering from their exposed coastal location and (especially those on the coastal footpath) are also in places significantly affected by visitor footfall. The major structures at Wheal Coates and the engine house at Wheal Charlotte have been previously conserved and to a large extent the earlier conservation works have been successful although in the intervening time some minor issues have become apparent and has proved essential to safeguard the buildings into the future.

A brief titled 'Project Development of Consolidation Works with Archaeological and Ecological Recording at St Agnes, Cornwall' was developed by Ann Reynolds of Historic Environment, Cornwall Council (Appendix 1). Invitations to tender on the basis of this brief were then issued by Natural England and the National Trust. The tender was won by PDP Green Consulting Limited, with archaeological input from Historic Environment Projects (now Cornwall Archaeological Unit). The resulting Written Scheme of Investigation set out the approach to archaeological recording works during the conservation process, the working methods to be employed and the arrangements for archiving and reporting of results (see Appendix 2).

The consulting engineers also produced a structural assessment report to form the basis of a tender specification document for the extent of conservation works as defined by Natural England. This included preliminaries, general conditions, schedule of works, provisional sums and detailed survey plans with building conservation annotations. This document was informed by the Stage 1 Assessment.

Detailed building conservation recommendations were provided for each building within the project, annotated on measured building survey elevations and plans. In addition the schedule of works contained a specification document with details of the mortar and pointing mix as well as a general approach to the conservation of the standing archaeology of the mine buildings affected by the works.

Stage 2 of the project comprised the practical conservation works to the structures, which were be overseen by the engineer with input from the archaeologist (Historic Buildings Consultant, Cornwall Archaeological Unit).

2.2 Aims

Stage 1

Stage 1 consisted of a scoping survey to inform work within Stage 2.

The aims of Stage 1 were to:

- Carry out a structural and physical condition survey on targeted sites.
- Carry out an ecological appraisal, to minimise impacts on the ecological resource.
- Assess priorities for building conservation works, minimising adverse impacts upon the archaeological resource.

Stage 2

The objectives of Stage 2 were to:

- Ensure site works were undertaken in such a way as to maintain, if not enhance, the integrity and authenticity of the historic resource, minimising adverse impact upon the resource.
- Ensure that (within NE financial guidelines) appropriate conservation of the historic resource was a prime objective.
- Ensure (through site and monitoring meetings), the methodologies and techniques of all aspects of the site works accorded with the method statements and agreed methodologies outlined in the schedule of works and specifications.
- Ensure best practice and the highest possible standards of workmanship were maintained during conservation works.
- Ensure adequate recording of remains was undertaken in areas affected by conservation works.
- Ensure arrangements were in place for communication on progress and any issues, etc. with the landowner, NE and CC (HE Countryside Advice) throughout the duration of the project.
- Record sites, features, deposits and artefacts affected by or uncovered by the works and the character/extent of works for Cornwall's Historic Environment Record.
- Disseminate the results of the project appropriately and arrange for deposition of the project archive.

3 Location and setting

The sites conserved and recorded during this project fall within a strip of National Trust coastal holdings on the west-facing coast to the west of St. Agnes Beacon, as well as in Chapel Combe to the east of Chapel Porth. Wheal Coates is centred at SW 69939 50038, Charlotte United's sole surviving engine house is at SW 70133 49042 and the New Century Works are located at SW 70050 49279 (Figs 1 and 2).

The majority of the area, including that occupied by Wheal Coates consists of exposed, heathy coastal land; gorse scrub has developed around Charlotte United (Figs 5, 9 and 12). Chapel Combe is a relatively narrow and steep-sided south-east heading valley whose stream rises at Mingoose, 2.2km inland. This area, too, has seen the development of scrub and stretches of Willow Carr over recent decades.

The whole of the coastal area and much of Chapel Combe is characterised by evidence for extractive industry. To the north of the Combe, lodes of copper and tin have been worked intermittently at Wheal Coates since at least 1692, activity finally ceasing in 1914. Wheal Coates is one of Cornwall's most iconic mining sites, and certainly one of its most-photographed. Stone artefacts possibly associated with prehistoric mining have been found in this area. On the eastern edge of this part of the property are a number of clay/sand pits. The stream running through Chapel Combe was employed to power a number of dressing floors, whilst near the centre of the NT northern property boundary in the Combe, a solitary engine house marks the site of Charlotte United Mine which occupied the south-eastern part of Charlotte Moor and worked intermittently for copper between 1806 and 1877. Great Wheal Charlotte (or Wheal Charlotte) worked the northern part of Charlotte Moor, again for copper. Its only standing remains consist of a bob wall, though the surrounding landscape is characterised by extensive spoil dumps and a scatter of mine shafts.

4 Designations

4.1 International

All of the sites incorporated within this project fall within the Cornwall and West Devon Mining Landscapes World Heritage Site, inscribed in 2006.

The coastal sites fall with the Godrevy Head to St. Agnes Special Area of Conservation (SAC).

4.2 National

The following structures are Listed Buildings:

- LB II – 63884 – Chimney east of New Whim (Wheal Coates)
- LB II – 63882 – Stamps house at SW 700 500 (Wheal Coates)
- LB II – 63885 - Calciner immediately north of the Stamps House Wheal Coates)
- LB II – 63883 – Old whim and new whim at SW 700 500 (Wheal Coates)
- LB II – 63881 – Towanroath engine house at SW 699 500 Wheal Coates)
- LB II – 63769 – Engine house at SW 699 492 (Charlotte United)

All of the areas within which the project took place fall within the Cornwall AONB. The coastal sites fall within the Godrevy Head to St. Agnes Site of Special Scientific Interest (SSSI).

4.3 Regional/county

These sites fall within the St. Agnes to Perranporth Area of Great Historic Value (AGHV) and Area of Great Scientific Value (AGSV) as well as the St. Agnes Heritage Coast.

5 Site histories

Reproduced from Sharpe et al 2010, with minor edits. Numbers in square brackets are National Trust HBSMR site references.

5.1 Site 1: Wheal Coates

See Figures 3 to 6, 13 to 45, 60-110.

Surface indications near the clifftop at Wheal Coates [190375] make it seem almost certain that minerals have been extracted from this site over a very long period of time: currently the earliest documentary references date from 1692, when the records of the Enys family detail the sale of mining materials to local adventurers. Evidently underground mining was already in progress as the source specifically references the sale of '*candells*', '*coales*', and '*roape*', materials which would not be needed if operations on the lodes were by openwork alone. A tin bound for Wheal Mapp [190396] just to the south in 1720 refers to *Wheal Coats old addit* (sic); it would seem that the mine was already considered relatively ancient by this date. There are also sketch maps of 1792 showing the inter-relationship between Wheal Bungay and Wheal Coates (CRO WH-2090, 2091-1 and 2091-2) which suggests that there was a need at the time to more accurately determine the exact location of what seems to have been a modified boundary between the two mines. Unfortunately, it is difficult to reconcile these with the modern mapping, though the 1792 plan suggests that the mine was drained via two adits, a second opening lying on the cliffs well to the north of Towanroath Vugga, probably somewhere just to the north of Tubby's Head. A late 18th century bounds map CRO EN/1381 marked Wheal an Nithan, Little Wheal Coates [190275] and Sherrick's Bounds to the north of the openworks and outcrop workings, Wheal Coates in the area of the openworks together with Good Fortune [190366], Wheal Level [190419], Wheal an Nap [190396], Wheal Uny [190406], Wheal Drunckard [190427], Wheal Rock [190411] and Wheal Hope [190452] between Wheal Coates and Chapel Combe.

In 1791 a sett agreement was drawn up between the then mineral lord: Sir William Lemon, Bar^{t}., and a gentleman from St Agnes: Mr. John Tregollas Jun^{r}, and in 1804 the mine appeared on maps as *Wheal an Coates tin mine*. The mine appears to have been

active in 1815 together with others, as is evinced by a sale of shares published in the *West Briton* at the end of March for that year and was again mentioned seven years later. By 1828 the mine had acquired a steam engine, and the workings were down to 135m; accounts continued to be kept for the period 1839-42. In 1844, however, the mine was sold up, together with the 60" pumping engine and the remainder of the equipment, and it is evident that all the sub-surface materials were recovered, and the mine was allowed to fill with water.

Some work seems to have continued above the natural drainage level until 1847, when 133 persons were recorded as still at work on the mine. The engine appears to have remained unsold until at least December 1849, for it was again advertised for sale in that year. Work appears to have continued in a desultory fashion above the water table through to 1856, and in 1858 the sett was taken over by John Taylor and Sons. Spargo's map dating to 1870 suggests that the mine was functioning at this date, the main focus of works being adjacent to Beacon Drive, where a surviving chimney marks the location of the original pumping engine house. The dressing floors were located near the western end of the rock-cut section of the openwork at the northern end of the site.

The mine was once more restarted on 19th of October, 1872 with a 36" pumping engine on Towanroath Shaft [190390] (Figs 34–37, 89-97); a 24" combined stamping and winding engine [190381] (Figs 20 to 26, 71-79) was started in the following year in a new engine house at the top of the cliff. The OS 1st Series 1:2500 mapping (dating to *c*1877) indicates an extensive dressing floor [190384] to the west of the stamps engine house incorporating a large number of buddles and other unspecified machinery (Figs 43, 102), as well a small 'burning house' with a short flue [190348]. Work stopped at about this date, however, operations being curtailed in March 1877. The mine was suspended in February, 1879, and the company was liquidated. Work, however, resumed in January of the following year, a new all indoor beam whim [190378] (Figs 14-18, 67-70) being installed in 1880. This period of reworking appears to have lasted only three or four years, and that rather intermittently, the lease being again for sale after the liquidation of the company in late 1881. The mine was taken over by a new cost book company in 1882, but seems to have been poorly run during a time of declining tin prices, and work lapsed during 1883. With the exception of a 'call' on shareholders in August 1884 for funds to purchase a new and larger pumping engine, a few reports from 1888 were the last that was heard of the company. The mine was advertised for sale on 2nd June 1887 with its machinery as a going concern. Dines (1956) mentioned some small-scale work on site until 1889 and there are output figures for both 1888 and 1889. A very small scale working of the mine (very likely of dump material) took place between 1901-2, probably associated with the small-scale waterwheel, stamps and buddle floor [190340] at the northern end of the site (Figs 30–33, 87-88).

In 1906, prospecting was undertaken on the site, and in 1910 an attempt was made to unwater the workings using a steam pump [190391] brought from Wheal Merth, Lelant, sited inside part of the old boiler house [190392] attached to the Towanroath pumping engine house (Figs 38-40, 98-99). A 12" twin cylinder horizontal steam winder was installed in a new winder house [190376] at the top of the cliff slope (Figs 13-14, 18-19, 60-66), whilst a Tangye producer-gas 32 horsepower engine [190379] was set up to drive ten heads of Californian stamps (Figs 42, 101, 103-105), though these were apparently never used, all ore dressing being undertaken at a water-powered dressing floor and mill in Chapel Combe. A small calciner [190346] (Figs 27-29, 80-86) was constructed to burn off the arsenical content of the ores, and other buildings were refurbished or rebuilt.

The mine was bedevilled by problems throughout this period of working, most of the company's capital being spent on unwatering the flooded workings. By 1914, the accumulation of a number of adverse factors coupled with a fall in the price of tin and the outbreak of the Great War finally closed the mine, the Duchy of Cornwall as landlords seizing the majority of the equipment as distraint for arrears. The mine was allowed to fill with water, and all the machinery was cleaned and left ready for a possible future

reworking. Within a couple of months, however, all the remaining materials were salvaged. Unsuccessful efforts by Mr Sawle, the former manager, to raise interest in a reworking of the mine continued until 1929.

5.2 Site 2: Charlotte United and Old Century Works

5.2.1 Charlotte United Mine

See Figures 7-9, 54-59, 119-128.

Charlotte United mine was centred about half a mile from the coast on the southern side of Chapel Combe. Archive plans of the mine are thin on detail, though the mine appears to have worked three parallel copper lodes. Charlotte United is recorded (Dines 1956) as having produced 23,100 tons of 8½ % copper ore between 1820 and 1856. New Charlotte or North Towan [190698] is recorded as having produced 3 tons of black tin in 1870, when it was shown on a plan. There is a prospectus for the opening of Charlotte United dating to 1875.

The names used for this mine are the subject of some confusion, the Trevithick Society website suggesting that the mine was known as North Towan in 1806, when it was the subject of a short period of working, the steam engine and mine materials being offered for sale in the Royal Cornwall Gazette on the 17th March 1807 and again in the following March. It was re-opened in the 1830s as New Charlotte (though was shown as North Towan Mine on a map of the Manor of Tywarnhaile dating to 1846 – CRO AD-145-32) and was renamed Charlotte United in 1877, though was shown as *'Charlotte United Mine (tin and copper disused)'* on the 1878 1st Edition OS 25" mapping (Fig 7). Almost all of its buildings were dismantled in the following years and their sites are now very overgrown. The property was acquired by the National Trust in 1956.

5.2.2 Old Century Works

See Figures 10-12, 46-53, 111-118.

In September 1847 the lower and higher stamping mills at Chapel Porth, both '*now or lately occupied by the Wheal Rock adventurers'*, were advertised for lease, with the taker of the higher stamps required to covenant to 'put up a new Wheel within one year' (*Penzance Gazette,* 22 September 1847). An advertisement during the previous year for the Chapel Coombe stamps indicated that they were then in the hands of the 'Wheal Charlotte or North Towan Adventurers' and the 'Wheal Coates Adventurers' (*Royal Cornwall Gazette,* 23 January 1846).

In May 1867 localised heavy rainfall produced a flood in the Coombe which

> '*broke in on the stamping mill premises of Messrs Bryant and Waters so suddenly that those employed had great difficulty to make their escape without being washed down with the flood. From these premises about a ton of tin, together with some hundreds of tons of debris, were in a few minutes washed away . . .*' (*Royal Cornwall Gazette,* 16 May 1867).

The higher and lower stamps at Chapel Coombe are marked on Symons' 1870 map (CRO LC-XIII-6) and as clusters of buildings on the OS 1st Series 1:2500 mapping (dating to *c*1877) (Fig 10). The lower stamping mill was advertised for lease in 1885, at which time it was said to have been 'recently worked, and is in good condition' (*Royal Cornwall Gazette,* 19 June 1885). However, the advertisement also suggested that in addition to stamping ore the mill could be used for 'bone crushing, or for any similar industry' and it seems probable that it finally ceased operation at about this time. Both stamps sites appear to have been out of use by the time the 2nd edition Ordnance Survey map of *c* 1907 was surveyed (Fig 11). Those in the mid-point of the Combe [190510] were the last to work, being named as the 'Old Century Works' on a postcard in the Benney Archive.

6 As built drawings

See Figures 60 to 127

6.1 Site 1: Wheal Coates

Asset 1 (NT Ref: 190376)

Wheal Coates Horizontal Engine House, part Refs 4001-4011

Asset 2 (NT Refs: 190378 190377)

Wheal Coates Beam Whim Engine House and Boiler house, part Refs 1001-4011

Asset 3 (NT Ref: 190381)

Wheal Coates Stamps Engine House, refs 4030-4038

Asset 4 (NT Refs: 190346 190349)

Wheal Coates Calciner and Calciner Flue, refs 4040-4046

Asset 5 (NT Ref: 190340)

Wheal Coates Tributer's Stamps and Waterwheel Pit, refs 4050-4051

Asset 6 (NT Ref: 190390)

Towanroath Engine House, refs 40560-4068

Asset 7 (NT Ref: 190391)

Wheal Coates Lower Horizontal Engine House, part refs 4070-4071

Asset 8 (NT Ref: 190392)

Wheal Coates Lower Boiler House, part refs 4070-4071

Asset 9 (NT Ref: 190385)

Wheal Coates Dry, ref 4090

Asset 10 (NT Ref: 190379 190384)

Wheal Coates Gas Engine House with associated structures and Dressing Floor Walls, refs 4100-4104

Asset 11 (NT Ref: 190343)

Wheal Coates Mine Smithy, refs 4110-4114

6.2 Site 2: Charlotte United and Old Century Works

Asset 12 (NT Ref: 190510)

Old Century Works, refs 4120-4124

Asset 13 (NT Ref: 190616)

Charlotte United, refs 4130-4139

7 Method statements

7.1 Archaeological works

All recording work was undertaken according to the Chartered Institute for Archaeologists *Standards and Guidance for Archaeological Investigation and Recording.* Staff will follow the CIfA *Code of Conduct* and *Code of Approved Practice for the Regulation of Contractual Arrangements in Archaeology.* The Chartered Institute for Archaeologists is the professional body for archaeologists working in the UK.

7.1.1 Fieldwork: survey

With the exception of Old Century Works, all buildings had previous recent archaeological measured surveys, including plan and elevation detail (see Kirkham, Sharpe and Spalding Associates 2010). During the course of conservation works additional measured information and detail was added as appropriate to copies of these existing drawings.

The Old Century Works was the subject of a new measured survey, including an overall plan and elevations of surviving walls. This survey was carried out by a commercial survey contractor, though its results were added to, annotated and interpreted by the CAU archaeologist.

7.1.2 Fieldwork: photographic recording

This consisted of colour photographs taken with a digital SLR camera (with a minimum resolution of 8 million pixels).

The photo record comprised:

- General views of each accessible elevation, taken before conservation works were undertaken.
- Examples of structural and architectural detail, including during conservation.
- General views of each accessible elevation following the completion of works.

The methodology for the archive standard photography was as follows:

- Photographs of details were taken with lenses of appropriate focal length.
- A tripod was used to take advantage of natural light and slower exposures.
- Difficulties of back-lighting were dealt with where necessary by balancing the lighting by the use of flash.
- A metric scale was included in all views, except where health and safety considerations make this impractical.

7.1.3 Consultancy

The CAU project officer attended a pre-works meeting with the landowner, Natural England officer, contractors and structural engineer to agree site access, site compound, stockpile areas, agree details of location/preparation/number of mortar test panels, agree working methods and any changes to the proposed work programme and to discuss Health and Safety issues with NE requirements (in order to minimise damage to known or unknown sub-surface archaeological features).

The CAU project officer regularly liaised with the project's stakeholders (landowners, CC's Historic Environment Countryside Advice Officer, and the NE Officers), using the mechanism of regular update emails.

The CAU project officer provided historic building conservation advice to the site engineer and site contractor in line with English Heritage guidelines, during regular weekly site visits.

The CAU project officer attended regular site meetings at an approximate frequency of 0.5 day per week during the building contract. The meetings were held with the site engineer, site contractor, client and NE (as appropriate) to discuss ongoing conservation work methods, detail of repairs and resolve any conservation work problems. The structural engineer and site contractor had a proven track record in historic building conservation.

The CAU project officer ensured that site conservation works were carried out in accordance with best practice, and would have halted inappropriate or sub-standard work and informed the stakeholders.

7.1.4 Fieldwork: historic building recording

Detailed recording was undertaken for all newly exposed architectural features and any features revealed during the course of the conservation works. Measured detail was added, where appropriate, to the existing survey drawings.

As well as new detail, the nature and extent of all conservation works was added to the existing archaeological/engineering building survey drawings by the Structural Engineer

(supplied to CAU by the client), as part of the CDM regulations (provision of 'as built' survey drawings).

7.1.5 Fieldwork: archaeological recording

Archaeological recording was undertaken during any ground disturbance that revealed archaeological features. Recording was undertaken using a mix of direct measurement, sketch plotting and photography, as appropriate (constrained by safety factors).

The archaeological recording report was enhanced by the structural engineer's 'as built' survey drawings detailing the nature and extent of building conservation works. 'Before' and 'after' photographs were also used to graphically illustrate the site conservation works.

Where significant remains were encountered the archaeologist was to be given the opportunity to make an appropriate form of record before work proceeds; where a temporary stop of work would have been required to undertake this, the site archaeologist had the right to make a request via the project engineer and landowner.

7.1.6 Creation of site archive

This included:

- Digital colour photographs (stored according to historic environment guidelines and copies of images made available to the National Trust).
- Preparation of finished drawings.
- Completion of the English Heritage/ADS OASIS online archive index.

7.1.7 Archive report

A written report (this report) includes:

- Summary
- Project background
- Aims and objectives
- Methodology
- Location and setting
- Designations
- Site history
- Archaeological results
- Conclusions
- References
- Project archive index
- Supporting illustrations: location map, historic maps, plans, elevations/sections, photographs.

A digital (PDF) copy of the report, together with all relevant illustrations and other files has been lodged with the Cornwall HER. Paper copies of the report have been distributed to the client, to local archives and national archaeological record centres.

7.1.8 Archive deposition

An index to the site archive has been created and the archive contents prepared for long term storage, in accordance with HE standards.

The archiving comprises the following:

1. All correspondence relating to the project, the WSI, a single paper copy of the report together with an electronic copy on CD, stored in an archive standard (acid-free) documentation box.
2. A2 drawn archive storage (plastic wallets for the annotated record drawings).
3. Archive standard negative holders and archive print holders, to be stored in the HE system until transferred to the Royal Cornwall Museum.
4. The project archive, deposited initially at ReStore PLC, Liskeard and in due course (when space permits) transferred to Cornwall Record Office.

8 Repair philosophy

8.1 Design statement

This document provided a review of the approach to the design and method of reconstruction to meet the requirement for stabilising and consolidating the existing stone masonry structures.

8.2 Design philosophy

All designs were prepared with the aim of minimising the invasive nature of any repair techniques and to employ as far as possible materials and methods of work in keeping with the original construction.

The intention of the works was for the existing structures to be consolidated in such a way as to ensure that the buildings retained their current integrity for the foreseeable future and that further decay and damage was halted.

A further intention of the project was that the buildings became more legible and 'readable' by the general public and therefore, where possible within the cost restrictions of the project, it was intended to further expose and explain their original construction features and floor plans.

8.3 Structural philosophy

The primary forces acting on the structures in their current state are gravity and wind loading. Over time, the erosion of the stone masonry through wind and rainwater has had a deleterious impact upon the integrity of the stone masonry and the work was aimed at reinstating as far as possible, the homogeneous nature of the masonry construction.

For the purposes of design loading, it has been assumed that all structures will be required to perform under the following criteria:

1. To resist overturning moments arising from any out of balance profile of the structures.
2. To resist wind loading.

8.4 Materials utilised

All consolidation work was based upon the following primary materials:

1. Pointing and hearting mortar based on lime.
2. Stainless steel in the form of wire rope, mesh and rod, together with appropriate fixings where required.
3. Oak timber for lintels and inset timbers.

8.5 Codes of Practice and Guidance

In the main, a decision upon the method of stabilisation and structural remediation was based on a combination of experience and an understanding of the structural performance of masonry buildings.

For reference purposes, the team consulted with the guidance provided by English Heritage in their published handbooks '*Practical Building Conservation'*, British Standards, and various technical guides provided by SPAB.

9 Summary description of works undertaken

A preliminary assessment of the conditions of the buildings at Wheal Coates, the Old Century Works and Charlotte United had been undertaken during the assessment carried out by Kirkham, Sharpe and Spalding Associates in 2010, allowing a prioritised schedule of works to be drawn up with the National Trust Property Manager for the St. Agnes properties. Further condition assessments were made of the structures by pdp Green during Phase 1 of the project, allowing the production of a list of 'necessary' and 'desirable' works to be produced for each structure. These were then re-assessed against the budget which would be available during Phase 2, taking into account the tender returns. It was recognised at this stage that at two sites in particular: the Old Century Works and Charlotte United, the schedule of works might be subject to variation once on-site scrub vegetation had been removed; further potential variations might arise following detailed inspections of structural stonework and incorporated timbers on some of the engine houses, as some of these could not be inspected in detail until suitable access provision had been put in place.

At the higher Wheal Coates site, a proprietary treatment was applied to all incorporated timber exhibiting any woodworm or rot. Within the beam whim engine house, a lintel was replaced over a blocked doorway, as was a substantial supporting timber within a machine pit. In the horizontal whim engine house, minor rebuilds were carried out to a wall end and to an eroded cill and tell-tales were added along a crack to determine whether this feature was moving, whilst within the boiler house new stonework was used to underpin the party wall with the horizontal whim engine house.

At the stamps engine house, the cill to the cylinder doorway was rebuilt, and limited underpinning of the cylinder bedstone undertaken. Minor repairs were carried out to a window cill and around the steam pipe opening, whilst the eroded section of the cobbled former stamps tramway was stabilised.

Minor works were undertaken to the gas engine house to stabilise two small sections of walling, but the proposed works to the dressing floor retaining walling and to the smithy were omitted.

At the double-bayed arsenic calciner, minor erosion damage was repaired on a window cill and at the threshold of the doorway which formerly led into the upper chamber, an iron lintel to the internal chimney was replaced and all incorporated timbers were treated against rot and woodworm.

In the lower part of the Wheal Coates site, no works were undertaken to the horizontal engine house, the nearby boiler house and the remains of the dry adjacent to Towanroath Shaft. The shaft grille was replaced and tell-tales were installed on cracks in the pumping engine house walling to monitor potential movement along cracks which had developed in them.

The tributers' stamps and wheelpit were cleared of scrub vegetation, following which lost masonry was replaced where this was required to confer stability to the remains, and the whole of the structure was repointed.

The majority of the works during Phase 2 of the project were focussed on the Old Century Works in Chapel Coombe and on the engine house and boiler house at Charlotte United further up the valley.

Following the removal of extensive scrub growth across the whole of the Old Century Works site and the exposure of its remaining components, including a number of machine plinths, a topographical and elevation survey was undertaken. Following the clearance of rubble from in and around the wheelpit and adjacent calciner, the structural remains in this western part of the site were consolidated and repointed. A

limited number of further surviving structures on the site were also stabilised and repointed. Access to the site was also improved.

The Charlotte United site was the subject of considerable work, as once its obscuring scrub and other vegetation had been removed it was found that the boiler house was in particularly poor condition, whilst the engine house also required some attention to prevent any further collapse. Rubble was removed from within the boiler house, revealing detail of the boiler under-flue in the process. Following a structural inspection, some reconstruction of the walls (particularly around their openings) was undertaken and their elevations were fully repointed. On the engine house, some limited rebuilding of the cylinder doorway reveals was carried out to stabilise the adjacent chimney; a stub lintel was installed in the new masonry and additional stonework added above this to support the remains of the rear wall of the engine house. Limited consolidation of the plug doorway and window cills was also undertaken. Some replacement lintels were required (for example, in the inner face of the bob wall), together with the reinstatement of stonework which had lost the support of the former failed timberwork. Patch pointing was undertaken on the engine house walls and on the lower section of the chimney, and all timberwork was treated against worm and rot.

10 Asset summary

Throughout this section the initial paragraphs of descriptive text are derived from Sharpe et al 2010.

10.1 Site 1: Wheal Coates

Asset 1 Horizontal Engine House

HBSMR number: 190376 SW 69992 50040

See Figures 6, 13-14, 18-20, 60-66

A rectangular building, constructed in 1910 to house a twin-cylinder horizontal winding engine to replace the all-indoor beam whim used in the previous workings, but re-utilising its boiler house [190377].

Of shillet and mine waste construction without quoins. Its internal dimensions are 7.35m x 6.0m with walls 0.6m thick. The rear gable (to east) is 5.0m high with a central doorway 2.2m high and 1.0m wide with three timber lintels over (now showing some signs of woodworm) and a window offset to the southern end of the wall with a cill at 0.8m above floor level which measures 1.3m x 0.8m (measured to apparent location of original lintels). The side walls (north and south) average 2.2m high. The southern wall contains a boiler house door at its western end, this being 1.1m wide x 1.9m high. The cill of this doorway has been broken away somewhat. There are two elongated slots against of the northern and southern walls, these being 0.94m wide, 1.45m deep and 7.15m long. The southern slot extends underneath the western wall of the whim engine house for its full width of 0.55m and has timber lintels over at this point. There are two windows in the eastern elevation with their cills at 0.85m from floor level, the original heights were about 0.95m and the windows are 1.9m wide. The western wall would have incorporated the whim cables opening, which would have been closed off in planking; the opening in this face is 2.0m wide, though the probable removal of the machinery through this opening has resulted in some parts of the wall being demolished in the process. A white brick 'honest repair' undertaken in 1999 was undertaken to pick up unsupported masonry. The wall survives to 2.2m high, the height from internal floor level to external ground level being 1.13m. The floor is of concrete throughout, and incorporates a large square pit (possibly from brake and other gear) and a shallow pit to the west which would have housed the whim drum. This has a curving base and measures 2.3m x 1.7m x 0.6m deep.

PDP Green observations

This structure was constructed in or just after 1906 to provide the means to wind ore from Towanroath Shaft via an inclined cliffside tramway, the nearby all-indoor beam

whim having been scrapped some years previously. The structure consists of an uncoursed single storey gabled masonry structure whose interior is infilled to a depth of an average of 1.1m with a mass concrete plinth which incorporates the engine mounts and a series of machine pits.

The consolidation of the structure in 1986/7 included limited patch pointing where mortar loss had been significant, the construction of a panel of white brick in the western face of the building to support a potentially unstable overhanging section of this wall, the re-setting of some masonry cills, the capping of the wall tops and the replacement of decayed timber lintels.

Conservation works undertaken

- Treat woodworm in timber components;
- Localised repointing as drawings (average nominal 10%);
- Consolidate small localised areas of loose stonework;
- Consolidate cills;
- Re-build undermined area of SE corner (facing into the boiler house).

Asset 2

Beam Whim Engine House

HBSMR number: 190378 SW 69984 50035

See Figures 15-17, 60-61, 63, 67-68

An originally hip-roofed building of shillet and mine waste construction, without quoins, constructed in 1880 to house an all-indoor beam winding engine. The engine was removed on the closure of the mine in 1889, and on the reopening of the mine in 1910 a replacement engine house for a twin cylinder horizontal winder [190376] was constructed nearby, reutilising the original boiler house [190377].

The walls of the engine house are more or less complete to wall plate level. Demolition to remove the engine on the closure of the mine resulted in the removal of the axle loading and the infilling of the whim cage pit, which would have been to the east of the house. The walls survive to an average of 4.0m high off the internal floor level. The eastern wall is 5.0m high and has a blocked doorway at its centre with its cill 0.3m above the present floor level internally, making the door 2.55m high and 1.05m wide. The original timber lintel over the door has five equally-spaced nails set into its length. The lintel is of pine and is in good condition. The window at the head of the wall has been somewhat truncated by the loss of building fabric; this opening appears to again have been 1.05m wide and had splayed reveals, but only 0.4m of the depth of the window survives. The southern wall contains the (blocked) boiler house door measuring 0.9m wide, its cill appears to be about 0.7m above the internal floor level, making the door 2.55m high. An original timber lintel incorporated into the wall has some minor splitting but otherwise in good condition. The beam support timber opening is inaccessible, but appears to be 0.35m square. There are two joist pockets near the ends of the south wall at 3.8m above floor level, these being 0.3m x 0.2m in size. The southern wall is just under 6.0m high from the internal floor level.

There is a pit on the south eastern corner of the floor measuring 3.0m x 1.6m in plan and 1.8m deep with two 1.5m square vertical hold down bolt tunnels on its northern side. Near the base of the pit the bolts would have run through a timber cill beam with its base 300mm off the top of the current infill to this pit. There is a pair of openings 300mm high and 300mm wide at the base of the pit which would have provided access to the hold down bolts. A plinth traverses the engine house from north to south near its central point and is 1.35m wide. To the west of this is a T-shaped pit marking the original location of the cylinder, this being 1.05m wide x 1.9 m deep, off this an extension 1.25m long x 1.0m runs to the west.

In the eastern wall at floor level and immediately above the cylinder pit is a narrow diagonal opening 1.0m high and 0.5m wide with a rusty iron lintel which would have carried a cylinder drain pipe. Also in the northern wall are the remains of a possible

opening now 1.6m wide through which the whim axle would have passed. The broken opening runs to the full height of the wall and is likely to be the result of demolition of the central section of the wall to remove the machinery. The blocked steam pipe opening in the SW corner of the building is 400mm x 300mm high and topped with a corroded iron lintel. In the western wall just off the centre is a window opening with four timber lintels, the window having splayed reveals and measuring 1.4m wide internally and 1.5m high. The cill of the broken opening in the northern wall is 0.5m above external ground level. Externally, there is a narrow plinth course 0.13m wide and a maximum of 1.7m above ground level around the whole of the building. The maximum height of the building is on the south side where it abuts the associated boiler house. The blocked boiler house door has its cill at the plinth course and is 2.2m high. This has some rough quoining and a timber lintel. The blocked rear (eastern) door is partly obscured by the western wall of the horizontal whim engine house and only 0.55m of its width is visible.

PDP Green observations

A hipped-roof building housing the whim engine installed in 1880 to take over one of the functions of the original stamps/whim engine house and standing just upslope from it at the head of the incline to Towanroath Shaft further down the cliff slope. This engine became redundant in 1884 and was sold, together with the rest of the machinery on the mine, in 1887. The building would have been unroofed at this time, whilst the removal of the engine components necessitated the demolition of a substantial section of its northern wall. The engine house was not re-used in the reworking dating from 1906, it being replaced by a new structure just upslope housing a twin cylinder horizontal winding engine. The whim axle loadings to the north of the building would have been demolished and the whim cage pit adjacent to the wall infilled at this time.

The structure was conserved during 1986/7, the works including the excavation of the interior of the building under archaeological supervision, wall capping, patch pointing where mortar loss had been significant, the replacement of small sections of missing masonry where required to reinstate structural stability and the replacement of a number of badly-decayed timbers using treated softwood.

Conservation works undertaken

- Treat woodworm in timber components;
- Replace lintel in outer face of east doorway;
- Replace timber baulk in machine pit;
- Consolidate small localised areas of loose stonework;
- Consolidate and re-bed wall tops;
- Localised repointing;
- Consolidate cills.

Boiler house

HBSMR number: 190377 SW 69989 50032

See Figures 17, 60, 62, 69-70

A boiler house was constructed in 1880 to serve the all-indoor beam whim engine and stamps engine and was subsequently (1910) adapted to provide steam for the nearby horizontal whim.

It measures 16.55m x 3.55m wide internally at its western end, though is now wider (at 6.0m wide) where it abuts the horizontal whim engine house. It may be that the northern section of the eastern wall was demolished when the horizontal whim was constructed. There are traces of some stonework more or less continuing the line of the southern wall of the all-indoor whim engine house to the east of its south–eastern corner, though this is only to about 500mm high, is of a different construction style from the engine house and on a slightly different line. The area between this walling and the horizontal whim engine house has been infilled with rubble, possibly

deliberately. An internal step matches the plinth course on the exterior of the all indoor whim, this averaging 1.45m above the ground level within the boiler house. The walls above the plinth course survive to 0.8m though are more typically between 0.45 and 0.6m high, in many cases this being close to or only just above prevailing ground level, particularly on the southern side of the building, all masonry above this level having been demolished on the closure of the mine and the recovery of materials. The highest standing section of the boiler house is at its western end where it is 3.7m high. There are traces of pointing around the original door frame on this wall reveal, the door being 2.68m wide. The boiler house had a window (or coal chute) in the south wall 2.8m in from the south-west corner, the cill being at 0.9m from ground level, 1.85m long and surviving to 0.7m high. At the eastern end of the building the flue runs out diagonally towards the chimney, but has lost its capping and can be traced for the first 1.5m after which it appears to have been infilled.

PDP Green observations

The elongated boiler house (16.55m long x 3.55m wide) to the south of the all-indoor beam engine house not only served the original whim engine but was probably partly re-used to site the steam generation plant for the later horizontal winder. It is likely that the original eastern section of the northern wall of the boiler house was demolished during this phase of working of the site. The upper section of most of the walls of the boiler house have been demolished to between 0.95m high and 1.35m high; over most of their length on the southern side these remnant walls revet the cut into the ground in which the boiler house was set. The eastern wall is now only 0.5m high and incorporates the first 1.5m of the 0.45m wide flue path; the remainder of the flue running towards the nearby chimney cannot be traced and has either become buried or has been collapsed. A short section of low revetting walling runs east from the south-east corner of the all-indoor beam whim engine house and appears to date from the early 20th century re-working. This revets a rubble infill and is of markedly poorer construction than the remainder of the walls of the building, as well as being on a slightly different alignment.

No works were undertaken to this structure during the 1986/7 conservation works. The pointing is in good condition but would benefit from the re-setting of the wall head masonry in lime mortar to limit water ingress to the wall cores and to stabilize these elements of the structure which are walked over by visitors.

Conservation works undertaken

- Rebuild reveals to flue opening where used as footpath access;
- Localised repointing where stonework lost or loose.

Asset 3 Stamps Engine House

HBSMR number: 190381 SW 69964 50039

See Figures 20-26, 71-79

Constructed in 1872/3 to a design by Michell of Redruth, though adapted to suit the site, the engine house was originally designed to both power the stamps and wind from Towanroath Shaft to the west via an incline down the cliff slope. After a short period of operation in this dual function mode, a new purpose-built winding engine house [190378] was constructed nearby, the boiler house adapted so as not to foul the incline road and the engine thereafter powered only the stamps, continuing in this role until the closure of the mine in 1887 when the engine was scrapped.

The south-eastern corner plinth course is 300mm above ground level. On the downslope, western end of the building, the sloping ground means that the plinth is 2.8m above ground level. There are two arch-headed ground floor windows in the southern elevation, both having two courses of brick headers and splayed reveals, partial brick quoining, being 900mm wide and 1.25m high to the springings. The cill of the westernmost opening has been partly infilled, that of the easternmost has been partly lost. The steam pipe opening is below the eastern end of the eastern window in

this elevation and measures 400mm wide x 750mm high. The wall thickness of this elevation at this level is 750mm. There are two symmetrically-placed middle floor windows, the easternmost being arch-headed in two courses of stretcher bricks with splayed reveals, the westernmost originally-arch-headed window was enlarged to the west and upwards during the 20th century reworking of the mine and now has a timber-lintelled head. The girder opening is above the middle floor eastern window and has three timber lintels in good condition and measures 400mm square. A pair of arch-headed windows on the bob loft are again symmetrically-placed and of similar dimensions and design to the others in this elevation. Below the western ground floor window at ground level is an opening 1.15m high and 0.42m wide extending through the full thickness of the wall. This connects with the cataract pit and has stone lintels internally and externally.

Wall construction is of un-coursed mortared killas and mine waste. There are three tie bolts at the western end of the wall, these being set immediately behind the bob wall, a closely-set pair at the level of the head of the second floor windows with a pair of boiler plate patrasses; below this just below the level of the base of the 2nd floor windows is a second pair, the easternmost having lost its patrass plate. A pair of hook bolts, one being just above the arch of the western ground floor window and just to the west of its centre; a second is about a metre to the west and set 1.5m lower down. About 750mm above the plinth course and 1.5m back from the face of the bob wall a rusty iron bar protrudes from the wall. The profile of the wall head on this elevation is slightly ragged there having been about 350mm of stone loss at the eastern end of the wall.

The rear wall which is 0.75m thick contains the rather narrow cylinder doorway (doubling as the boiler house door) 1.21m wide and 1.94m to the springings and has three courses of brick headers. The middle floor and upper floor windows are centrally set, whilst the cylinder arch is offset to the south. The middle and upper floor windows have two courses of brick headers in their arches, splayed reveals with brick long and shortwork quoining. The spring beam openings are about 0.4m square and are set between the middle and upper window; these extend fully through the wall. The top floor window appears to be slightly narrower than the middle floor window. Most of the northern part of the gable masonry has survived, though there has been some loss to the west. 0.5m to the north of the cylinder arch at the base of the wall is an opening 0.75m wide and currently 0.2m high with a masonry lintel which was probably the steam pipe entry. This suggests that the floor of the boiler house was originally below the current ground level and has been infilled.

The chimney is on the north-eastern corner of the house and has been built into it, though the masonry used for its construction is of a rather better quality than that used in most of the rest of the house. The chimney is truncated and its brick cap has been lost. The northern elevation includes a stone-lintelled opening measuring 0.86m x 0.44m wide near ground level – this matching the equivalent opening in the southern elevation. Above and forward of this an enlarged opening now 0.75m wide and 0.5m high with a stone lintel on its outer face. There appears to have been some stone loss at the eastern end of the original opening, which would have been about 0.4m wide. There is a single, centrally-placed ground floor window of similar design to those on the southern elevation. Above this the western middle floor window has again been modified and is now lintel-headed. The girder opening is 0.4m x 0.4m and has been slightly infilled. There are two patrass plates at a level half way between the middle and ground floor window openings – again these are of crude boiler plate fabrication. Only a small part of one top floor arched window survives, as the western section of this wing wall has collapsed. Some remnant inscribed false coursing is visible on this wall adjacent to the junction with the chimney.

The bob wall is to the west and is relatively plain, being almost entirely constructed of squared off mine waste. The loadings have been removed almost entirely, leaving only a pair of large stones projecting on the southern side of where these would have been sited and the scar where the loadings were removed was patched in. The plug door is

square-headed, 1.1m wide; its cill has been repaired. It is spanned externally and internally by stone lintels with a timber lintel between these. The fallen section of the wing wall has been mortared into place on top of the bob wall. The wing walls have erection steps at their heads; the western section of the southern wing wall above bob wall top height is leaning in slightly. Internally, most of the bedstones have survived, the maximum spacing between opposed bolt holes being 1.0m. Most of the remaining areas of the floor are lower than the bedstones, particularly to the north and sections of the leading edge of the upper part of the stepped cylinder plat seem to have been lost.

The eastern wall incorporates the cylinder opening and the two windows. Half way between the head of the cylinder opening and the base of the first floor window opening is an incorporated timber 0.07m thick, apparently in good condition. The base of the middle floor window has been cut into to construct a brick-faced socket 300mm x 300mm in size, but has been blocked in on the outside. Between the middle and upper floor windows are the openings for the spring beams and top floor joists, the inner pair being about 350mm square, the outer pair narrower – about 250mm wide x 300mm high. These have paired timber lintels over which are about 0.075m thick in good condition.

The northern wall incorporates the paired holes in the cataract pit which has been infilled to about half its depth with rubble and small stones. The forward hole is an enlarged original and has a pair of 50mm thick timber planks forming the inner lintel. This opening lines up with a pair of pockets in the north wall inner face, one set at the leading edge of the cylinder plat, the second half way between this and the east wall. These have 50mm thick timber lintels. Above this are another pair of pockets at the level of the springings of the middle floor windows, the westernmost measuring 250mm x 300mm with a 50mm thick lintel, the eastern is 300mm square with a 75mm thick lintel. An infilled socket in the NE corner of the building lines up with these and has a half-round timber lintel over it. A probable fourth infilled timber socket in the NW corner of the building at this level also has a timber lintel. At the level of the head of the ground floor window, a 50mm thick incorporated timber extends to the rear face of the east wall. There are two pockets mid-way between the ground floor and the middle floor windows, one in the NW corner of the house is 400mm high and 300mm wide with a granite cill and lintel. The second over the leading edge of the cylinder plat is 300mm square. Immediately below this is an incorporated timber and a patch of brickwork 300mm square, probably an infilled wall pocket. At the leading edge of the middle floor window are three incorporated timbers each 50mm thick leading from the new brickwork to the rear face of the bob wall. At its eastern side a timber leads from the springings of the window back to the east wall. Above the girder opening is a 100mm step. The girder opening is 400mm x 300mm and has two timber lintels in rather poor condition. There has possibly been some stone loss over the girder opening. Intersecting the middle of the upper floor window is another incorporated 50mm thick timber which runs to the east wall. The bob wall is plain internally with a granite lintel over the plug door and some incorporated timbers immediately over this.

The internal elevation of the southern wall matches that of the northern wall although there has been some significant stone loss between the base of the eastern ground floor window and the opening below and to its east. The iron lintel above this ground level opening is now very corroded and the inner timber lintel has gone. The incorporated timbers in this internal elevation match those in the northern wall. At the springing line of the ground floor window are incorporated timbers which span a wall pocket at the eastern end of this elevation. A full length timber runs from the crown of the western middle floor window back to the east end of the wall. There are three timbers just above the spring line of the middle floor windows. Masonry around the socket for a joist in the south-western corner of the wall has been repaired. There is an incorporated timber running across the crown of the eastern middle floor window matching that on the opposite wall.

PDP Green observations

Of conventional design and construction, this beam engine house was constructed in 1873 to provide both haulage power to draw ore from the mine and to power the stamps at the head of the dressing floor. In 1880 a new all-indoor beam whim engine took over the first of these functions. The mine effectively ceased operations in 1884 and the machinery was sold off in 1887. In 1906 the mine began a phase of reworking during which the new stamps were powered by a producer gas engine housed to the north of the old stamps engine house. It is suggested by some sources that the stamps engine house was converted into an ore bin serving the new stamps.

Although the middle floor west windows of the building were remodelled and the flywheel loadings to the west of the engine house were removed at this time, there is little other physical evidence to support this notion.

The structure, which is of un-coursed mine waste rubble and killas (with the exception of the bob wall, which incorporates a high proportion of squared mine waste) and incorporates a chimney in its north-eastern corner was conserved in 1986/7, the works including minor structural repairs, patch pointing using a lime based mortar, wall capping and the replacement of some structural timberwork. The stones representing the section of the northern wing wall which had collapsed onto the bob wall head were mortared in position to prevent them becoming a hazard to visitors, the alternative having been to remove them.

The majority of the building is in good condition, having been the subject of considerable attention in 1986/7, though some of the structural timberwork is beginning to deteriorate and it is now felt more appropriate that the fallen stonework on the bob wall should be removed.

Conservation works undertaken

- Survey and, if necessary treat indications of worm and rot in structural timbers;
- Check condition of remaining wing wall;
- Underpin cylinder bedstone;
- Localised repointing and rebuilding;
- Consolidate cills;
- Re-form threshold to east door opening;
- Consolidate edges of cobbled area to south of stamps house.

Asset 4

Calciner

HBSMR number: 190346 SW 69935 50087

See Figures 27-29, 80-86

Constructed in 1913 to clean arsenic and sulphur from the dressed tin ore, the later Wheal Coates arsenic calciner is a masonry-constructed gabled structure cut into the hillslope which contains a pair of boat-shaped reverberatory calciners fired from the west and discharging to the north and the south. A gabled extension to the west of the calciner contains two rabbling openings and a damper opening, as well as a domestic fireplace.

