



Prince of Wales Mine, Harrowbarrow, Cornwall Report on building conservation works



Historic Environment Projects

Prince of Wales Mine, Harrowbarrow, Cornwall

Report on building conservation works (2007/8)

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Within the Historic Environment (HE), the Project Manager was Colin Buck. The 2007 measured building survey for all of the mine buildings affected by building conservation works was undertaken by Team Surveys of St Austell. The 'as built' conservation works drawings were produced by Andrew White of Knevitts (Cons. Engs). The East Cornwall Regeneration Project was managed by Chris Hariades.

Within HE Projects the Project Manager was Colin Buck, and Andy Young edited this report.

The views and recommendations expressed in this report are those of Historic Environment Projects and are presented in good faith on the basis of professional judgement and on information currently available.

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Cover illustrations

Front cover images of Prince of Wales pumping engine house, before (2006) and after (2008) works.

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Abbreviations

| | |
|-------|--------------------------------------------------------------|
| ALSF | Aggregates Levy Sustainability Fund |
| CCC | Cornwall County Council (now CC- Cornwall Council) |
| ECRP | East Cornwall Regeneration Project |
| EH | English Heritage |
| HER | Cornwall and the Isles of Scilly Historic Environment Record |
| HE | Historic Environment, Cornwall Council |
| NGR | National Grid Reference |
| NHL | Natural Hydraulic Lime |
| PRN | Primary Record number (old PRN in HBSMR) |
| SWRDA | South West Regional Development Agency |
| SMC | Scheduled Monument Consent |
| WHS | World Heritage Site |

1 Summary

The mine site conservation scheme was part of the East Cornwall Regeneration Project (ECRP) which took place from 1991 to 2001. This was followed by a second phase of conservation works (2006 – 2009) to Tamar Valley mine sites, including their access links and village improvement works. This report describes the building consolidation phase to Prince of Wales Mine, north of Harrowbarrow, St Anne's Chapel. The site is owned by the Duchy of Cornwall, although Cornwall Council has agreed to purchase parts of the site.

The Prince of Wales Mine (Scheduled Monument No. 36035), includes two largely extant engine houses (pumping and stamps engines), a further partially extant winding engine house, a partially extant boiler house, two fully extant chimneys, a Miners Dry and other mining related features. The East Cornwall Regeneration Project (ECRP) seeks to conserve the significant remaining buildings. There were a few structural remediation works to undertake that entailed small amounts of removal and rebuilding of masonry. However, mechanisms were put in place to ensure that there was a high degree of historic buildings consultancy and archaeological recording.

Following Scheduled Monument Consent in November 2007, contractors were tendered and Darrock & Brown were successful. Work started on the winding engine house in mid November 2007 after scaffolding, followed by the winder drum slot and loadings. This work finished in mid January 2008. Conservation works to the pumping engine house only were grant aided by the Countryside Agency Aggregates Levy Sustainability Fund (ALSF), administered by English Heritage. Works to this building were also started at a similar time as the winding engine house building. Repointing, building conservation and timber lintel replacement for the pumping engine house was finished by the end of February 2008. The stamps engine house was in a parlous and unstable condition; its upper walls falling inwards and collapsing. Large (upper) areas had to be removed and rebuilt, with replacement (similar) stone brought from a nearby mine site. These works finished in June 2008.

Project funding included the provision of site safety fencing, some drainage works and the two site information boards detailing the overall site archaeology, history, ecology and mineralogical assets. Finalisation of this project enabled this former 19th century site of intensive mining to be safely used for public access dedicated to historical, leisure and educational activities as part of a wider scheme of similar co-ordinated land reclamation and regeneration works in east Cornwall.

2 Introduction

2.1 Project background

Prince of Wales Mine is one of a number of mine sites (Hingston Down Mine, Holmbush Mine, Drakewalls Mine, Silver Valley Mine and Wheal Brothers), which all formed part of the overall East Cornwall Regeneration Project (ECRP: 2006-2009). The ECRP is the second phase of building conservation works following the first phase from 1999-2001 (mine sites at Gunnislake Clitters, Okel Tor, and Wheal Brothers). It had been formulated with the co-operation of local community groups and each of the site's landowner. The conservation and management of features relating to the site's mining heritage and enablement of safe public access forms the basis for this conservation scheme.

The site (SX 4010 7055, PRN 42142– see Figures 1 and 2 for site location and conservation works project area), was designated a Scheduled Monument (No 36035) in March 2007, and is also part of the Cornwall and West Devon World Heritage Site. The ECRP project aims comply with the overall strategy for the Tamar Valley (see CCC Strategy document 1998). Funding for the project had been secured from a variety of sources; primarily the South West Regional Development Agency (SWRDA), Objective One funds, Cornwall Council (CC), and the Tamar Valley Service.

The Historic Environment Projects team, Cornwall Council (previously Historic Environment Service Projects, Cornwall County Council), had previously produced an archaeological assessment of the Prince of Wales mine site (Buck 2006, Rep No. 2007R009), in which each site was identified and management recommendations produced. An Ecological assessment report was compiled in January 2007 (John Sproull, Cornwall Environmental Consultants). Sherrell Ltd of Tavistock (Geotechnical Mining Consultants), produced a mine assessment (Rep. No. 2931 in January 2007), which included a report of a risk assessment in relation to proposed public access within the site and included a Geological report (Scrivener 2007). In February 2007, Team Surveys of St Austell carried out EDM surveys of all the extant mine buildings relating to the building conservation project (before works). A structural buildings assessment survey on each of the buildings, including on-site supervision of the contractors and the production of 'as-built' drawings, was commissioned from Knevitts Cons. Eng. of Wadebridge (Andrew White – B6148.1 June 2007). A subsequent detailed specifications report and tender document report was also produced by Knevitts (B6148.1 August 2007).

Given a lack of sufficient funding for the proposed building conservation works for all of the sites, a decision was taken to apply for a grant from EH (ALSF), to undertake building conservation work to the Pumping Engine House (Buck 2006, Site 5). Accordingly, the Historic Environment Projects team (HE Projects) was commissioned in June 2007 by Cornwall Council Landscape and Urban Design Unit (Chris Hariades), to undertake production of an EH Project Design for building conservation works to the pumping engine house, clearly following AGLSF priorities (Buck 2007, Rep No. 2007R040). The EH grant application was successful.

In addition, the HE Projects team was commissioned in July 2007 by Cornwall Council Landscape and Urban Design Unit (Chris Hariades), to undertake an impact assessment survey of the site (Buck 2007, Rep No. 2007R045). The report assessed the impact of the proposed works on the site's significant assets, giving mitigation recommendations for their impacts and described the proposed site management. Scheduled Monument Consent for the currently planned works was given by DCMS in November 2011. Colin Buck was employed as the archaeological consultant and recording archaeologist.