The western gable stands to 4.5m high, the southern wall of the western extension is 2.82m high (to original wall plate height) to the south and 2.2m high to the north. The western gable of the calciner is 6.5m high, whilst the gable of the western extension is about 4.5m high. The western wall of the extension contains a window offset from the centreline of the wall, this measuring 1.15m high and 0.9m wide. Four timber lintels over have some traces of woodworm. The window reveals retain flashing showing the window frame location. This wall also incorporates a fireplace and chimney, the fireplace opening measuring 0.62m wide and 0.9m high and 0.35m deep. The fireplace has a very corroded iron lintel which requires replacement. The chimney is 0.2 deep and 0.62m wide. There is a 1.1m wide doorway to the north. This would have had a

lintel at 2.2m above current ground level. In the southern wall is a window 1.0m wide and 1.2m high with a cill 1.2m above ground level. The cill has lost some stonework and requires repairs. There are paired timber slots in the widow reveals. The eastern wall is the western wall of the calciner and contains a pair of brick arch headed openings with stone slab cills (in which there are sockets for door hinges); these are 0.4m high x 0.45m wide to springings, 0.53m to top of springings set with their bases 1.5m above ground level. White china clay brick was used for reveals and arches of these openings. At the centre of the wall is a damper opening with its base at 1.67m above ground level which measures 0.25m square.

On both the northern and southern walls are the hearth openings (set at the northern end of the building) and the openings into which the calcined ore was raked through the rabbling openings. The arched opening near the centre of the elevation is 0.9m wide, 0.65m to springings and 0.95m to the underside of its rather flat white brick arch. At the eastern end of the buildings is a second opening measuring 0.93m wide, 1.1m high to the springings and 1.4m high to the base of the rather flat brick arch. A massive piece of granite runs from underneath the springings on the western side of the eastern opening to above the western opening. The window in the southern wall of the calciner is 0.8m wide.

The eastern wall of the building is built into the slope and at its northern and southern ends the head of the wall is only 1.5m above average ground level. The gable is 3.5m above average ground level. The door into this elevation is offset to the south and measures 1.0m wide x 1.85m high, though the cill to the doorway has been broken away. The walls are 0.6m thick. Internally, the calciner consists of a pair of upturned boat-shaped calcining hearths, each with its brick-lined hearth and discharge pit, separated by the remnants of the masonry separating wall. The upper superstructures of the hearths have gone completely, but are likely to have been of brick, the space between and around them probably originally filled with soil or rab for insulation. The hearths and ash pits are 0.5m wide and 1.4m long, with stepping to their sides and internal ends. The discharge pit is 0.9m wide and 1.3m long and 0.45m deep. There is a step all around the interior of the building at the level of the bases of the damper opening. The general floor level is 0.6m below this and the remains of the dividing wall is 0.3m above this 'floor' level. On the northern wall near the centre is the flue leading to the chimney upslope. This has its base at the level of the floor step, is stone-capped and appears to be open over most of its length. It measures 0.45m square.

PDP Green observations

A very well preserved gabled, masonry-constructed single storey structure housing a pair of reverberatory calcining beds with a gabled extension to the west which housed the mess room and rabbling facilities, this building was constructed in or around 1906-7 in order to remove the arsenic present in the tin ore concentrated on the nearby dressing floors. The fumes were not sent for collection in a condensing labyrinth, but fed directly to the northern half of the chimney near the winding engine houses, and discharged to the atmosphere. The flue connecting the calciner and the chimney runs just under the ground surface, one section of this being exposed where its brick arch has collapsed. Most of this section of the flue had been covered with a protective steel grille.

The building was excavated under archaeological supervision during 1986/7 and some consolidation works undertaken, these including wall capping and patch pointing. The building is currently in good condition, though there has been some erosion of its fabric through visitor access and other uses, resulting in damage to the masonry cill of one of the southern windows and the spreading of rubbish and the disposable barbecues around its interior. The iron lintel supporting the fireplace opening is now in poor condition and should be replaced.

Conservation works undertaken

- Replace corroded iron lintel supporting fireplace opening in western extension;

- Survey interior of flue to check for structural stability;
- Localised repointing as drawings;
- Consolidate sills and eroded thresholds;
- Make good damage to cill of southern window in western extension.

Calciner Flue

HBSMR number: 190349 SW 69940 50085 to SW 70006 50047

See Figures 29, 80

The 1910 arsenic calciner [190346] is linked to its chimney by an underground flue 55m long and probably 0.5m wide and 0.6m high. Its western end is capped in stone slabs, though an exposed section at its mid-point has a brick-arched top. The flue was constructed in 1872 to link the original calciner [190345] to the chimney, and seems to have been extended to the west in 1910 when the replacement calciner was constructed.

Conservation works undertaken

- Bridge/plate over exposed section of calciner flue to protect it from damage.

Asset 5 Tributer's Stamps and Waterwheel Pit

HBSMR number: 190340 SW 69903 50128

See Figures 30-34, 87-88

Some distance to the north of the core area of Wheal Coates are the remains of a small wheelpit which would have driven stamps serving an associated dressing floor immediately to the south. The date of construction of this element of the site is unknown, though Dines (1956) refers to a small-scale working between 1901-2, which might have consisted of the re-processing of dump material using this site.

The wheelpit consists of a massive masonry plinth 3.65m long x 2.35m wide which stands to a maximum of 2.0m high to the south. On its upper surface are a pair of walls 0.55m high and 0.6m high, these probably originally joined along the western end of the structure, though there has been considerable masonry loss in this area and possibly retaining the northern loading for a set of stamps set to the south of the plinth. The wheelpit, which incorporates some re-used masonry, is set to the north of the plinth and measures 1.15m wide x 1.65m deep x 6.15m long. One axle bearing hold-down bolt tunnel can still be seen on the head of the northern wall near its centre. The remainder cannot be seen and must have become obscured or infilled. The wheelpit walls are 0.75m thick. Its tailrace was led off downslope, passing beneath a path via a stone-lined culvert. There are no obvious signs of a feed leat for the waterwheel. The path leading towards the stamps from the north is 3.0m wide, suggesting that dump material from the openwork was the principal material reworked at the time.

PDP Green observations

To the north of the main complex at Wheal Coates and set slightly downslope is a small masonry-constructed 6m long x 1.15m wide wheelpit, an adjacent masonry plinth which would have supported the drive to a set of stamps and a levelled area to the south which would have sited a buddle floor. This small works is undocumented, but might have dated to the period between 1884 and 1906, when a small scale dump recovery operation is known to have taken place at Wheal Coates, though might equally have been established and operated at an earlier date.

No works had been undertaken to this group of structures in 1986/7.

Both the plinth and the wheelpit were constructed of lime-mortared mine waste and killas, and have suffered some significant deterioration due to weathering and root damage since their abandonment over a century ago. Masonry loss from the western face of the plinth is more pronounced than elsewhere, though both structures are

structurally stable. Re-pointing and some limited replacement of lost masonry would be advantageous.

Conservation works undertaken

- Remove intrusive vegetation;
- Re-build: undertake limited replacement of lost masonry from the western faces of the structures;
- Consolidate and re-bed wall tops;
- General repointing (100%).

Asset 6 Towanroath Engine House

HBSMR number: 190390 SW 69877 50012

See Figures 34-37, 41, 89-97

Constructed in 1872 to a design by Michell of Redruth, this pumping engine house housed a 36" cylinder beam engine working Towanroath Shaft. The building was not constructed according to the original drawings, the windows in its eastern wall being omitted, as were three of those on the western elevation.

The engine house was built from a mix of locally-derived shillet (killas) and mine waste, imported granite being used for wall corners and red brick to frame all of the wall openings except for the quoining of the plug door. The engine house measures 8.25m x 6.25m in plan, being aligned north-south, Towanroath Shaft being adjacent to its northern (bob) wall. The basal plinth course is a maximum of 3.41m high, with the wing wall heads being 13.5m above ground level and the gable 16.0m high. The chimney, which is 3.8m in diameter at ground level is also constructed of a mixture of shillet and mine waste with a red brick capping, the masonry section being 14.9m high, the upper brick section (82 courses) rising to a height of 21.65m. The tops of the wing walls incorporate erection steps.

The bob wall is 1.3m thick and incorporates the plug door, which 1.23m wide and 3.5m high, its arch consisting of three courses of header bricks.

The eastern wall is blank apart from the timber-cilled and lintelled girder opening and a pair of tie bolts, one of these having a substantial timber patrass. The western wall contains an arch-headed window in the plinth lighting (and possibly also serving as access to) the cataract pit, a pair of splay-revealed arch-headed windows lighting the ground floor and the girder opening.

The rear (southern wall) contains the 1.5m wide, 2.5m high cylinder opening; above this are arch-headed windows lighting the middle floor and bob loft. This wall, like the wings walls, is 0.8m thick. Internally, the walls incorporate four rows of cut-off half-round timbers which look as if they originally supported internal framing, probably a structure installed during the 20th century reworking of the mine.

The engine house was substantially reconstructed by the National Trust in 1986 to repair damage done during the adaptation of the engine house in 1910, a section of the bob wall below the plug door opening being reconstructed, as also the face and surface of the cylinder plat and sections of the rear wall. Some new brickwork repairs are visible in the arch to the cylinder opening. Cracking has occurred in the lower part of this elevation and in the upper part of the bob wall suggesting that some movement is occurring within the structure.

PDP Green observations

Constructed for a medium sized beam pumping engine in the 1870s, this building was stripped of its machinery and fittings on the close of the mine. During the early 20th century reworking, a horizontal pumping engine was erected on a plinth within the remains of the boiler house, and masonry was removed from both the northern and southern walls of the building to allow a connection between the engine and the pitwork in the shaft. A network of timbers seem to have been inserted at three levels within the

building at this time, these now indicated by their stubs, which have been cut off flush with the wall faces.

This building was one of the first industrial structures to be conserved by The National Trust, the decision being taken to undertake reconstruction of the elements of the building damaged or removed during the early 20th century. It is currently in fair condition, though it would be advisable to replace the cementitious pointing using a suitable hydraulic lime based mortar in the medium term. Cracking was evident on both the external and internal elevations of the bob wall, running from its head down to the arch springings on the western side of the plug door opening. A second crack was noted running from the head of the cylinder doorway crown up to the western side of the base of the middle floor window in the rear (southern) elevation. Taken together, this cracking suggests some movement within the building. Although the movement at present appears small-scale, it is recommended that this requires monitoring, and that telltales are fixed across both cracks as a matter of urgency. A structural engineer should be engaged to carry out a survey of the building to attempt to identify the reasons for this failure and the means by which it could be arrested.

Other works required in the short term include the installation of a safety barrier across the northern face of the cylinder plat, as there is presently an unguarded drop of 3.55m into the cataract pit from this relatively readily-accessible area. In the medium term, some of the timbers appear to be suffering from damp, with indications of woodworm and rot apparent in some areas.

Some consideration should also be given to the replacement of the shaft grille. The original, installed in 1970, was constructed of round-section steel bars set on a concrete slab. These have corroded to some degree, and were forced apart by visitors wishing to drop small stones down the shaft. A Lionweld pattern galvanized steel grille was subsequently fixed down over the original grille, but this has, again, been vandalized in a similar fashion. A patch repair has been carried out recently to cover the central part of the grille, though this is now showing signs of attack. Given the clearly apparent desire for visitors to drop small stones down into the flooded shaft and the failure of all previous attempts to prevent this, it would probably be advisable to replace the present grilles with one of robust construction which incorporates a 150mm x 100mm opening at its centre to allow visitors to drop small stones down the shaft without having to damage the grille to achieve this.

Conservation works undertaken

- Fit tell-tales to cracks on northern and southern elevations;
- Replace shaft grille.

Asset 7 Lower Horizontal Engine House

HBSMR number: 190391 SW 69874 50002

See Figures 38, 40, 98-99

In 1910, with the reopening of Wheal Coates, a horizontal steam pumping engine was purchased from Wheal Merth, Lelant and set up on a plinth within the former pumping engine boiler house, this being constructed of material recovered from the flywheel loadings of the old stamps engine house upslope. In order to link this engine to the pitwork over and in Towanroath Shaft parts of the northern and southern walls of the pumping engine house were broken away.

An angle crank was set up to the north of the engine house on a concrete foundation measuring 1.8m x 1.9m supporting a cubic machine plinth 1.2m square with two mounting bolts set into its upper surface powered the pump rods, whilst a surface balance bob was sited to the north of the shaft. The remains of the later pumping engine house now consist of a series of elongated mass concrete plinths surrounded on its western and southern sides by a single skin masonry wall 1.6m high. The concrete platform 7.2m wide contains a pair of concrete plinths; the first, 1.6m wide and 11.6m long stands 2.0m high. This supported a number of machine mountings on its upper

surface. The second concrete plinth is parallel to the first and set to its east, measuring 5.7m x 1.95m wide. This incorporates a central trench 2.6m long x 0.48m wide and 0.4m deep.

PDP Green observations

This structure appears stable, though has suffered some masonry damage from visitors clambering up its southern wall to gain access to the interior of Towanroath pumping engine house. It is recommended that the damaged masonry is made good; this would also help to prevent access by small children. Once visitors have gained access to the platformed area forming the floor of the horizontal engine house, they are exposed to an unguarded 2.0m high drop to the west between the central platform and the surrounding masonry walls and can access the interior of the pumping engine house (above). The upstanding concrete plinths on the upper surface of the structure pose minor trip hazards, though these probably are not significant enough to need to be addressed.

Conservation works undertaken

- Make good minor damage to masonry at southern end of building (adjoining asset 8.

Asset 8 Lower boiler house

HBSMR number: 190392 SW 69873 49987

See Figures 39, 98-99

The 1872 boiler house serving the Towanroath pumping engine is shown on the 1st Edition OS 1:1500 mapping as a roofed rectangular structure 15m x 6.5m in plan, the 1908 OS mapping showing a narrow elongated extension to its west, the building eventually housing three boilers. Unusually, these were fed with a mixture of fresh and sea water, which necessitated one after another being taken out of service for flushing and cleaning to prevent damage, whilst the other pair fed the engine. The flue path seems to have been complex, running the whole length of the building and returning via a large flue to the chimney incorporated into the south-eastern corner of the engine house. The original boiler house was substantially altered during the 1910 reworking of the mine, resulting in the demolition of most of the original structure.

A surviving wall 14.4m long on the eastern side of the southern part of the boiler house revets the cliff slope and stands up to 3.5m high and incorporates some rock outcrops near its southern end as well as a few wall sockets. The southern end of the building is represented entirely by a cut into bedrock. The northern end of the building incorporates the flue running towards the chimney; this is 0.7m wide and 1.1m high; it appears to be capped with slate slabs and its walls are of mortared coursed killas. In the centre of the southern section of the boiler house and 3.0m from its eastern wall is an elongated, raised partly revetted area which measures 8m x 3m and stands to 0.75m height. Most of this feature consists of rubble fills incorporating granite and brick and may be the remnants of the fill between a pair of boilers. There is no obvious trace of the coal chute which would have supplied the building from the east, and it must be assumed that coal was brought along the adjacent coastal track through a door in the western wall near its southern end. There are no traces of flashing on the engine house to indicate the roof line(s) of the boiler house roof(s).

PDP Green observations

The majority of this structure was demolished during the re-arrangement of this part of the site in 1906, leaving only the eastern wall which revets the cliffslope to a height of 3.5m and a length of 14.4m. This walling appears to be stable and does not require any consolidation. The northern end of the building forms part of the surrounding walls to the horizontal engine house, and incorporates a partly rubble-choked stone-capped flue 1.1m high and 0.7m wide running to the base of the stack. The flue capping stones and side walls appear stable and do not require any works.

Conservation works undertaken

- Make good minor damage to masonry at southern end of building (adjoining asset 8);

Asset 9 Miners' change house (Dry)

HBSMR number: 190385 SW 69878 50047

See Figures 41, 100

A north-south aligned roofed rectangular structure measuring 9.5m x 5.5m in plan 24m to the north of Towanroath Shaft shown on the 1st Edition OS 1:2500 mapping may well have been the miners' dry or change house. The building was shown as unroofed in 1908 (OS map evidence).

What survives is a simple rectangular, shillet and mine waste-constructed building which has been substantially demolished, its remains being 9.5m long x 4.02m wide internally with walls 0.6m thick standing to a maximum (on the eastern side) of between 1.2m and 1.5m high where they revet the cliffslope. There are traces of internal rendering and limewash. The floor has grassed over, and no internal features are visible. A fragmentary section of the south-west corner of the building survives to 1.35m high. The doorway in the western end of the building is 1.8m wide.

PDP Green observations

A 9.05m long x 4.2m wide building which was still roofless in 1878 and evidently dates from the mid-19th century phase of working on this site. It was roofless by 1907 and may not have been re-utilised in the working dating from 1906. It does not seem to have been conserved during the 1970 conservation works.

Its walls stand to between 1.2m and 1.5m high to the east where they revet the cliffslope; elsewhere the walls have by and large been reduced to less than 1.0m high, except in the south-west corner of the building which stands to 1.35m high. The majority of the wall pointing is original and in fair condition. In the medium term it would be advantageous to re-set the top courses of all wall head stonework in a lime based mortar to prevent any deterioration through water ingress and to stabilize the walls, parts of which are climbed over by visitors. Some attention should probably be given to the masonry of the south-western corner of the building, where there has been some limited masonry damage.

Conservation works undertaken

- No works undertaken.

Asset 10 Wheal Coates Gas Engine House with associated structures

HBSMR number: 190379 SW 69976 50051

See Figures 42, 101, 103-105

A masonry-constructed ruin dating to 1910, which has lost all of its upper sections, the remaining walls surviving to a maximum of 2.95m high, though most are less than this, averaging 1.65m high, this building was constructed to house a producer gas plant and a gas engine used to drive dressing floor machinery.

The building is 7.4m x 4.36m in plan internally and has walls 0.6m thick. It may have been built in two phases of construction, as the lower 1.6m of the wall structure are of notably better quality build than the upper sections. There is evidence for a timber closure to the western end of the building in the form of four timber channels set into the western wall ends – this appears to have been an open-ended building which was closed off in planking. The interior of the building was probably concrete floored throughout, though most of this is currently obscured by vegetation and rubble which may mask diagnostic features. Some traces of render survive on the inner faces of the walls.

Extending downslope on the western end and offset to the south of the building is a 0.57m wide and 2.85m long x 0.25m deep slot which would have carried pipework or belting. Immediately downslope again is a massive concrete plinth carrying four bolts which would have supported the gas engine itself. This is on a low base 0.4m high and 4.8 long x 3.5m wide. The plinth itself is 3.65m x 1.2m and 0.45m high and is on a sub-slab, the plinth being on the southern side of the base. The building widens to the north at this point, the extension being 1.95m wide, 3.25m of its length survives; the remainder downslope has been demolished.

Downslope again and to the south of the gas engine plinth is a power transfer slot which deepens to the west and with its base cut into bedrock. This feature is 10.4m long x 1.1m wide and reaches a maximum depth of 1.45m, the whole of this feature being flush-pointed in cement mortar. At the western end of the slot are a series of walls and concrete plinths which would have supported pulverisers, screens and vanning tables. The pair to the north measure 1.97m long x 0.6m wide, the plinths towards the east are narrower. Downslope again are another pair of plinths incorporating a central slot 1.76m x 0.5m wide on a concrete strip base 3.9m long, the slot between being 0.65m wide and currently 0.65m deep. To the east again are a series of four north-south orientated machine concrete bases. Some elements of these bases show damage. Downslope again is what appears to have been part of a concrete floor or a large machine base, most of which has been broken up.

PDP Green observations

Constructed in 1906 to house a producer gas unit and the gas engine which powered the stamps and dressing floor machinery, this group of low ruins and concrete machinery bases lies to the north of the stamps engine house. Most of these structures would probably have been housed in a collection of timber and sheet steel roofed and clad buildings, though the producer gas unit stood within a building whose lower wall sections were of cement-mortared masonry revetting a rectangular cut in the ground. The only surviving remains of the buildings downslope now consist of a series of concrete plinths and low walls. On the closure of the mine all of the equipment would have been removed for re-use or scrapping, together with recoverable materials making up the covering buildings.

No works were undertaken on this area of the site during the 1986/7 works programme. The concrete plinths are massive and require no attention, whilst the revetting walls of the gas producer house require little more than wall capping and the removal of the loose rubble which has built up in its interior.

Conservation works undertaken

- Minor re-build to section of unsupported masonry;
- Re-build small water eroded section to south wall.

Ore dressing floors

HBSMR number: 190384 SW 69937 50044

See Figures 43, 102

The 1st Edition OS 1:2500 mapping shows the layout of the 19th century dressing floors at Wheal Coates. Two groups of stamps were sited to the north of the engine house at its western end in an area subsequently occupied by the crushing equipment powered by the gas engine installed in 1910. Seven large buddles (two measuring 10m diameter, five measuring 7.25m diameter) were arranged on two tiered platforms separated by masonry walls to their west. Other dressing floor structures including the calciner and tin house were arranged to the north. Water was probably supplied via the main reservoir at the top of the site [190394] whilst waste water was discharged over the cliff via a cross-contour channel.

Little remains of the original arrangement, given that this area was reused for the 20th century dressing floors. The dressing floor terrace revetment walling seems to have

been refurbished, though some sections of walling were not reused, these lying to the north and south of the 20th century dressing floors.

Conservation works undertaken

- No works undertaken.

Asset 11 Mine Smithy
HBSMR number: 190343 SW 69977 50095
See Figures 44-45, 106-110

This masonry-constructed, originally gabled smithy building dates from 1910. It measures 7.0m x 4.2m in plan and its walls, which are 0.6m thick stand to a maximum height of 2.7m high internally, though at the northern end of the building they have been reduced in height to no more than 0.5m. The western wall averages 0.85m high. At the interior of the southern end of the building is a plinth 0.4m high, 1.65m x 1.26m in plan which was the forge base. Above this and just to the east of its centre is a 0.3m square opening. The chimney opening for a stovepipe flue is directly above this, partly cut into the wall (0.7m x 0.3m in plan), the upper section incorporating it; the hole in the wall head is roughly 0.3m square, its form suggesting that it incorporated a steel stovepipe. In the wall to the west of the base of the forge is a pair of 0.15m square holes 1.5m above ground level which extend half way through the wall, their locations suggesting that they supported a frame holding up the eastern edge of the hood over the forge. On the eastern wall only one of these openings survives, the northernmost having been infilled. In the northern wall is a doorway 1.15m wide, whose jambs are now only 0.5m high. The floor of the building consists of levelled rab and small stone.

PDP Green observations

The building dates from 1906/7 and replaced one used in the 19th century working, this having been a short distance downslope and immediately to the north of the site presently occupied by the reverberatory calciner. Although the southern wall and the southern ends of the western and eastern walls of the building survive in fair condition, the northern half of the building has been substantially demolished.

As well as the archaeological excavation of the building, wall capping and some pointing were undertaken in 1986/7. The wall capping has deteriorated in places and the top courses of the wall should be re-set in a suitable lime-based mortar.

Proposed conservation work

- No works undertaken.

10.2 Site 2: Charlotte United and Old Century Works

Asset 12 Old Century Works
HBSMR number: 190510 SW 70043 49274
See Figures 46-53, 111-118

The 1st Edition of the OS 1:2500 mapping shows a water-powered tin dressing works at this site in Chapel Combe (Fig 10), the site consisting of a waterwheel pit which would have driven tin stamps and a series of small roofed structures. The most likely source of material for this site at this date would have been a combination of mine waste from nearby disused mines and tailings from the valley base, but it is probable that the dressing floors had been in existence long before and had stamped tin from the local mines. By 1908 (OS mapping) it was shown as disused (Fig 11). A photograph of the works is reproduced in Brown and Acton (1999, 171), dating from the early 20th century and labelled 'Old Century Tin Works, Chapel Porth', but it is unclear whether the site, which consisted of a mixture of small timber and masonry structures was operational or derelict at that date.

A sketch plan reproduced in the same source shows the remains of the wheelpit, a rectangular building, the site of Cornish tin stamps, a large buddle and the base of a

feature interpreted by Brown as that of a vanning or shaking table. The foundations of these structures survive, though vegetation encroachment made access to the site very difficult.

Conservation works undertaken

- Undertake initial scrub clearance work;
- Undertake topographical survey;
- Remove any remaining vegetation and clear debris;
- Improve existing footpaths;
- Consolidate and re-bed all wall heads and cills;
- Re-build and re-point as required.

Wheelpit
HBSMR number: 190511 SW 70046 49300
See Figures 46-47

The wheelpit which housed the principal waterwheel on the Old Century Works, this drove the tin stamps and powered equipment on the dressing floors. The wheelpit is shown on the 1st and 2nd Editions of the OS 1:2500 mapping as measuring 9.5m long x 2.75m wide (Figs 10 and 11). It was not visible in archive photographs of the works taken during the 1920s when the site appears to be derelict, and it is probable that the wheel had been dismantled by this date. The wheelpit survives, but is an area which has scrubbed to in such an extent that it is inaccessible.

Conservation works undertaken

- Clear vegetation, record condition and undertake necessary structural consolidation works.

Demolished dressing floor structure in Chapel Combe
HBSMR number: 190512 SW 70054 49296

A roofed structure set just to the north-east of the wheelpit [190511] shown on the 1st Edition OS 1:2500 mapping as measuring 6.0m x 4.0m. By 1908 (map evidence) it had been demolished and the function of the building is unknown. The area in which it was sited was so densely vegetated that it could not be accessed for survey, though it was thought possible that overgrown footings survived within this area.

Conservation works undertaken

- Clear encroaching vegetation, carry out detailed survey and undertake necessary structural consolidation works.

Remains of dressing floor structure in Chapel Combe
HBSMR number: 190513 SW 70047 49279

An elongated rectangular structure forming the largest of the buildings making up the Old Century Works, shown as a roofed structure measuring 23.75m x 7.0m on the 1st Edition OS 1:2500 mapping. The building was roofless by 1908 (OS map evidence), though a photograph in Clive Benney's collection which is thought to date to the 1920s shows what appears to be a completely different arrangement of structures on this site.

The remains of a rectangular building survive in more or less this location, though dense vegetation made survey difficult. What survives consist of a masonry wall to the north about 20m long and 3.5m high and walls to both east and west surviving up to 2.5m high, though reduced in height at their southern ends. The southern wall consists of a 25mm high footing which is 500mm wide, immediately inside which is a drainage gully 350mm wide and 150mm deep. It is probable that the southern wall of the building consisted of a planked wall on studwork.

Conservation works undertaken

- Clear vegetation, record condition and undertake necessary structural consolidation works.

Demolished dressing floor structure in Chapel Combe
HBSMR number: 190514 SW 70027 49279

One of the structures making up the Old Century Works, this was shown as a roofed structure measuring 11.5 x 8.0m on the 1st Edition OS 1:2500 mapping, and as a roofless ruin on the 1908 mapping. Immediately to its north-east was a small shed measuring 7.25m x 2.5m and on its south-eastern corner measuring 4.5m x 3.25m. Again, these were roofless by 1908 (map evidence).

The area within which these structures were located was densely scrubbed in, and no trace of them was found during survey. It is likely that the buildings would originally have been timber constructed, though were possibly built off concrete slabs or masonry footings, which may still survive.

Conservation works undertaken

- Clear vegetation, record condition and undertake necessary structural consolidation works.

Demolished dressing floor structure in Chapel Combe
HBSMR number: 190515 SW 70042 49271

A rectangular roofed structure within the Old Century Works, shown on the OS 1:2500 1st Edition mapping as measuring 8.0m x 5.5m in plan. The building was shown as demolished by 1908 (OS map evidence).

This part of the site was occupied by a single cement-rendered convex buddle; lying under dense scrub, this seems to have been 6.0m in diameter. Immediately adjacent to this an iron pin protruded from the ground surface. This was noted by Brown (Brown and Acton 1999) and thought to be one of four set on concrete mountings which mark the site of a vanning table.

Conservation works undertaken

Clear vegetation, record condition and stabilise remains.

Leat in Chapel Combe
HBSMR number: 190517 SW 70075 49238 to SW 70127 49179

A leat shown on the 1st Edition OS 1:2500 mapping whose source appears to have been in the valley near Chapel Porth Farm entered NT land at the north-western corner of the western enclosure associated with this holding. It was shown running parallel and 12m upslope from leat [190518], crossing streamwork gully [190485] but fading out 18m to its north-west. It is probable that it followed the access track to the Old Century Works, but would have then met the access road to Chapel Porth. It is probable that it formed a high level feed to the Old Century Works.

The western part of the leat could not be followed, given dense vegetation, but to the east of the streamwork gully it showed as a substantial cut through spoil dumps, being 0.6m wide in its base and between 1.2m and 2.2m deep. Beyond the cut through the dumps it is 0.6m wide and 0.4m deep, with a linear spoil dump on its southern side, but was quickly lost beyond this point within dense vegetation.

Conservation works undertaken

- Manage encroaching scrub vegetation.

Demolished dressing floor structure in Chapel Combe
HBSMR number: 190519 SW 70058 49238

The OS 1:2500 1st Edition mapping shows a 7.75m x 4.5m plan roofed structure at the south-eastern end of the Old Century works, a small open yard lying immediately to its south-east. The building had been demolished by 1908, leaving a scattered tumble of masonry on its site.

Conservation works undertaken

- Clear vegetation, record condition and undertake consolidation works.

Asset 13
Charlotte United pumping engine house
HBSMR number: 190616 SW 70134 49040
See Figures 54-59, 119-126

The engine house at Wheal Charlotte United was constructed in 1869-70, containing a 36" cylinder pumping engine which had been moved from Wheal Freedom not far to the north. The engine was advertised for sale in July 1873 (the mine at the time being known as New Wheal Charlotte) and in 1878 (when the mine was known as Charlotte United). As well as pumping from Pleasant Shaft just to its east [190618] the engine also drove flat rods to another (unidentified) shaft 80 fathoms away. The single eight ton boiler in the nearby house also supplied steam to the nearby winding engine.

Half of the engine house has collapsed, only the bob wall to the east and the northern wing wall surviving to more or less their original height, the western wall having almost completely disappeared and the eastern wall being reduced to the height of the cylinder plat. The chimney survives to a height of 17.25m, the upper section above the drip coursing retaining 45 intact courses of brickwork.

The house, which measures 8.35m x 5.55m in plan, is constructed of killas with granite framing to wall corners and wall openings, the bob wall containing notably more granite than the other walls and retaining traces of false coursing on its pointing. The head of the plug door has a brick-arched top. The surviving northern wall includes the timber-lintelled boiler house door, the girder opening, steam pipe opening and cylinder drain opening, as well as a row of pockets for the boiler house roof joists. The remains of the southern wall retain the bases of a pair of splay-revealed ground floor windows. An archive photograph in the Benney Collection shows that there was also a centrally-placed window lighting the middle floor on this elevation. The fragments of the rear wall which still remain attached to the chimney show the locations of a probably lintelled cylinder doorway and a window on the middle floor. It is likely that there was a centrally-placed window lighting the bob loft. The engine house was partly conserved by the National Trust in 1999.

PDP Green observations

Some unknown factor(s) have brought about the substantial collapse of nearly half of the engine house since 1908, only the bob wall, the northern wall of the engine house and the incorporated chimney having survived, the other walls having been almost entirely lost. Brown and Acton (1998) reported that the engine house had recently been consolidated by the National Trust, though the relevant NT files had apparently been mislaid when they were requested (June 2009, Sharpe et al 2011), and no record of the range of work undertaken could be located.

The nearby shaft has coned out very extensively and may threaten the stability of the foundations of the bob wall of the engine house and is certainly undermining the remains of the balance bob loadings. The area containing these and the engine house, together with the site of the attached boiler house and associated surface balance bob mounting is enclosed within stock fencing topped by barbed wire. As a result there is no access to the building, and the area within the fence line has scrubbed in. An examination of the building suggests that most of the surviving walls have been patch pointed and that the majority of the structural timberwork is in fair condition

Proposed conservation work

- Remove any remaining vegetation and clear debris;
- Re-survey boiler house;
- Rebuild boiler house walls where required;
- Reconstruct lower parts of reveals to cylinder opening;

- Consolidate and re-bed wall heads and cills;
- Replace timber lintels as necessary; treat remaining timbers;
- Re-point where required (boiler house 100%, main engine house nominal 20%);
- Replace any damaged fencing.

Boiler house

HBSMR number: 190617 SW 70133 49047

See Figures 54-55, 57, 119, 127-128

The masonry-constructed boiler house serving both the pumping and winding engines at Charlotte United is sited on the northern side of the pumping engine house, and housed a single 8 ton boiler.

The surviving remains of the building measure 6.25m wide and 14m long (though the building would originally have been 16.35m long). The eastern wall of the structure has been was undermined by the subsidence of the shaft collar and has disappeared completely, whilst the western wall has collapsed to some degree and has an opening 3.55m wide at its centre, probably the original doorway through which the boiler would have been brought into the house. The northern wall survives to a height of 2.65m and includes a small window opening just to the east of its centre. The floor of the building is partly covered with vegetated rubble.

Conservation works undertaken

- Clear encroaching vegetation;
- Clear rubble from interior;
- Consolidate walls where required;
- Repoint all elevations;
- Repair an partially reconstruct reveals and cills to wall openings;

Mine shaft

HBSMR number: 190618 SW 70140 49039

New Engine or Pleasant Shaft in Charlotte United may originally have been sunk during the working of North Towan and is noted by Brown and Acton (1999) as reaching 'no depth to speak of'. Dines (1956) provides no information regarding this shaft, suggesting that the mine plans have probably been lost.

The collar of the shaft has collapsed, leaving a 5.0m deep, 9.25m diameter steep-sided crater immediately to the east of the engine house. On the south-eastern side of this parts of the surface balance bob mountings [190619] survive, albeit precariously. The mid-1980s Operation Minecap Project undertook no works at this shaft, which has recently been re-fenced by the National Trust.

Conservation works undertaken

- No works undertaken.

Balance bob loadings

HBSMR number: 190619 SW 70147 49034

See Figure 56

A pair of tall masonry structures on the south-eastern side of the crater which now marks the site of New Engine or Pleasant Shaft in Charlotte United [190618] represent the remains of the mountings for the surface balance bob fitted here to counterbalance the weight of the pump rods in the shaft. Brown and Acton (1999) note that this bob also drove 80 fathoms of surface flat rods to pumps in a further shaft.

Proposed conservation work

- No works undertaken.

Horse whim

HBSMR number: 190620 SW 70184 49001

A levelled platform measuring 18m x 18m on the hillslope to the east of the pumping engine house at Charlotte United [190616] represents the site of either a horse whim or a capstan servicing the nearby shaft [190618].

Proposed conservation work

- Prevent scrub encroachment across this feature.

Discussion

The clifftop mine buildings at Wheal Coates are some the most iconic in Cornwall, and certainly the amongst the most photographed. Their acquisition by the National Trust occurred during an early point in the implementation of a strategy drawn up by this national charity to tackle the management of Cornwall's industrial sites. The works undertaken on Towanroath engine house in 1973 mark an important milestone on the conservation of the region's industrial heritage and significant step towards the eventual (2006) inscription of the Cornwall and West Devon Mining Landscape Word Heritage Site.

The works undertaken in 1973 at Towanroath Shaft, Wheal Coates, were, in retrospect, somewhat intrusive and involved a considerably greater amount of reconstruction than would be felt appropriate today. The second round of works carried out here in 1986/8 involved only limited amounts of reconstruction, being based on a *de minimis* approach, but secured the majority of the buildings on this site against further degradation. A similar approach was taken at Charlotte United in 1999, though in this instance, consolidation works were restricted to the engine house, in particularly its landmark chimney.

A review of the conservation requirements of structures at Wheal Coates, Charlotte United and in Chapel Combe was undertaken as part of the property assessment carried out by Sharpe, Kirkham and Spalding Associates in 2010, given that one buildings had not received any conservation attention for up to four decades, others had not been the subject of any remedial works for the best part of two decades, and some sites or structures within the property (the Wheal Coates tributers' stamps and the Old Century Works) had lain derelict for over a century.

The survey results showed that the majority of the structures within the property required only minor works to bring them back into optimal condition, and that the undertaking of a limited programme of conservation works would prevent further degradation. At Charlotte United, by contrast, it was evident that prompt action was required to prevent substantial collapse of the boiler house, whilst some structural works would be required to prevent the collapse of further sections of the engine house. At the Old Century Works, the spread of scrub vegetation made an assessment of the condition of any remains very difficult. Access to the site was almost impossible, but it appeared to incorporate a range of ruinous structures which, if cleared and conserved, would materially add to the ability of the visiting public to interpret the long and important industrial history of Chapel Combe.

Once detailed and costed, the full range of works identified in the assessment proved beyond the means of the available project budget, and a prioritised schedule of works was therefore drawn up through discussions between the National Trust, pdp Green and Cornwall Archaeological Unit.

In line with the philosophy underlying the project, the works undertaken in this most recent conservation programme were both limited to those which would safeguard the structures in the medium term and consistent with modern conservation approaches, being based on the use of traditional materials and techniques. All of the aims and objectives identified within the prioritised programme were successfully achieved within the project budget and timetable.

Further recommendations

Although the project achieved much, budget limitations and the resultant prioritisation exercise meant that not all of the work which was felt to be required on the sites involved in this project could be achieved. The following works are recommended on a site by site basis and should be considered when resources allow. The priorities given are, as previously **L**ow, **M**edium and **H**igh, together with **P**rovisional (dependant on findings of investigations, or if circumstances change).

WHEAL COATES

Towanroath pumping engine house

- Safeguard drop into cataract pit within building. **M**.
- Address stability issues of the installed telltales suggest that these are ongoing. **P/M**.
- Repoint building in lime mortar. **L**.

Horizontal engine house

- Replace honest repair in brickwork. **L**.
- Repoint building in lime mortar. **L**.

Beam winding engine house

- Repoint building in lime mortar. **L**.

Whim boiler house

- Consolidate wall tops. **L**.
  Repoint building in lime mortar. **L**.

Stamps engine house

- Remove consolidated fallen wing wall material on bob wall. **L**.
- Repoint building in lime mortar. **L**.

Dressing floors

- Consolidate wall tops. **M**.
- Repoint walling in lime mortar. **L**.

Calciner

- Consolidate wall tops and internal features where required. **L**.
- Repoint structure in lime mortar. **L**.

Lower horizontal engine house

- Consolidate wall tops. **L**.
- Repoint building in lime mortar. **L**.

Lower boiler house

- Repoint remaining wall in lime mortar. **L**.

Dry

- Repoint remains of structure in lime mortar. **M**.
- Consolidate wall tops. **M**.

Gas engine house

- Consolidate wall tops. **M**.
- Repoint remains of structure in lime mortar. **L**.

Smithy

- Consolidate wall tops. **L**.
- Repoint structure in lime mortar. **L**.

Tributers' stamps site

- Clear scrub from dressing floors and immediate surroundings. **M**.

OLD CENTURY WORKS

- Clear remaining rubble from interior of buildings/floors. **M**.

- Consolidate cracked/broken concrete screeded floor surfaces. **M**.
- Chemically treat gorse stumps within the site. **H**.
- Consolidate/repoint standing walling on northern side of site. **M**.
- Clear scrub from within 5m of site. **M**.

CHARLOTTE UNITED

- Stabilise shaft cone and secure shaft if not already undertaken. **P/H**.
- Underpin balance bob mountings and repoint/repair balance bob mountings as required. **M**.
- Clear scrub from whim platform and other associated earthworks. **L**.

11 References

11.1 Primary sources

Ordnance Survey, *c*1880. *25 Inch Map First Edition* (licensed digital copy at CAU)

Ordnance Survey, *c*1907. *25 Inch Map Second Edition* (licensed digital copy at CAU)

Ordnance Survey, 2015. *Mastermap Digital Mapping*

Tithe Map and Apportionment, *c*1840. *Parish of St Agnes* (licensed digital copy at CRO)

11.2 Publications

Dines, HG and Phemister, J, 1956. *The Metalliferous Mining Region of South-West England,* HMSO (1988 reprint)

English Heritage/Historic England, 1988-2015, *Practical Building Conservation* Vols 1-10

Sharpe, A, Kirkham, G and Spalding Associates, 2010. *St Agnes Beacon, Tubby's Head, Wheal Coates, Chapel Combe and Charlotte Moor, St Agnes, Cornwall: Archaeological and ecological assessment for the National Trust,* Truro

11.3 Websites

http://www.heritagegateway.org.uk/gateway/ English Heritage's online database of Sites and Monuments Records, and Listed Buildings.

12 Project archive

The CAU project numbers are **146328 (Stage 1), 146400 (Stage 2)**

The PDP Green Consulting Limited project number is **J13-091**

The project's documentary, digital, photographic and drawn archive is maintained by Cornwall Archaeological Unit, Cornwall Council, Fal Building, County Hall, Treyew Road, Truro, TR1 3AY.

English Heritage/ADS OASIS online reference: cornwall2-216483

Appendix 1: HLS Project brief

Brief for Project Development of Consolidation Works with Archaeological and Ecological Recording at St Agnes, Cornwall (SW 6997 5005)

Introduction

The National Trust holdings at St Agnes include St Agnes Beacon and a swathe of coastal land from St Agnes Head to just short of Porthtowan. The land has been entered into the Higher Level Stewardship scheme (St. Agnes Coast and Beacon, HLS agreement No. AG00438963).

This brief is for a project to draw up the specifications and project manage the consolidation/repair of a number of the mine buildings (as outlined in a previously prepared plan which informed prioritised works).

The prime importance of this landscape lies in its industrial heritage, which has been recognised as being of international importance through its World Heritage Site (WHS) status. Wheal Coates is one of the most prominent elements of the WHS, appearing in photographs around the world. Beyond the highly visual engine houses, the heathland contains good examples of mining related features, including an early and well-preserved open-working on a tin lode and an unusual double-bayed reverberatory calciner.

The site was initially entered into a one year HLS agreement to produce a comprehensive Management Plan (Kirkham and Sharpe & Spaldings Associates 2010) which summarised and prioritised the management needs of the various structures and habitats. As part of the current ten year HLS agreement this brief is for a project to move the site towards the recommended conservation work through further surveys, recording, the development of specifications and acquisition of costings and tenders; and the project management of priority implementation works.

Designations

The following historic environment designations are covered by this work:

World Heritage Site

- Part of the St Agnes Mining District of the Cornwall and West Devon Mining Landscape World Heritage Site

Listed Buildings (all Grade II)

- Calciner north of stamps house (Wheal Coates) 63885
- Stamps house (Wheal Coates) 63882
- Old whim and new whim (Wheal Coates) 63883
- Chimney east of new whim (Wheal Coates) 63884 (No works envisaged in MP)
- Towanroath Engine House (Wheal Coates) 63881
- Engine house at SW 699492 (Wheal Charlotte United) 63769
- Engine house at SW 696491 (Great Charlotte) 63770 (No works envisaged in MP)

The site is also within the Godrevy Head to St Agnes Site of Special Scientific Interest, part designated for its important maritime heath habitat. Part of the SSSI (between Tubby's Head to Porth Towan) is also a Special Area of Conservation (SAC), designated for Annex I Habitats and Species - Temperate Atlantic wet heaths with *Erica ciliaris* & *Erica tetralix,* European dry heaths and Early gentian Gentianella anglica.

History of management and recording prior to 2010 Management Plan

(Excerpt from Management Plan, pages 28-30)

The section of the project area around Wheal Coates was the subject of an archaeological survey in 1986, based on detailed plane table mapping at a scale of 1:1000, this being undertaken by Cornwall Archaeological Unit (Sharpe and Smith 1986). St Agnes Beacon and an area at Chapel Porth were the subject of National Trust archaeological surveys (National Trust, undated and National Trust 1985 respectively), whilst recent desktop assessments of substantial parts of these areas have been undertaken by Graeme Kirkham as part of the HEATH Project work carried out by HES (Kirkham 2006a, 2006b). However, none of these properties have been subjected to archaeological field surveys which meet current standards prior to the 2010 Management Plan, with the exception of a small area between Wheal Coates and St Agnes Head, which was assessed in 2007 by HES (Dudley 2007).

- Dudley, P, 2007. *Trevellas Coombe, New Downs Head and St Agnes Head, Cornwall: archaeological assessment,* HES report 2007R092 for The National Trust
- Kirkham, G, 2006a. *Chapel Porth, St Agnes, Cornwall: HEATH management assessment.* HES report for the HEATH Project.
- Kirkham, G, 2006b. *St Agnes Beacon, St Agnes, Cornwall: HEATH management assessment.* HES report for the HEATH Project.
- Sharpe, A., and Smith, J.R, 1986, *Wheal Coates: An Archaeological Survey for the National Trust*. CAU report for The National Trust
- The National Trust 1985, *Archaeological Survey: Chapel Porth (Cornwall)*. National Trust.
- The National Trust (Undated), *Archaeological Survey: St Agnes Beacon (Cornwall)*, National Trust.

Other relatively recent archaeological work undertaken by HES staff includes:

- Aerial photo mapping by HES – the areas have been plotted digitally as part of the National Mapping Programme. This provides a useful overview of archaeological potential, but this data must always be verified by checking on the ground.
- St Agnes Beacon – measured survey of some summit features, and historical account of the summer house, beacon, Ordnance Survey station, and barrows (A. Preston-Jones, n.d. [*c* 1997], St Agnes Beacon, *Journal of the St Agnes Museum Trust 13.*)
- St Agnes holy well, chapel and cave cult site – discussed in P. Rose, 2000-1, Shadows in the imagination: encounters with caves in Cornwall, *Cornish Archaeology* 39-40 (published 2004).
- Wheal Charlotte – measured survey of possible roundhouse platforms (1985, HES archive).
- Wheal Charlotte – elevation drawing of engine house bob wall, 1990 (HES archive)

Other relevant recent work includes:

- St Agnes Well – historical account by Jo Mattingly (1998), A well without water? The rise and fall of the Holy Well at Chapel Porth, St Agnes, *Journal of the St Agnes Museum Trust 14.*)
- Wheal Coates – early mine workings – P. Budd and D. Gale, 1994, Archaeological survey of an early mine working at Wheal Coates, near St Agnes, *Cornish Archaeology* 33.

Previous ecological survey

Information (used in the 2010 Management Plan was) extracted primarily from two documents: A National Vegetation Community survey of Godrevy Head to St. Agnes Site of Special Scientific Interest and Special Area of Conservation (SSSI/SAC) carried out by Wessex Environmental Associates in 2003 (this did not include the area at St Agnes Beacon) and a Nature Conservation Review, carried out by Ecology Land and People (ELP) in June 2007 for the National Trust (NT).

From these two documents information on protected, Biodiversity Action Plan (BAP) and Red Listed species have been extracted for all taxa with the main focus being on plants and invertebrates as they were the focus of these two earlier studies; also listed are noteworthy and Biodiversity Action Plan Habitats. The purpose of this (was) to identify which species and which habitats are most threatened from the proposed (management) activities and which may benefit so as best to advise working methods and protocols.

Conservation history

The pumping engine house at Towanroath was conserved by the National Trust in 1973. This work involved a substantial amount of rebuilding work, 'restoring' the engine house to more or less its late 19th century appearance, and 'undoing' some of the modifications undertaken to it during the last re-working from 1906-14, when flat rods from the horizontal engine sited on the foundations of the old boiler house were taken through the old engine house following the removal of some stonework from the bob and rear walls. The 1970s pointing was undertaken using a cementitious mortar.

The upper engine houses (the stamps and the two whims), together with the surviving boiler house, the traction engine house and the chimney were conserved in 1986-8 by Percy Williams and Sons of Redruth. The exposed open section of the calciner flue to the chimney was grilled over as part of these works, whilst the interior of the calciner was excavated under archaeological supervision before the re-pointing of parts of the structure). At the same time, some rationalisation of the path network from the upper part of the site down to Towanroath Shaft was undertaken in order to limit the effects of foot traffic on the eroding face of the coastal mine dumps. To control vehicle access to the site, one of the former clay pits adjacent to the road was partly infilled and levelled to create a visitor car park, whilst a bund to prevent vehicular access to the clifftops was created at its western end and a site interpretation panel was installed on the northern wall of the all-indoor beam whim engine house.

Towanroath Shaft was capped off with a concrete slab incorporating a welded steel grille, this work almost certainly having taken place in 1973 during the conservation of the engine house. This original grille was subsequently replaced when inspection revealed that it had become corroded and unsafe. Some of the other shafts on site were treated as part of Carrick District Council's 'Operation Minecap' during 1983, Water Shaft being equipped with a masonry bat castle incorporating a raised grille on its upper surface, the other shafts tackled being closed off with two part Clywd Caps.

The remaining bob wall of Great Charlotte pumping engine house was consolidated between 1987 and 1990. The shaft was plugged in 1983. Other shafts on Charlotte and Towan Moors were treated by Operation Minecap in the mid-1980s.

Charlotte United pumping engine house was stabilised and partly re-pointed in 1989. Works were undertaken to the remains of the Charlotte United engine house in 1993.

2010 Management Plan

The 2010 Management Plan included the re-assessment of the archaeology and built structures of the project area, the re-assessment of previous ecological surveys, an outline structural assessment of buildings within the property, the provision of a photographic record of all structures and recommendations for the management of the properties.

The National Trust has recently entered into a ten year Higher Level Stewardship (HLS) scheme, to help with management of the site. It is as part of the HLS scheme that the recommendations made in the Management Plan are to be developed further and consolidation carried out on the priority structures (within a set budget).

A pdf copy of the Management Plan (report no. 2011RO37) on disk will be forwarded to all those who express an interest in tendering for this work.

Future Management requirements

The range of works identified in the Management Plan includes wall capping and pointing in lime mortar, limited rebuilding of lost masonry where this compromises structural stability and the treatment or replacement of rotten/wormed timber lintels.

It is expected that the recommendations laid out in the Management Plan are followed closely to deliver this work, particularly section 7, pgs 89 – 119).

The main elements requiring works, as identified in the Management Plan are (showing their National Trust URNs):

1. Wheal Coates Horizontal engine house NT 190376
2. Wheal Coates beam whim - NT 190378
3. Wheal Coates stamps engine house – NT 190381
4. Wheal Coates calciner – NT 190346
5. Wheal Coates tributers' waterwheel – NT 190346
6. Towanroath – NT 190390
7. Wheal Coates lower horizontal engine house – NT 190391
8. Wheal Coates lower boiler house – NT 190392
9. Wheal Coates dry – NT 190385
10. Wheal Coates gas engine house – NT 190379
11. Wheal Coates smithy –NT 190343
12. Old Century Works - NT 190510
13. Wheal Charlotte United – NT 19616

These have been grouped into three phases of priority as part of the management plan works and form the basis of this work:

Wheal Coates A
Towanroath, Horizontal engine house, beam whim (lintel replacement), stamps engine house, calciner, tributers waterwheel

Wheal Coates B
Lower horizontal engine house, lower boiler house, dry, beam whim (woodworm treatment), gas engine house, smithy

Old Century Works

Charlotte United

Outline brief

An appropriately qualified and experience professional organisation should on behalf of the applicants prepare a Project Design/Written Scheme for the preparatory work necessary to forward and project manage selected consolidation works (identified above as Wheal Coates A, Wheal Coates B, Old Century Works, Charlotte United).

Liaison with Natural England, The National Trust, the Cornwall Council Conservation Officer and the Cornwall Council Historic Environment Countryside Advice Officer is required throughout the assessment. Contact details are given at the end of this brief.

Provision of this guidance is for the benefit of the HLS agreement holder to help ensure relevant tenders which fulfil HLS scheme requirements are received. Any contract however would be between the agreement holder (The National Trust) and the contractors. All day to day agreements, health and safety requirements including CDM regulations etc. are matters between these parties.

Aims

- identifying additional ecological and archaeological works,
- carrying out necessary further structural/condition surveys following on from previous work,
- identifying any short term access issues during the works ,
- writing the schedules of repair and works specifications for the works and sending these out to tender
- project management of stage two consolidation works

It is expected that some of these elements could be carried out 'in-house' by the successful contractor and some will have to be sub-contracted out, depending on the field of expertise of the project manager and their team.

The Project Design / Written Scheme should be submitted to and agreed in writing by Natural England before the work is commissioned and carried out. Please note that Natural England cannot accept 'contingency' amounts. All reasonably foreseeable work should be quoted for. The final amount payable will be based on work actually required and completed.

Those wishing to tender are advised to visit the site before completing their specification as there may be implications for accurately costing the work.

All costings must be clearly itemised in the submitted tender. Each item should include identification of who will carry out the work and time allocated to it.

Quotations should allow for statutory responsibilities which arise, including but not limited to, any duties under the Construction (Design and Management) Regulations 2007.

The task list below should be used to guide the itemisation of each element.

Tasks

(to be read in conjunction with the additional task guidance notes which follow)

The following tasks will make up this project, for which the project manager will have overall responsibility for ensuring they are carried out on time, to cost and at the appropriate professional standard:

1. Initial liaison with The National Trust, the Natural England Project Officer and Historic Environment Specialist, and Cornwall Council Conservation Officer and Historic Environment Countryside Advice Officer.
2. Further structural and condition surveys on the features as required, following on from the assessment carried out as part of the 2010 Management Plan.
3. Options appraisals on the features
4. Identifying the required consolidation works necessary
5. Identifying the required archaeological recording necessary to carry out stage two works

6. Identifying the required ecological surveys necessary to carry out stage two works
7. Identify permissions required to carry out the works (eg LBC, SSSI)
8. Prepare estimated costings for the works outlined above
9. Review point meeting to discuss proposed works and costings.

Stage two

10. Preparing the schedule of repair works and specifications ready for tender, including consent applications, provision for archaeological/ecological recording or other necessary works as required.
11. Send the above out to tender
12. Review meeting following return of tenders to determine appointment of preferred contractors for consolidation works
13. Project management of the stage two priority consolidation works
14. Draw together the results of the above into a final report.

Additional task guidance

Within all the tasks it is expected that the issues identified in the MP are considered and addressed where required to deliver the above tasks. Some elements of the work required to meet the tasks have already been completed as part of the MP and the structural surveys, and should be used to further inform the tasks.

1. Task 2 - The condition and structural surveys - This should build upon the assessment already carried out as part of the 2010 Management Plan. It should seek to provide additional and/or updated information where this is required, rather than a full reappraisal of the previous assessment. It should include an assessment of the feasibility and health and safety implications of carrying out the work and potential post works consequences, i.e. increased public accessibility etc (with particular reference to Charlotte United).
2. Task 3 - Options appraisals - Use appropriate historical sources to identify what options there may be in undertaking consolidation works at the structures, including materials used, styles, phases of construction/use. The appropriate level of archaeological recording required as part of the works should also be identified, particularly any pre conservation works surveys that will be required. Full liaison with the National Trust and the Cornwall Council Conservation Officer is expected to inform these options, which will feed into the works specifications (this may require a pre application advice submission to the Council).
3. Task 7 - Consideration of short term access and compound sites for contractors should also be considered, including identifying areas of archaeological and ecological features, and any permissions needed from adjacent land owners to access the sites by vehicles.
4. Task 10 - Specifications and Schedule of works – following consultation with the appropriate agencies (task 9 review meting), schedules of works should be drawn up against the identified priorities. This should also include briefs for appropriate levels of pre works wildlife survey and archaeological recording which should be used to inform the works, an archaeological watching brief during works where required and post works photographic record. Designation consent applications should also be prepared and submitted as required.

   It will be important to identify archaeological and ecological elements within the vicinity of and on the access route to the features that may be affected by any consolidation works and take specialist advice about their management/protection during the consolidation process. The 2010 Plan and liaison with the National Trust should be used to inform this element.

5. Task 11 – put the above works out to tender to at least three appropriate and experienced contractors able to carry out each element required (building works/archaeological recording/ecological recording etc)

Report Production

A report should be produced and should bring together the results of all the tasks and consolidation works. It should follow good practice by ensuring that:

- Draft and final versions of the report are clearly labelled with full explanatory title, their status and date;
- The format of the plan follows that used within this brief to ensure compliance with all required elements.
- All sections of all versions are adequately and sequentially numbered;
- All people and organisations involved in developing the plan are acknowledged;
- All facts (including dates) and texts properly referenced;
- A full bibliography, reference and archive sources is provided;
- Appendices with useful information are included, with full reference to and supporting evidence from previous reports/surveys as appropriate
- Include useful contact names and addresses.
- A4 or folded-out A3 plans, dependant on whichever will be easier to use.

Guidance for tenders

The successful organisation will be expected to oversee the provision of all appropriate work to ensure a successful outcome. This includes all health and safety related services, CDM and dealing with all consents required to carry out this stage of work. They will need to be familiar with the requirements of all the bodies and designations involved in the project, particularly in relation to:

- Natural England and the agri-environment scheme which will be the principal funding stream,
- the Listed Buildings
- the SSSI and SAC and all relevant natural environment designations and legislation

Provision of this guidance is for the benefit of the HLS agreement holder to help ensure relevant tenders which fulfil HLS scheme requirements are received. **Any contract however would be between the agreement holder (The National Trust) and the contractors.** All day to day agreements, health and safety requirements etc., are matters between these parties.

Liaison with The National Trust and Natural England is essential throughout the project.

The Tender will be evaluated on the following criteria (not set out in order of importance):

- Price
- Capability and Quality (including the ability to meet the deadlines indicated)
- Previous relevant experience

Deposition

Five copies of the completed report should be sent to The National Trust, one copy each to the Natural England Historic Environment Advisor at Exeter, the NE Project Officer at Truro, the Cornwall Council Conservation Officer and the Countryside Advice Officer.

In addition digital copies should be provided to all of the above in a format acceptable to the National Trust and Natural England (to be advised upon commission of successful tender).

A digital copy should be deposited with the Historic Environment Record held by Cornwall Council, along with archived site notes, plans and photographs.

Dissemination & Publication

A summary of the results of the work should be sent to the Principal Archaeologist (Historic Environment Record Officer), Cornwall County Council either through an Event Record Pro-forma or concise summary containing equivalent information.

The work should be registered on OASIS (Online Access to the Index of Archaeological Investigations).

Monitoring

Variations in the project design should be submitted in writing to the NE Project Officer.

Additional monitoring meetings may be requested by the project manager, The National Trust, Natural England, or Cornwall Council if required.

Timetable

The stage one and two work should be completed and the final report submitted by the end of March 2015.

Details should be supplied of the projected programme of the project through to completion.

- the programme should be expressed on a cascade chart or by some similar form of graphic representation. The cascade chart should show:
    - all the tasks to be undertaken in the correct sequence
    - the inter-relatedness and interdependence of tasks
    - time-critical elements
    - the length of time allocated to each task
        - the personnel (or grade) allocated to each task
        - agreed monitoring points

Personnel

Each aspect of the work should be carried out by suitably experienced and qualified professionals with specialist expertise in their area of competence. The names and titles of the Project Manager and all staff should be listed with a précis of their relevant and recent experience.

It would be preferable for the professional organisations and key personnel to be members of their relevant professional institutions.

Key contact for this assessment will be through Beth Tonkin, the Natural England Project officer for this agreement. Bill Makin, The National Trust Mid Cornwall Head Ranger, Jim Parry the National Trust Archaeologist and the Cornwall Council Conservation Officer will also be key contacts throughout the project. Joy Ede, Natural England Historic Environment Advisor and Ann Reynolds of Historic Environment, Cornwall Council, should be kept informed of the works progress.

Contact with The National Trust should be through:

Bill Makin
The National Trust
Wayside Studio
West Kitty
St Agnes
TR5 0SU
Tel. 01872 552412
Bill.Makin@nationaltrust.org.uk
Beth Tonkin
Lead Advisor
Natural England
Pydar House
Pydar Street
Truro
TR1 1XU
Tel. 0300 060 1625
Mob: 07980 863093
beth.tonkin@naturalengland.org.uk
James Parry
Archaeologist
National Trust
South West Region
Cornwall Office
Lanhydrock
Bodmin
Cornwall
Tel: 01208 265238
james.parry@nationaltrust.org.uk
Joy Ede
NE SW Historic Environment Advisor
Level 9 and 10, Renslade House,
Bonhay Road,
Exeter
EX4 3AW
Tel: 0300 060 0851
Mobile 07748 148213
Joy.E.Ede@naturalengland.org.uk

Ann Reynolds

Senior Archaeologist, Countryside Advice

Historic Environment Service, Cornwall Council

Kennall Building,

Old County Hall,

Truro

TR1 3NB

01872 322055

annreynolds@cornwall.gov.uk

This brief has been prepared by Ann Reynolds (Senior Archaeologist, Countryside Advice, Historic Environment Service, Cornwall Council)

Date: 14th June 2013

Appendix 2: Written Scheme of Investigation

Historic Environment Projects, Cornwall Council

St Agnes Mine Buildings: Written Scheme of Investigation for archaeological recording during consolidation/repair works

Client:	National Trust
Client contact:	
Client tel:	
Client email:	

Project background

The National Trust holdings at St Agnes include St Agnes Beacon and a large area of coastal property from St Agnes Head to just east of Porthtowan. The land has been entered into Natural England's Higher Level Stewardship scheme (St Agnes Coast and Beacon, HLS agreement No. AG00438963).

The site was initially entered into a one year HLS agreement to produce a comprehensive Management Plan (Kirkham and Sharpe & Spaldings Associates 2010) which summarised and prioritised the management needs of the various structures and habitats.

Sites in this area are subject to weathering from their exposed coastal location and (especially those on the coastal footpath) also visitor footfall. The major structures at Wheal Coates and the engine house at Wheal Charlotte have been previously conserved and to a large extent the earlier conservation works have been successful although in the intervening time some minor issues have become apparent and it will be important to safeguard the buildings into the future.

A brief titled 'Project Development of Consolidation Works with Archaeological and Ecological Recording at St Agnes, Cornwall' was developed by Ann Reynolds of Cornwall Council. Invitations to tender on the basis of this brief were then issued by Natural England and the National Trust. The tender was won by PDP Green Consulting Limited, with archaeological input from Historic Environment Projects. This Written Scheme of Investigation sets out the approach to archaeological recording works during the conservation process, the working methods to be employed and the arrangements for archiving and reporting of results.

The consulting engineers will also produce a structural assessment report to form the basis of a tender specification document for the extent of conservation works as defined by Natural England. This will include; preliminaries, general conditions, schedule of works, provisional sums and detailed survey plans with building conservation annotations. This document will have been informed by the Stage 1 Assessment.

Detailed building conservation recommendations will be given for each building within the project, annotated on measured building survey elevations and plans. In addition the schedule of works will contain a specification document with details of the mortar

and pointing mix as well as a general approach to the conservation of the standing archaeology of the mine buildings affected by the works.

Stage 2 of the project includes practical conservation works to the structures, which will be overseen by the engineer with input from the archaeologist (Historic Buildings Consultant).

Project extent

The project area includes buildings and structures at Wheal Coates and two sites, Old Century Works and Wheal Charlotte United that are located in Chapel Coombe (see Fig 1). These sites have been prioritised for management works (*ibid*).

The prime importance of this landscape lies in its industrial heritage, which has been recognised as being of international importance through its World Heritage Site (WHS) status. The buildings at Wheal Coates, and especially the engine house on Towanroath Shaft situated on a dramatic cliff top location, is one of Cornwall's most photographed buildings. Beyond the highly visual engine houses, there are good examples of other mining structures including ore dressing floors and an unusual double-bayed reverberatory calciner. The heathland at Wheal Coates also contains mining related features, including an early and well-preserved open-working on a tin lode, and a small tin dressing floor powered by a waterwheel.

At Chapel Coombe are the remains of Old Century Works, which had become largely forgotten and overgrown during the later 20th century, and the pumping engine house with associated structures at Wheal Charlotte United.

The sites identified for prioritised conservation works are as follows:

1. Wheal Coates Horizontal engine house NT 190376
2. Wheal Coates beam whim - NT 190378, Grade II Listed 63883
3. Wheal Coates stamps engine house — NT 190381, Grade II Listed 63882
4. Wheal Coates calciner — NT 190346, Grade II Listed 63885
5. Wheal Coates tributers' waterwheel — NT 190346
6. Towanroath engine house — NT 190390, Grade II Listed 63881
7. Wheal Coates lower horizontal engine house — NT 190391
8. Wheal Coates lower boiler house — NT 190392
9. Wheal Coates dry — NT 190385
10. Wheal Coates gas engine house — NT 190379
11. Wheal Coates smithy — NT 190343
12. Old Century Works - NT 190510
13. Wheal Charlotte United — NT 190616, Grade II Listed 63769

Aims and objectives

Stage 1

Stage 1 is essentially a scoping survey to inform work within Stage 2. The aims of Stage 1 are to:

- Carry out a structural and physical condition survey on targeted sites.
- Carry out an ecological appraisal, to minimise impacts on the ecological resource.
- Assess priorities for building conservation works, minimising adverse impacts upon the archaeological resource.

Stage 2

The objectives of Stage 2 are to:

- Ensure site works are undertaken in such a way as to maintain, if not enhance, the integrity and authenticity of the historic resource, minimising adverse impact upon the resource.
- Ensure that (within NE financial guidelines) appropriate conservation of the historic resource is a prime objective.
- Ensure (through site and monitoring meetings), the methodologies and techniques of all aspects of the site works accord with the method statements and agreed methodologies outlined in the schedule of works and specifications.
- Ensure best practice and the highest possible standards of workmanship are maintained during conservation works.
- Ensure adequate recording of remains is undertaken in areas affected by conservation works.
- Ensure arrangements are in place for communication on progress and any issues, etc. with the landowner, NE and CC (HE Countryside Advice) throughout the duration of the project.
- Record sites, features, deposits and artefacts affected by or uncovered by the works and the character/extent of works for Cornwall's Historic Environment Record.
- Disseminate results of the project appropriately and arrange for deposition of the project archive.

Working methods

All recording work will be undertaken according to the Institute for Archaeologists *Standards and Guidance for Archaeological Investigation and Recording.* Staff will follow the IfA *Code of Conduct* and *Code of Approved Practice for the Regulation of Contractual Arrangements in Archaeology.* The Institute for Archaeologists is the professional body for archaeologists working in the UK.

Fieldwork: survey

With the exception of Old Century Works, all buildings have previous archaeological measured surveys, including plan and elevation detail. During the course of conservation works additional measured information and detail will be added as appropriate to copies of existing drawings.

Old Century Works will be the subject of a new measured survey, to include an overall plan and elevations of surviving walls. This survey will be carried out by a commercial survey contractor. Results of this survey will be annotated and interpreted by an archaeologist from HEP.

Fieldwork: photographic recording

To include colour photographs taken with a digital SLR camera (with a minimum resolution of 8 million pixels).

The photo record will comprise:

- General views of each accessible elevation, to be taken before conservation works are undertaken
- examples of structural and architectural detail, including during conservation
- General views of each accessible elevation after the completion of works.

Methodology for the archive standard photography is set out as follows:

- Photographs of details will be taken with lenses of appropriate focal length
- A tripod will be used to take advantage of natural light and slower exposures
- Difficulties of back-lighting will be dealt with where necessary by balancing the lighting by the use of flash
- A metric scale will be included in all views, except where health and safety considerations make this impractical

Consultancy

- The HE project officer will attend a pre-works meeting with the landowner, Natural England officer, contractors and structural engineer to agree site access, site compound, stockpile areas, agree details of location/preparation/number of mortar test panels, agree working methods and any changes to proposed work programme and discuss Health and Safety issues with NE requirements (in order to minimise damage to known or unknown sub-surface archaeological features).
- The HE project officer will regularly liaise with the project's stakeholders (landowners, CC's Historic Environment Countryside Advice Officer, and the NE Officers), using the mechanism of regular update emails.
- The HE project officer will provide historic building conservation advice to the site engineer and site contractor in line with English Heritage guidelines, during regular weekly site visits.
- The HE project officer will attend regular site meetings at an approximate frequency of 0.5 day per week during the building contract. The meetings will be held with the site engineer, site contractor, client and NE (as appropriate), to discuss ongoing conservation work methods, detail of repairs and resolve any conservation work problems. The structural engineer and site contractor will have a proven track record in historic building conservation.
- The HE project officer will ensure that site conservation works are carried out in accordance with best practice, and will halt inappropriate or sub-standard work and inform the stakeholders.

Fieldwork: historic building recording

- Detailed recording will be undertaken for all newly exposed architectural features and any features revealed during the course of conservation works. Measured detail will be added, where appropriate, to the existing survey drawings.
- As well as new detail, the nature and extent of all conservation works will be added to the existing archaeological/engineering building survey drawings by the Structural Engineer (to be supplied to HES by the client), as part of the CDM regulations (provision of 'as built' survey drawings).

Fieldwork: archaeological recording

- Archaeological recording will be undertaken during any ground disturbance that has revealed archaeological features. Recording will be undertaken using a mix of direct measurement, sketch plotting and photography, as appropriate (constrained by safety factors).
- The archaeological recording report will be enhanced by the structural engineer's 'as built' survey drawings detailing the nature and extent of building conservation works. 'Before' and 'after' photographs will also be used to graphically illustrate the site conservation works.
- Where significant remains are encountered the archaeologist will be given the opportunity to make an appropriate form of record before work proceeds; where a temporary stop of work is required to undertake this, the site archaeologist will make a request via the project engineer and landowner.

Creation of site archive

To include:

- Digital colour photographs (stored according to historic environment guidelines and copies of images made available to the National Trust)
- Preparation of finished drawings
- Completion of the English Heritage/ADS OASIS online archive index

Archive report

A written report will include:

- Summary
- Project background
- Aims and objectives
- Methodology
- Location and setting
- Designations
- Site history
- Archaeological results
- Chronology/dating evidence
- Significance
- Conclusions
- References
- Project archive index
- Supporting illustrations: location map, historic maps, plans, elevations/sections, photographs

A paper copy and a digital (PDF) copy of the report, illustrations and any other files will be held in the Cornwall HER. Paper copies of the report will be distributed to the client, to local archives and national archaeological record centres.

Archive deposition

An index to the site archive will be created and the archive contents prepared for long term storage, in accordance with HE standards.

The archiving will comprise the following:

5. All correspondence relating to the project, the WSI, a single paper copy of the report together with an electronic copy on CD, stored in an archive standard (acid-free) documentation box
6. A2 drawn archive storage (plastic wallets for the annotated record drawings)
7. Archive standard negative holders and archive print holders, to be stored in the HE system until transferred to the Royal Cornwall Museum.
8. The project archive will be deposited initially at ReStore PLC, Liskeard and in due course (when space permits) at Cornwall Record Office.

Timetable

The study is anticipated to be commenced during March 2014. The archive report will be completed within 6 months of the end of the fieldwork. The deposition of the archive will be completed within 3 months of the completion of the archive report.

Project monitoring

Monitoring of the project will be carried out by James Parry, the National Trust's Archaeologist for Devon and Cornwall. Where the NT Archaeologist is satisfied with the archive report and the deposition of the archive written discharge of the planning condition will be expected from the local planning authority (LPA).

Monitoring points during the study will include:

- Approval of the WSI
- Completion of fieldwork
- Completion of archive report
- Deposition of the archive

Historic Environment Projects

Historic Environment Projects is the contracting arm of Historic Environment, Cornwall Council (HE). HE employs some 20 project staff with a broad range of expertise, undertaking around 120 projects each year.

HE is committed to conserving and enhancing the distinctiveness of the historic environment and heritage of Cornwall and the Isles of Scilly by providing clients with a number of services including:

- Conservation works to sites and monuments
- Conservation surveys and management plans
- Historic landscape characterisation
- Town surveys for conservation and regeneration
- Historic building surveys and analysis
- Maritime and coastal zone assessments
- Air photo mapping
- Excavations and watching briefs
- Assessments and evaluations
- Post-excavation analysis and publication
- Outreach: exhibitions, publication, presentations

Standards

HE is a Registered Organisation with the Institute for Archaeologists and follows their Standards and Code of Conduct.

As part of Cornwall Council, HE has certification in BS9001 (Quality Management), BS14001 (Environmental Management), OHSAS18001 (Health, Safety and Welfare) and Investors in People.

Terms and conditions

Contract

HE Projects is part of Historic Environment, Cornwall Council. If accepted, the contract for this work will be between the client and Cornwall Council.

The views and recommendations expressed will be those of the HE projects team and will be presented in good faith on the basis of professional judgement and on information currently available.

Project staff

The project will be managed by a nominated Senior Archaeologist who will:

- Discuss and agree the detailed objectives and programme of each stage of the project with the client and the field officers, including arrangements for health and safety.
- Monitor progress and results for each stage.
- Edit the project report.
- Liaise with the client regarding the budget and related issues.

Work will be carried out by HE field staff, with assistance from qualified specialists and sub-contractors where appropriate. The project team is expected to include:

Nigel Thomas BA MIfA

Senior Archaeologist who has worked with HE and its predecessors since 1987. Responsible for management of projects relating to historic building recording and surveys of historic landscapes. Past work has included recording and structural analysis at Launceston and Restormel Castles, medieval chapels at Rame, Bodmin and Hall (Bodinnick), as well as landscape surveys at Lanhydrock park and Godolphin gardens. Project manager for historic building analyses at Tintagel Old Post Office, Cotehele House, St Michael's Mount summit complex and Trerice for the National Trust. Has recorded numerous industrial structures including Harveys Foundry, Loggans Mill (Hayle), Town Mills at St Columb Major, and china-clay area features including the waterwheel at Virginia CC Works, Greensplat engine house and Carrancarrow chapel. Project team leader for the Lostwithiel Town Characterisation Study. Member of the IfA's Buildings Group and Graphic Archaeology Group. An experienced user of AutoCAD and is responsible for HE's survey methodology.

Adam Sharpe BA MIfA

Senior Archaeologist specialising in the recording, interpretation and conservation management of industrial buildings, sites and landscapes, having worked with HE and its predecessors since 1984 and has published guidance on the conservation of mine buildings. Major projects during the past two and a half decades have included the Bodmin Moor and West Penwith Projects, the St. Just survey and all of the related National Trust and Objective One conservation projects, the Minions Survey, most elements of the Mineral Tramways Project and the recent conservation of Trewavas mine. Adam has been closely involved with the development of Geevor into a major heritage site since its closure in 1991 and managed the data collection and boundary identification stages of the successful Cornish Mining World Heritage Site Bid. Member of the IfA Buildings Group.

Report distribution

Paper copies of the report will be distributed to the client, to local archives and national archaeological record centres.

A digital copy of the report, illustrations and any other files will be held in the Cornwall HER and also supplied to the client on CD or other suitable media.

Copyright

Copyright of all material gathered as a result of the project will be reserved to the Historic Environment, Cornwall Council. Existing copyrights of external sources will be acknowledged where required.

Use of the material will be granted to the client.

Freedom of Information Act

As Cornwall Council is a public authority it is subject to the terms of the Freedom of Information Act 2000, which came into effect from 1st January 2005.

HE will ensure that all information arising from the project shall be held in strict confidence to the extent permitted under the Act. However, the Act permits information to be released under a public right of access (a "Request"). If such a Request is received HE may need to disclose any information it holds, unless it is excluded from disclosure under the Act.

Health and safety statement

HE follows the Council's *Statement of Safety Policy*. Prior to carrying out on-site work HE will carry out a Risk Assessment.

Insurance

As part of Cornwall Council, HE is covered by Public and Employers Liability Insurance, with a policy value of £50m. The Council also has Professional Negligence insurance with a policy value of £5m.

Nigel Thomas
Senior Archaeologist
6th March 2014

Historic Environment Projects
Environment Directorate
Cornwall Council

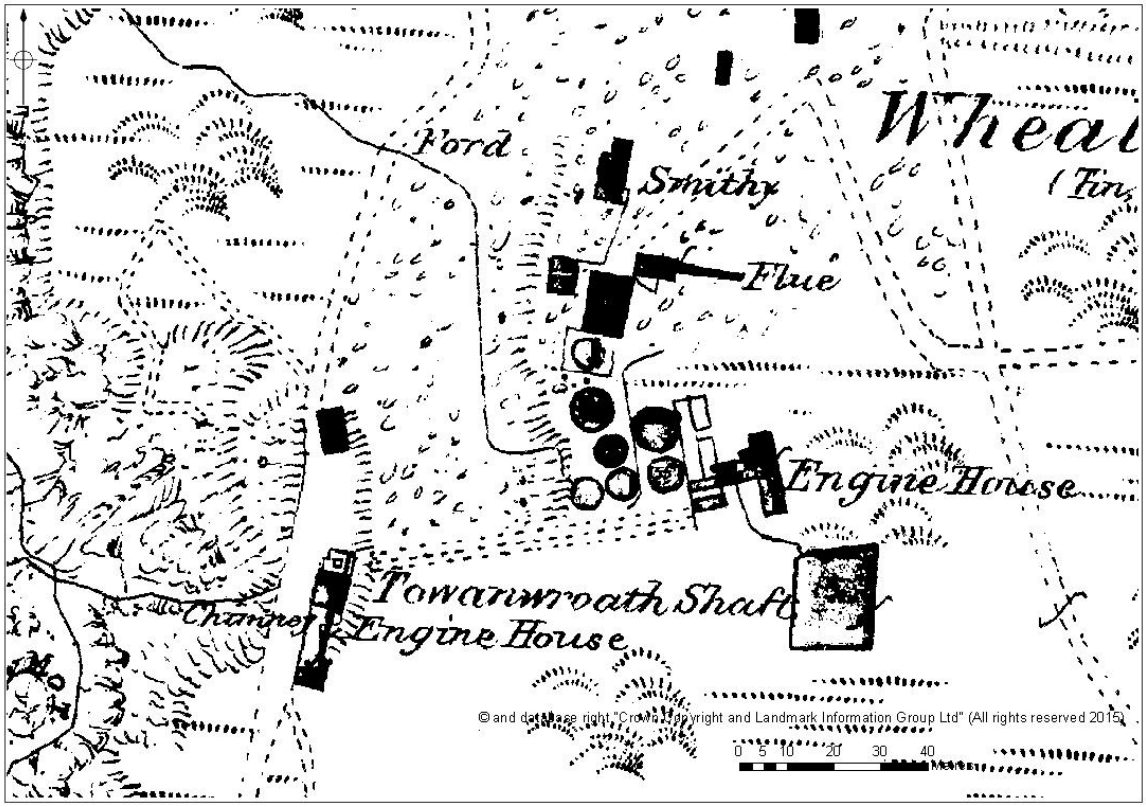

Fig 3. Wheal Coates as shown on the circa 1877 Ordnance Survey 25" to a mile mapping.

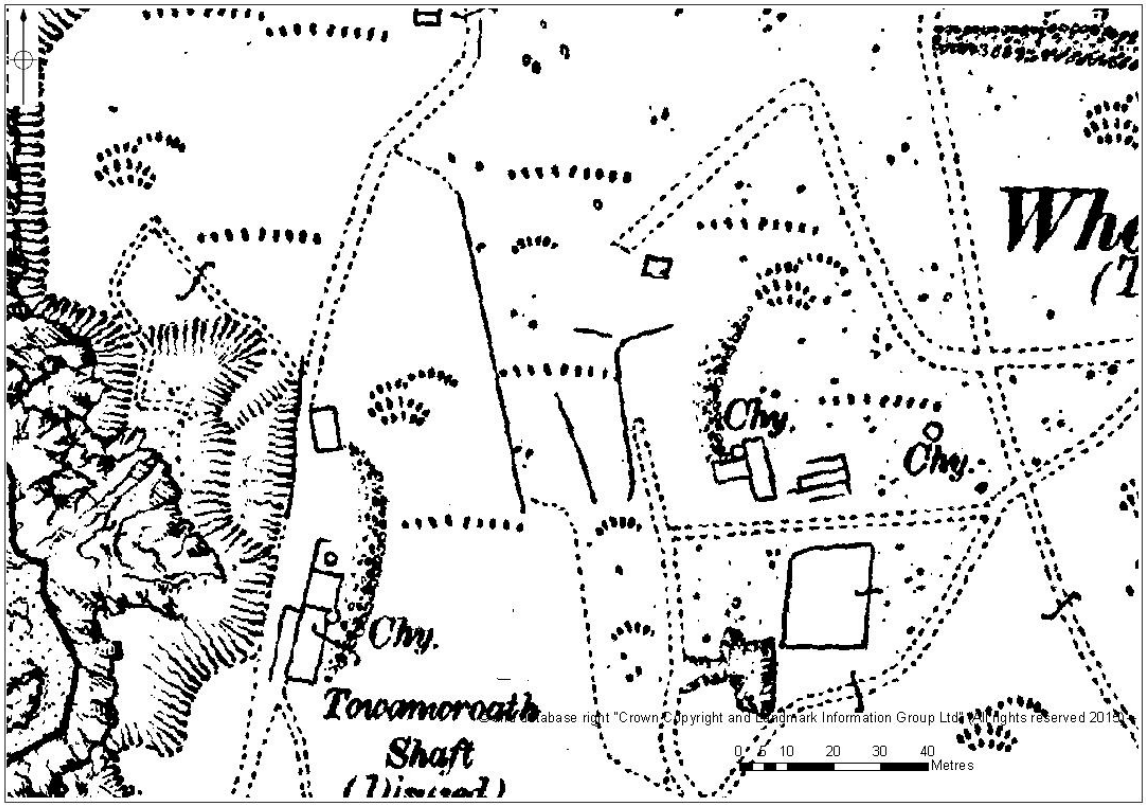

Fig 4. Wheal Coates as shown on the circa 1907 Ordnance Survey 25" to a mile mapping, immediately prior to its 20th century reworking.

Fig 5. Wheal Coates as it appeared on a 2005 Cornwall County Council aerial photograph. Note the significant level of path erosion visible on this source.

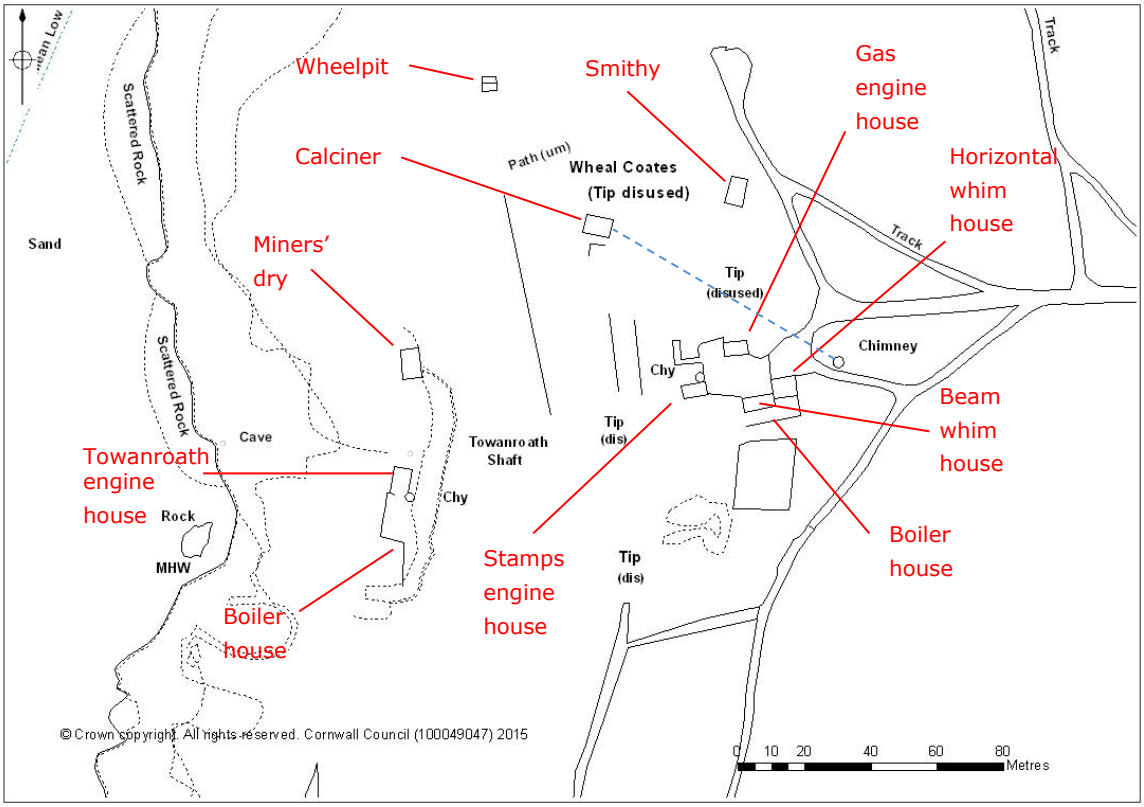

Fig 6. The locations of the principal structures at Wheal Coates. The calciner flue is shown by a dashed blue line.

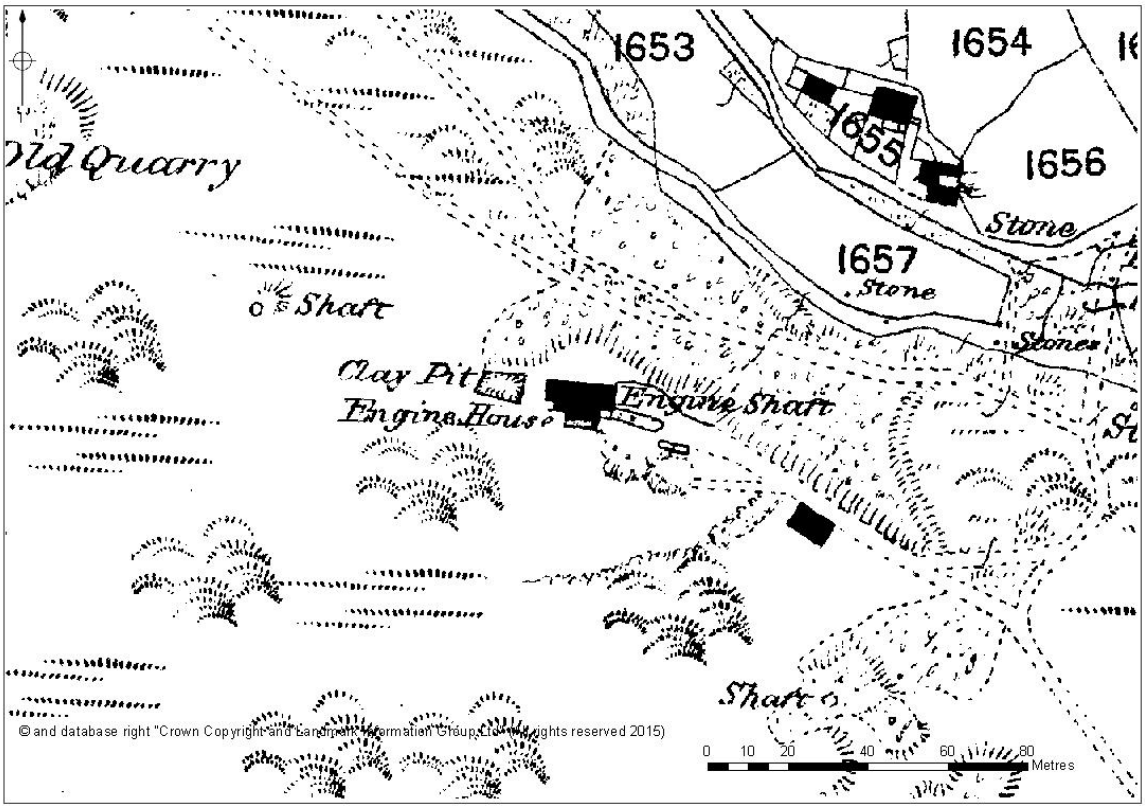

Fig 7. Wheal Charlotte United as shown on the circa 1877 OS 25" to a mile mapping.

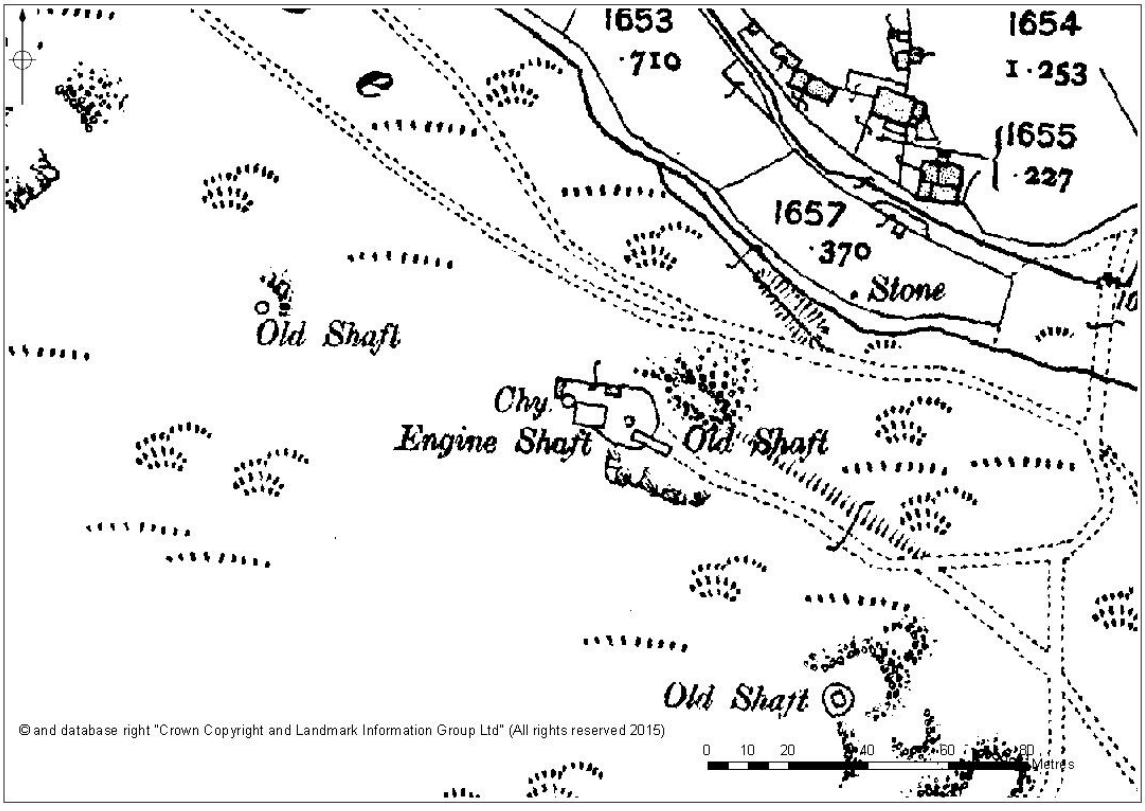

Fig 8. The disused Wheal Charlotte United as shown on the circa 1907 OS 25" to a mile mapping.

Fig 9. Wheal Charlotte United as it appeared on a 2005 Cornwall County Council aerial photograph, showing scrub development around its site.

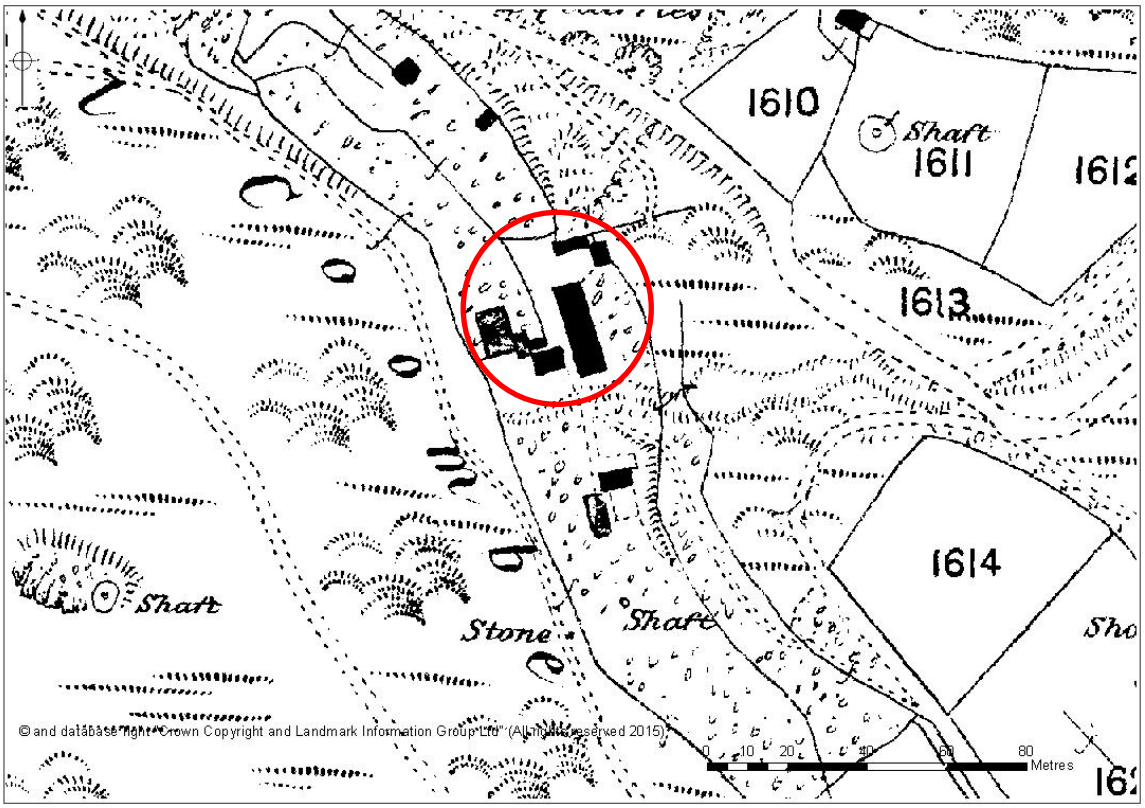

Fig 10. The Old Century Works in Chapel Coombe as shown on the circa 1877 OS 25" to a mile mapping.