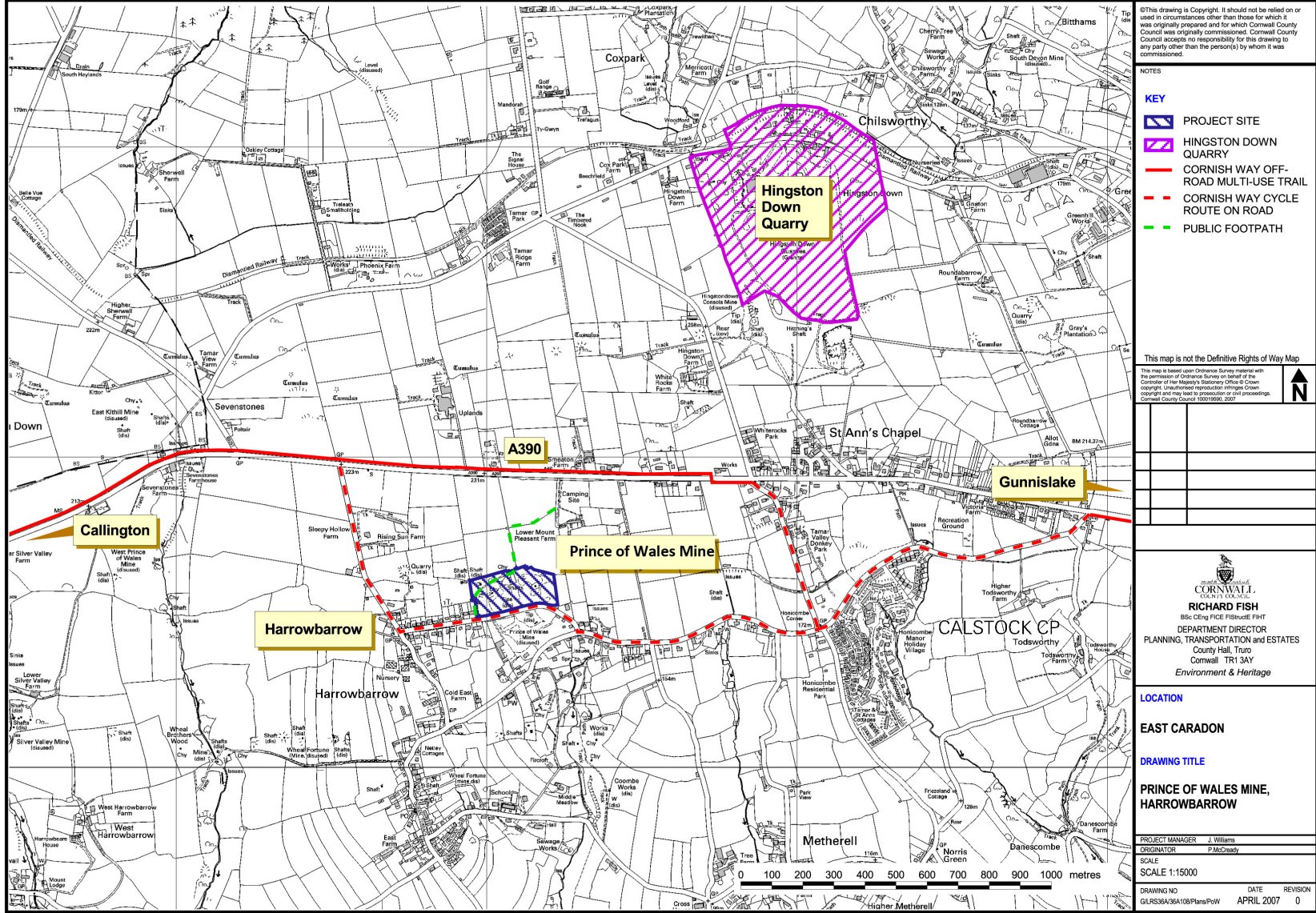


Figure 1 Site location plan

2.2 Aims

The main historic buildings consultancy and archaeological recording objectives of this project were to:

- Participate in the consultation process with the landowner, the ECRP Project Manager, structural engineers and contractors, and to agree appropriate specification for the remediation works in terms of building consolidation works, shaft treatment and site fencing.
- Ensure that there was an adequate level of recording of upstanding masonry features affected by the conservation works (as identified and described in the archaeological assessment of the site), during the consolidation works.
- Include a photographic record of all building and landscape features affected by the scheme (before, during and after works).
- Carry out regular site inspections whilst the remediation works were being carried out, to ensure compliance with the detailed agreed work specification.
- Produce a descriptive and survey record at an appropriate level of detail of those structures, features, and sites etc that were affected by the land reclamation scheme.
- Produce a report outlining the findings of the archaeological consultancy and to provide the ECRP and landowners with copies of the same.
- Provide archaeological field and archive data for inclusion in Cornwall and the Isles of Scilly Historic Environment Record.

2.3 Project methodology

A building conservation scheme (especially within the World Heritage Site), necessitates the intervention of a field archaeologist/historic buildings consultant at two main stages; the archaeological assessment, and the resulting site works (results contained within this report). Historic buildings consultancy and archaeological recording during these projects are to ensure that there is a record of archaeological features that are affected, disturbed or destroyed by the conservation works. Furthermore, ongoing consultation with the site contractors and engineers is of paramount importance to ensure that appropriate building conservation techniques and standards are consistently applied, and to promote the survival and protection of important surface and sub-surface archaeological features, and to mitigate or limit damage wherever possible.

For the buildings consolidation part of the works, it was decided at an early stage to hold bi-weekly progress meetings on site with the Cornwall Council project funding manager (Chris Hariades), the site archaeologist (Colin Buck of Historic Environment, Truro), the Structural Engineer (Andrew White of Knevitt Cons. Engineers) and the site manager for the contractors (Arthur Britton). These site meetings were also held throughout the scheme to view and comment on the works that had been carried out and to iron out any problems that occurred during the works.

The site gazetteer (Mitigation recording results - Section 4), contains a detailed description of how consolidation and preservation works affected each archaeological feature within the project area.