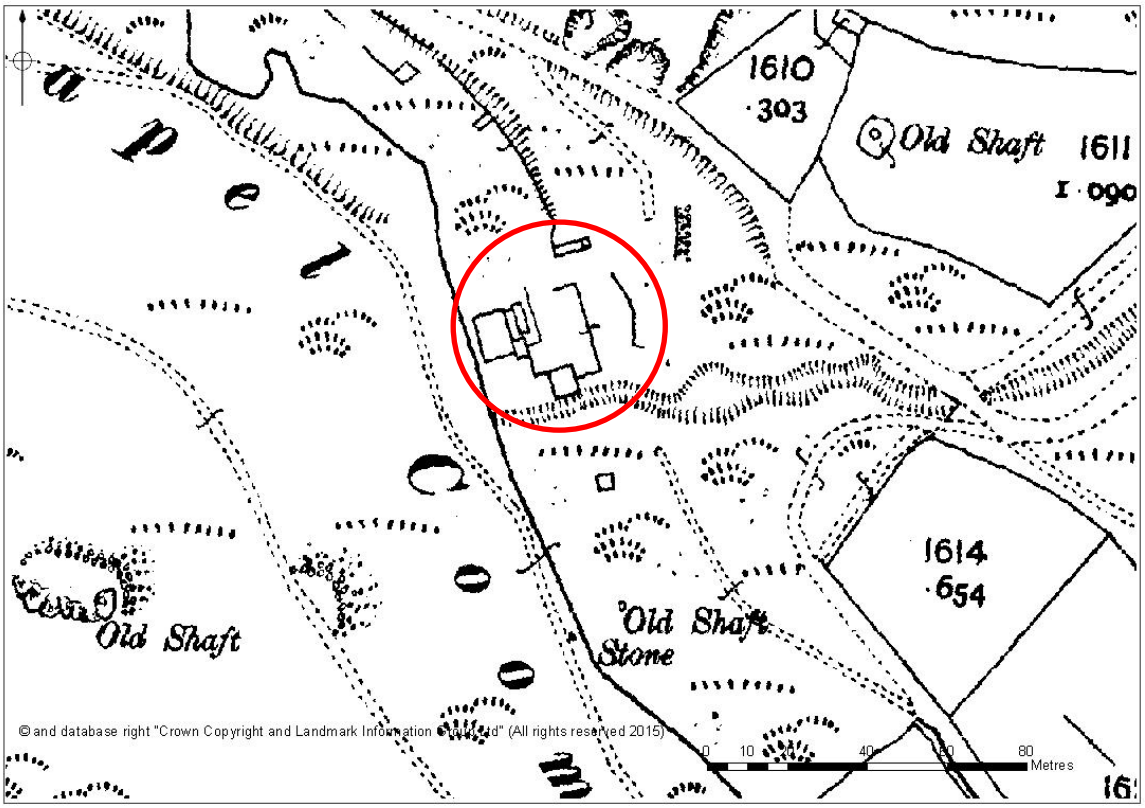

Fig 11. The disused Old Century works as shown on the circa 1907 OS 25" to a mile mapping.

Fig 12. The Old Century Works as depicted in a scrubbed part of Chapel Coombe on a 2005 Cornwall County Council aerial photograph.

Fig 13. The lintel over the doorway in the eastern elevation of the horizontal whim engine house.

Fig 14. The horizontal whim engine house (right), boiler house (centre) and beam whim engine house (left), with the stamps engine house in the background.

Fig 15. The replacement lintel over the blocked window in the southern elevation of the all-indoor beam whim engine house.

Fig 16. The Western elevations of the all-indoor beam whim engine house (left) and its boiler house (right).

Fig 17. The eastern end of the boiler house associated with the all-indoor beam whim engine house, showing the lost masonry over the flue connection to the chimney and the poor state of the wall heads.

Fig 18. The eastern end of the southern elevation of the horizontal whim engine house, showing stone loss at its base.

Fig 19. The repairs undertaken to the lower section of the walling of the horizontal whim engine house.

Fig 20. The cylinder opening in the eastern elevation of the stamps engine house, showing the low level flue connection to the boiler house which formerly abutted this side of the building.

Fig 21. The western elevation of the stamps engine house showing the infill of the scar left when the flywheel loadings were removed and the consolidated collapsed wing way masonry on the head of the bob wall.

Fig 22. The damaged cobbling at the head of the former tramway from Towanroath Shaft to the whim engine house where it abuts the southern side of the stamps engine house.

Fig 23. The repairs undertaken to the stamps tramway to stabilise it and prevent further foot erosion.

Fig 24. The southern elevation of the stamps engine house.

Fig 25. The underpinning masonry inserted beneath the western end of the cylinder bedstones in the stamps engine house.

Fig 26. The replacement stub lintel inserted over the ground floor opening in the southern wall of the stamps engine house.

Fig 27. The eroded masonry forming the cill to the doorway in the eastern elevation of the reverberatory calciner.

Fig 28. The lost brickwork from the head of the arched calciner flue where it runs just below the ground surface.

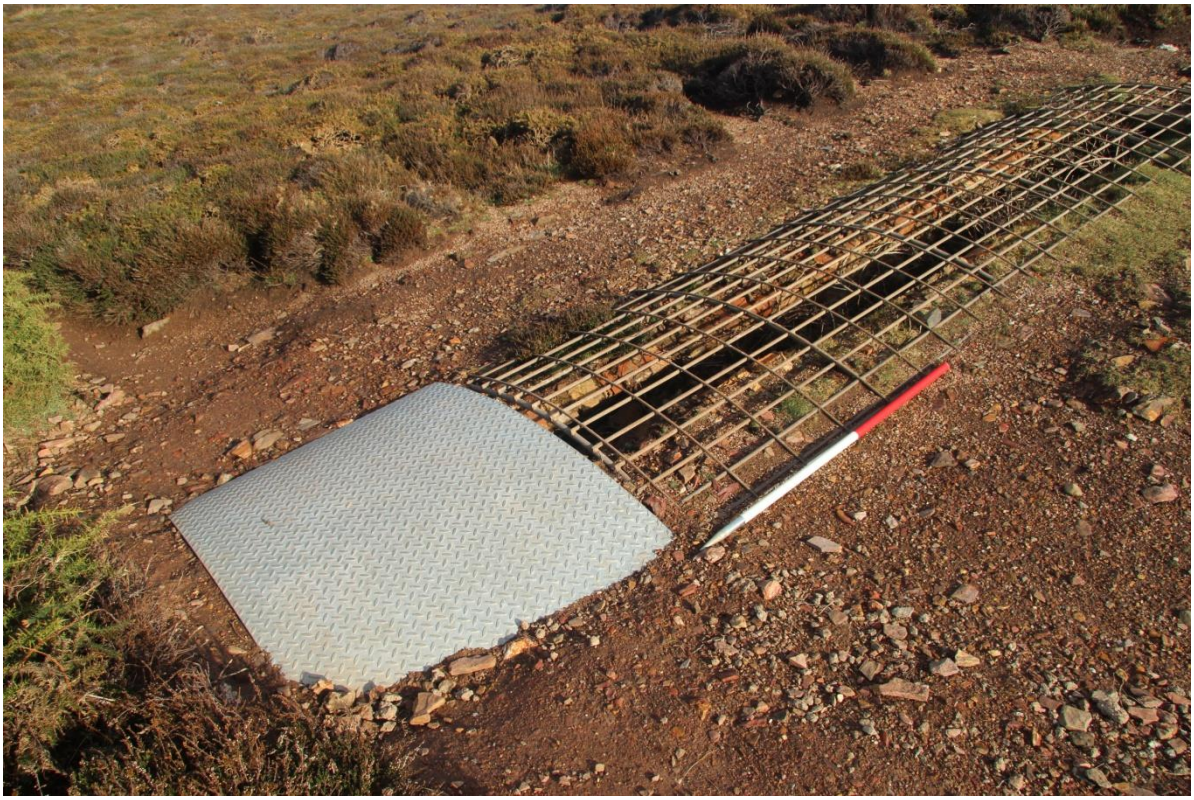

Fig 29. The galvanised steel plate installed over the hole in the calciner flue to prevent further loss of brickwork.

Fig 30. The tributers' stamps wheelpit (right) and gearing platform (left) prior to works.

Fig 31. The poor quality of the wheelpit walling prior to works.

Fig 32. Lost masonry on the south western corner of the stamps gearing platform.

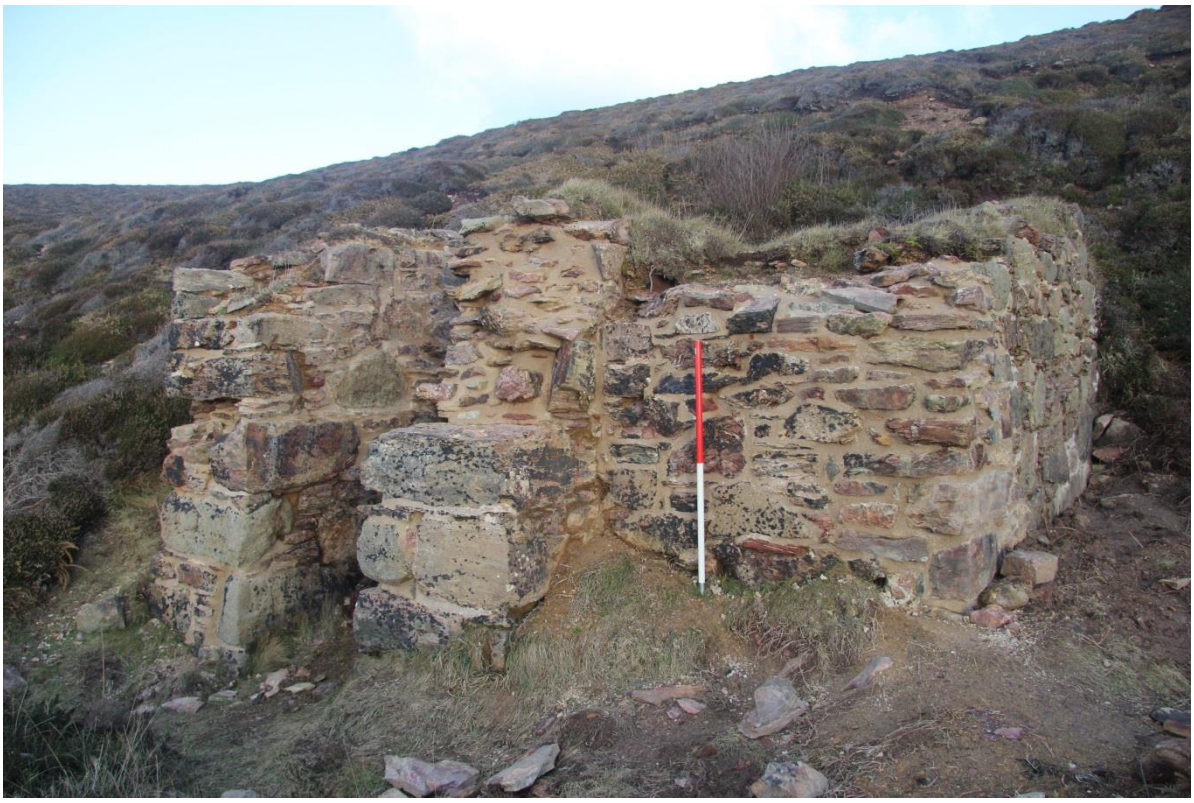

Fig 33. The wheelpit and stamps gear plat following repointing and limited re-building.

Fig 34. Towanroath engine house and the remains of the later horizontal engine house (foreground). The boiler house is in the shadowed area to their right.

Fig 35. Towanroath engine house from the north. Towanroath Shaft is immediately in from of the bob wall.

Fig 36. Towanroath Shaft, showing the steel barred grille inserted into the original concrete cap, the Lionweld grille set over it and the steel grille placed over that again. All had been damaged by visitors wishing to drop stones down the shaft.

Fig 37. The replacement grille over Towanroath Shaft.

Fig 38. The remains of the 20th century horizontal engine house constructed to the south of Towanroath engine house.

Fig 39. The remaining walling of the boiler house adjacent to the pumping engine house at Towanroath Shaft, showing the flue connection in its north eastern corner.

Fig 40. The southern end of the 20th century horizontal engine house at Towanroath Shaft, with the flue entry from the boiler house to the right.

Fig 41. Towanroath Shaft engine house from the north, showing the low walling of the former change house in the foreground.

Fig 42. The 20th century gas engine house at Wheal Coates.

Fig 43. The walling of the Wheal Coates stamps and buddle floors to the north west of the stamps engine house.

Fig 44. The northern end of the Wheal Coates mine smithy showing the low surviving walling.

Fig 45. The eastern and southern elevations of the mine smithy at Wheal Coates.

Fig 46. The Old Century Works stamps wheelpit prior to vegetation clearance and stabilisation.

Fig 47. The Old Century Works stamps wheelpit following vegetation clearance but prior to its stabilisation.

Fig 48. The eastern end of the Old Century Works dressing floors following the clearance of scrub and rubble. The concrete plinths would have supported vanning tables.

Fig 49. The doorway to the crib hut or office at the western end of the Old Century Works complex.

Fig 50. The convex buddle in the dressing yard on the southern side of the Old Century Works following initial vegetation clearance.

Fig 51. The convex buddle at the Old Century Works following the final removal of vegetation and rubble but prior to its consolidation.

Fig 52. Looking north-west across the Old Century Works following extensive vegetation and rubble clearance.

Fig 53. A general view of the structures at the western end of the Old Century Works following vegetation clearance and masonry conservation works.

Fig 54. The boiler house at Charlotte United prior to its conservation.

Fig 55. Conservation works in progress within the Charlotte United boiler house, which was fully re-pointed given its condition.

Fig 56. The balance bob mounting adjacent to the coned out shaft at Charlotte United.

Fig 57. The under-flue for the single boiler revealed during the excavation of the interior of the boiler house at Charlotte United.

Fig 58. The remains of the pumping engine house at Charlotte United during its consolidation. The quoined reveal which formed the left surviving side of the cylinder opening was partially reconstructed to strengthen the building.

Fig 59. The engine house and boiler house at Charlotte United on completion of the conservation works undertaken to them.

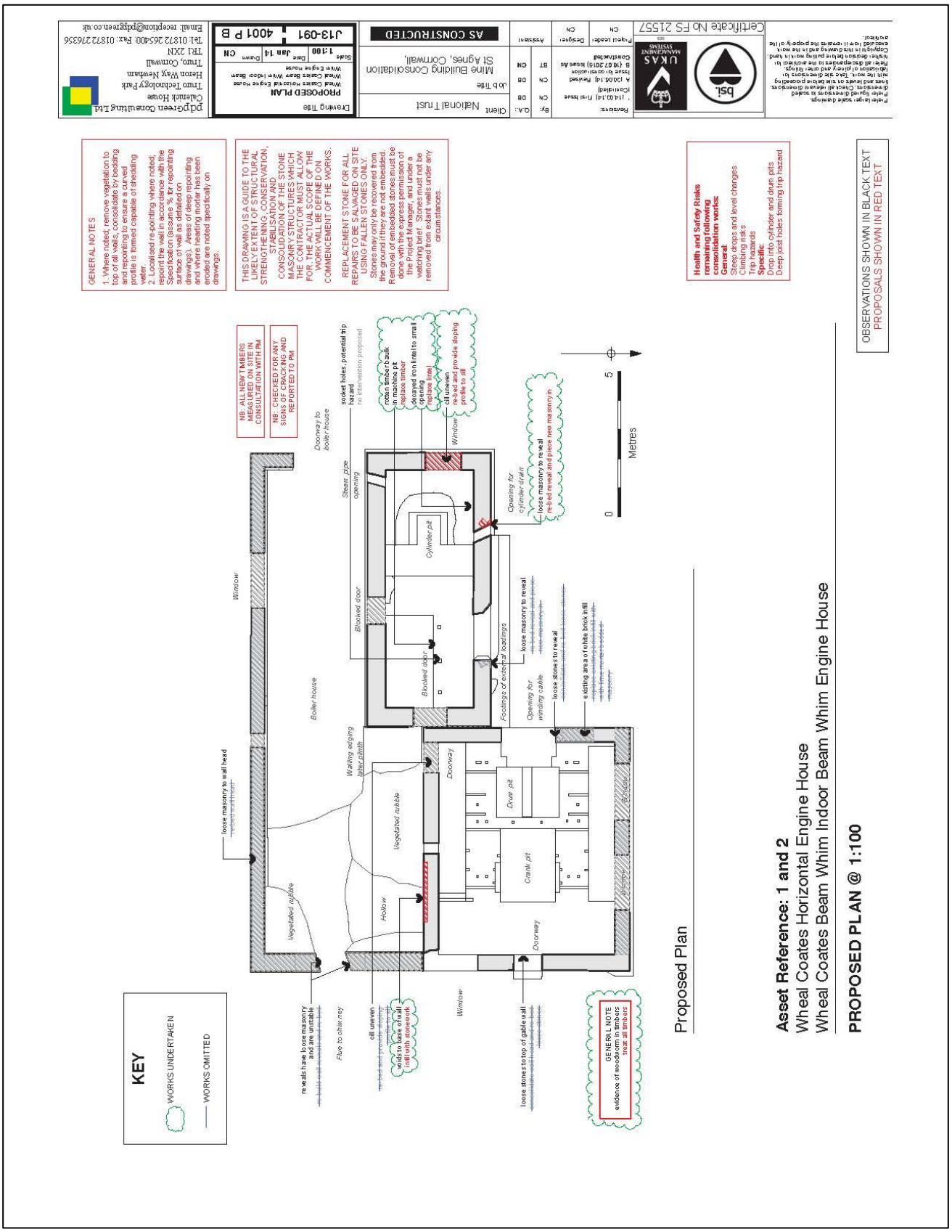

Fig 60. Plan of Wheal Coates horizontal engine house, beam whim and boiler house.

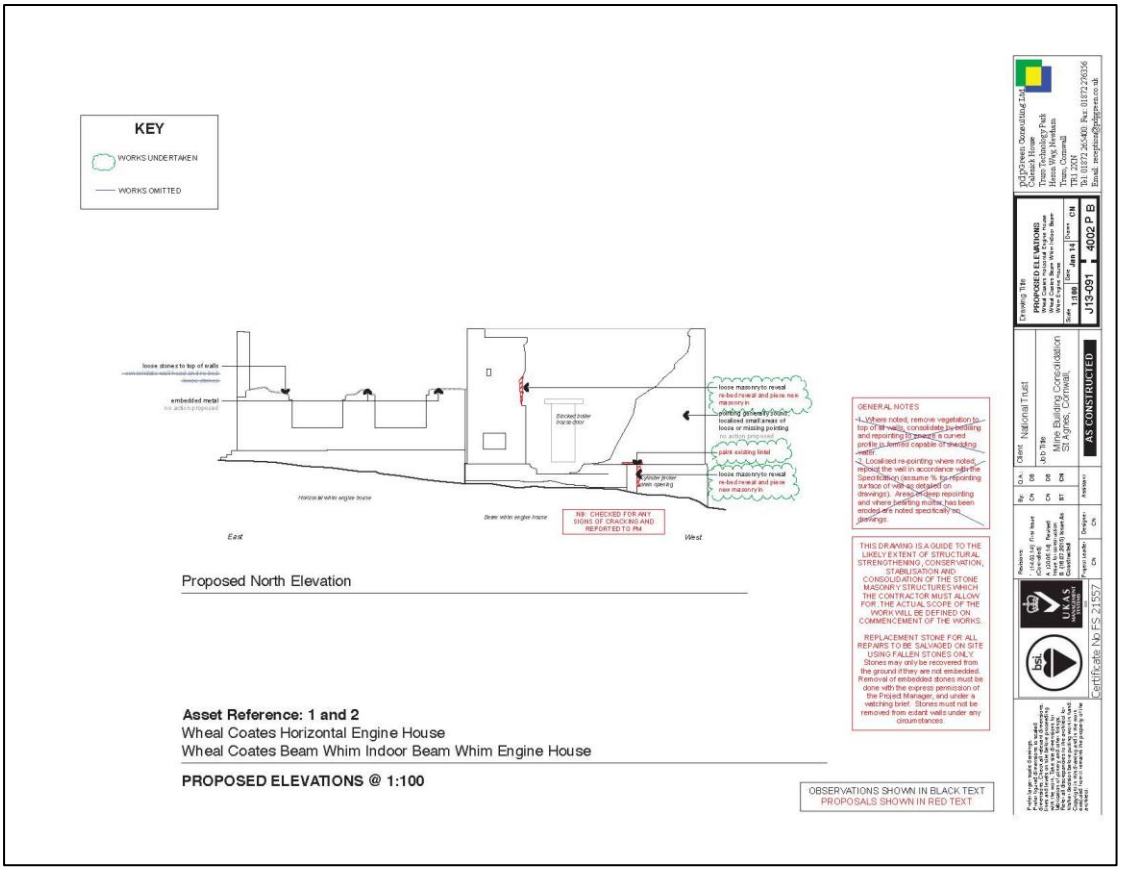

Fig 61. Northern external elevations of Wheal Coates horizontal engine house and beam whim.

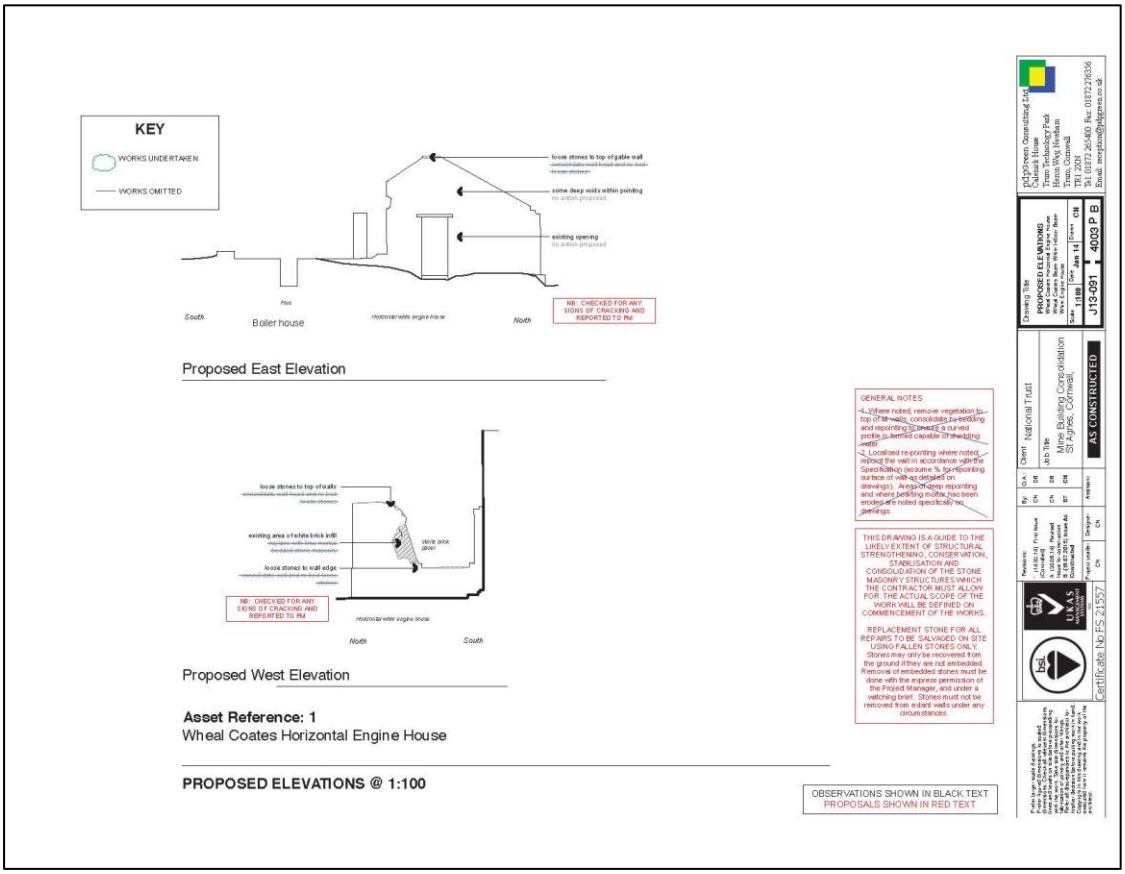

Fig 62. Eastern external elevations of Wheal Coates horizontal engine house and boiler house and western external elevation of horizontal engine house.

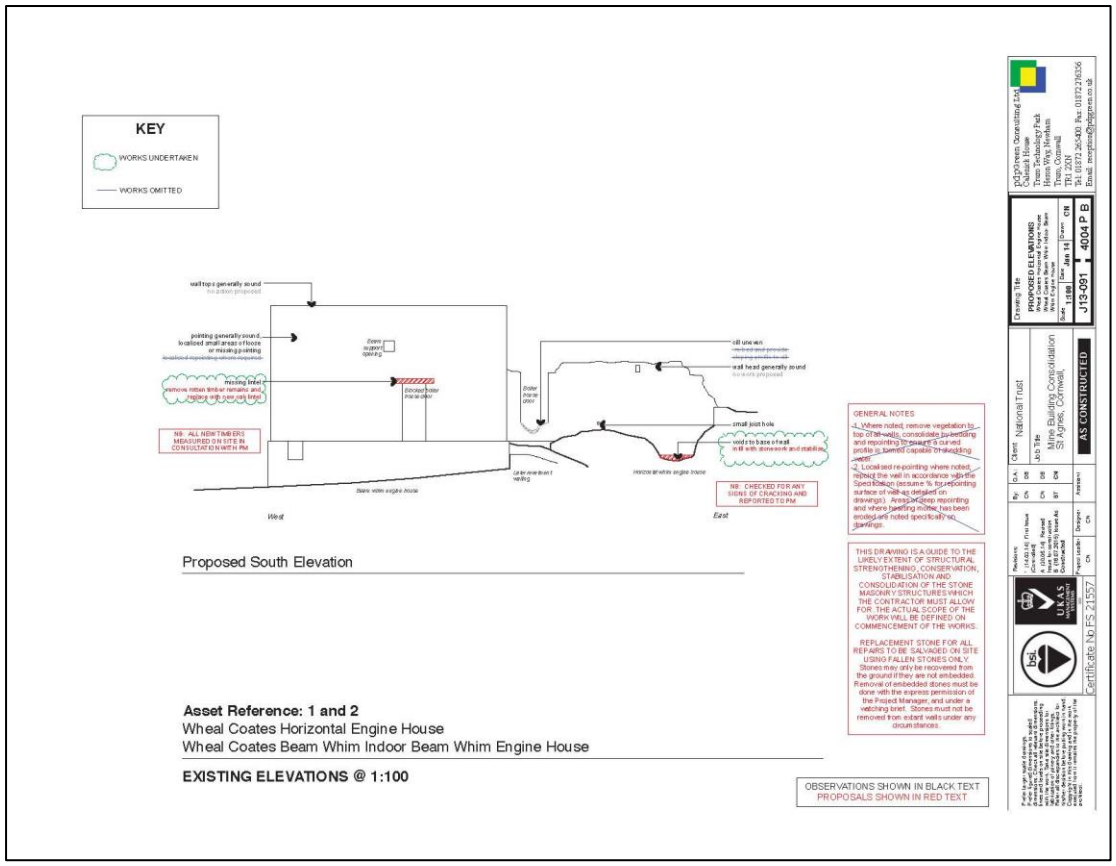

Fig 63. Southern external elevations of Wheal Coates horizontal engine house and beam whim.

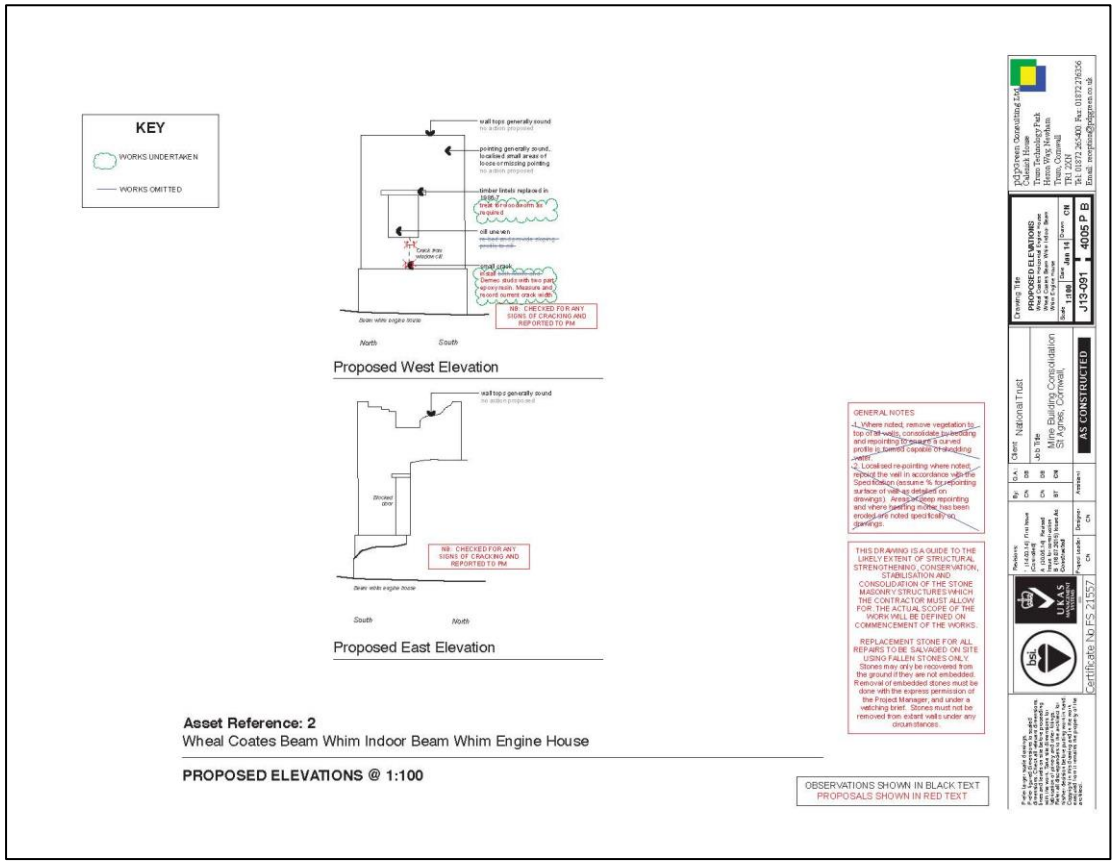

Fig 64. Eastern and western external elevations of Wheal Coates horizontal engine house.

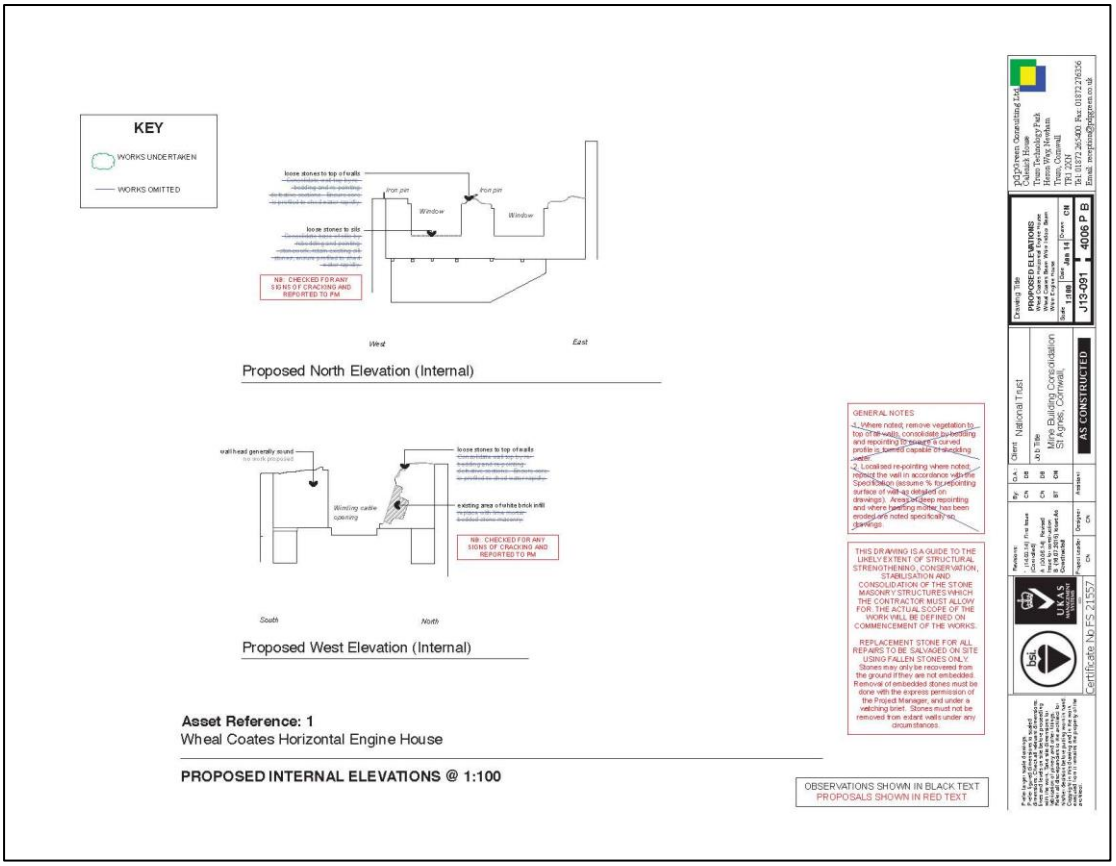

Fig 65. Northern and western internal elevations of Wheal Coates horizontal engine house.

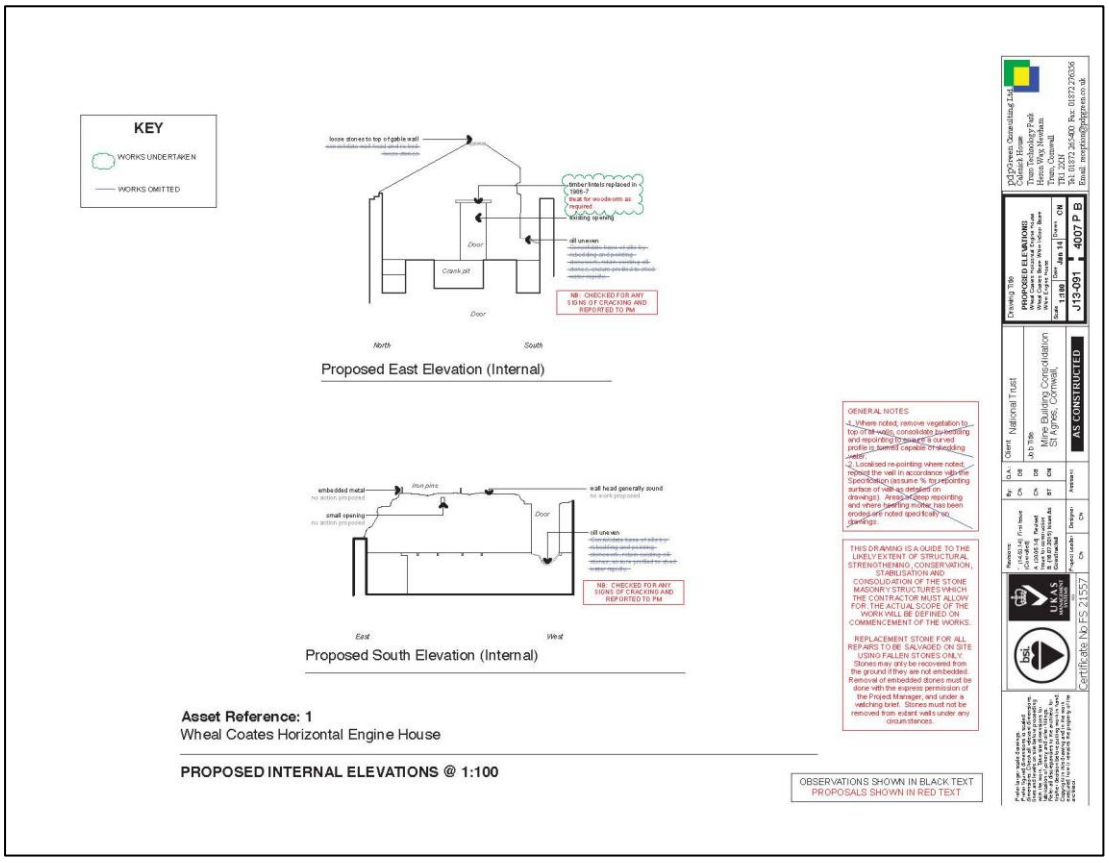

Fig 66. Southern and eastern internal elevations of Wheal Coates horizontal engine house.

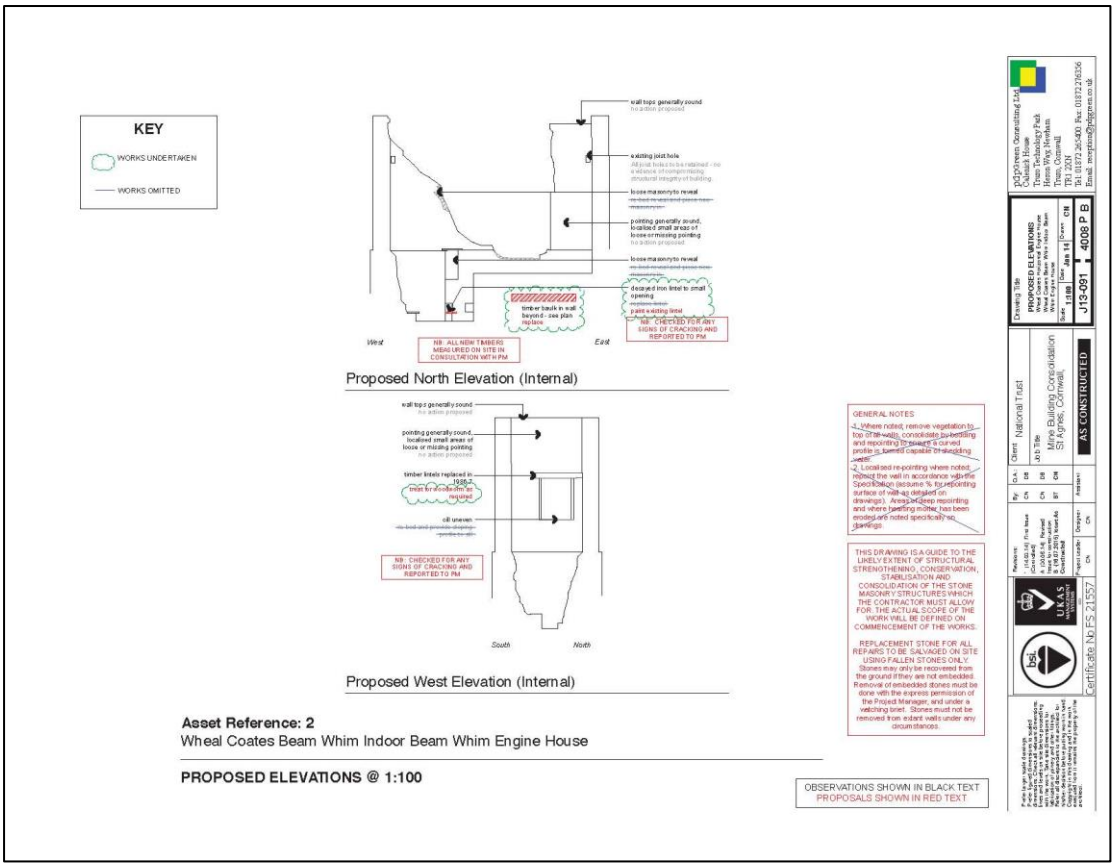

Fig 67. Northern and western internal elevations of Wheal Coates beam whim.

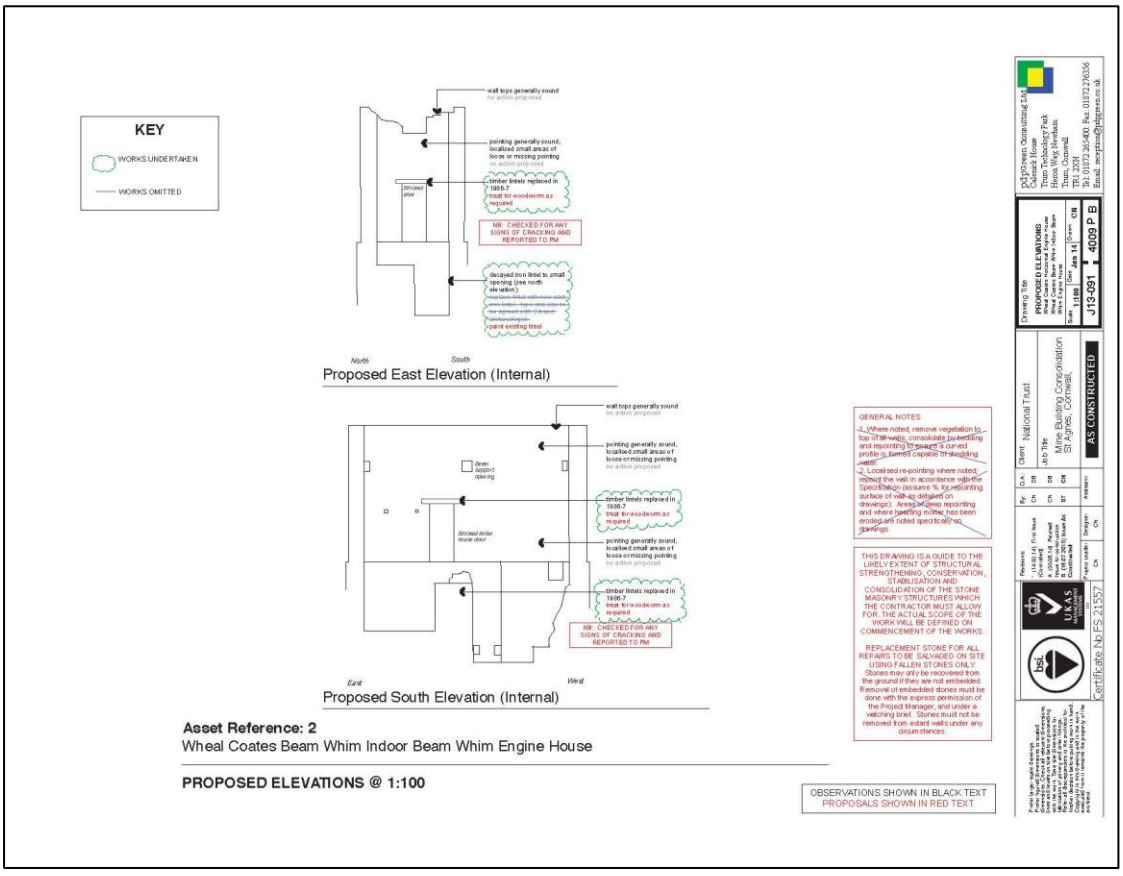

Fig 68. Southern and eastern internal elevations of Wheal Coates beam whim.

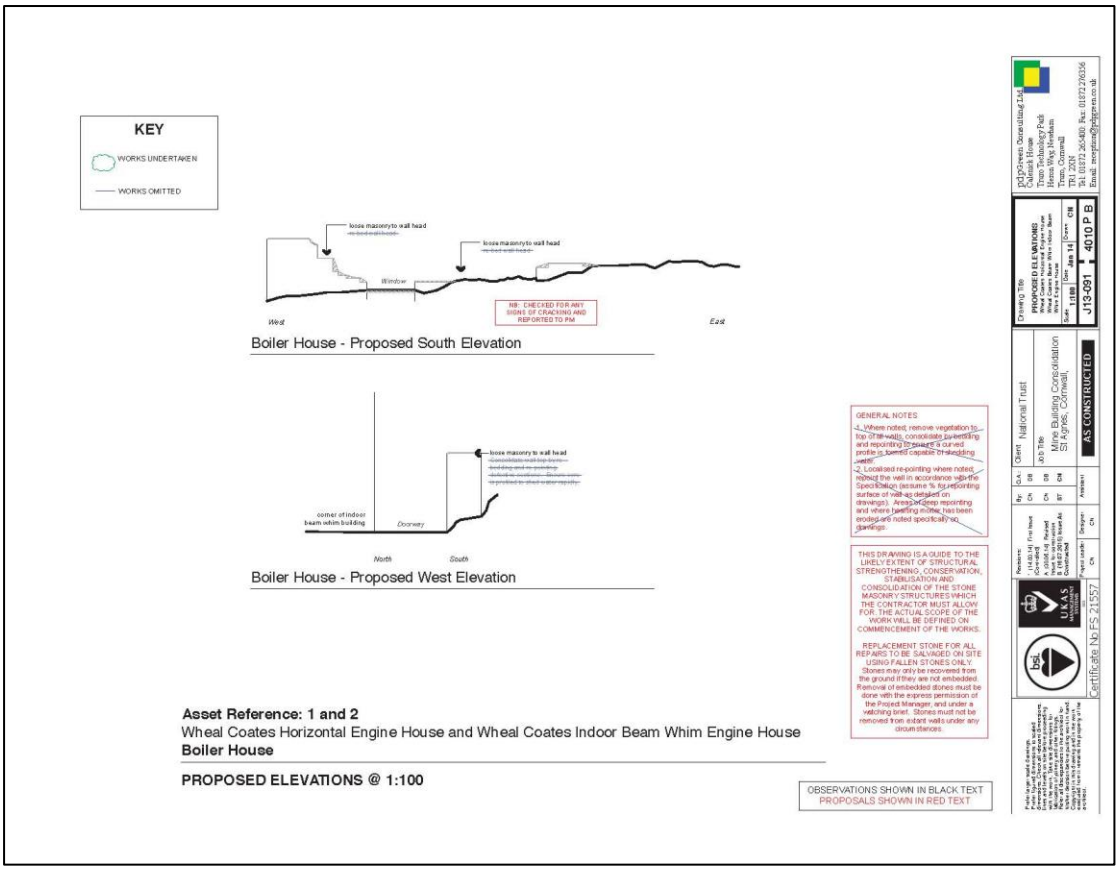

Fig 69. Western and southern external elevations of Wheal Coates whim boiler house.

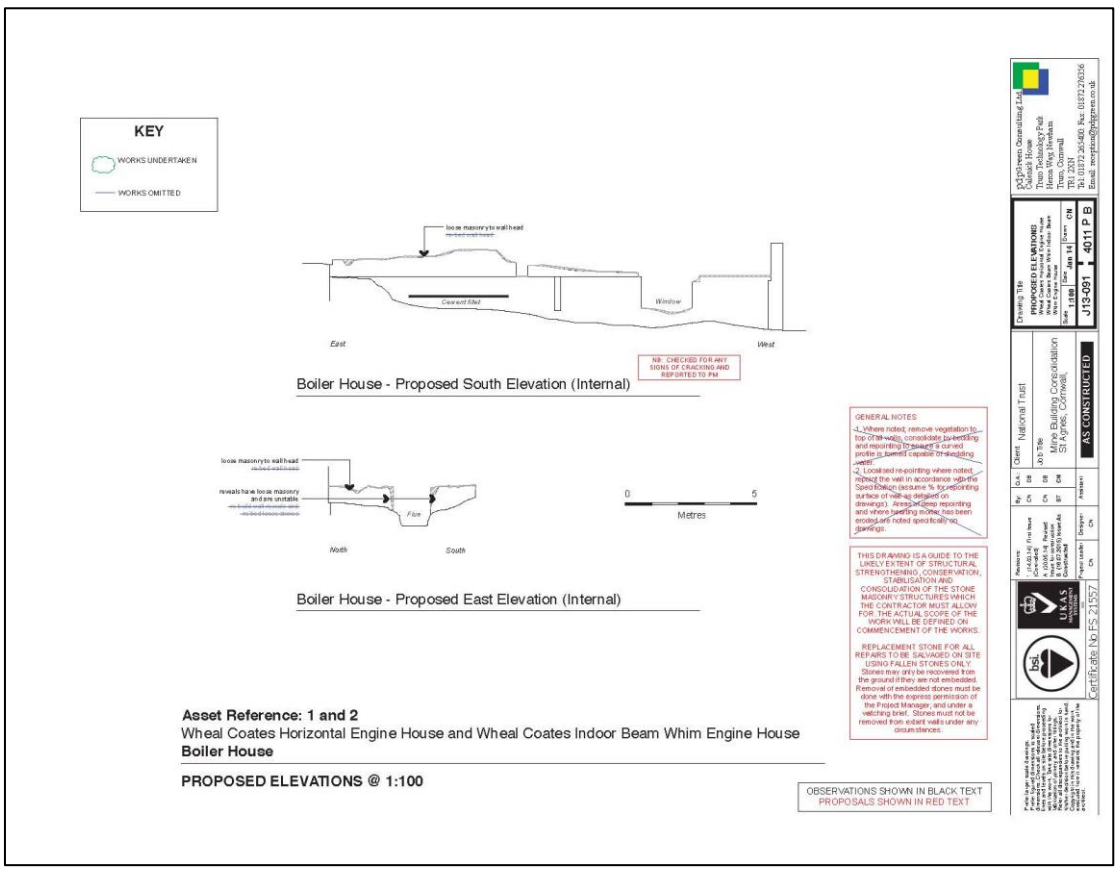

Fig 70. Southern and eastern internal elevations of Wheal Coates whim boiler house.

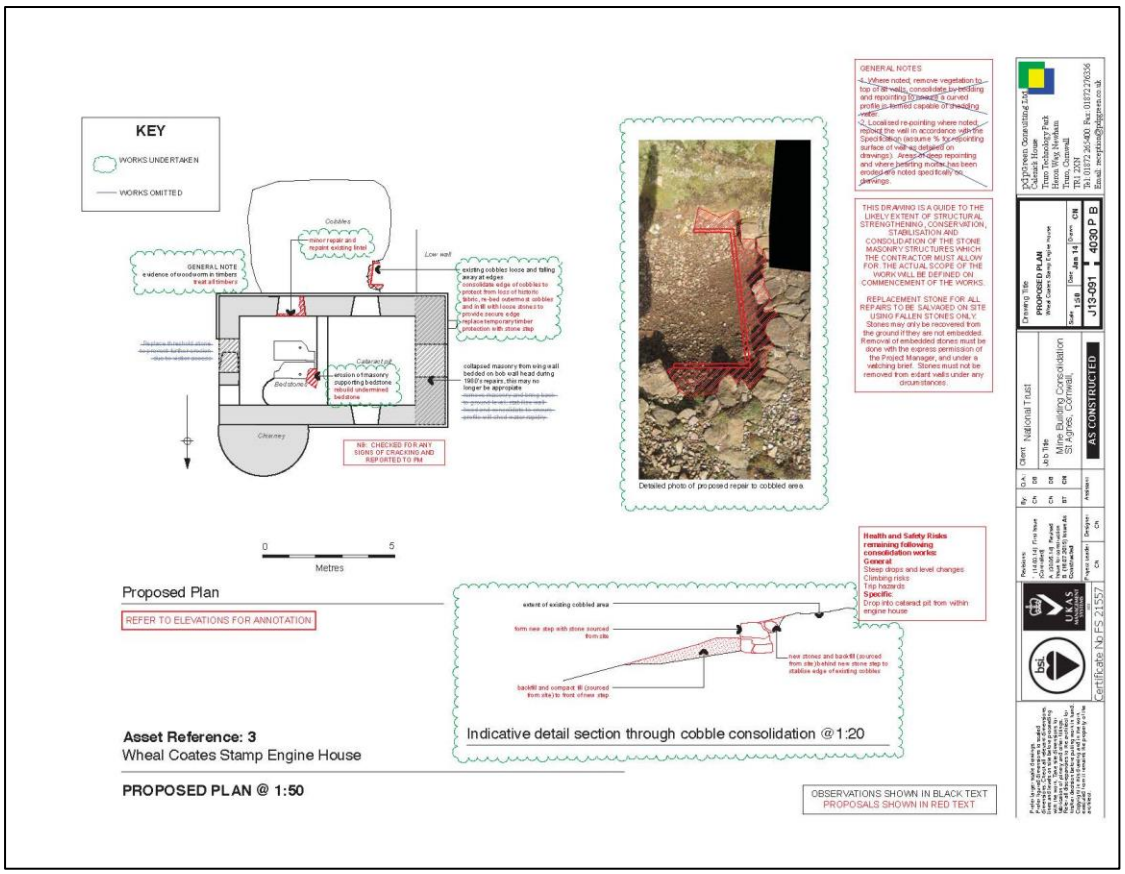

Fig 71. Plan of Wheal Coates stamps engine house.

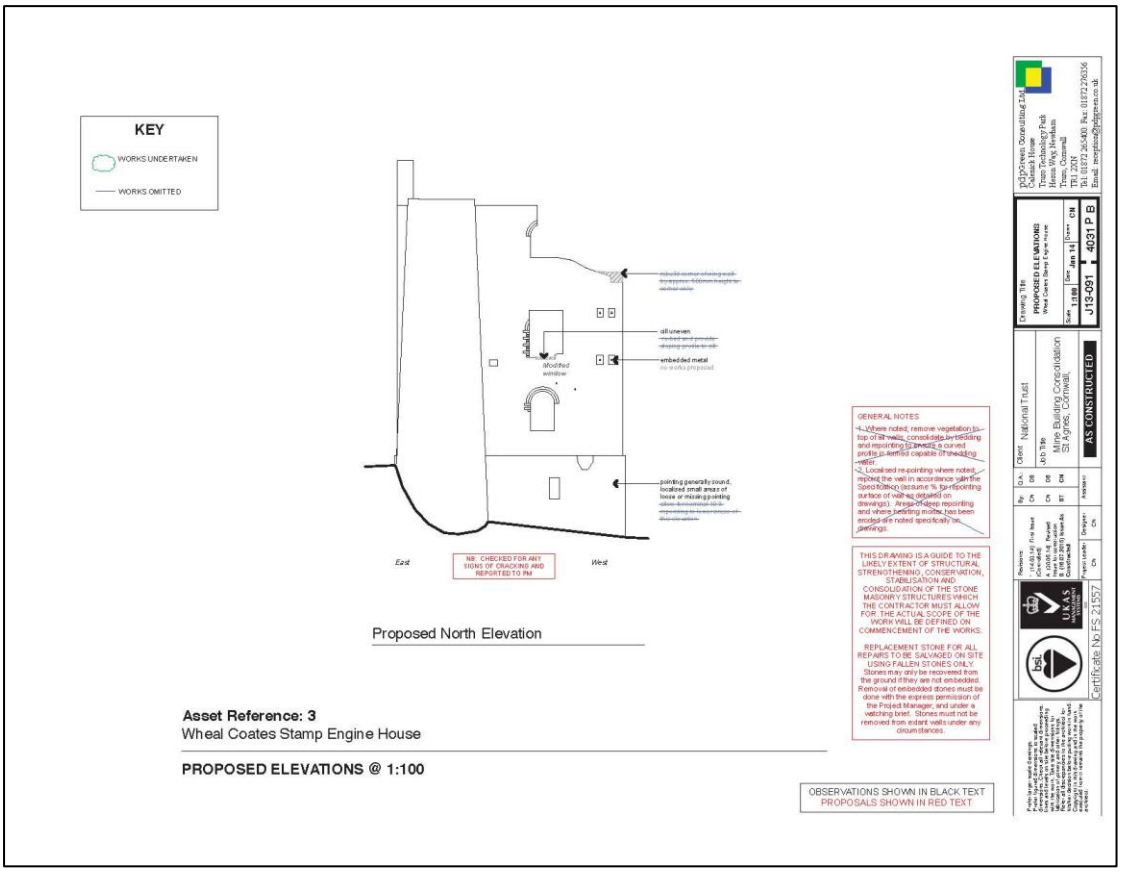

Fig 72. Northern external elevation of Wheal Coates stamps engine house.

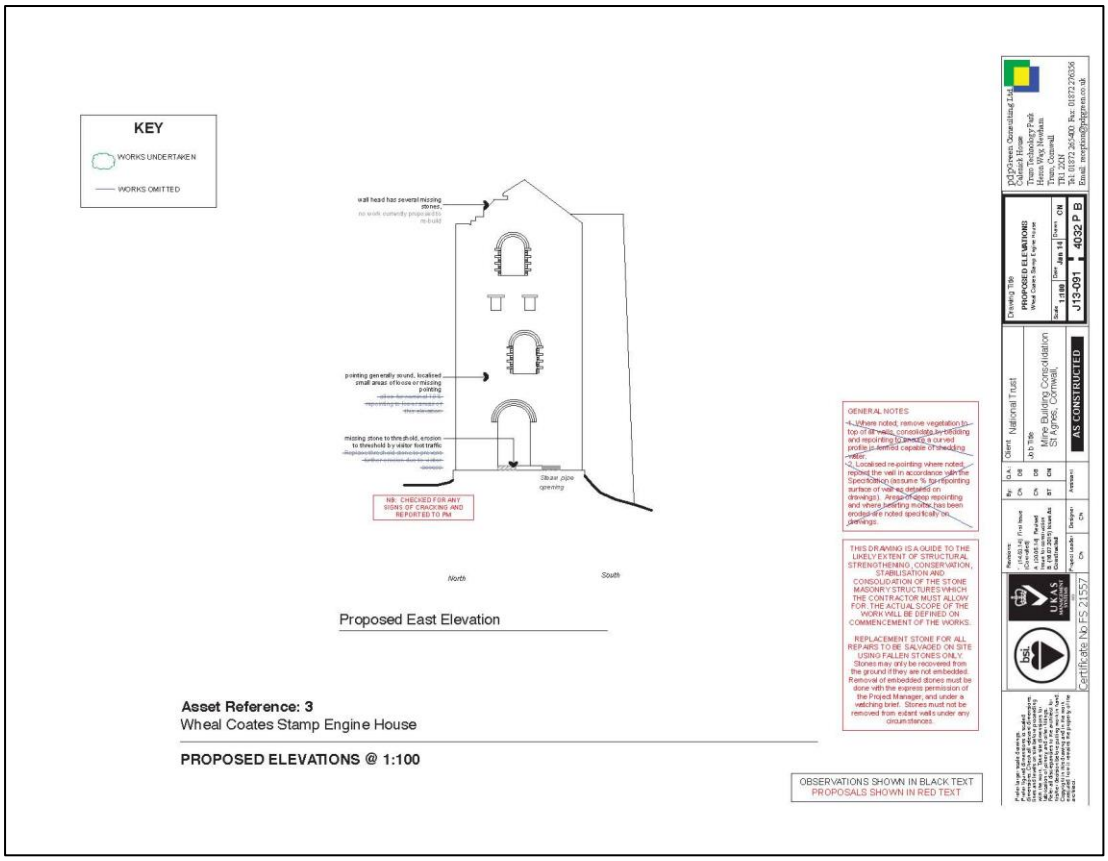

Fig 73. Eastern external elevation of Wheal Coates stamps engine house.

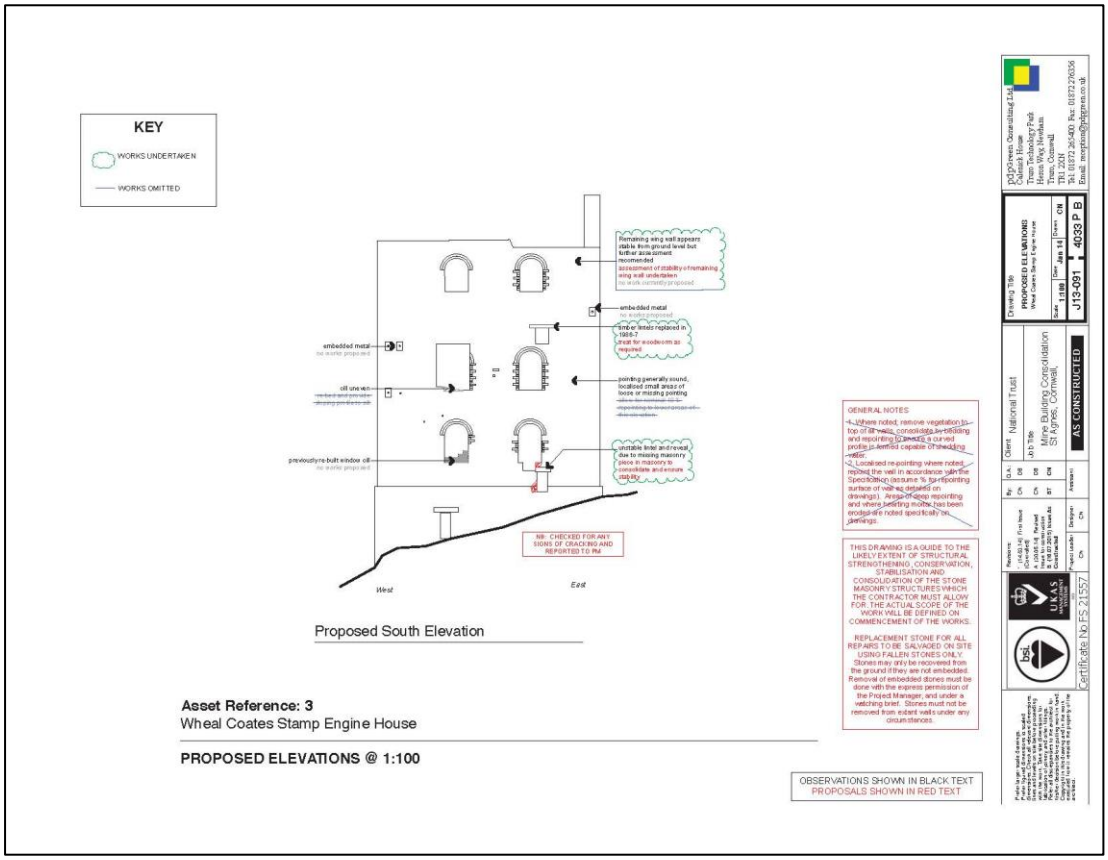

Fig 74. Southern external elevation of Wheal Coates stamps engine house.

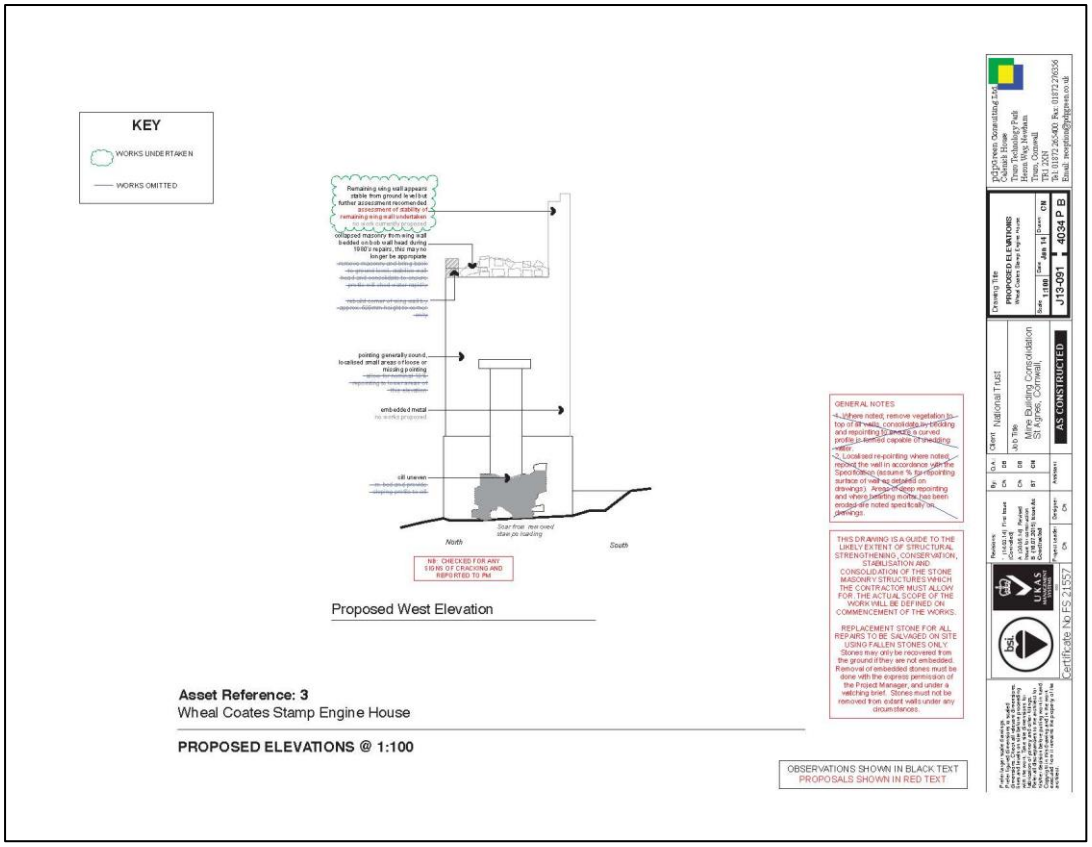

Fig 75. Western external elevation of Wheal Coates stamps engine house.

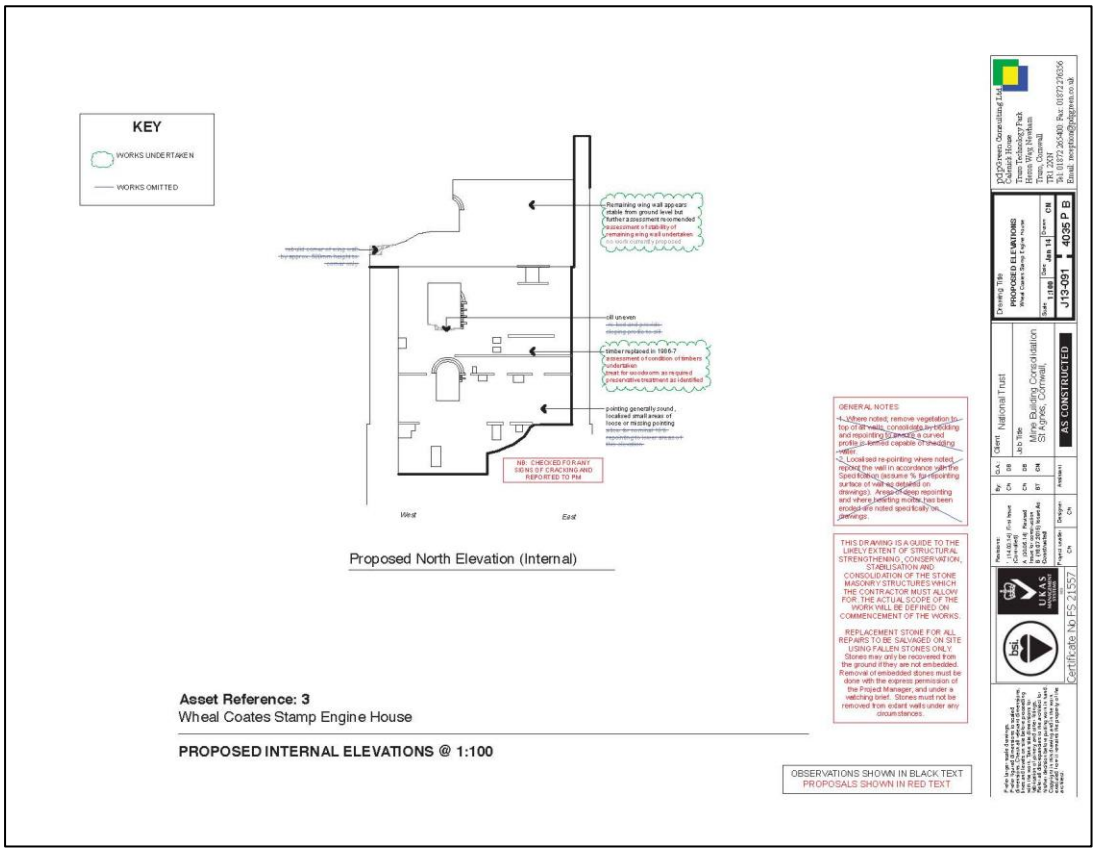

Fig 76. Northern internal elevation of Wheal Coates stamps engine house.

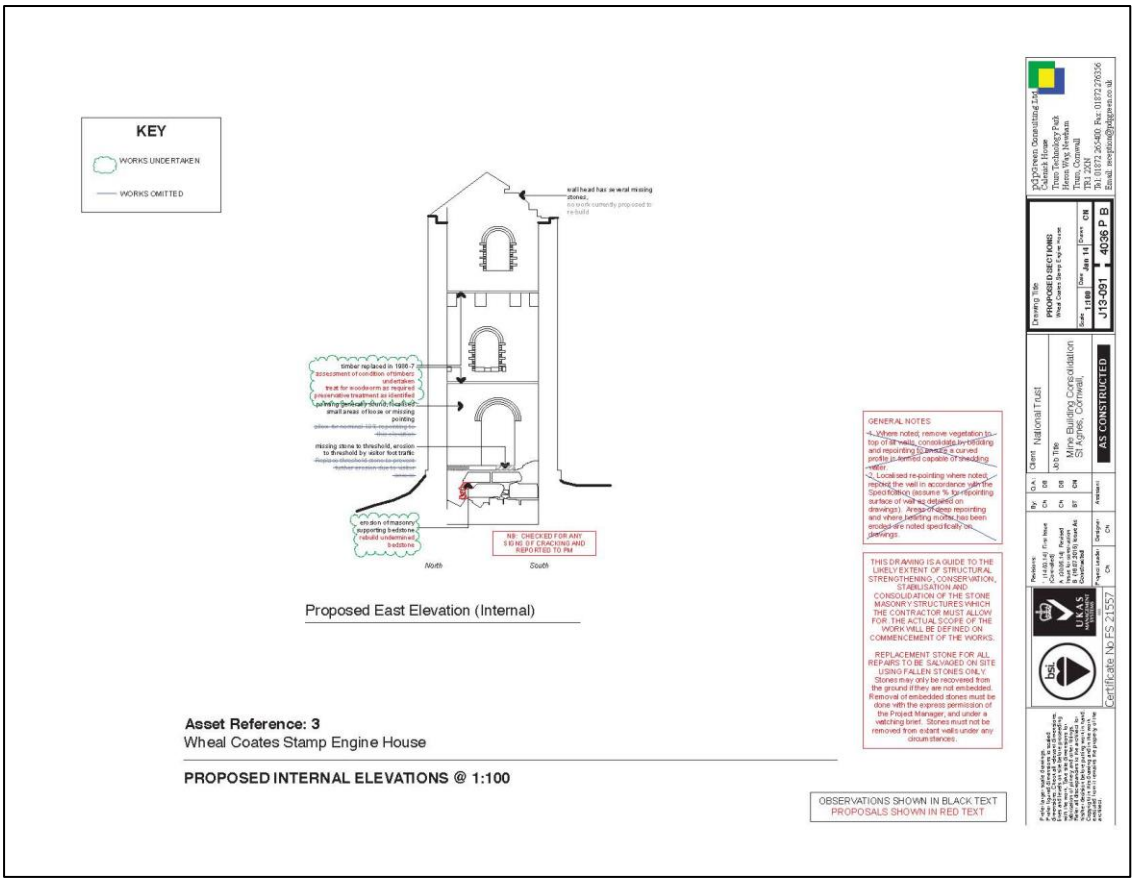

Fig 77. Eastern internal elevation of Wheal Coates stamps engine house.

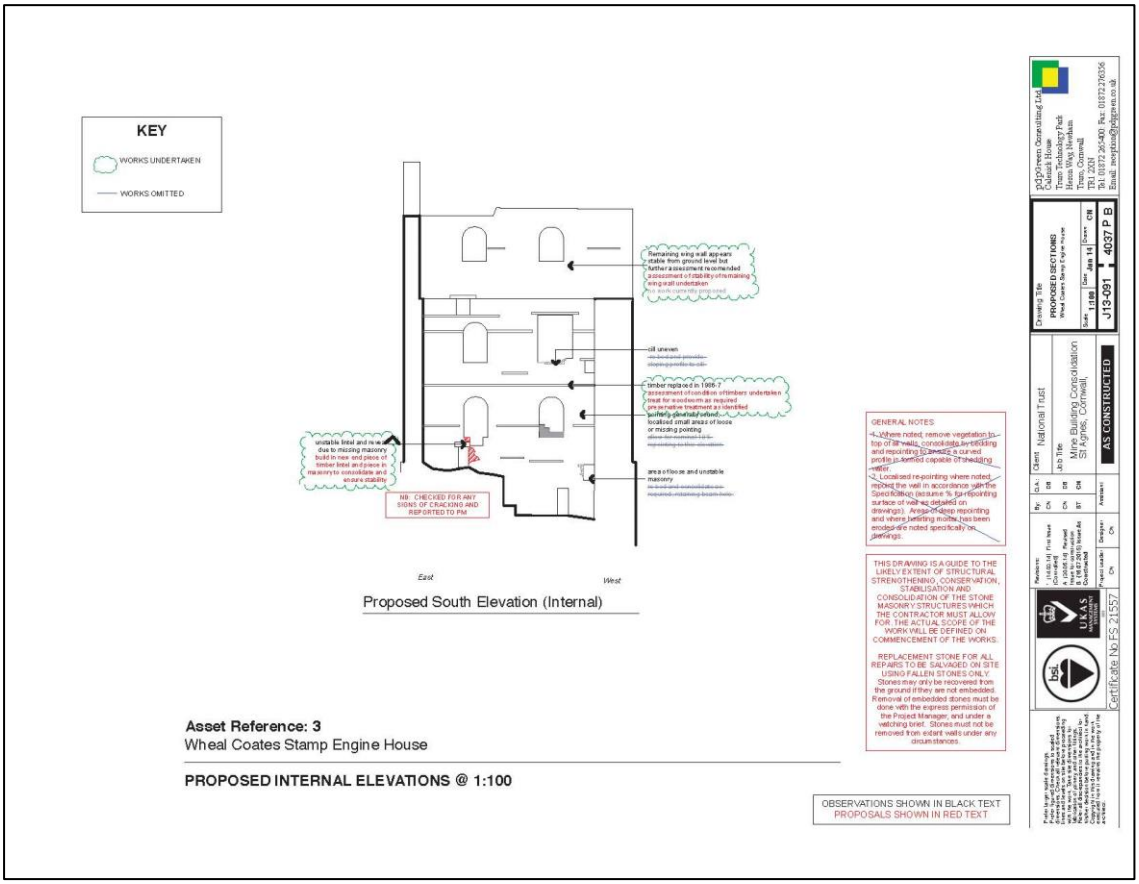

Fig 78. Southern internal elevation of Wheal Coates stamps engine house.

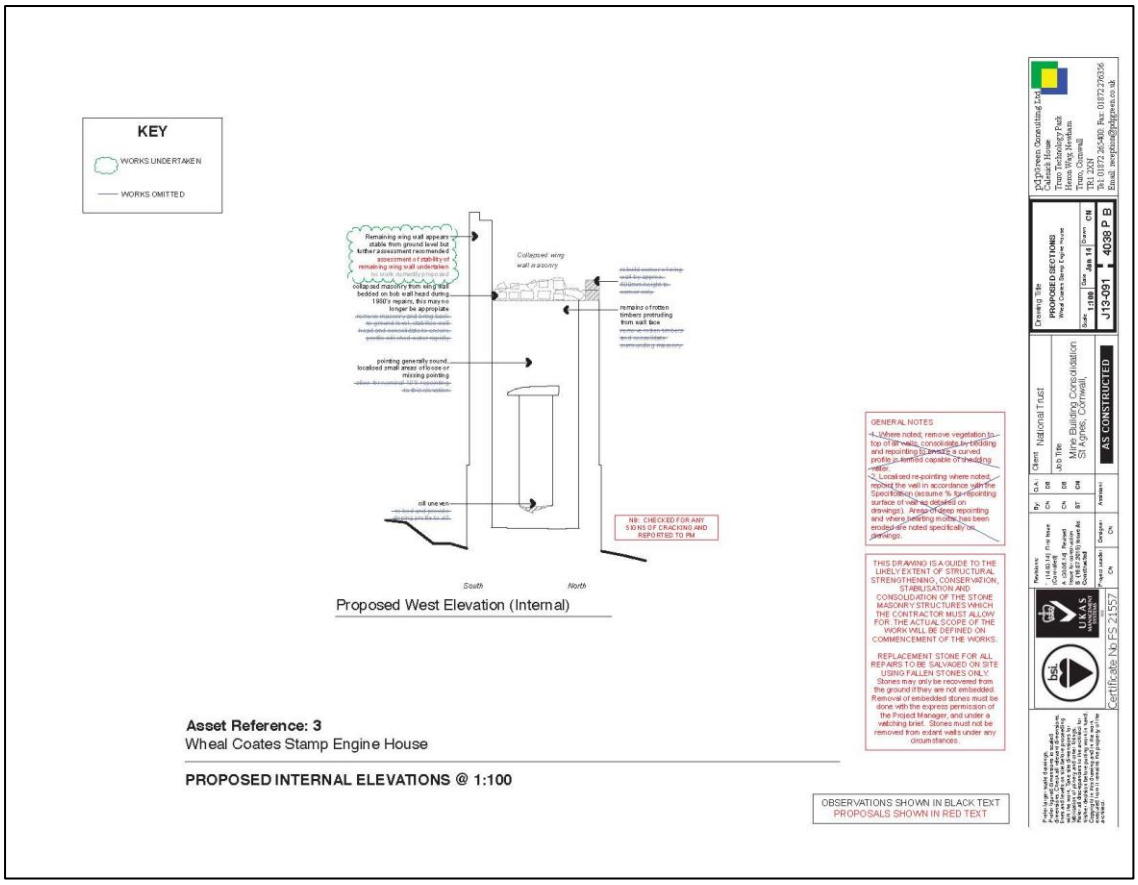

Fig 79. Western internal elevation of Wheal Coates stamps engine house.

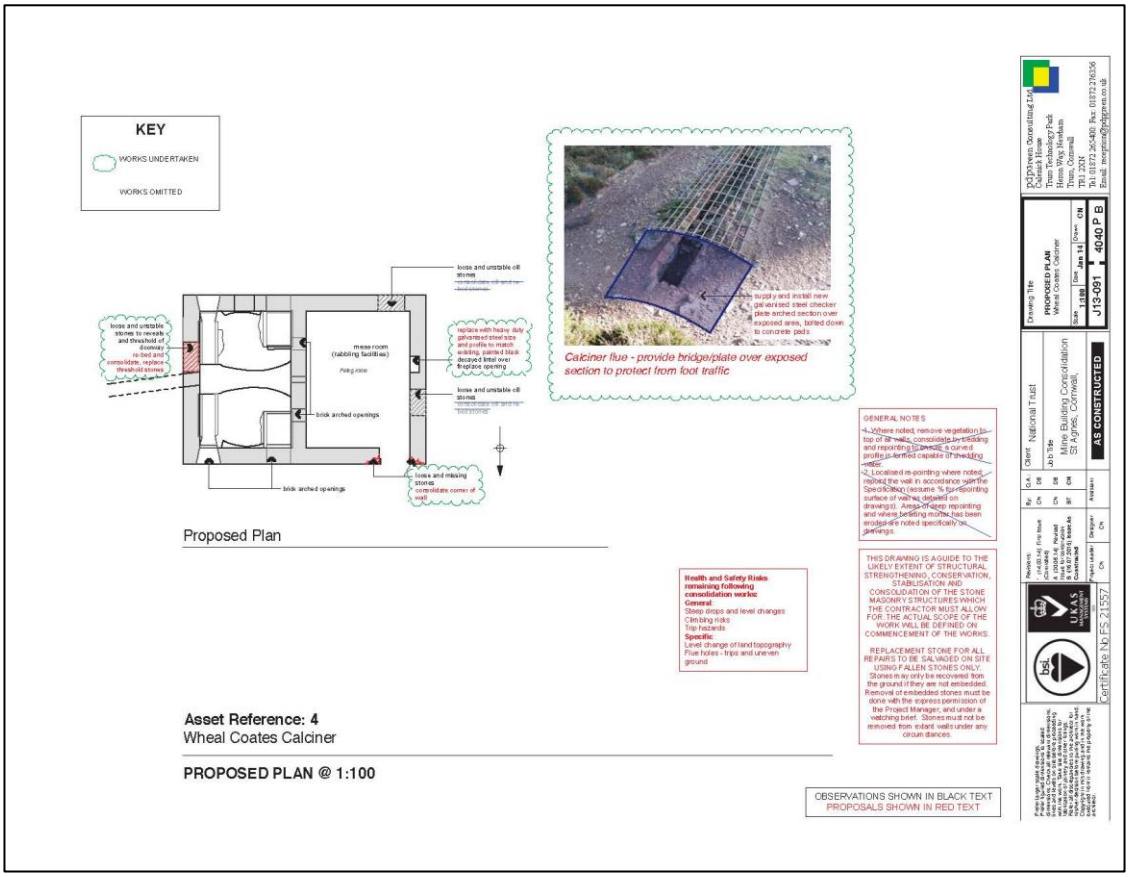

Fig 80. Plan of Wheal Coates calciner and flue detail.

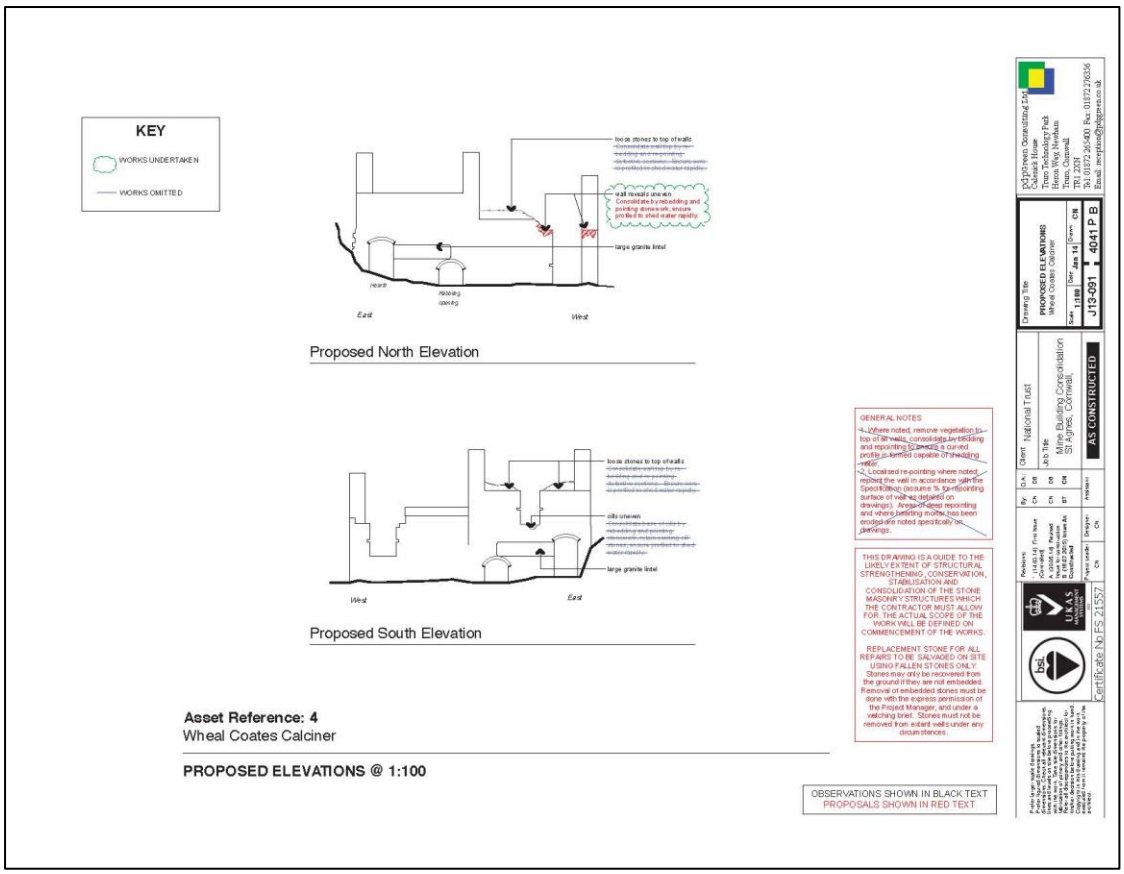

Fig 81. Northern and southern external elevations of Wheal Coates calciner.

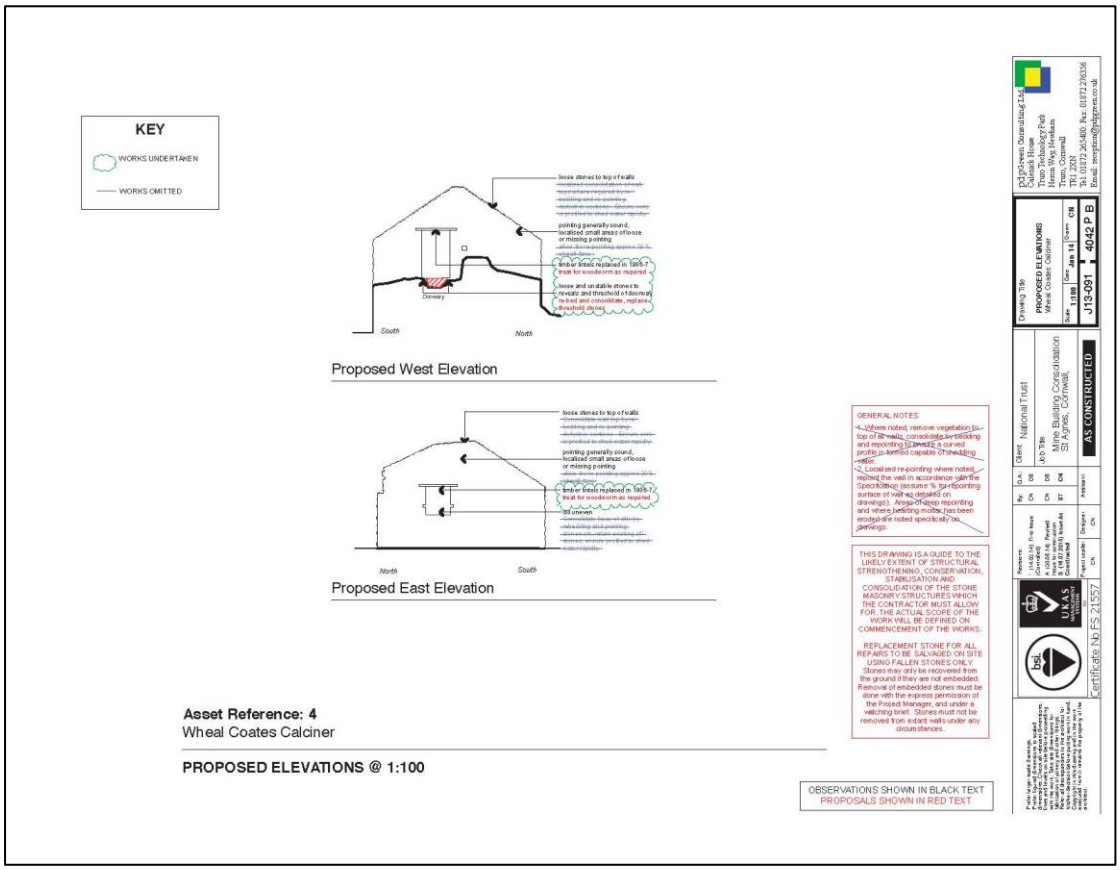

Fig 82. Eastern and western external elevations of Wheal Coates calciner.

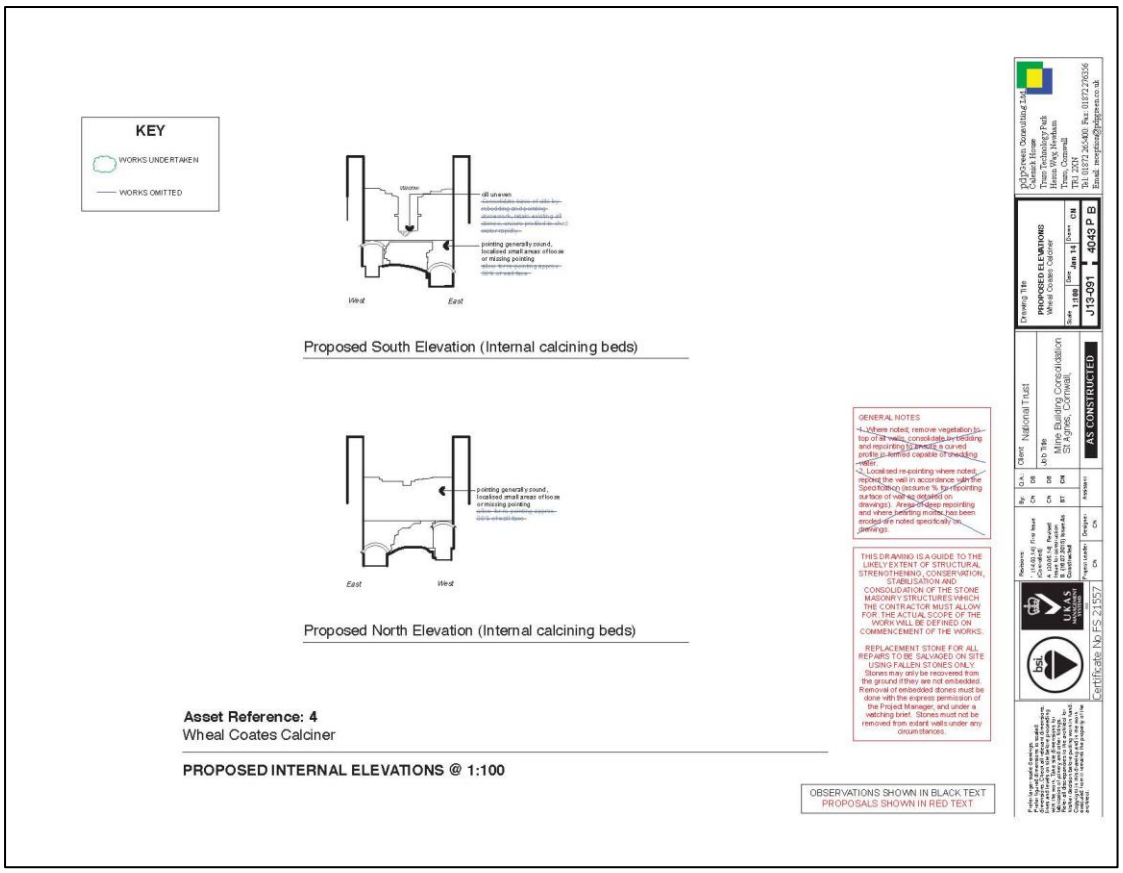

Fig 83. Northern and southern internal elevations of Wheal Coates calciner.

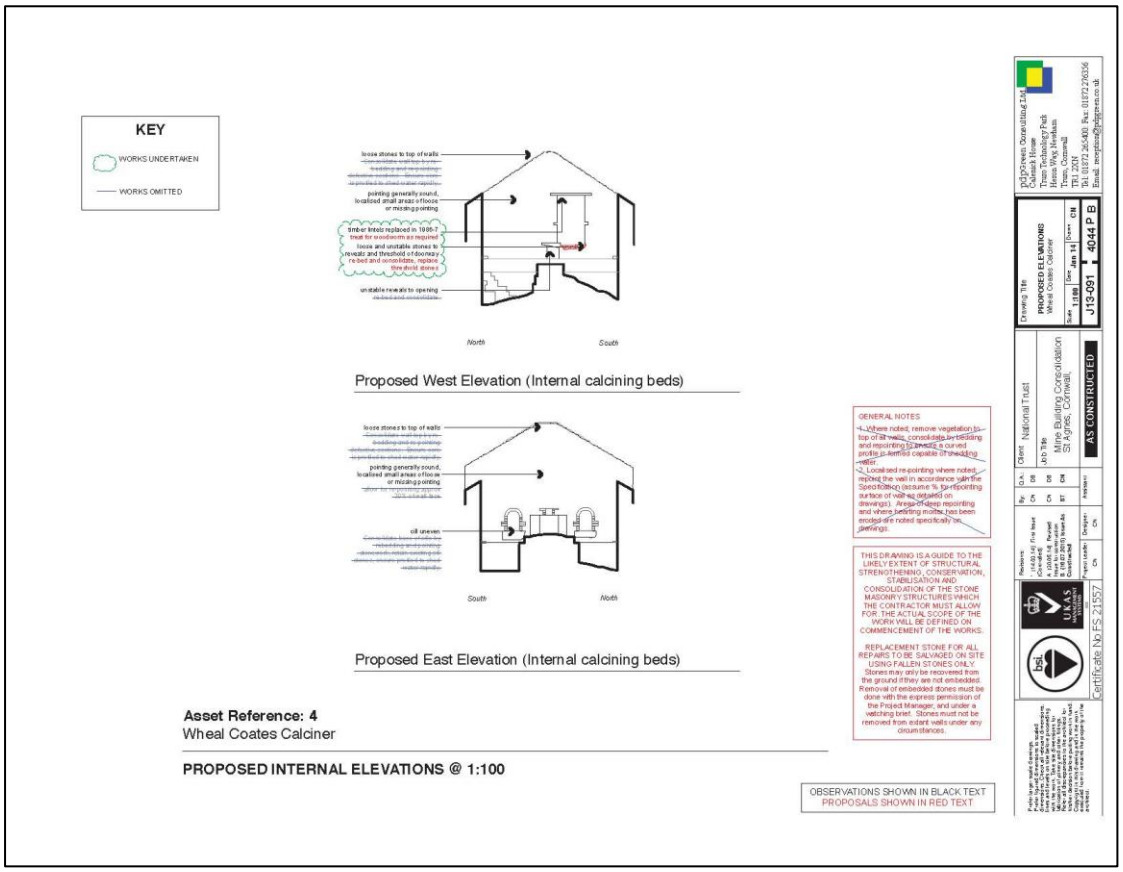

Fig 84. Eastern and western internal elevations of Wheal Coates calciner.