2.3.1 Site reports

The results of desk and field based surveys and reports (archaeological, ecological, geotechnical and structural), used and referred to during the course of the scheme are:

- East Cornwall Regeneration Project, Prince of Wales Bat Survey A McCarthy Assoc. September 2006 Ref 689.E
- Prince of Wales Mine, Harrowbarrow, Cornwall: Archaeological assessment report, (HES Projects CC (C Buck) Report No 2007R009, December 2006)
- Prince of Wales Mine, Harrowbarrow, East Cornwall: Risk Assessment in relation to public access within the site, (Frederick Sherrell Ltd, Report No. 2931, January 2007)
- Ecological Survey (Stage 1) Prince of Wales Mine, Harrowbarrow (Cornwall Environmental Consultants, Sprouall & Holyoak, January 2007)
- Prince of Wales Mine, Harrowbarrow, Cornwall: Project design for building conservation works (EH Proj. No. 5314), (HES Projects (C Buck) Report No. 2007R040, June 2007)
- Structural Appraisal Report: East Cornwall Regeneration Project, Prince of Wales, Harrowbarrow, Callington, Pumping Engine House, Knevitts Consulting Engineers, June 2007 B6148.1
- Structural Appraisal Report: East Cornwall Regeneration Project, Prince of Wales, Harrowbarrow, Callington, Winding Engine House, Knevitts Consulting Engineers, June 2007 B6148.1
- Structural Appraisal Report: East Cornwall Regeneration Project, Prince of Wales, Harrowbarrow, Callington, Stamps Engine House, Knevitts Consulting Engineers, June 2007 B6148.1
- Prince of Wales Mine, Harrowbarrow, Cornwall: Impact assessment report, (HES (Projects (C Buck) Report No. 2007R045, July 2007)
- European Protected Species License method Statement to cover conservation works at Prince of Wales and Drakewalls East Mines, A McCarthy Assoc. July 2007 Ref 689
- Structural Safety Works, Contract Documents, Form of Tender, Conditions of Contract, Schedule of Works, Specifications, etc – Prince of Wales Mine Complex, Harrowbarrow, Callington, Knevitts Consulting Engineers, August 2007 B6148.1
- Pre-Tender information Pack (CDM Regs. 2007) for Prince of Wales Mine Complex, Harrowbarrow, Callington,, Knevitts Consulting Engineers, August 2007 B6148.1
- Prince of Wales Mine, Harrowbarrow, East Cornwall: Results of in-situ investigations in relation to past metalliferous mining activity, (Frederick Sherrell Ltd, Report No. 2931/2, November 2007)

2.3.2 Survey and recording techniques

Measured building surveys were undertaken by Team Surveys of St Austell in December 2007, in order to have a detailed record of the buildings before any consolidation works were carried out (and before scaffolding had been erected). These were used throughout the project for a number of reasons:

- To provide essential dimensions and detail for rebuilding where removal of unsafe sections of masonry walls occurred.
- To provide a survey drawings for calculating/assessing detailed structural engineering solutions for building instability problems and liaison with the Historic Buildings Consultant and English Heritage.
- Calculation of accurate Bills of Quantity for production of the Contract documents and Tenders.
- Accurate medium upon which the archaeological watching brief results can be measured and recorded on-site.

- These EDM surveys are reproduced in the archaeological watching brief report (as 'As built' annotated survey drawings), and are an effective and cost efficient method of graphically showing the extent and nature of the consolidation works.

Archaeological recording for all conservation works (including fencing), consisted of a mixture of photography and annotated notes detailing their location and specification. Onsite preparatory works by HE Projects included a photographic survey of all visible buildings that were to be affected by the land reclamation scheme before tree/ivy and rubble clearance was carried out, during works and after they had finished.

The results of the watching brief are summarised below in the mitigation recording results inventory (Section 4). All plans, maps, photographs etc generated during the project have been appropriately archived in the Cornwall and Isles of Scilly Sites and Monuments Record, correspondence and other material related to the project has been archived into the project file (Section 6).

The recording and historic buildings consultancy was undertaken by a single member of staff (Colin Buck), who followed HE Projects Health and Safety guidelines outlined in the project specifications (which included the completion of a Health and Safety Risk Assessment Record). Safe working practices were observed at all times, especially where recording work was undertaken on features near or within shafts. The project archaeologist liaised closely with the site contractors (Darrock and Brown of Bodmin); the site works manager (Arthur Britton), the site supervisor (Pete West), and the Structural Engineer was Andrew White of Knevitt's Structural Eng. Ltd.