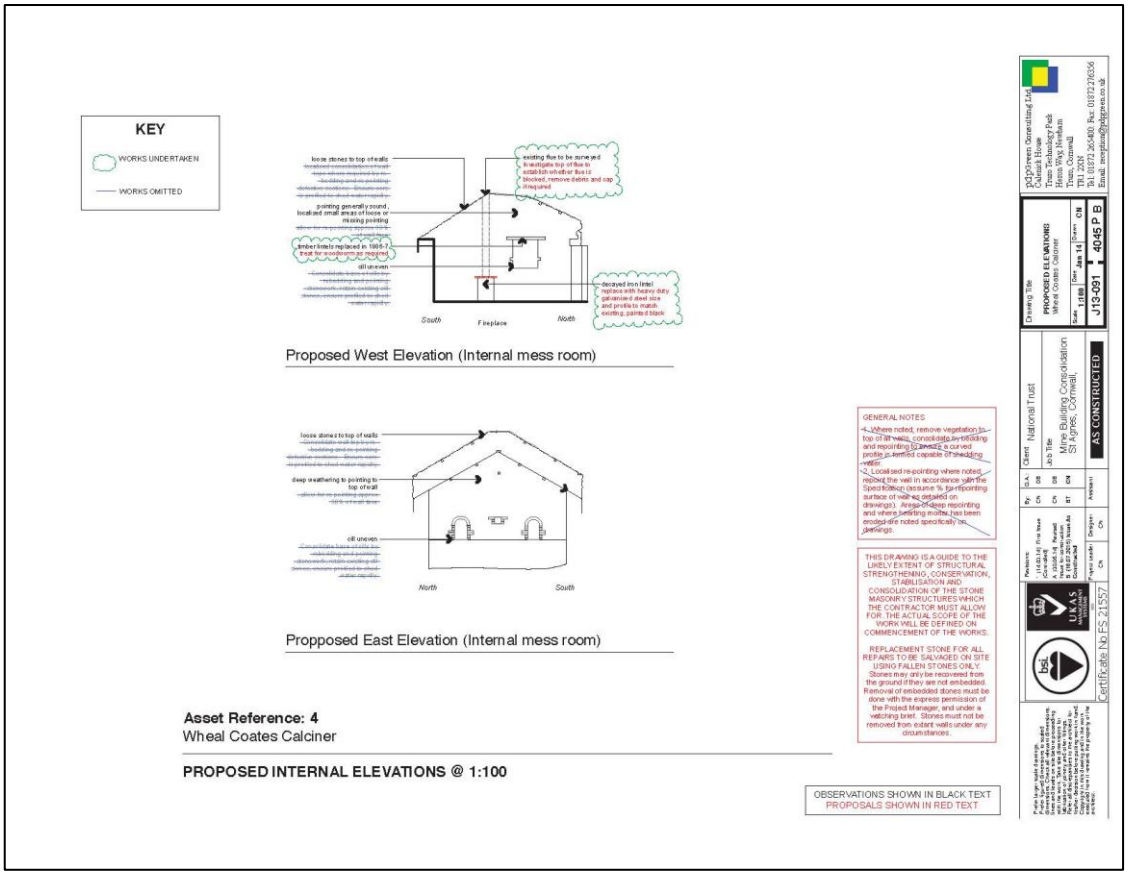

Fig 85. Eastern and western internal elevations of Wheal Coates calciner annexe.

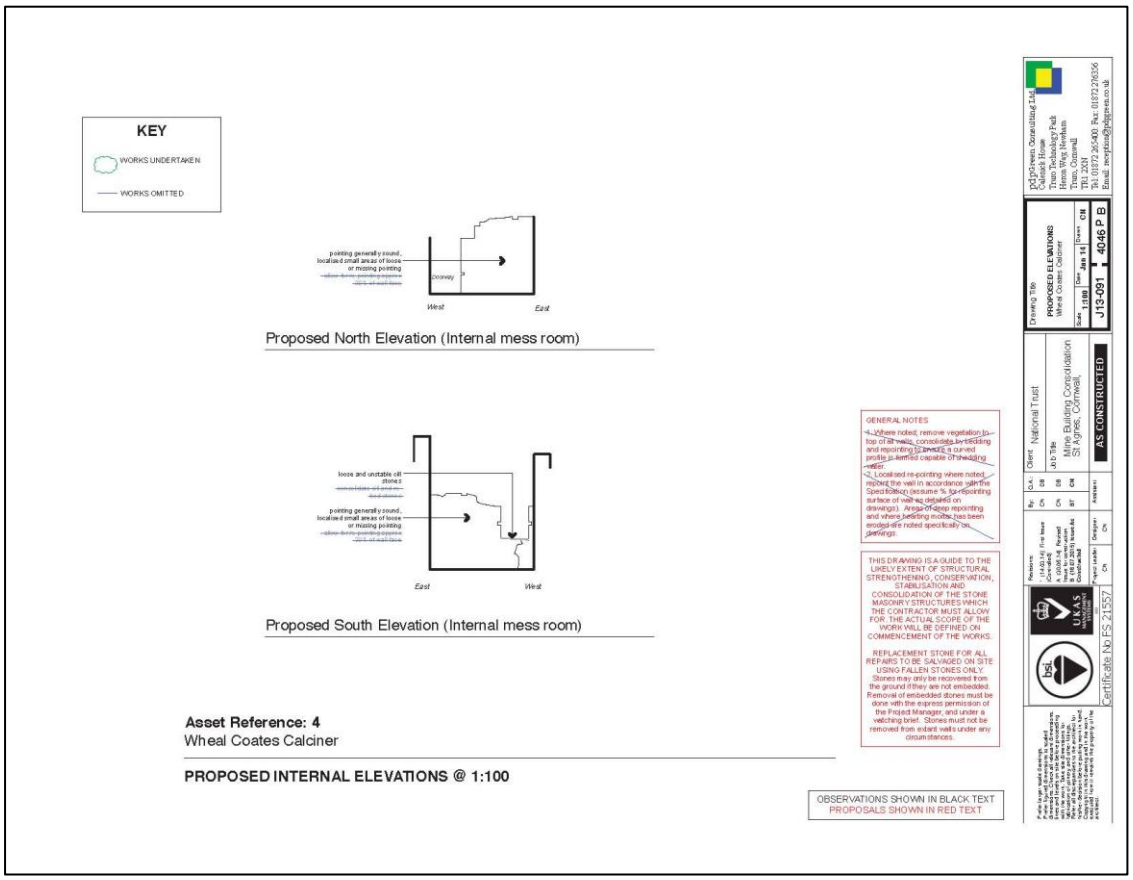

Fig 86. Northern and southern internal elevations of Wheal Coates calciner annexe.

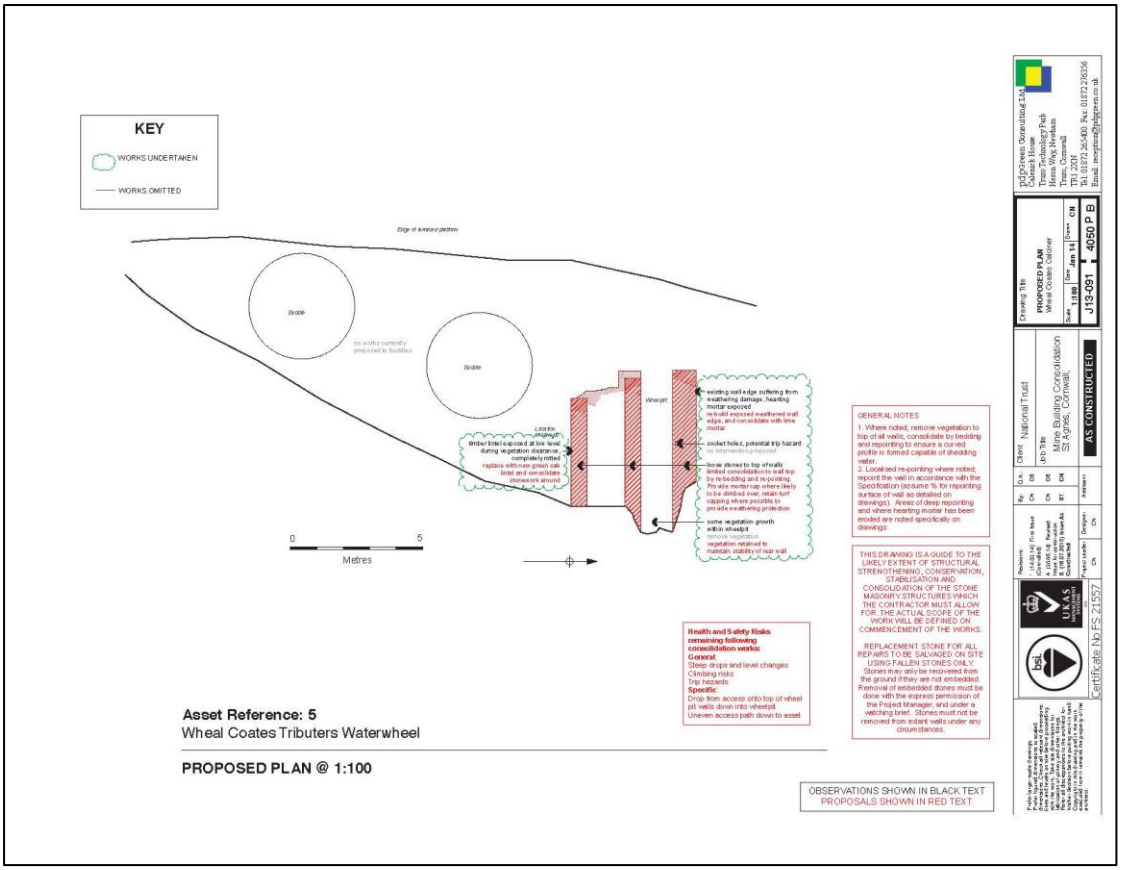

Fig 87. Plan of Wheal Coates tributer's stamps.

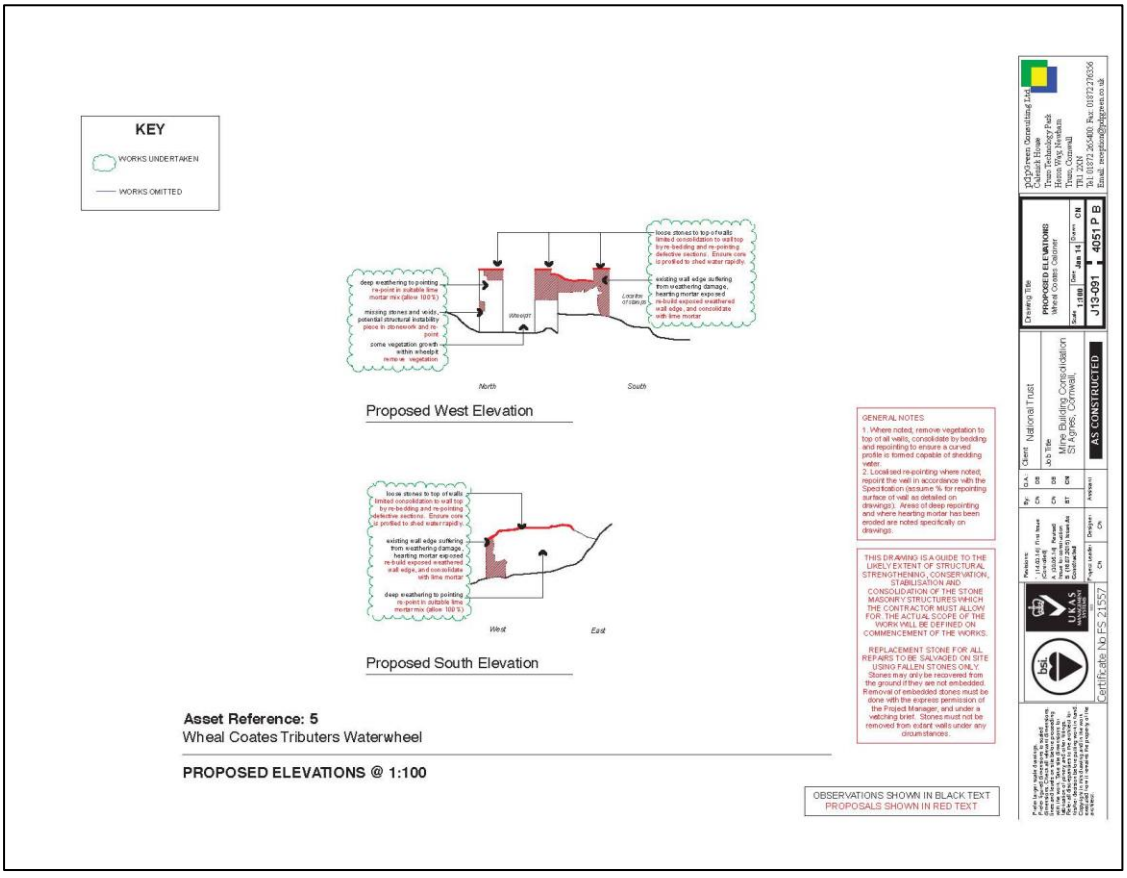

Fig 88. Western and eastern elevations of Wheal Coates tributer's stamps.

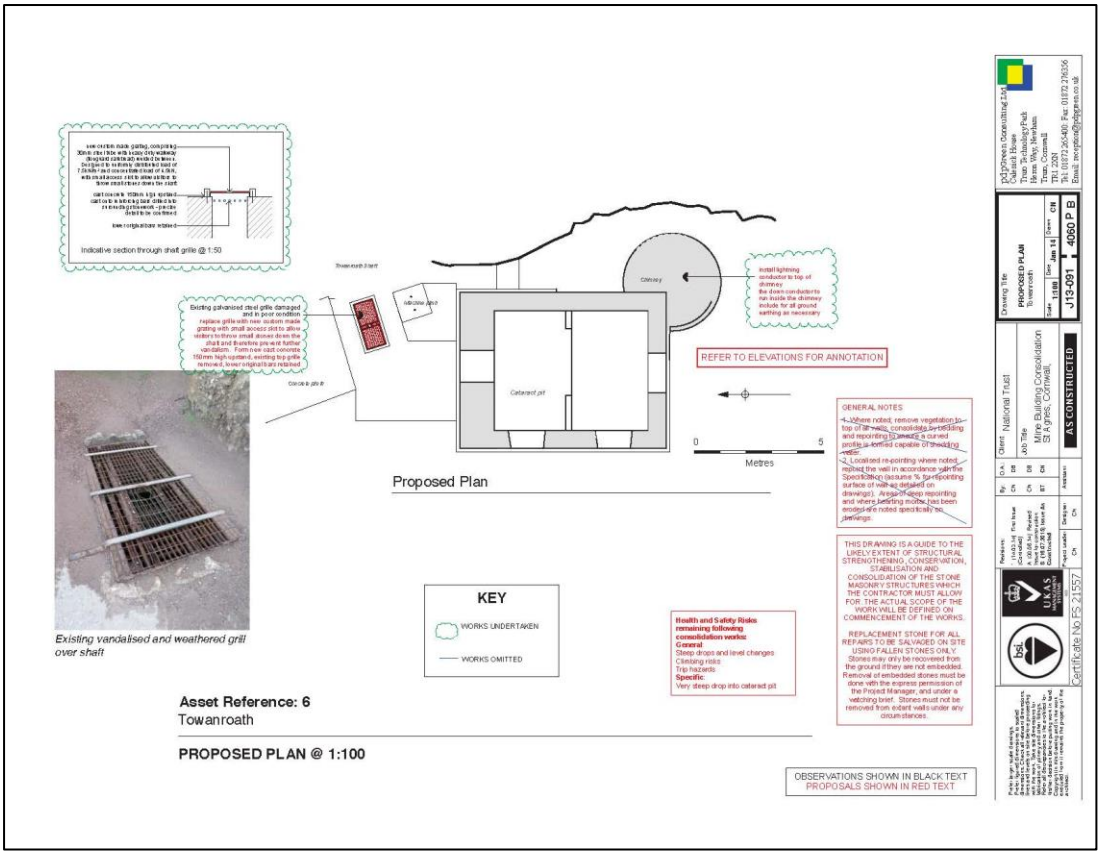

Fig 89. Plan of Wheal Coates Towanroath pumping engine house and detail of shaft.

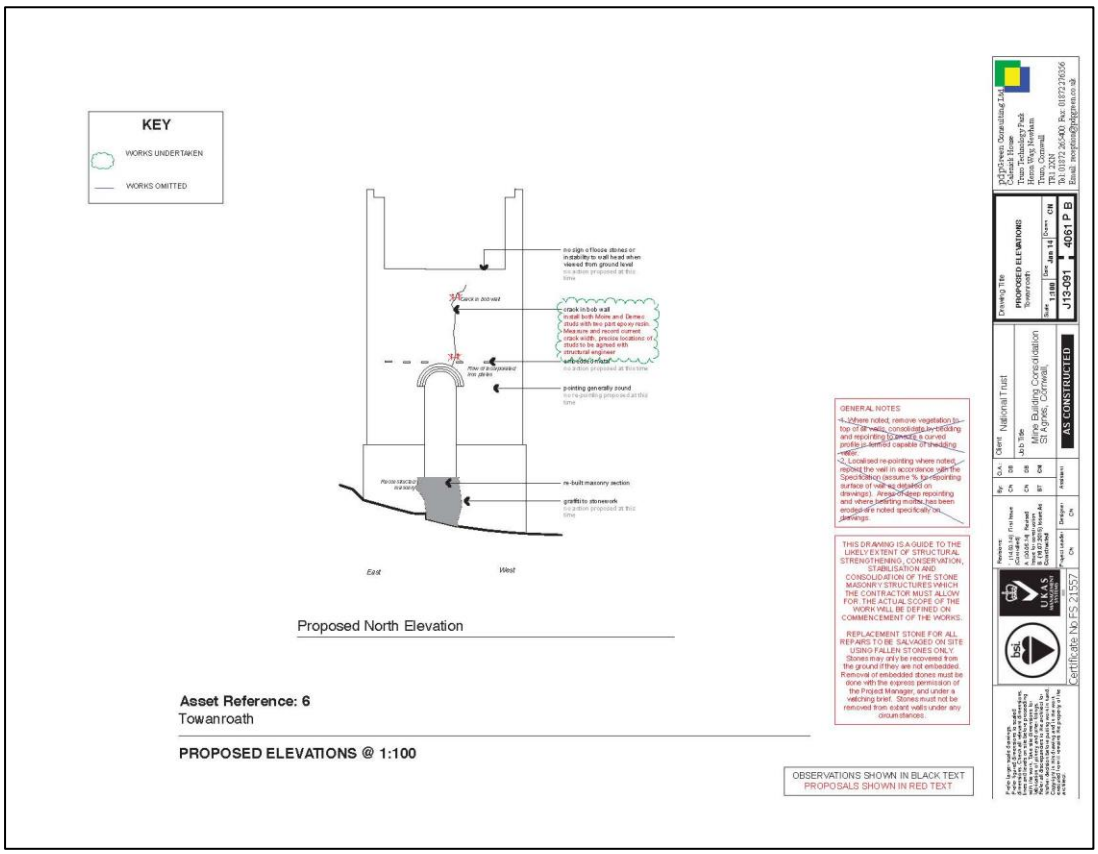

Fig 90. Northern external elevation of Towanroath pumping engine house.

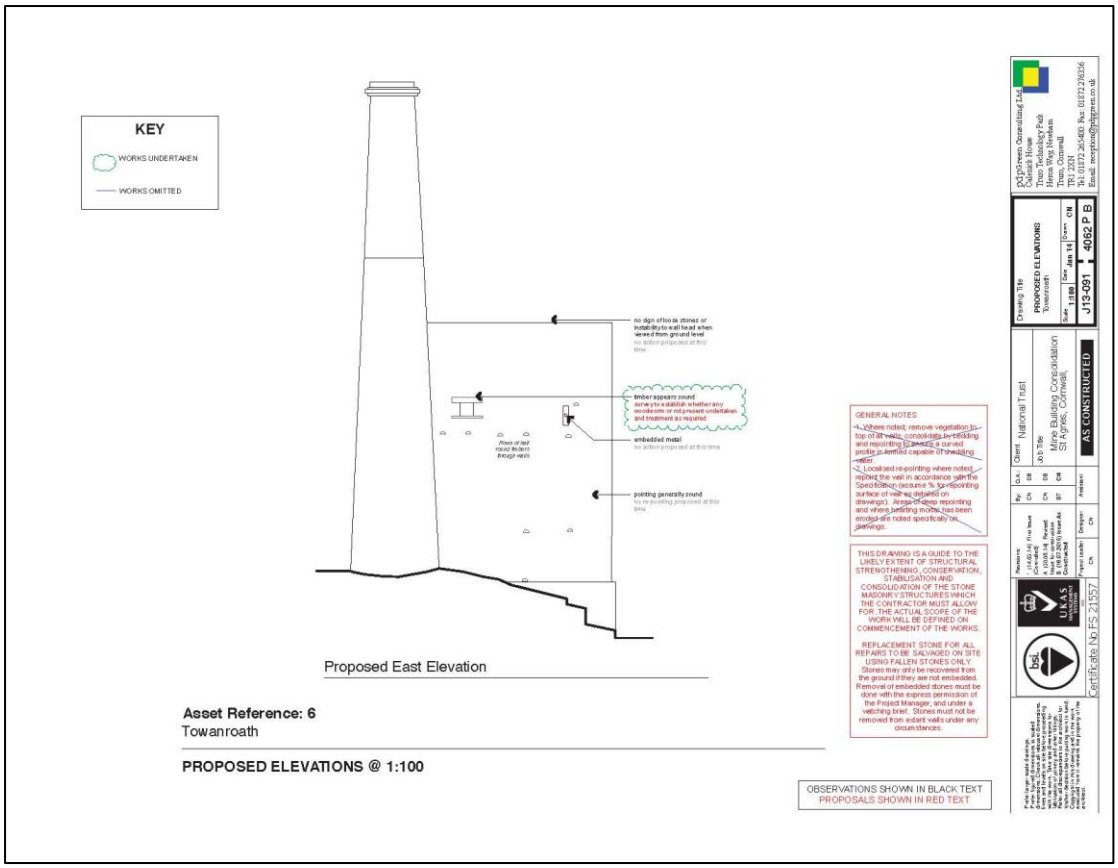

Fig 91. Eastern external elevation of Towanroath pumping engine house.

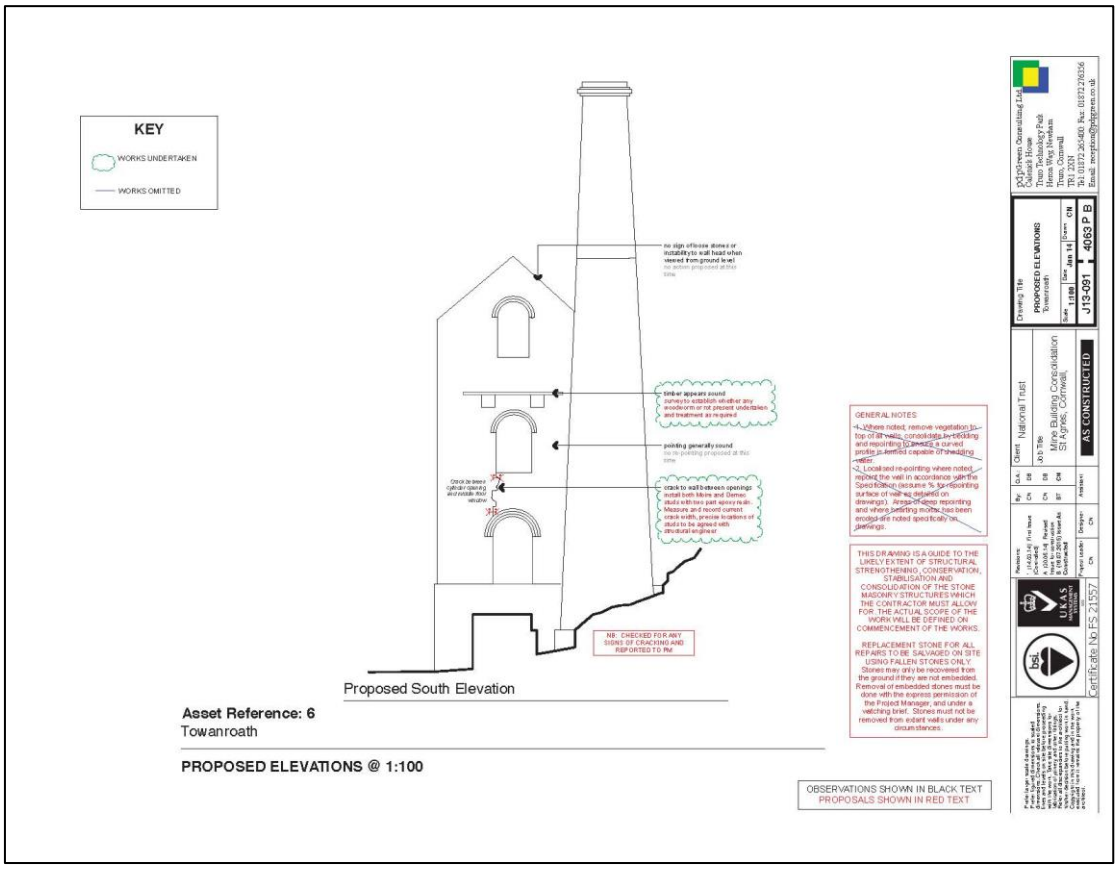

Fig 92. Southern external elevation of Towanroath pumping engine house.

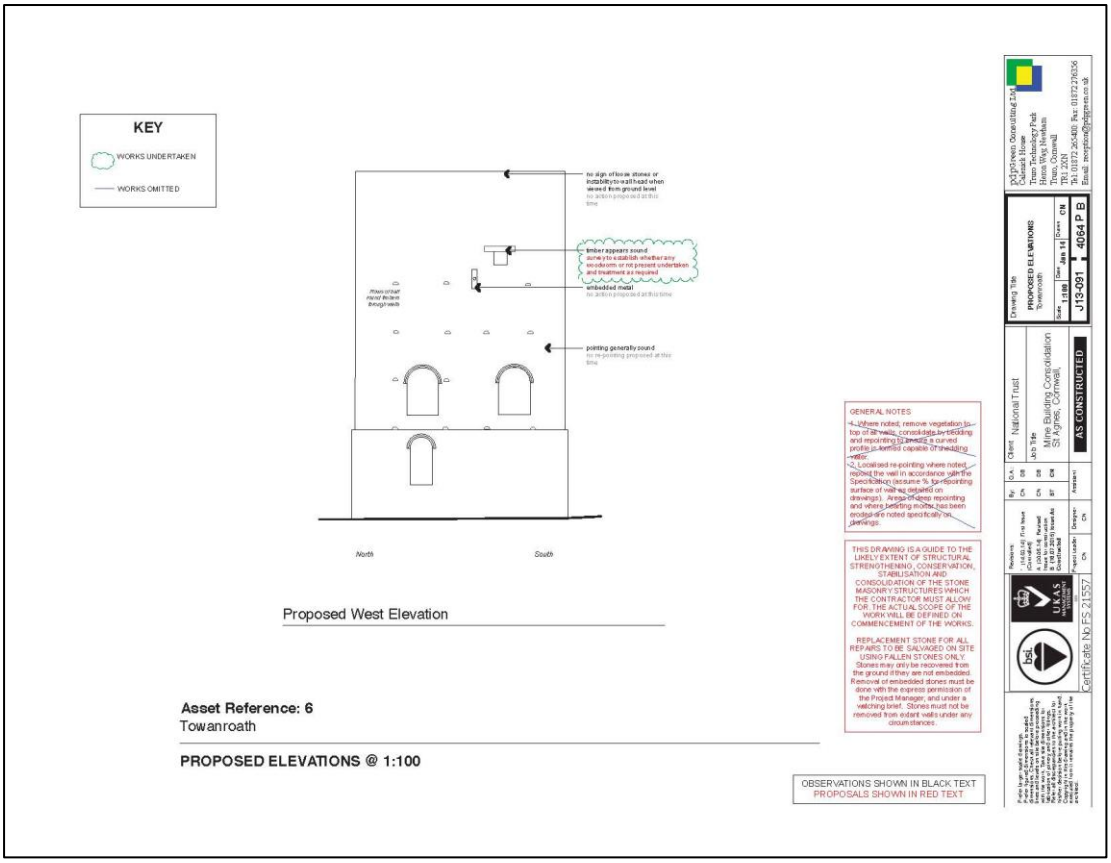

Fig 93. Western external elevation of Towanroath pumping engine house.

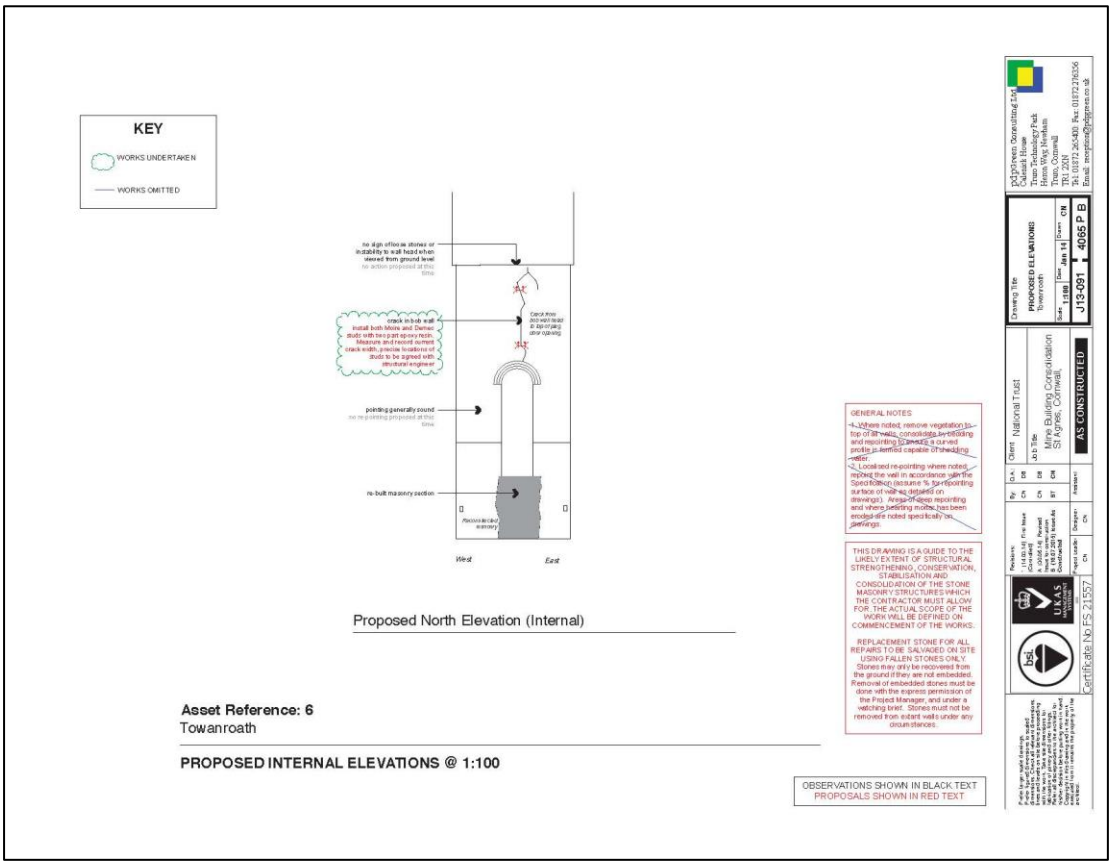

Fig 94. Northern internal elevation of Towanroath pumping engine house.

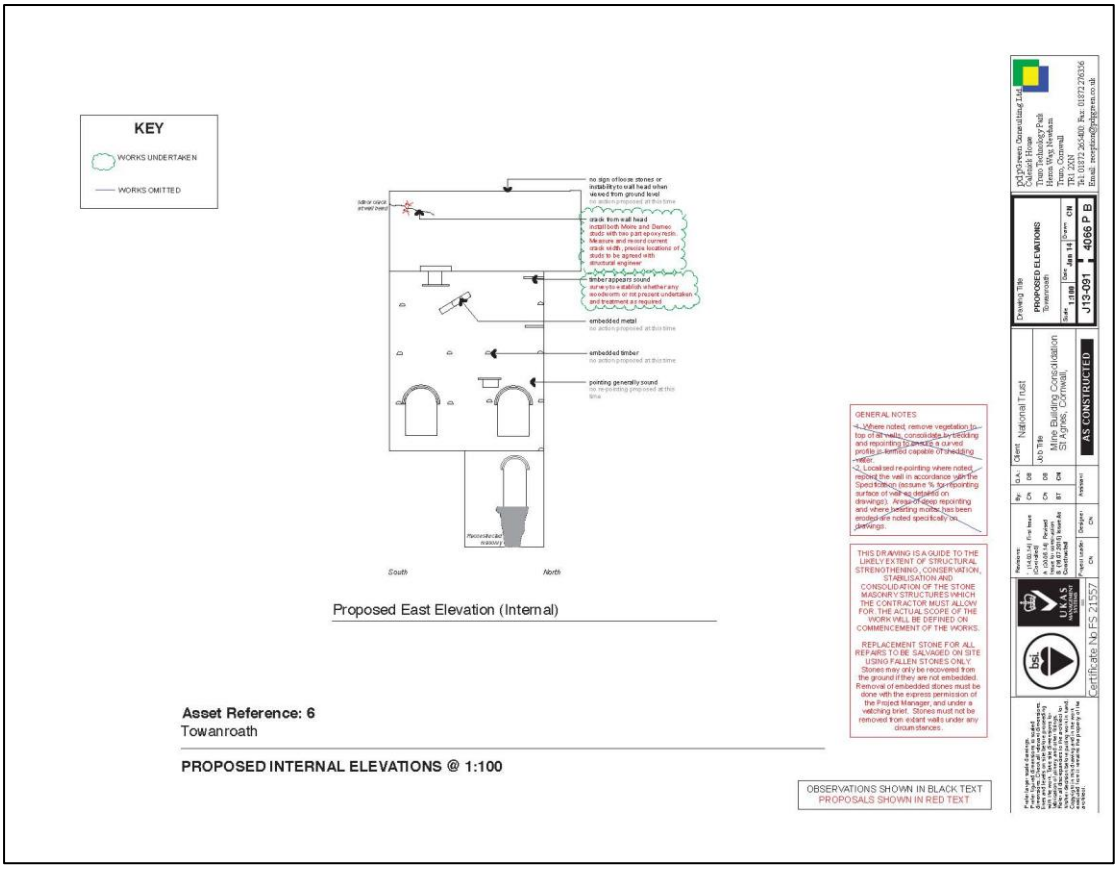

Fig 95. Eastern internal elevation of Towanroath pumping engine house.

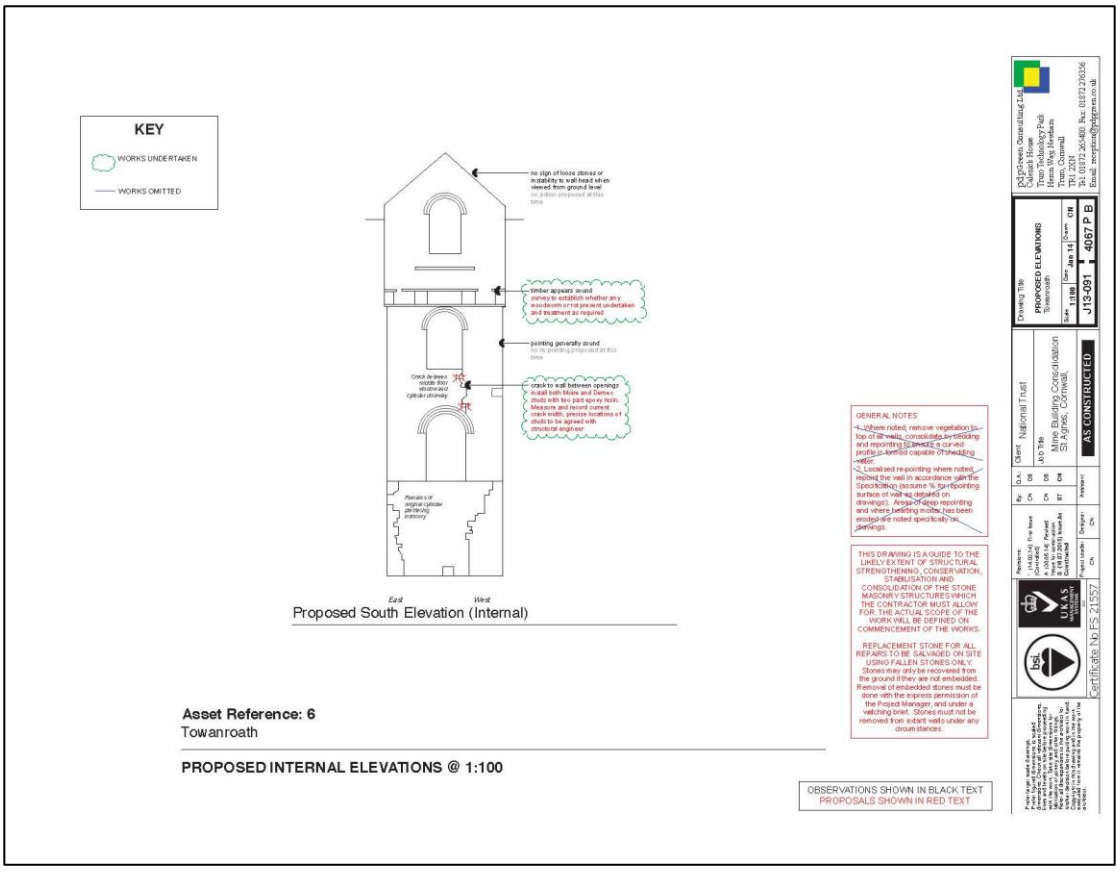

Fig 96. Southern internal elevation of Towanroath pumping engine house.

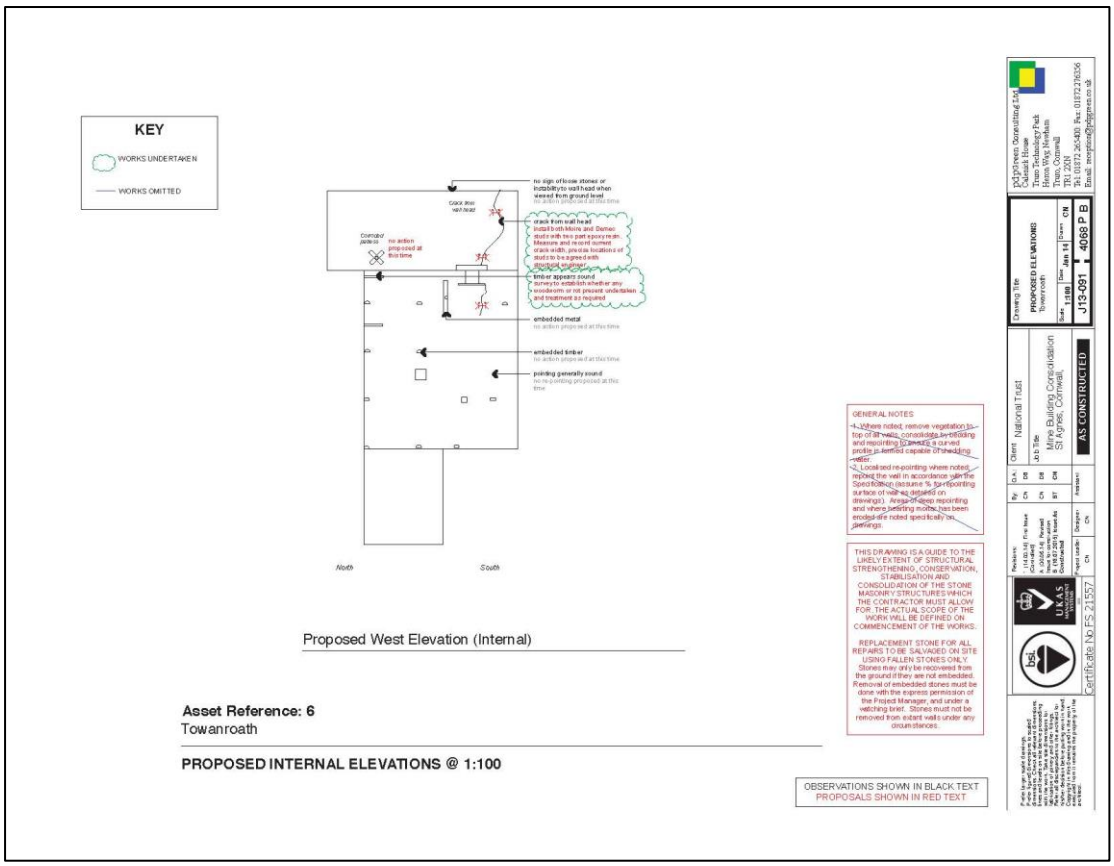

Fig 97. Western internal elevation of Towanroath pumping engine house.

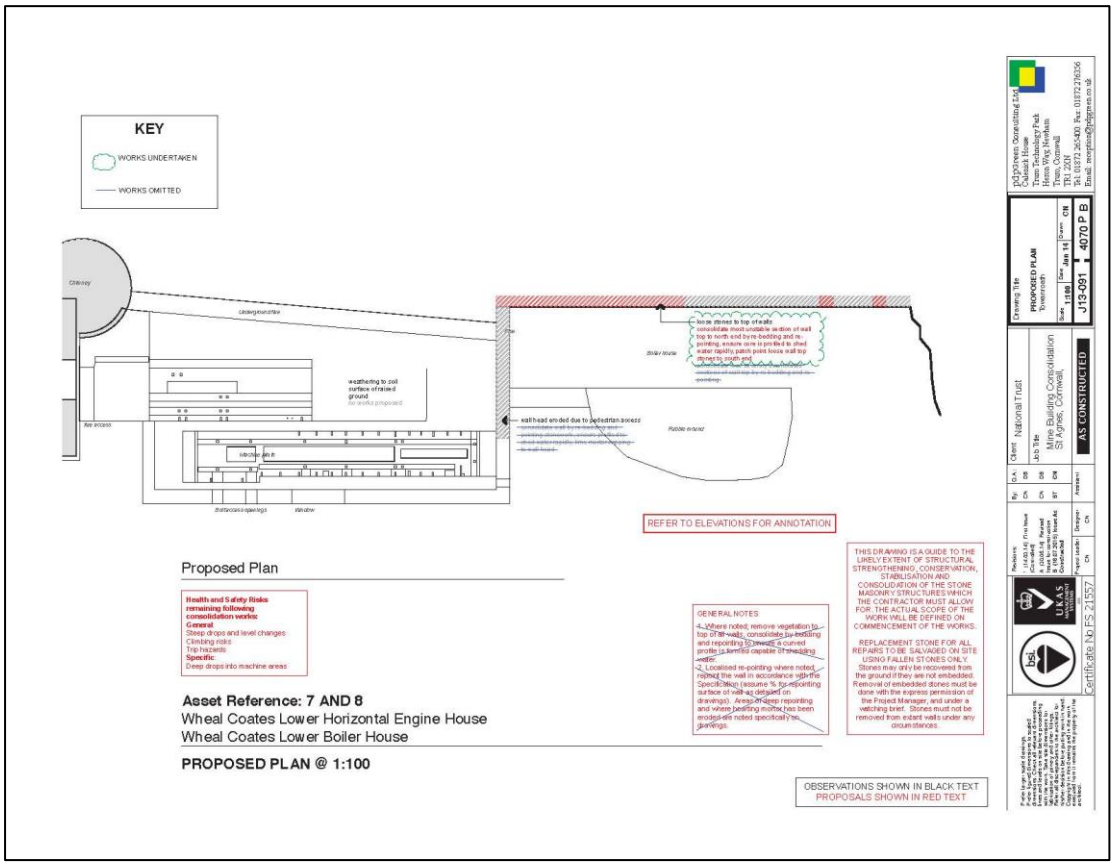

Fig 98. Plan of Towanroath winding engine house and boiler house.

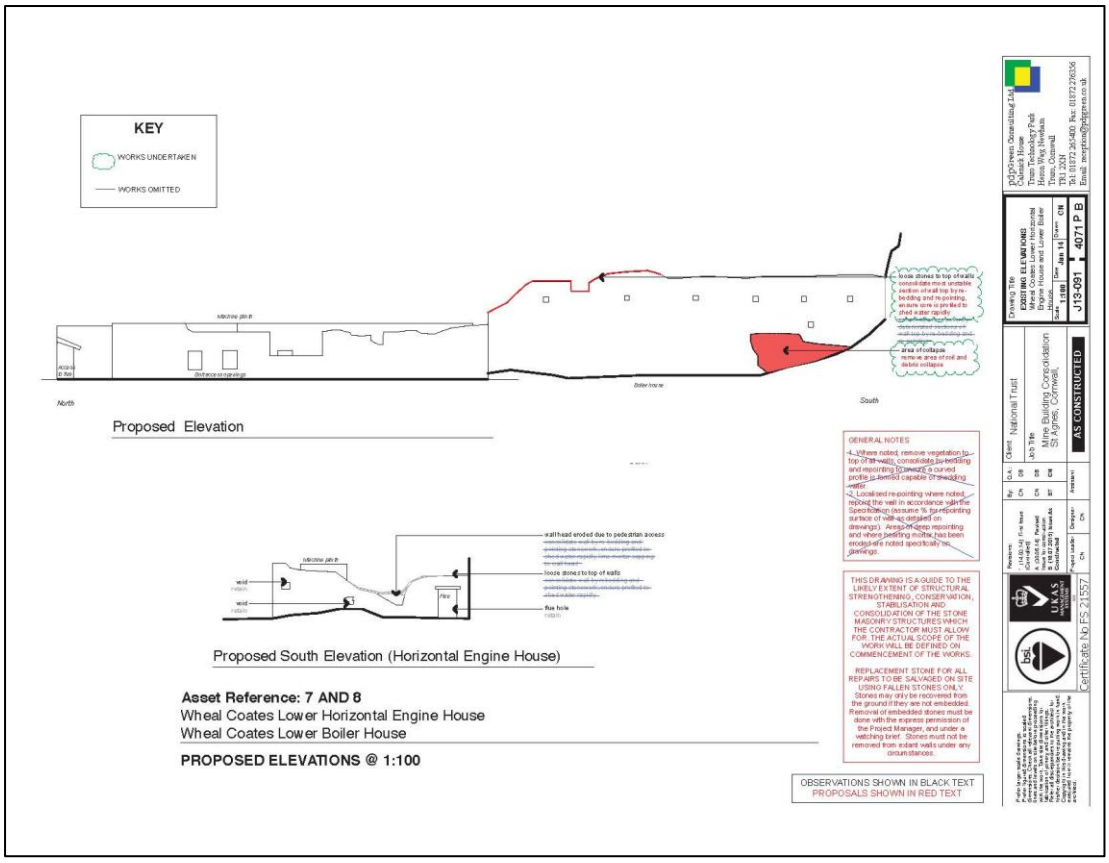

Fig 99. Western and southern external elevations of Towanroath winding engine house and western elevation of boiler house.

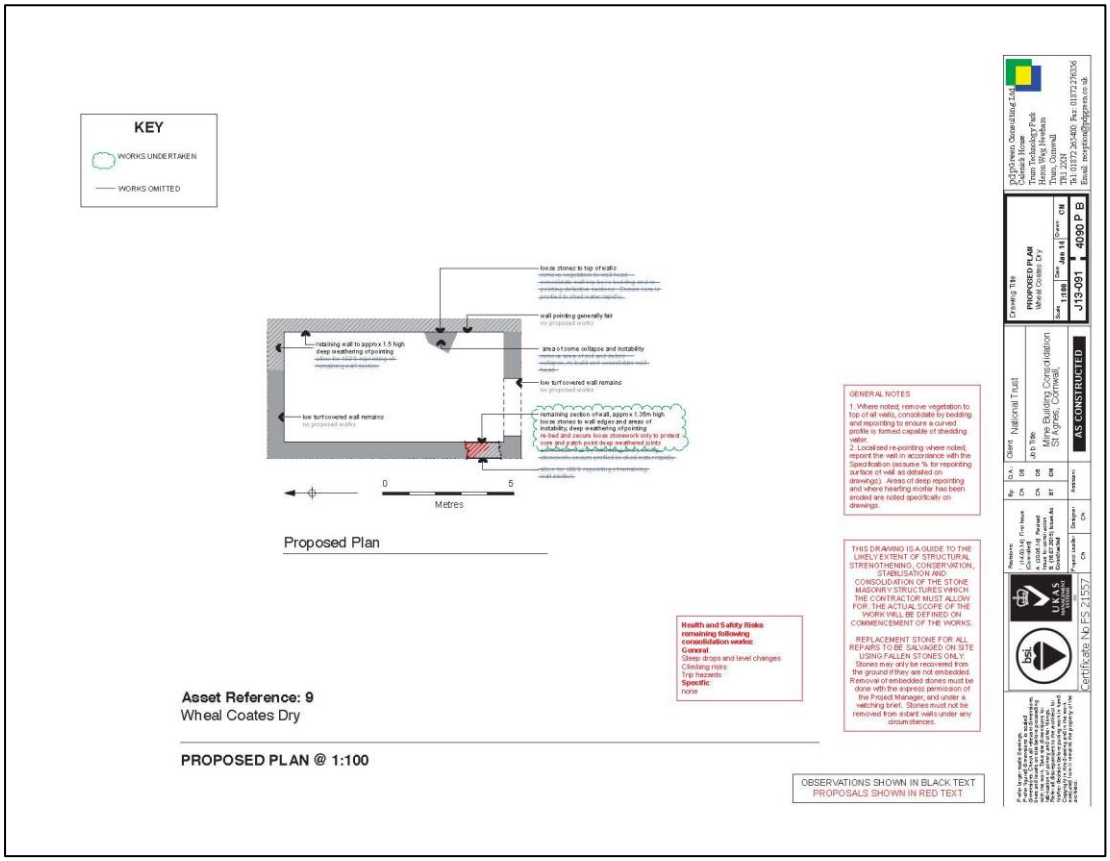

Fig 100. Plan of Towanroath Shaft dry.

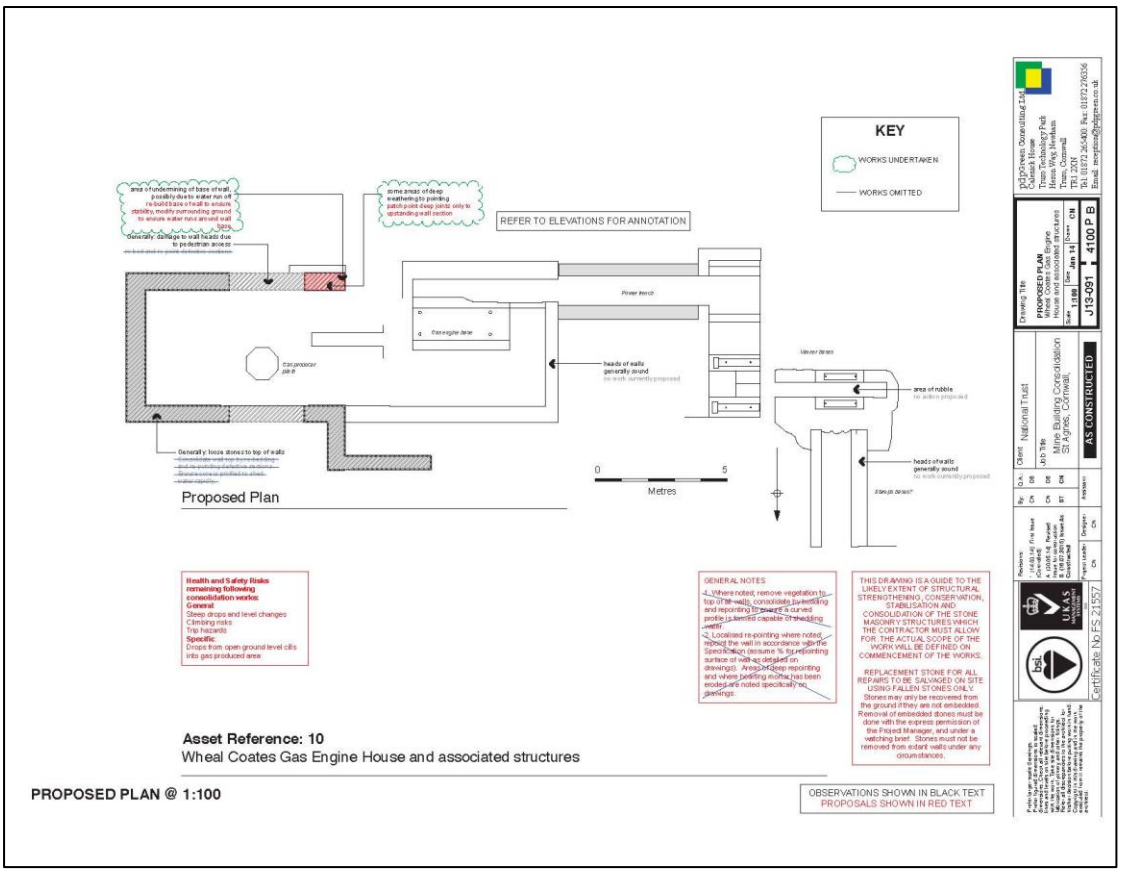

Fig 101. Plan of Wheal Coates gas engine house.

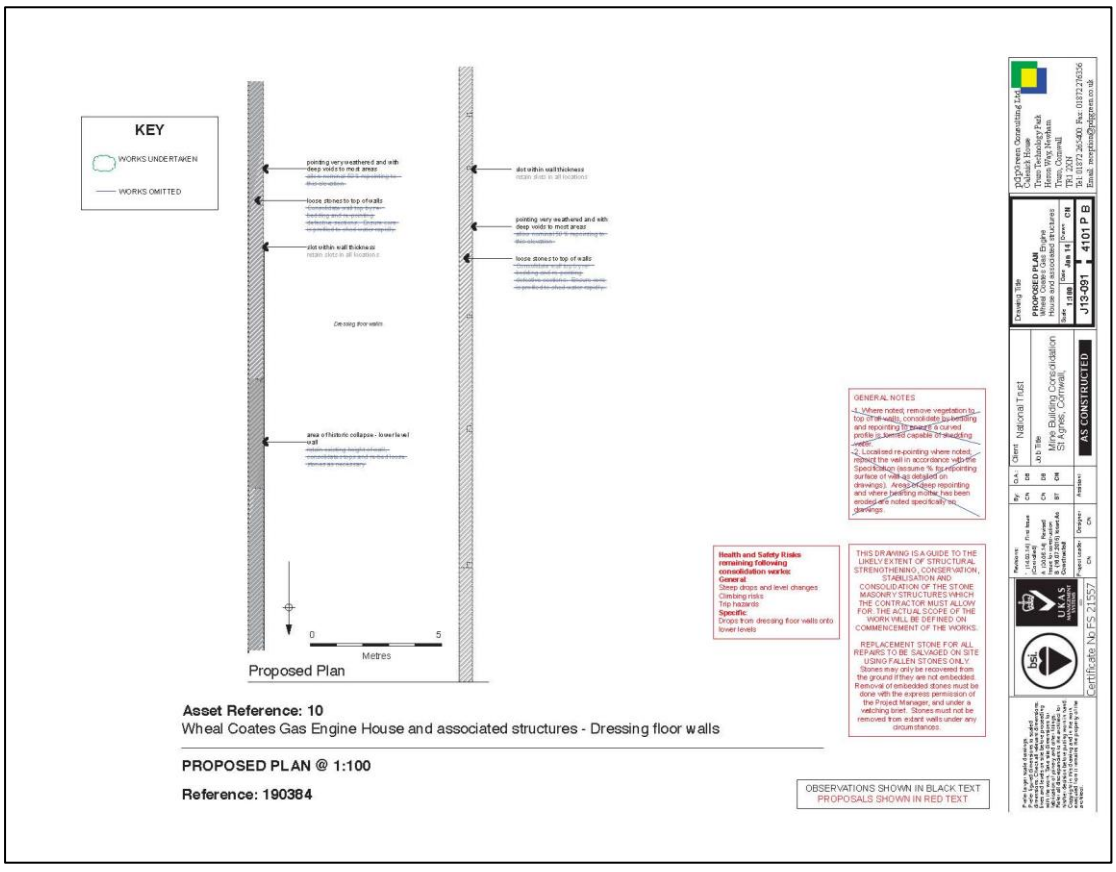

Fig 102. Plan of Wheal Coates dressing floor walls.

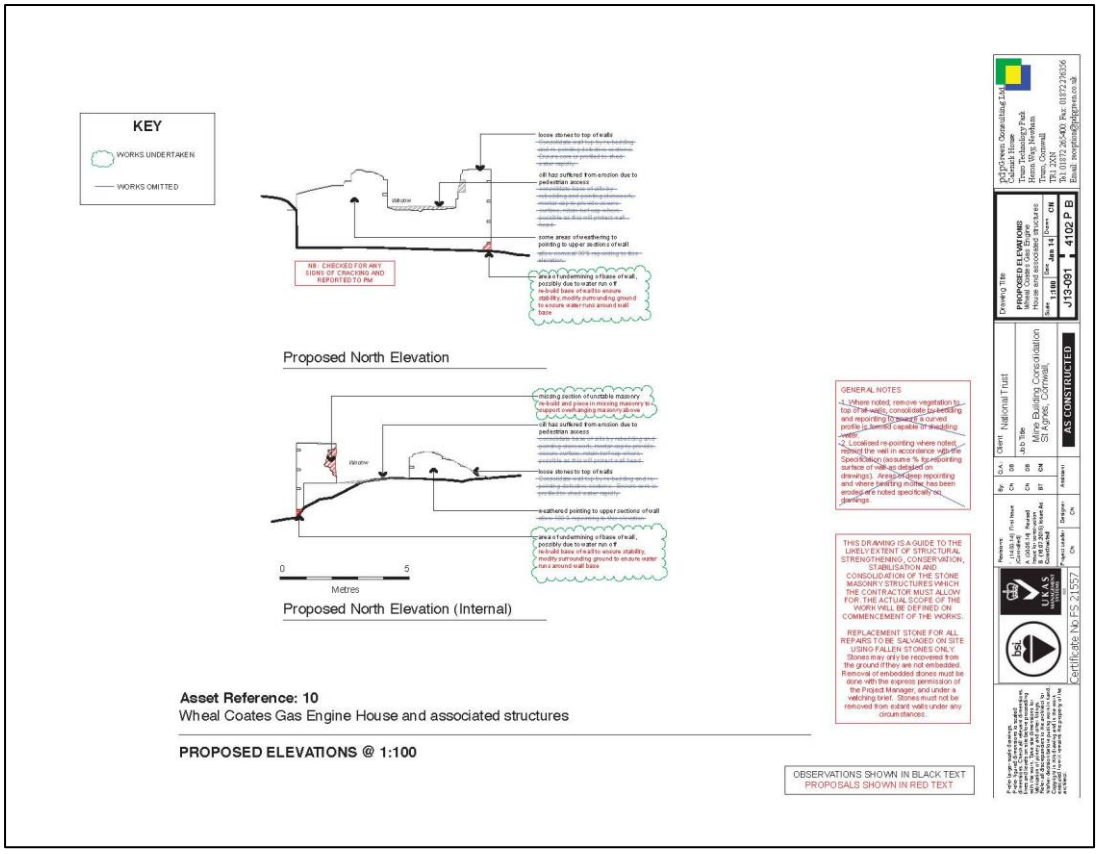

Fig 103. Internal and external northern elevations of Wheal Coates gas engine house.

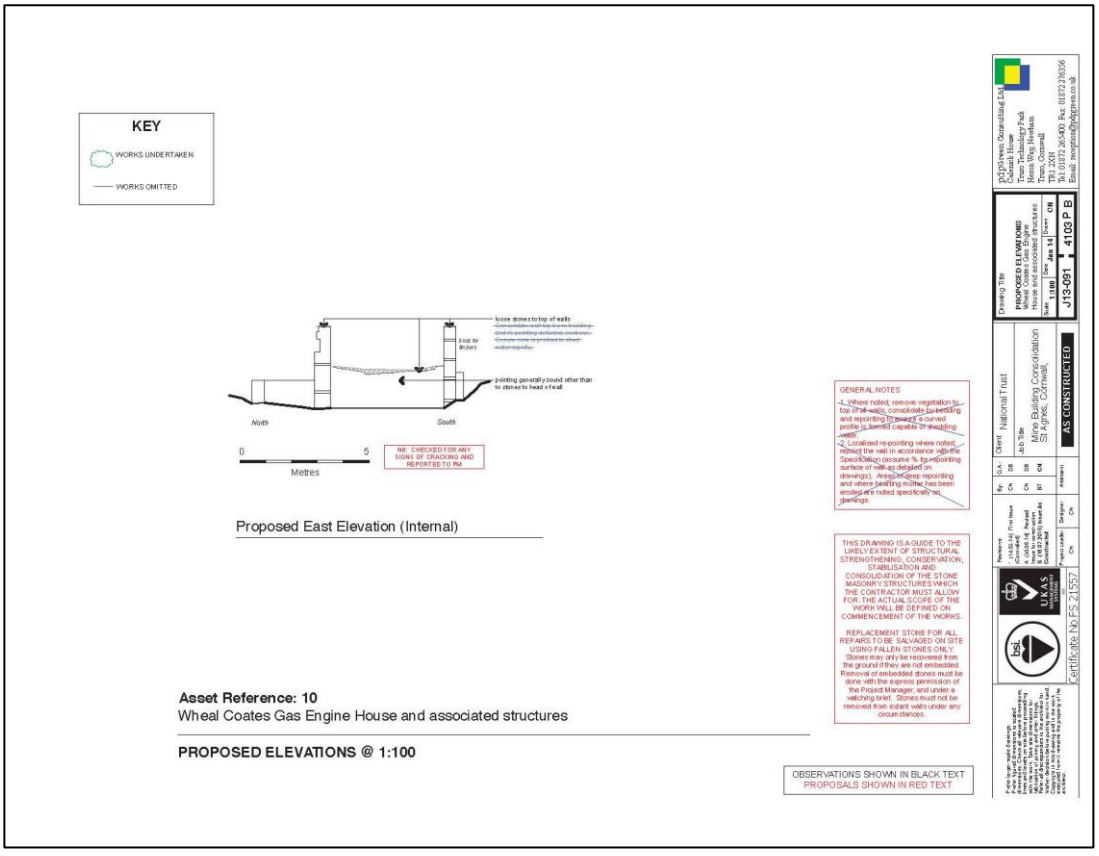

Fig 104. Internal eastern elevation of Wheal Coates gas engine house.

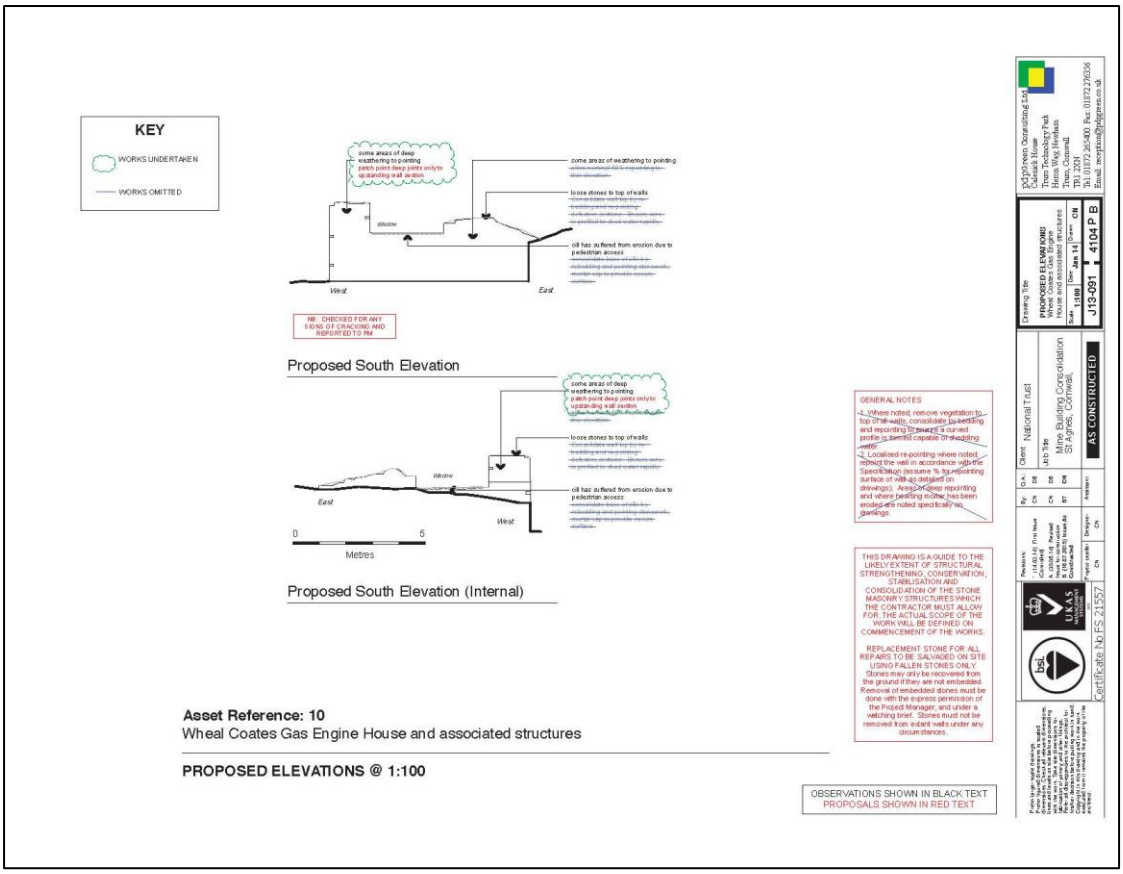

Fig 105. External and internal elevations of Wheal Coates gas engine house.

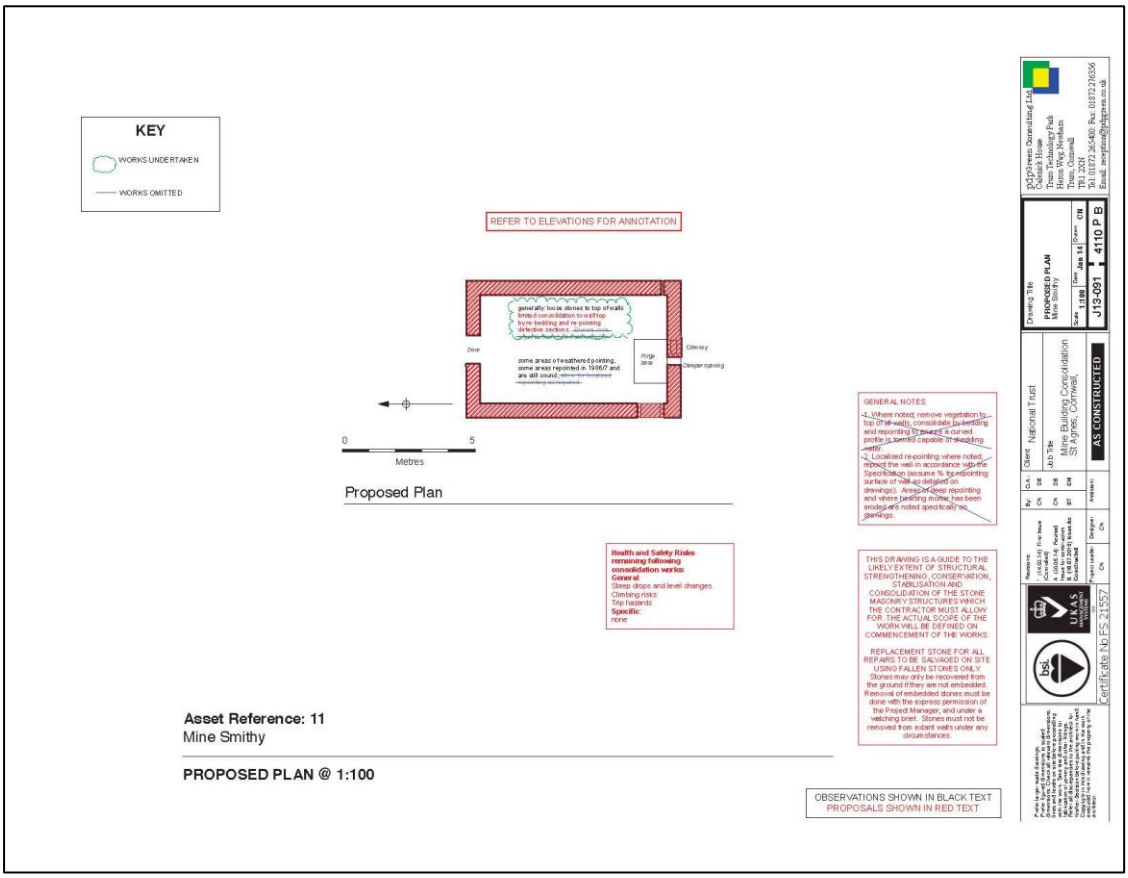

Fig 106. Plan of Wheal Coates mine smithy.

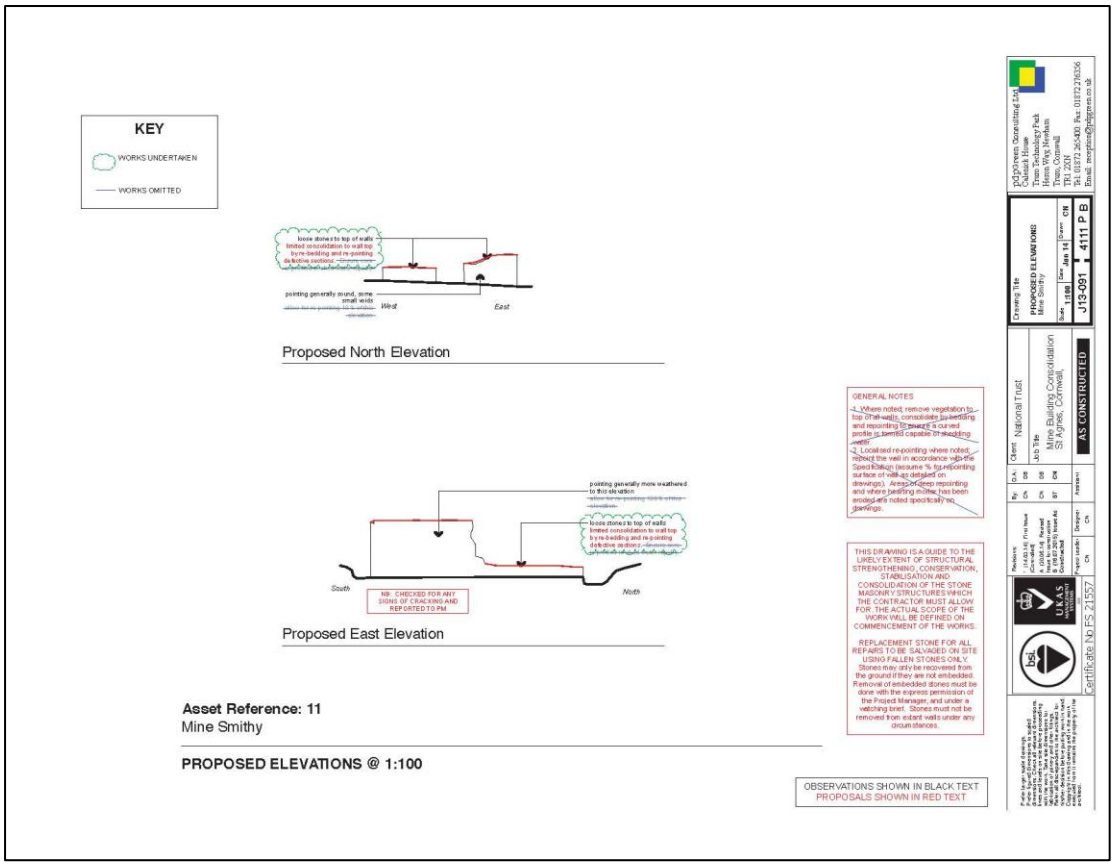

Fig 107. Northern and eastern external elevations of Wheal Coates mine smithy.

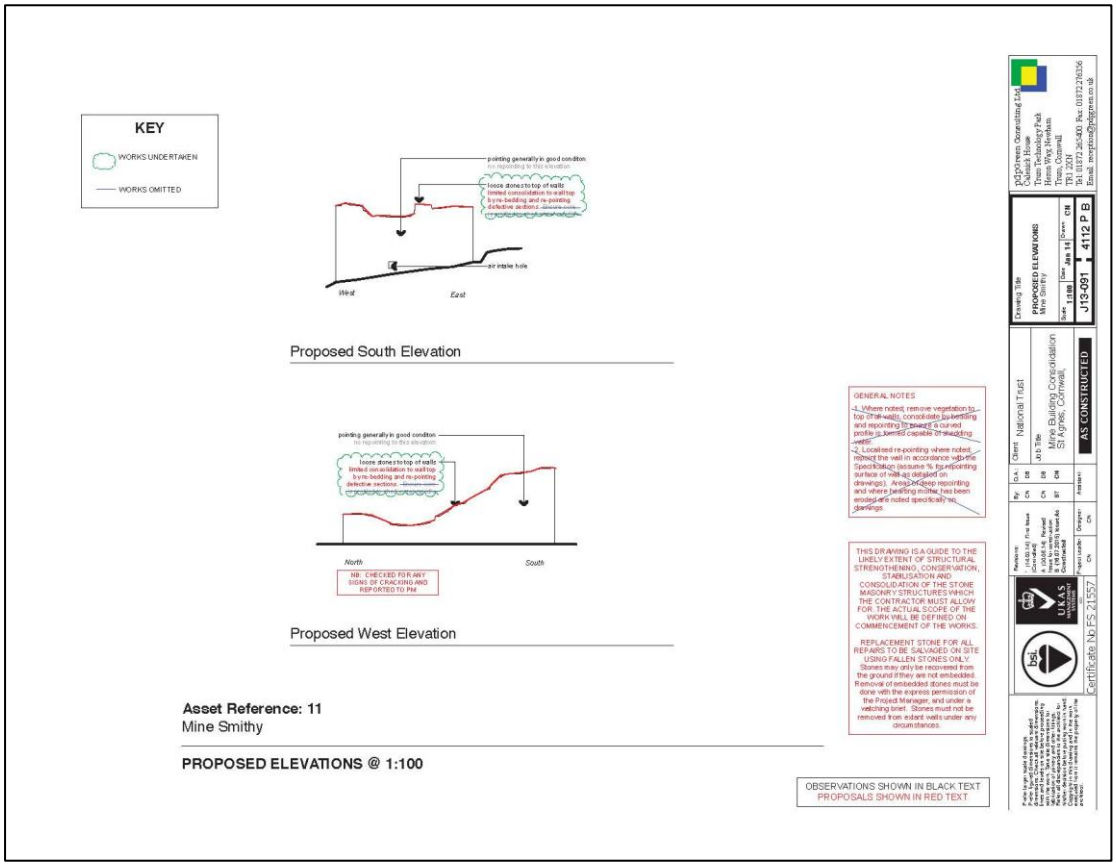

Fig 108. Southern and western external elevations of Wheal Coates mine smithy.

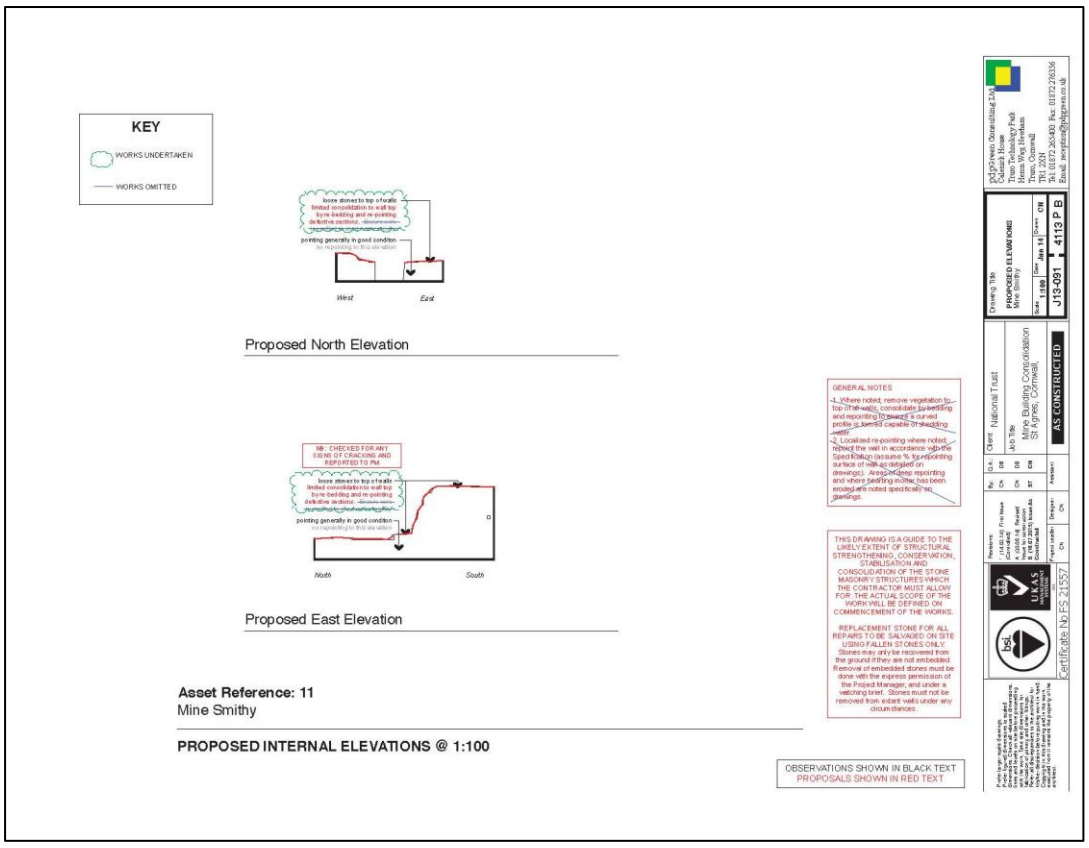

Fig 109. Northern and eastern internal elevations of Wheal Coates mine smithy.

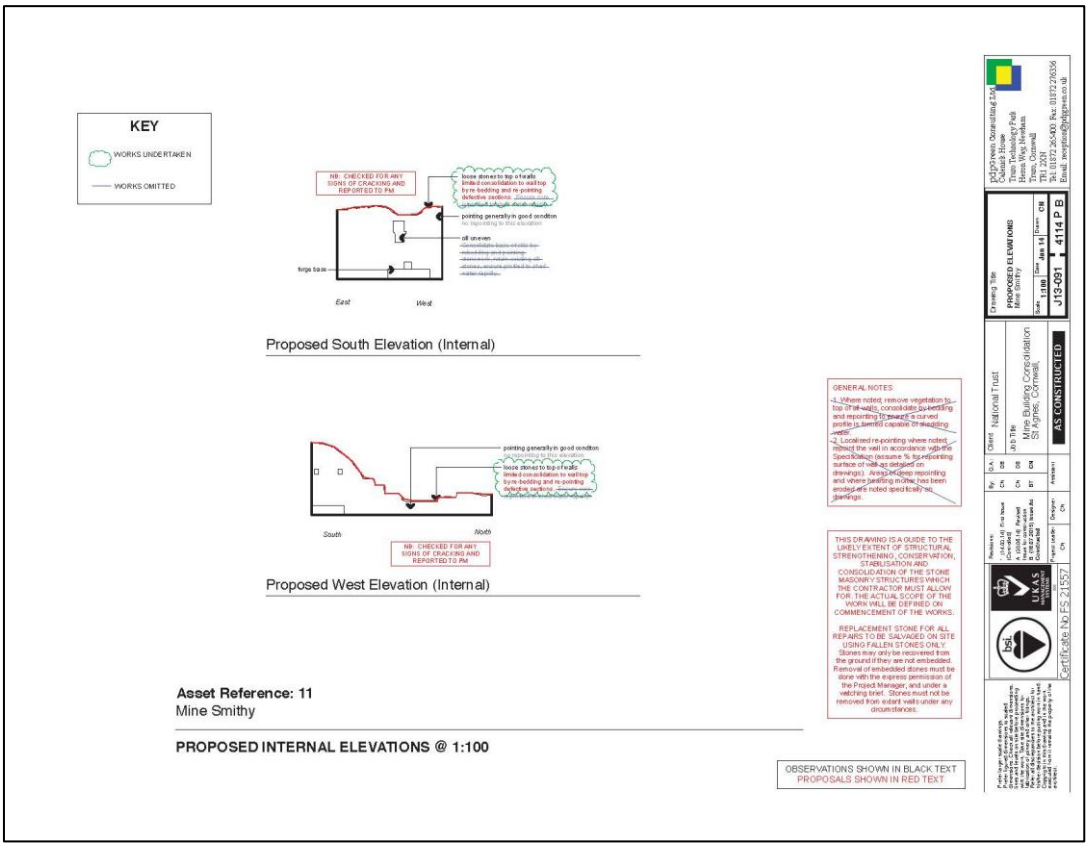

Fig 110. Southern and western internal elevations of Wheal Coates mine smithy.

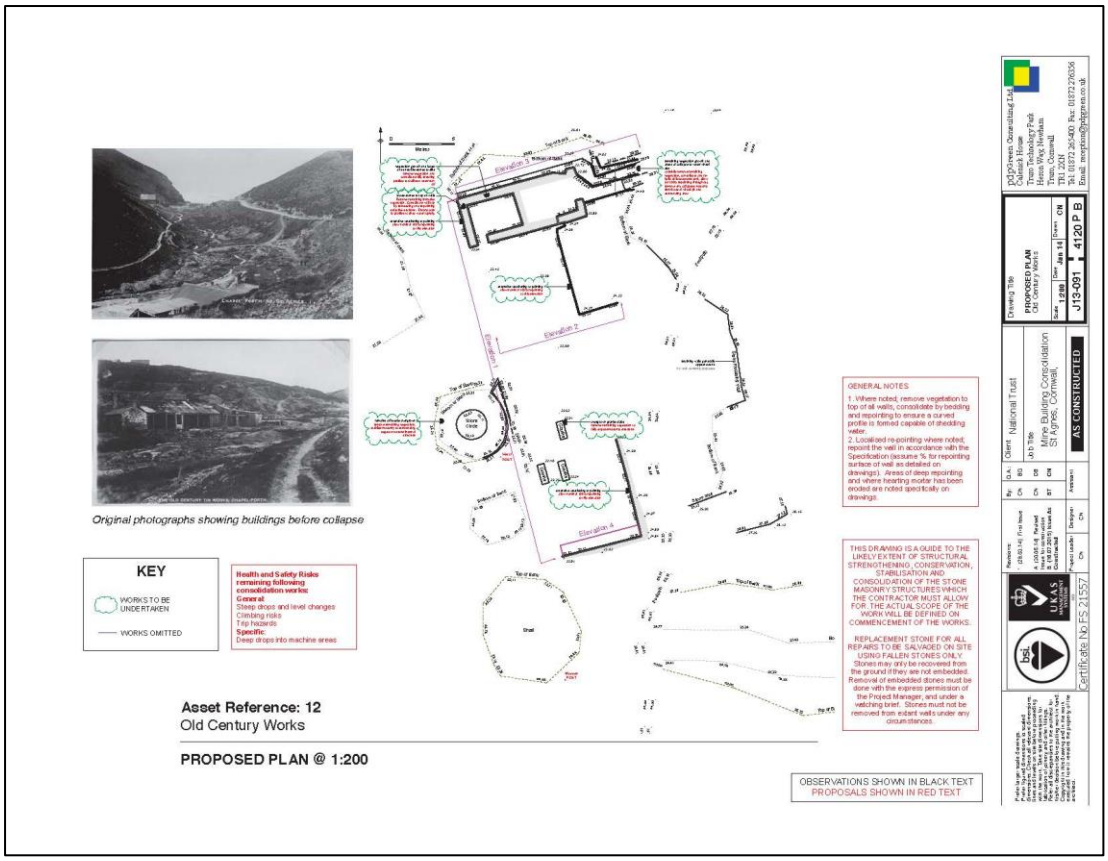

Fig 111. Plan of Old Century Works.

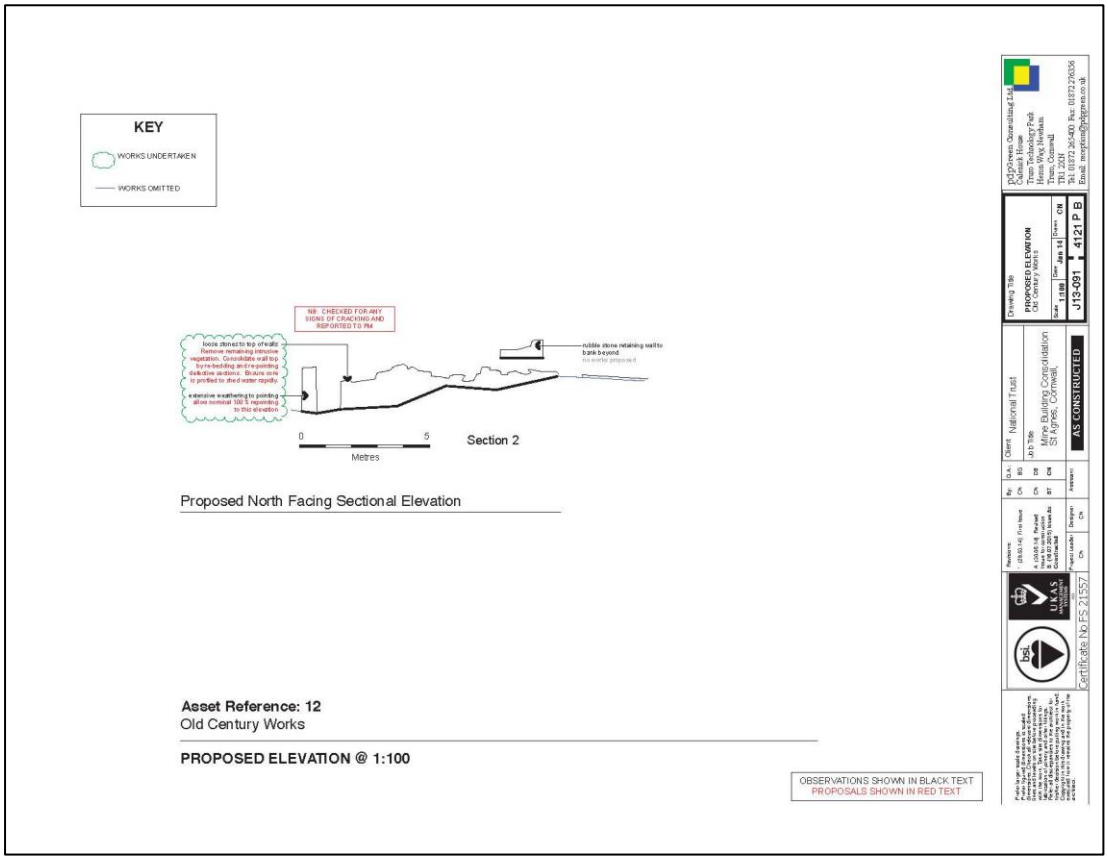

Fig 112. North facing sectional elevations at Old Century Works.

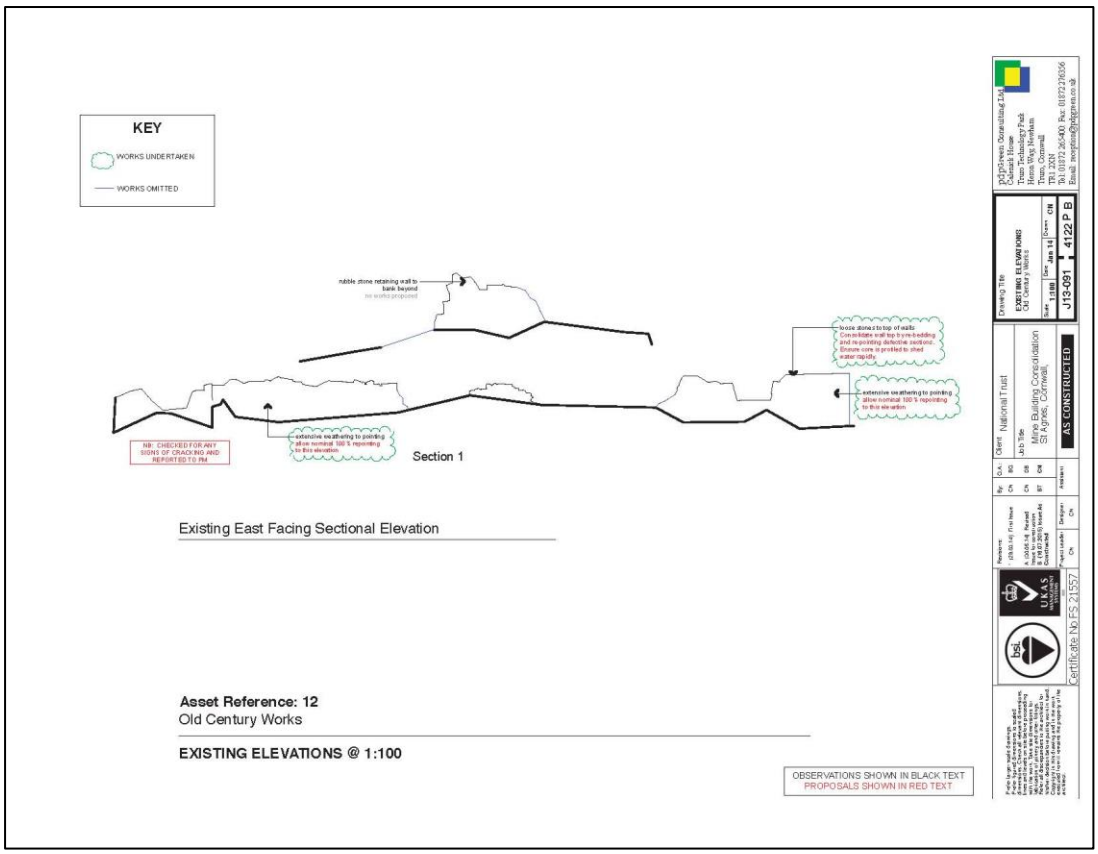

Fig 113. East facing sectional elevations at Old Century Works.