2.3.3 Pre-works consultations

Pre-works consultations, an important part of the historic buildings consultancy, with the structural building engineer; the landowner (Duchy of Cornwall), and ECRP Project Officers (Chris Hariades), were undertaken informally with HE Projects (Colin Buck) to ensure that the proposals did not undermine the historic character of the extant mine buildings and their setting within an industrial landscape in the World Heritage Site (WHS).

Regular on-site consultations between the structural engineer, the site contractors, and site historic buildings consultant, ensured that the agreed specifications were adhered to and that the techniques and quality of work were consistent throughout the contract term of the site.

2.3.4 Building conservation works summary

The archaeological assessment survey (Buck 2006), described in detail the remnants of buildings and related masonry features at Prince of Wales Mine; those affected by the conservation works are described below. Figure 2, a conservation scheme site plan, shows each structure. Douglas Fir timber was mainly used (the exception being some timbers in the Pumping Engine House – as specified), the new specifications matching the original sizes.

List of consolidation works (November 2007 – March 2008)

- Pumping Engine Boiler House chimney (Buck 2006, Site 3)
- Miners Dry (Buck 2006, Sites 4 and 4.1)
- Pumping Engine House (Buck 2006, Site 5)
- Pumping Engine Boiler House (Buck 2006, Site 6)
- Winding Engine House (Buck 2006, Sites 10 and 10.2 – winding drum loadings)
- Stamps Engine House (Buck 2006, Site 21)
- Stamps Boiler House chimney (Buck 2006, Site 22)

2008 Fencing works:

- Additional site fencing at a number of locations in the mine site (see Fig 2)

2008 Drainage and track regrading works:

- Drainage and track regrading works at a number of locations in the mine site (see Fig 2)

In the first phase of the building conservation scheme, the structural engineer carried out a preliminary structural survey of the main buildings included in the project. Few structural problems were identified in the Winding Engine House (Sites 10 and 10.2). There were a small number of structural stability problems to the large Pumping Engine House (Site 5), but the most visible and obvious problems could be seen at the Stamps Engine House (Site 21). Both of the wing walls were falling inwards, and the masonry itself was in a parlous state (fractured both across and from top to bottom).

Following the production by the structural engineer of a single document which detailed Contract documents, Tender forms, works specifications (agreed after consultation), and Bills of Quantities, the works were put to tender after consent for the works was given by the Objective 1, Cornwall Council fund providers, and the landowner (Duchy of Cornwall).

Darrock and Brown, a Bodmin based company (working with the Cornish Lime Company), with much experience of undertaking building consolidation works to historic buildings were successful in gaining the Prince of Wales Mine works contract. Following ongoing site discussions with respect to the building specifications with the structural engineer and site contractors during site works, the mine buildings were consolidated using sympathetic remediation and consolidation techniques.

An important aspect of the historic buildings consultancy and archaeological watching brief records were the weekly site consultations with the project structural engineer and contractors with regard to the extent of repointing and style of finish for all consolidation works (and where appropriate by phone/email). The Cornish Lime Company supplied a pre-washed aggregate Cornish Lime Sand (mainly CLS 26), which was mixed with NHL 5.0 strength for wall tops and 3.5 for the remainder. The aggregate was chosen (using the medium of agreed mortar panels), as being the most similar to that used during the original construction of all the mine buildings. For deeper pointing, CLS 24 was occasionally used (see the detailed site descriptions in Section 4 for exact specifications), in the heart of the wall. Following scaffold erection and removal of dangerous parts of the walls (for the Stamps Engine House before internal scaffold erection), the masonry was cleared of ivy and other vegetation growth, and where necessary wire brushed to remove mould in damp areas. Both the depth of 'raking out' and style of re-pointing was agreed and a standard style adopted:

- The aggregate: lime mix (2.5:1) was applied to walls after joints were raked back to sound mortar and pointed with a rebate depth of 2mm.
- After the mortar had taken on an initial 'set', the joints were struck off with a wire brush to expose the aggregate texture.
- The finished surface was regularly dampened to stop the lime from drying out too quickly and subsequently cracking.
- Loose wall tops were reduced to sound jointing material after earth and roots, etc, had been removed. The wall tops were rebbed and rebuilt with flush joints, but these were brushed off after the initial set. This applied mainly to the tops of the remnant boiler house walls. Following the completion of the building conservation element of the project, the site was fenced in some places (as described above), and a site drainage/track remediation scheme undertaken (as shown in Figure 2).