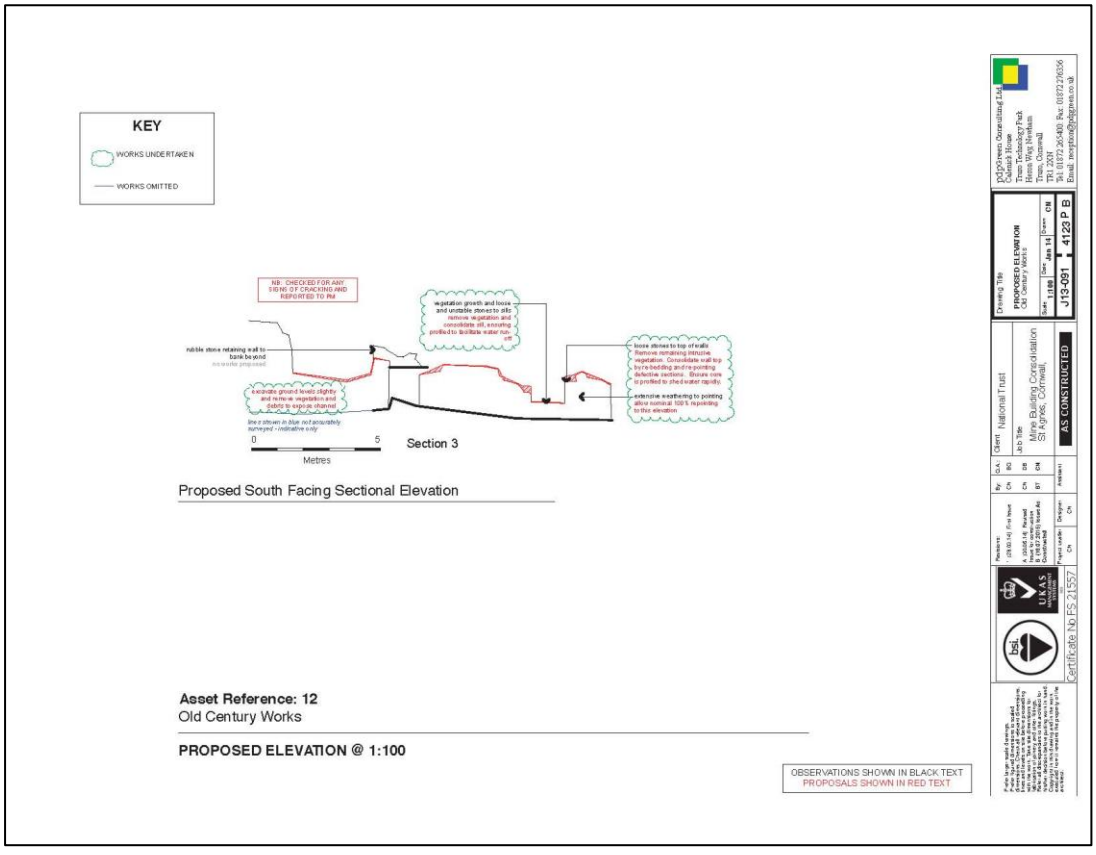

Fig 114. South facing sectional elevation at Old Century Works.

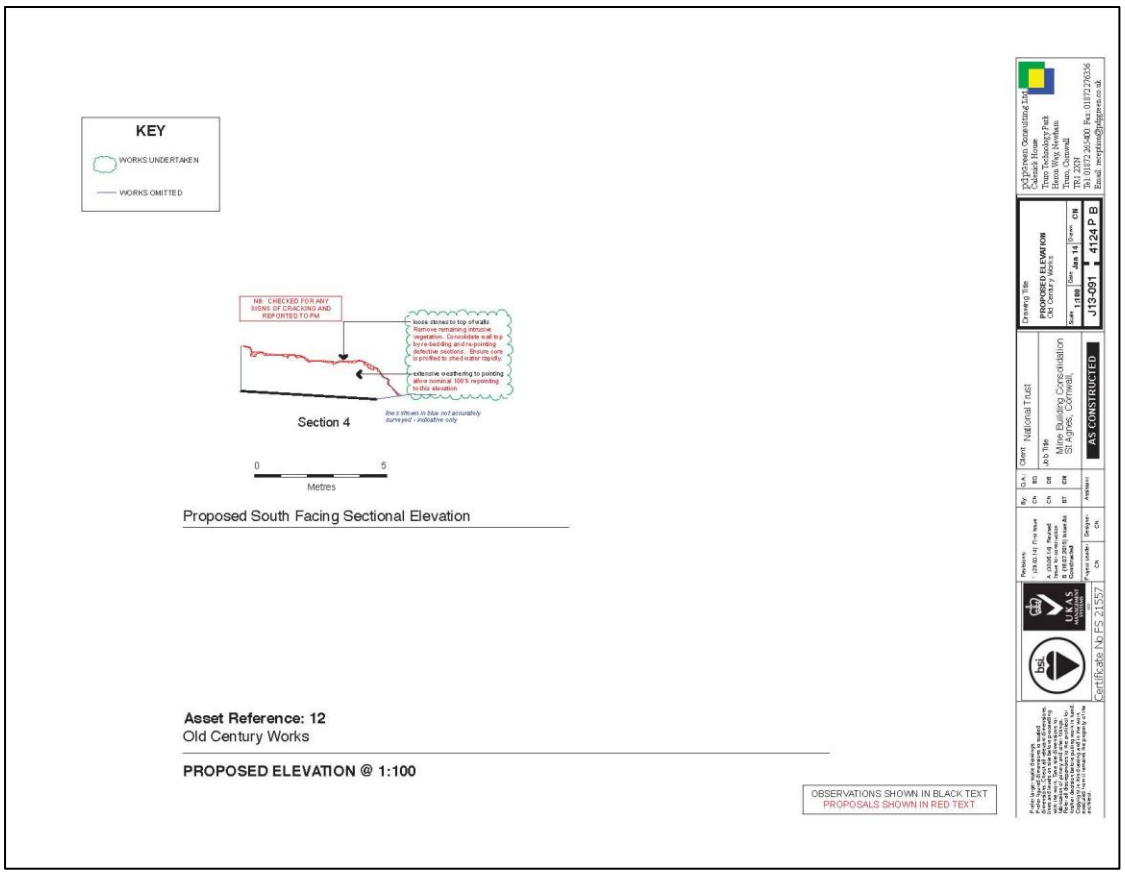

Fig 115. South facing external elevation at Old Century Works.

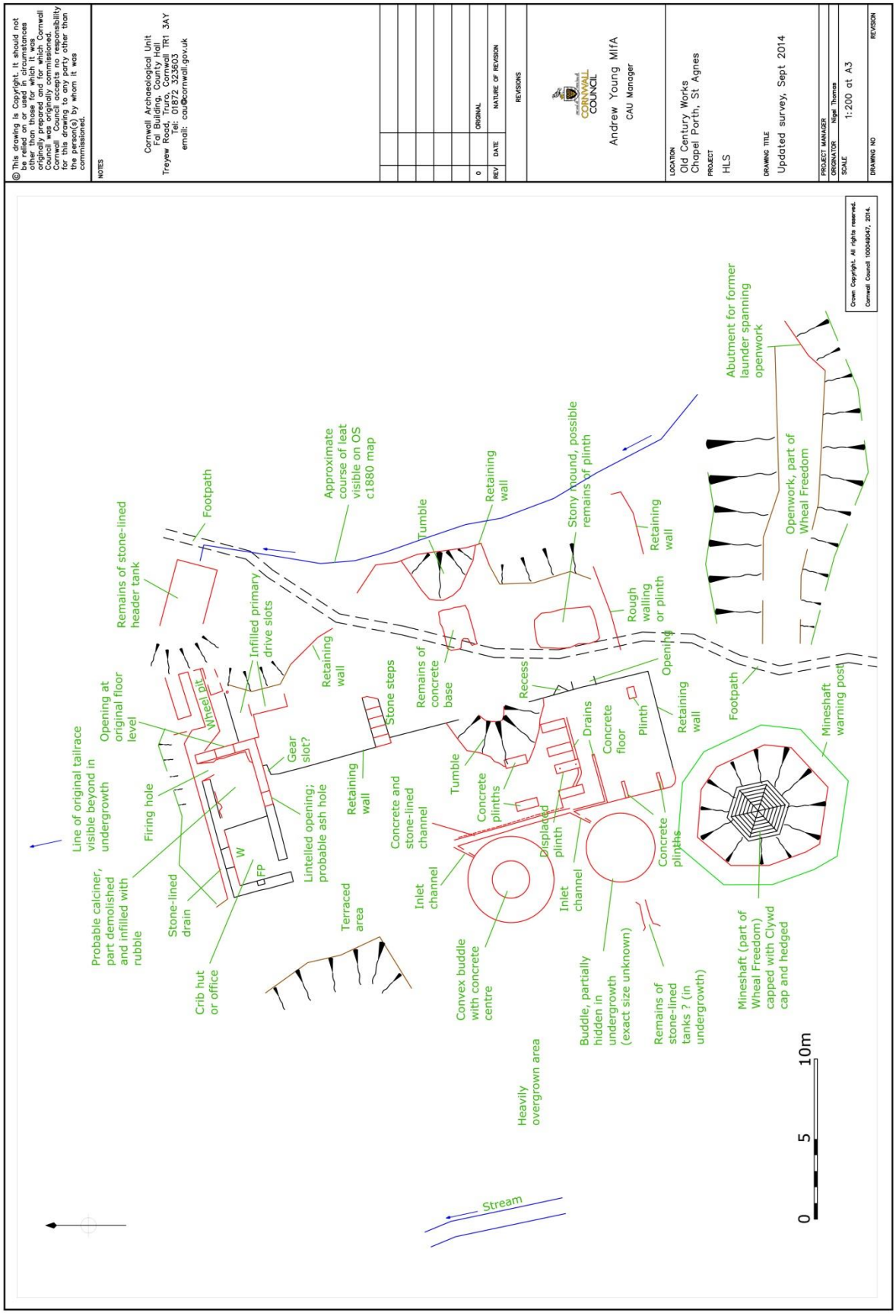

Fig 116. Amended CAU plan of Old Century Works.

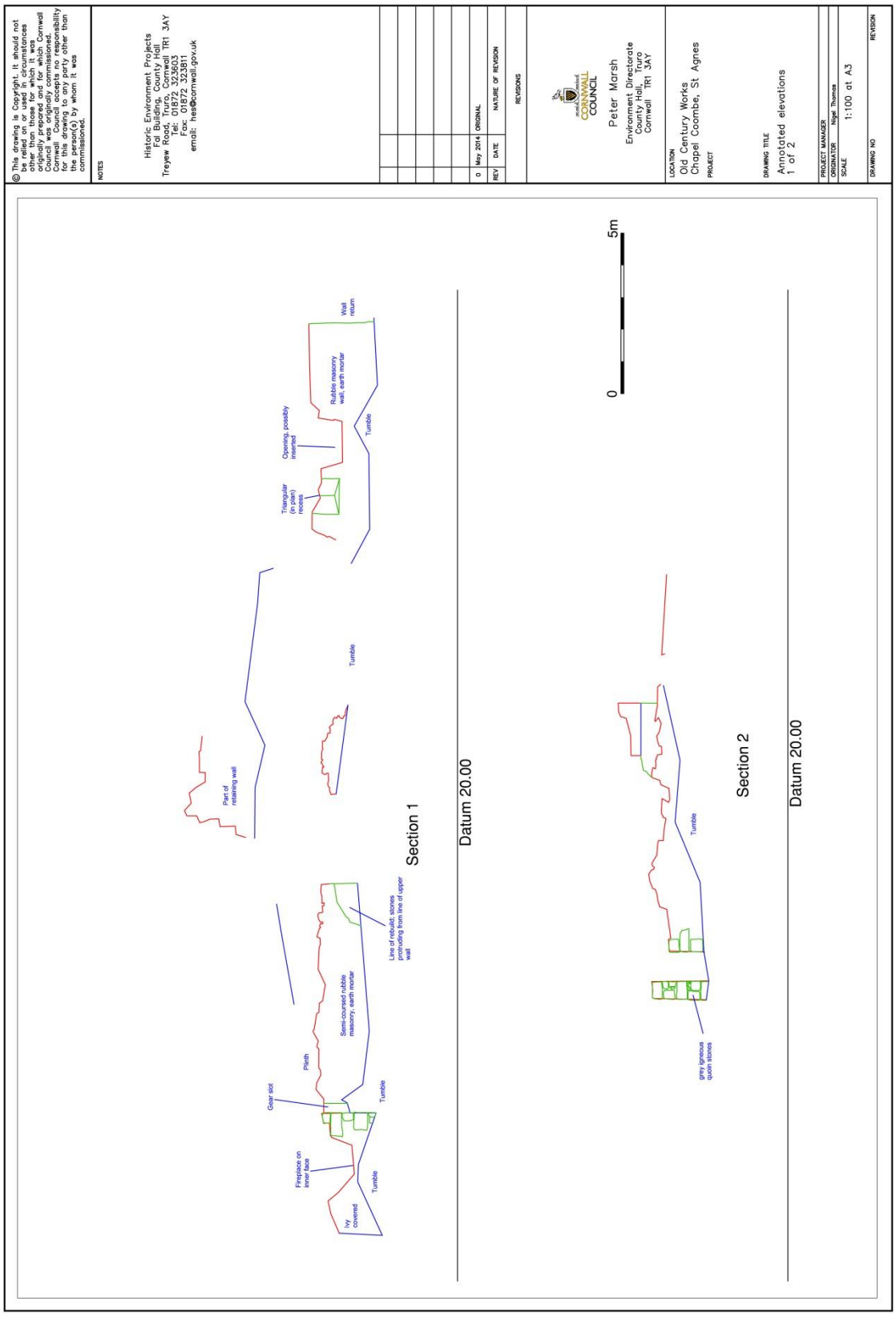

Fig 117. Amended CAU elevations at Old Century Works.

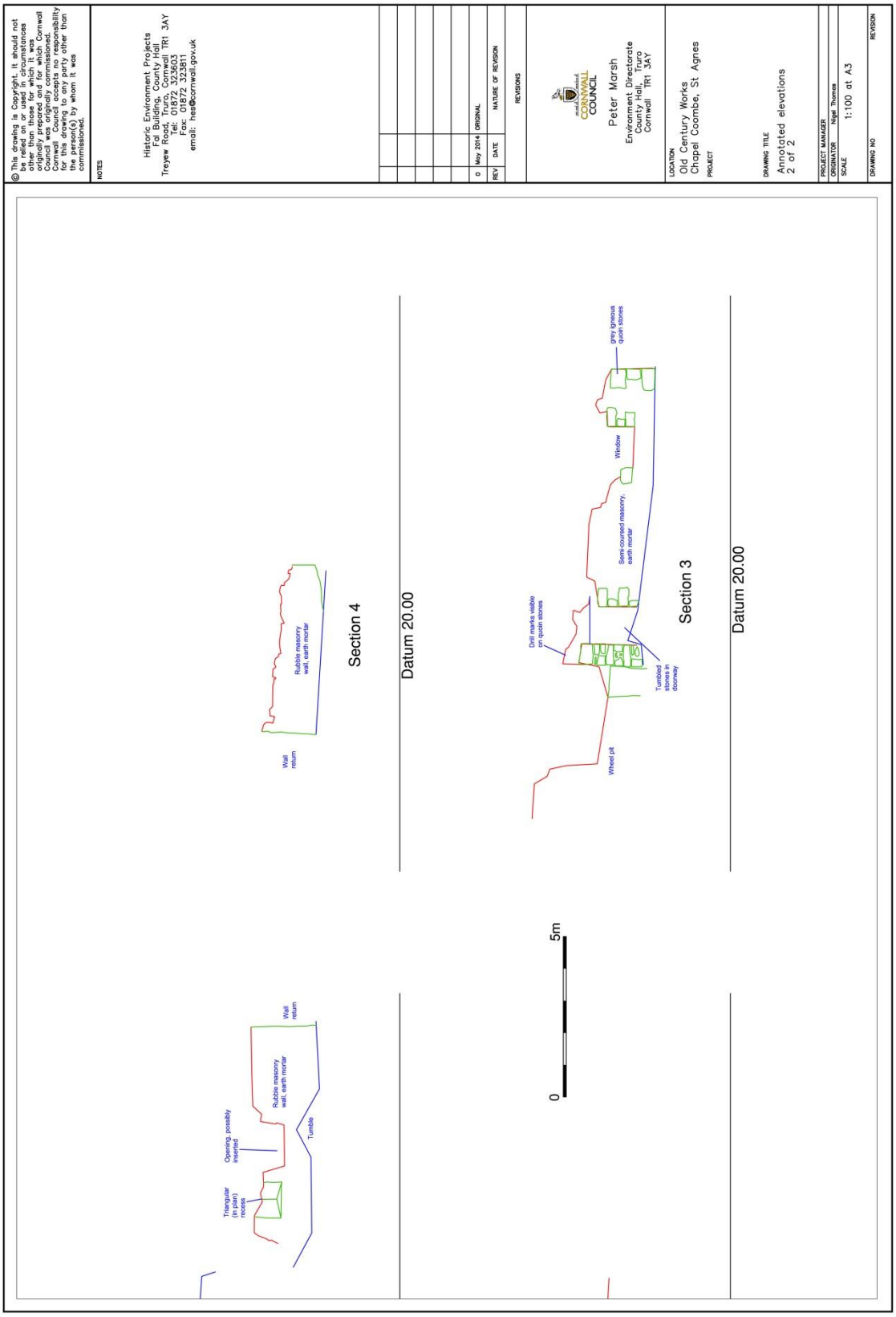

Fig 118. Amended CAU elevations at Old Century Works.

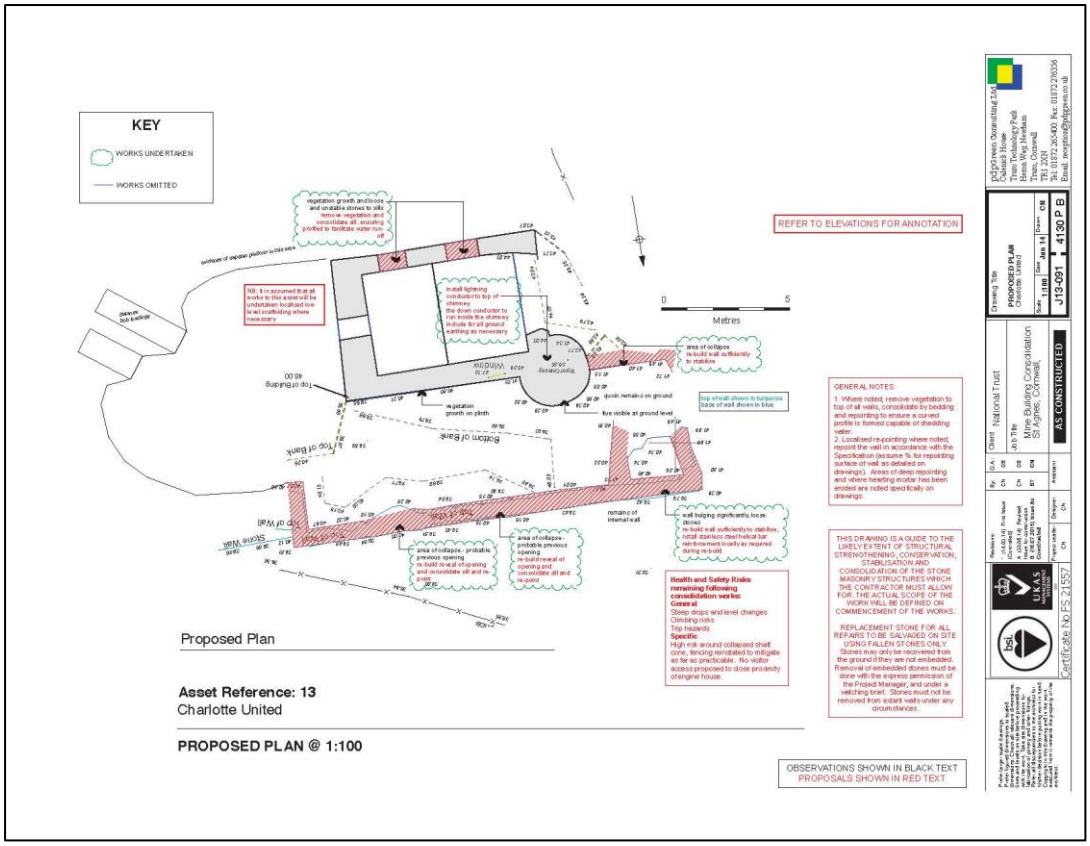

Fig 119. Plan of engine house and boiler house at Charlotte United.

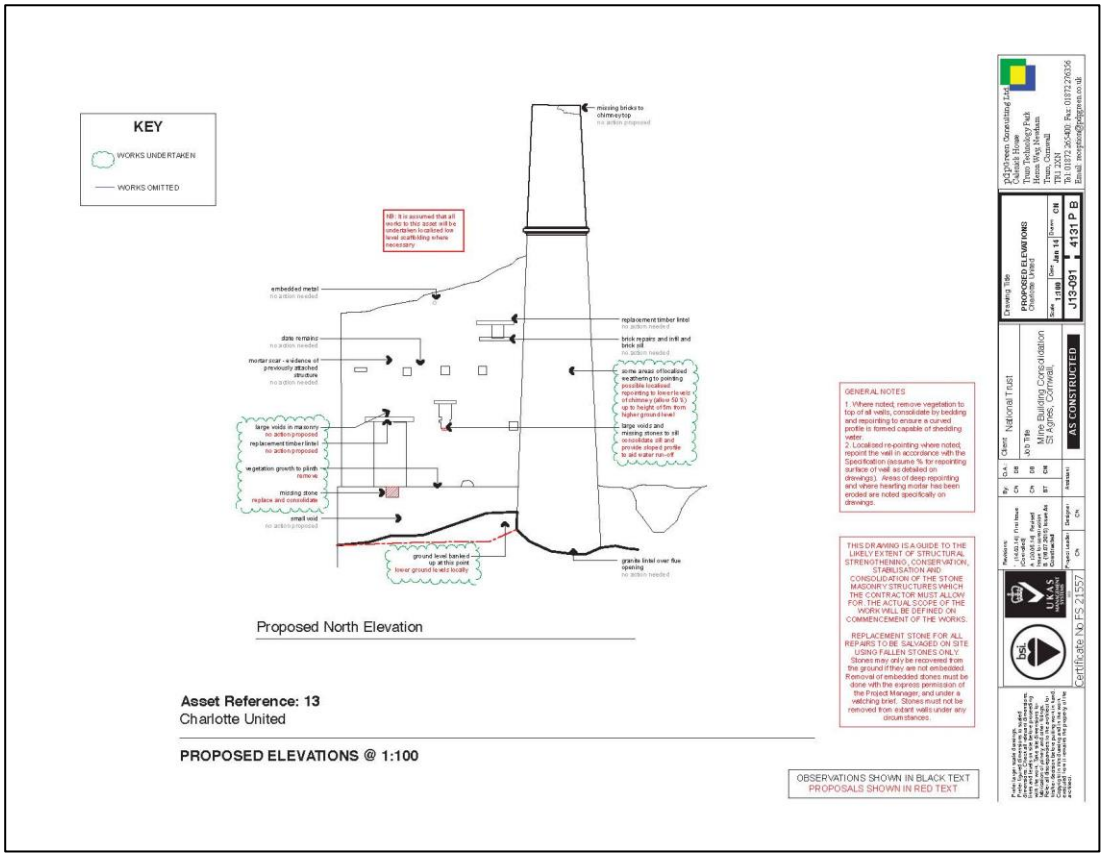

Fig 120. External northern elevation of Charlotte United engine house.

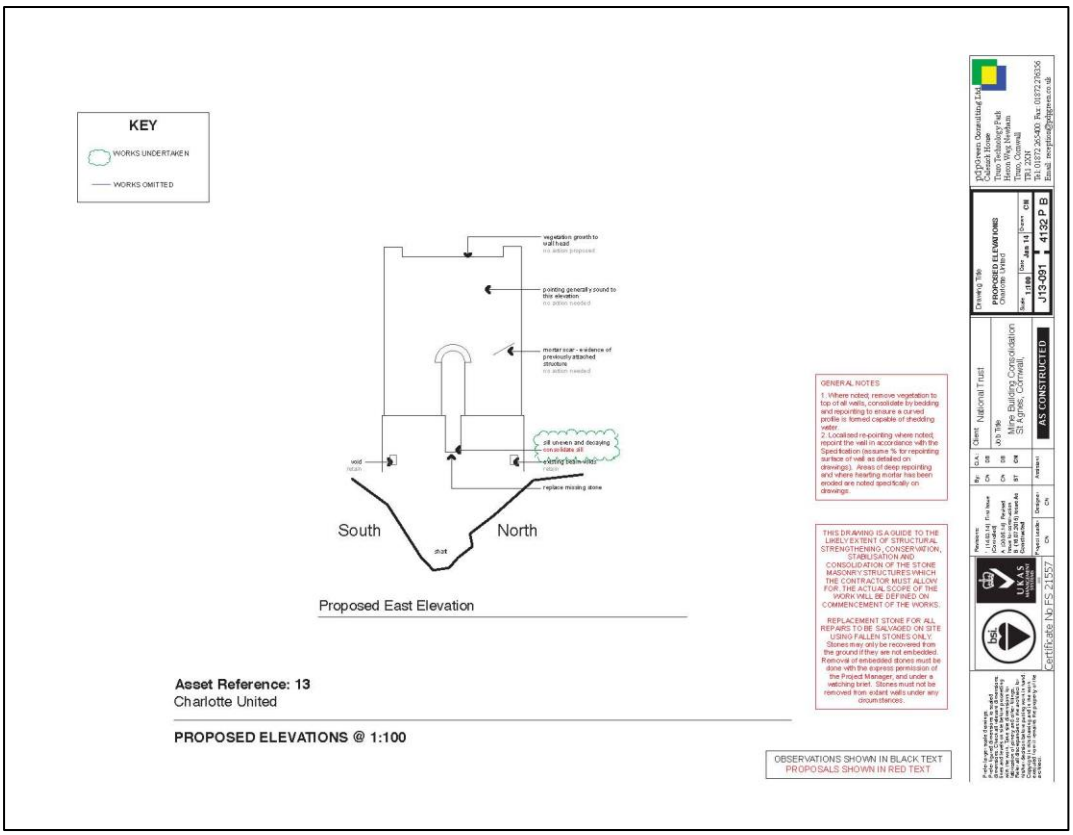

Fig 121. External eastern elevation of Charlotte United engine house.

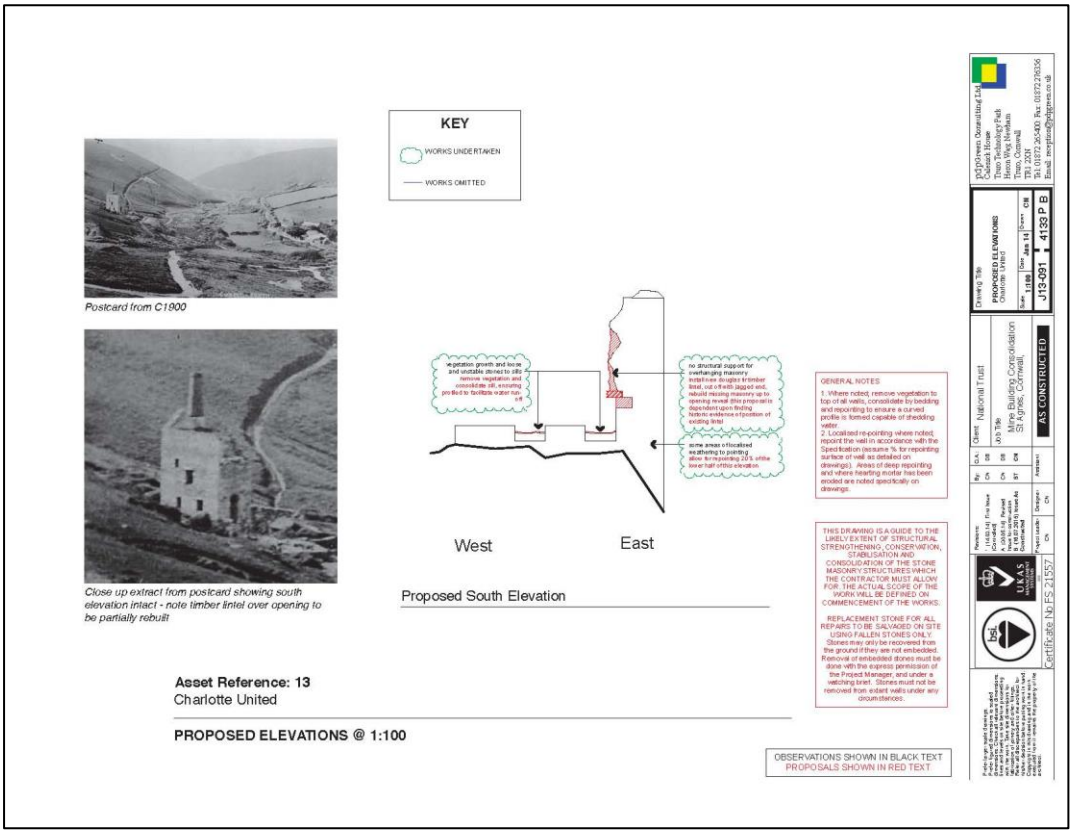

Fig 122. External southern elevation of Charlotte United engine house.

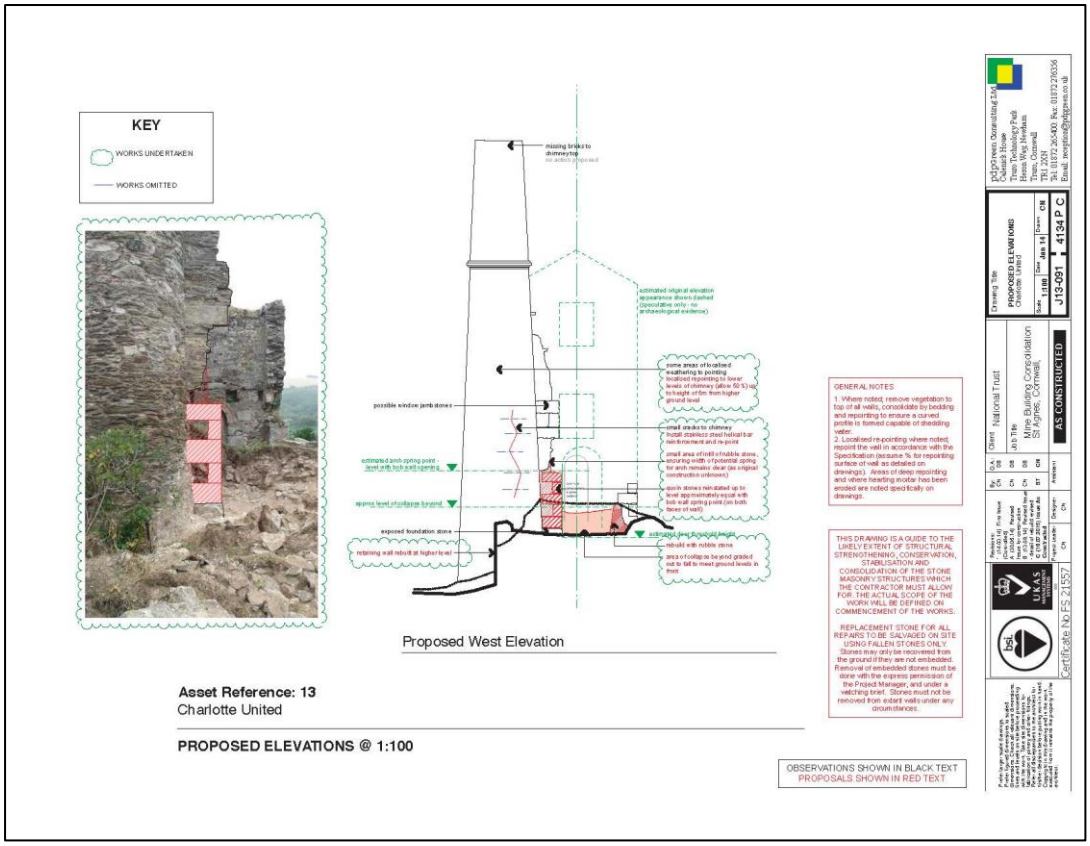

Fig 123. External western elevation of Charlotte United engine house.

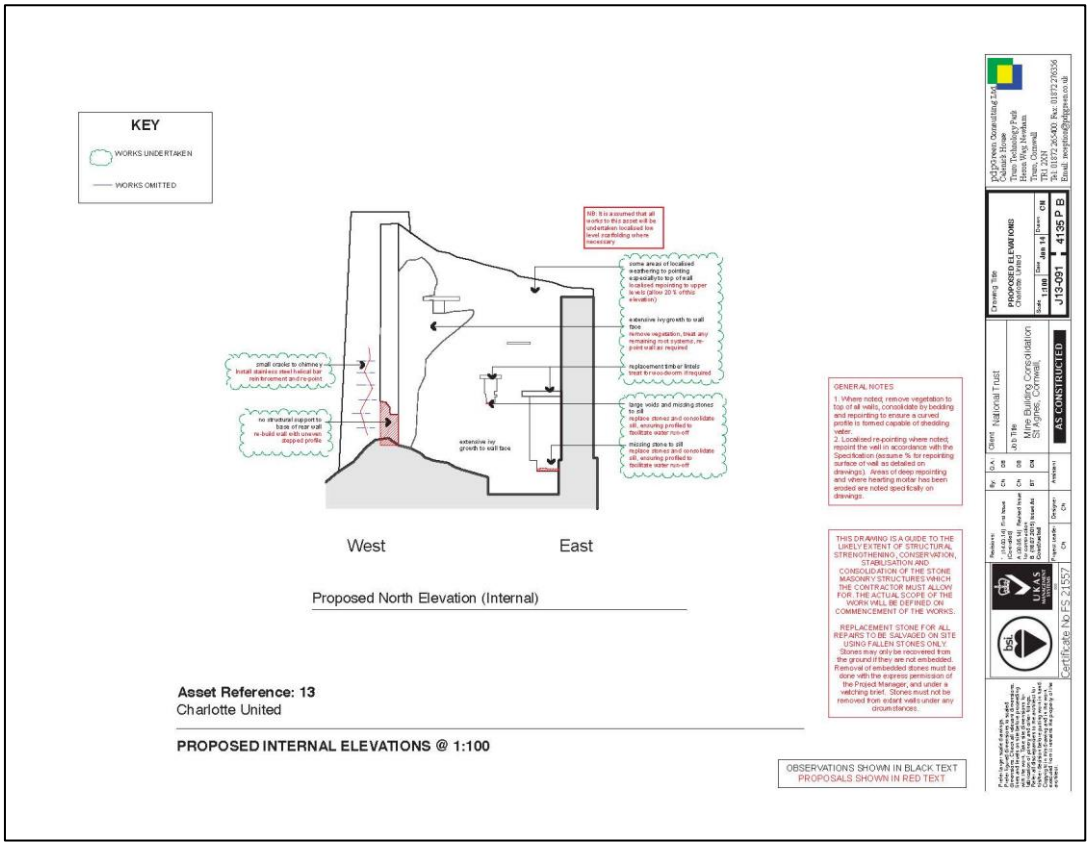

Fig 124. Internal northern elevation of Charlotte United engine house.

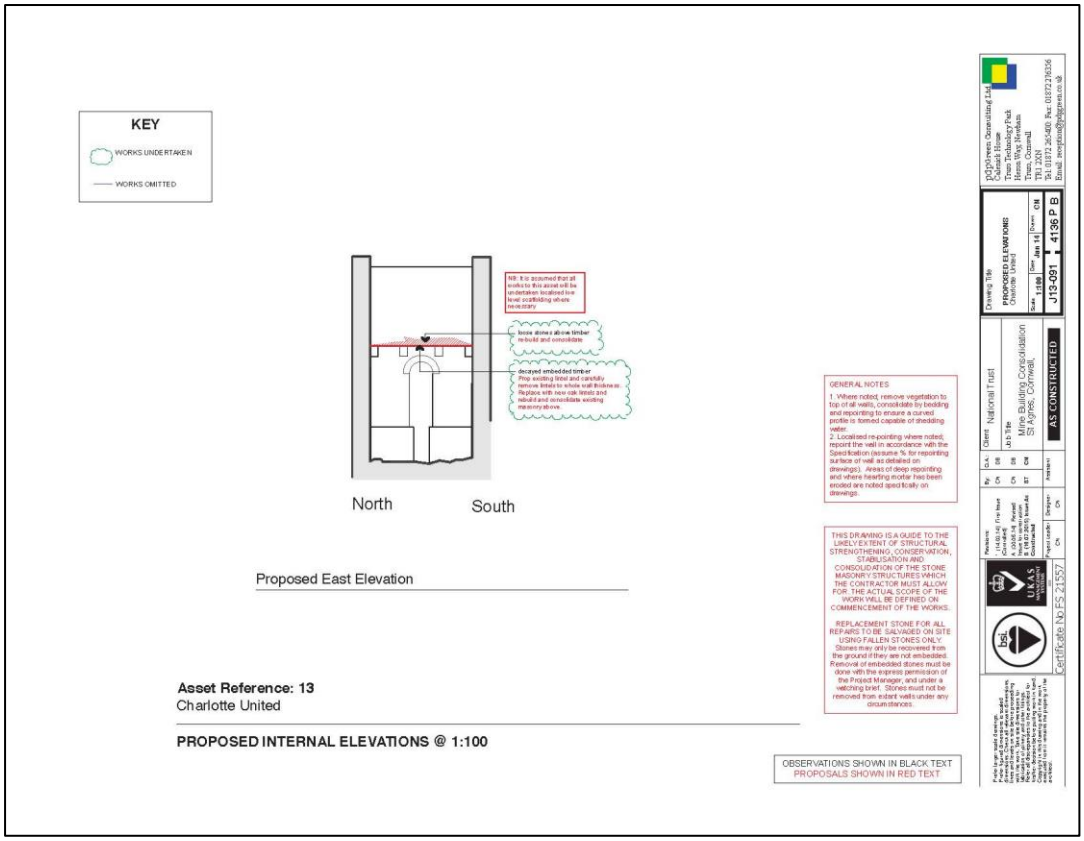

Fig 125. Internal eastern elevation of Charlotte United engine house.

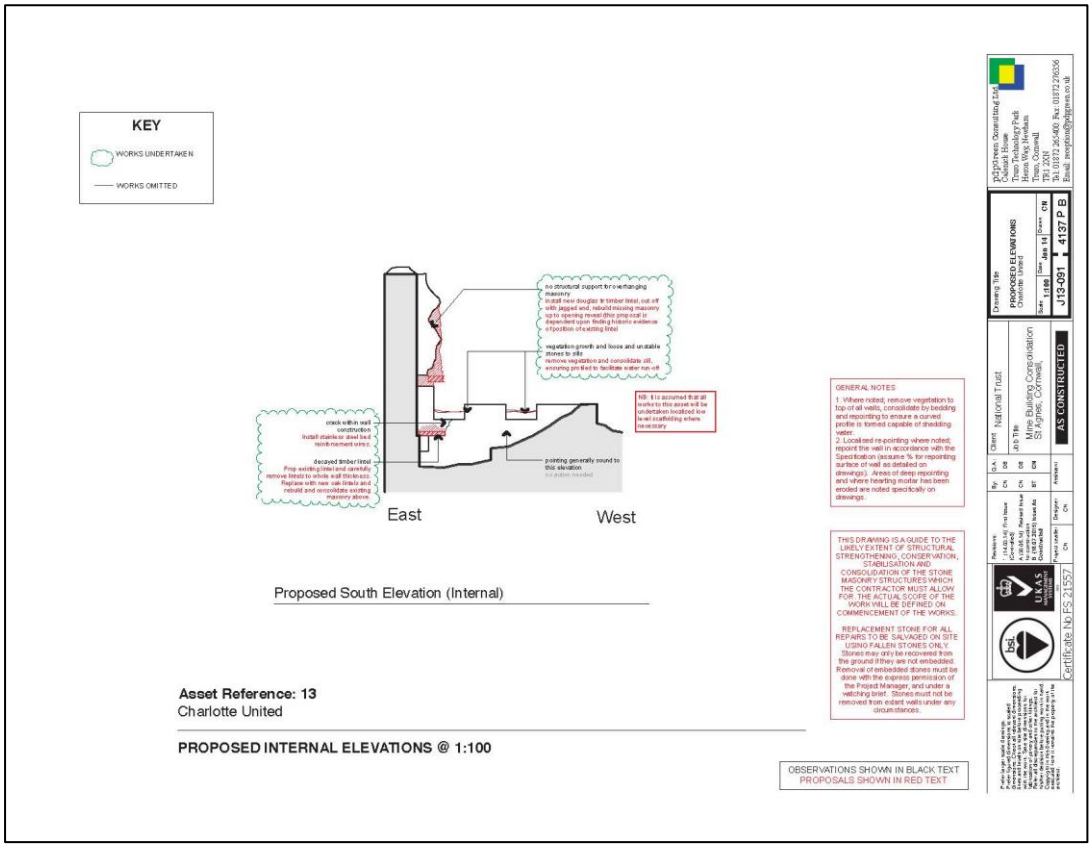

Fig 126. Internal southern elevation of Charlotte United engine house.

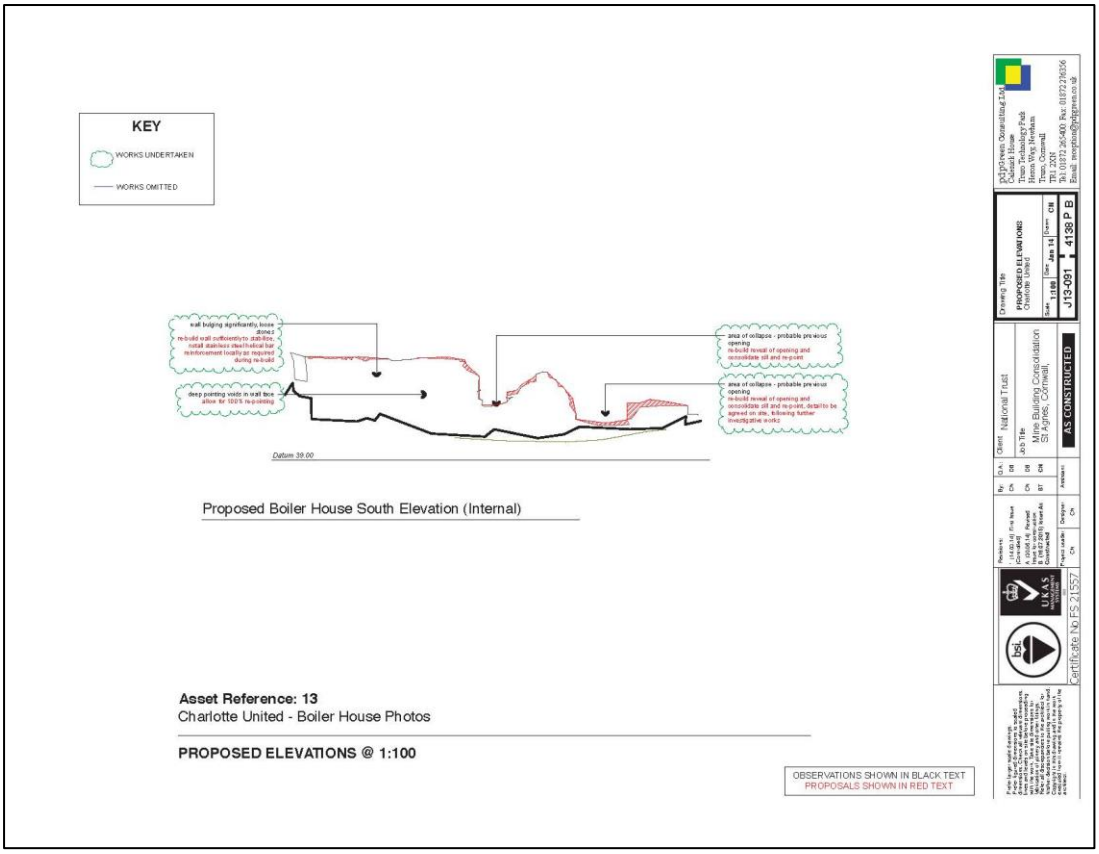

Fig 127. Internal southern elevation of Charlotte United boiler house.

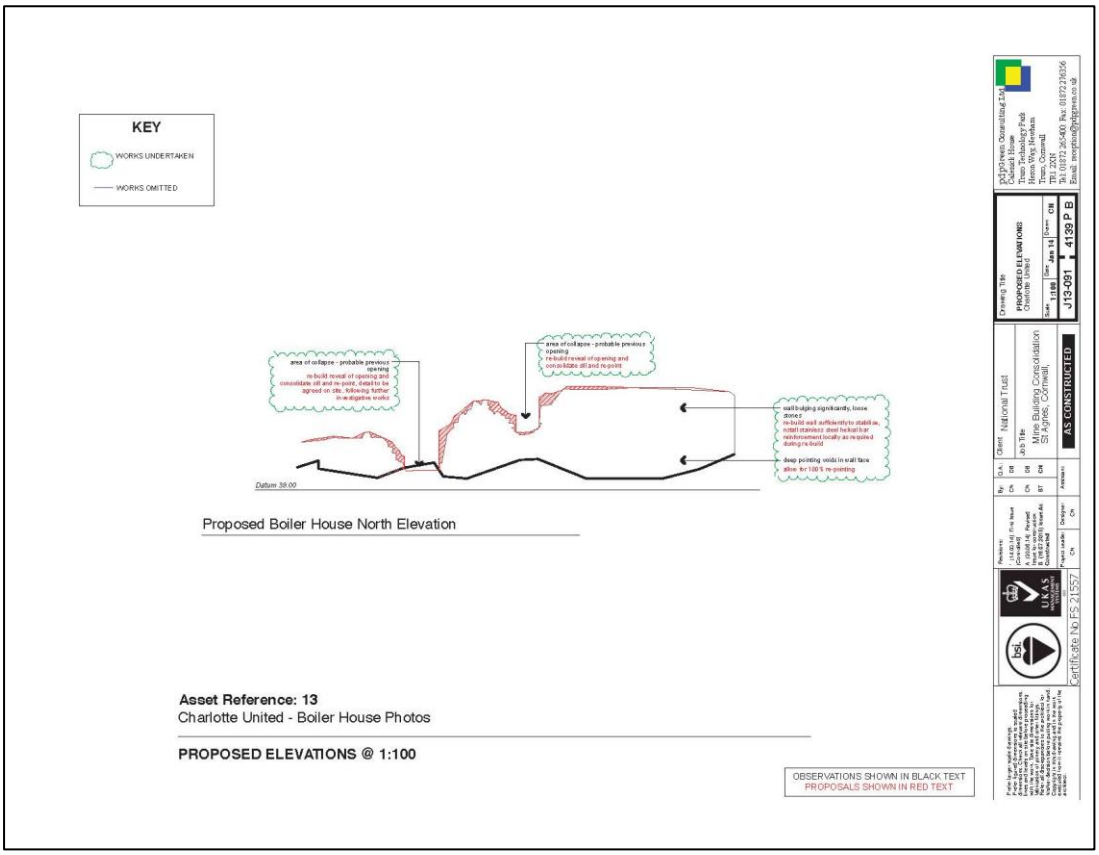

Fig 128. Northern elevation of Charlotte United boiler house.