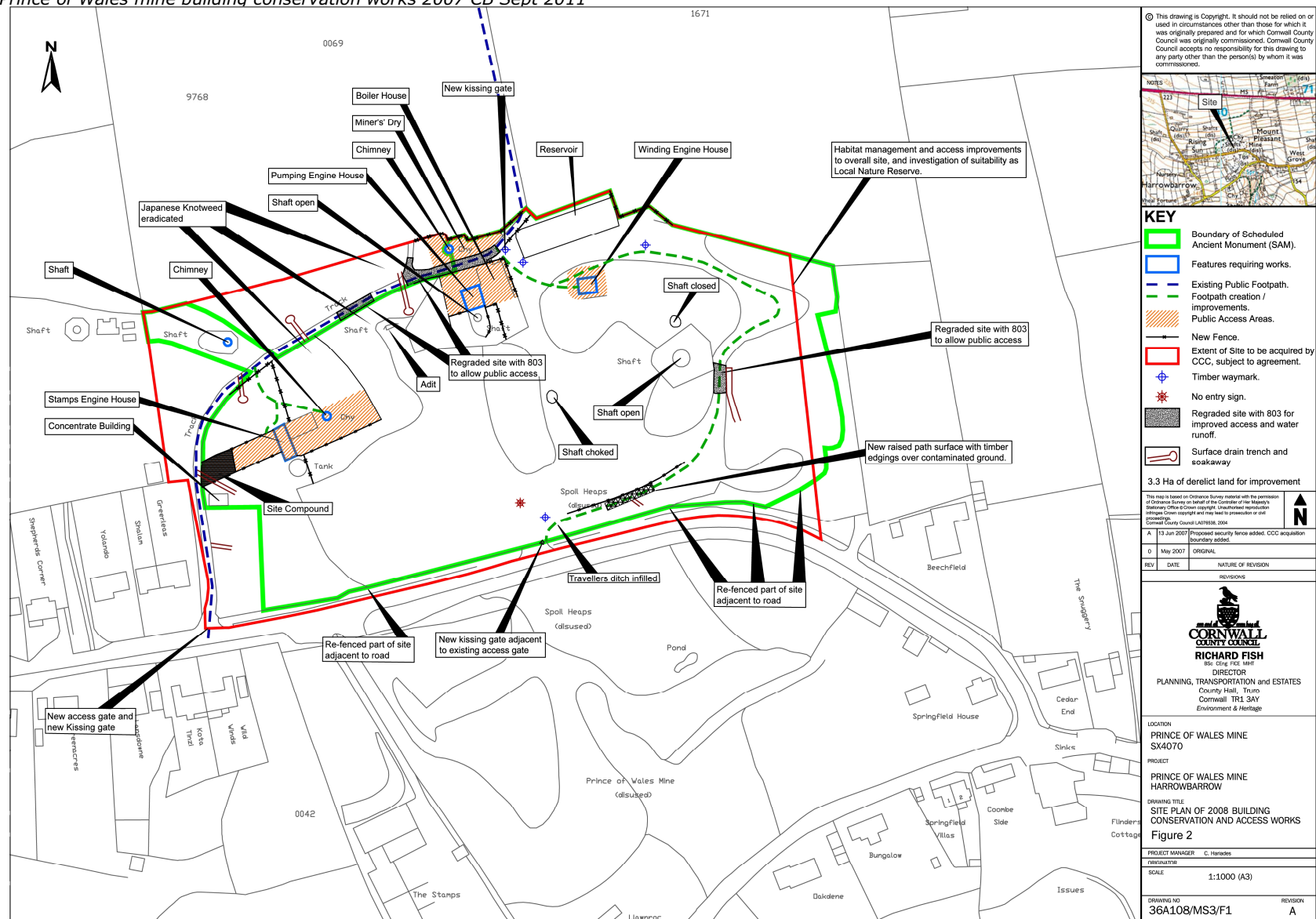


Figure 2 Site plan of building conservation, access and fencing works

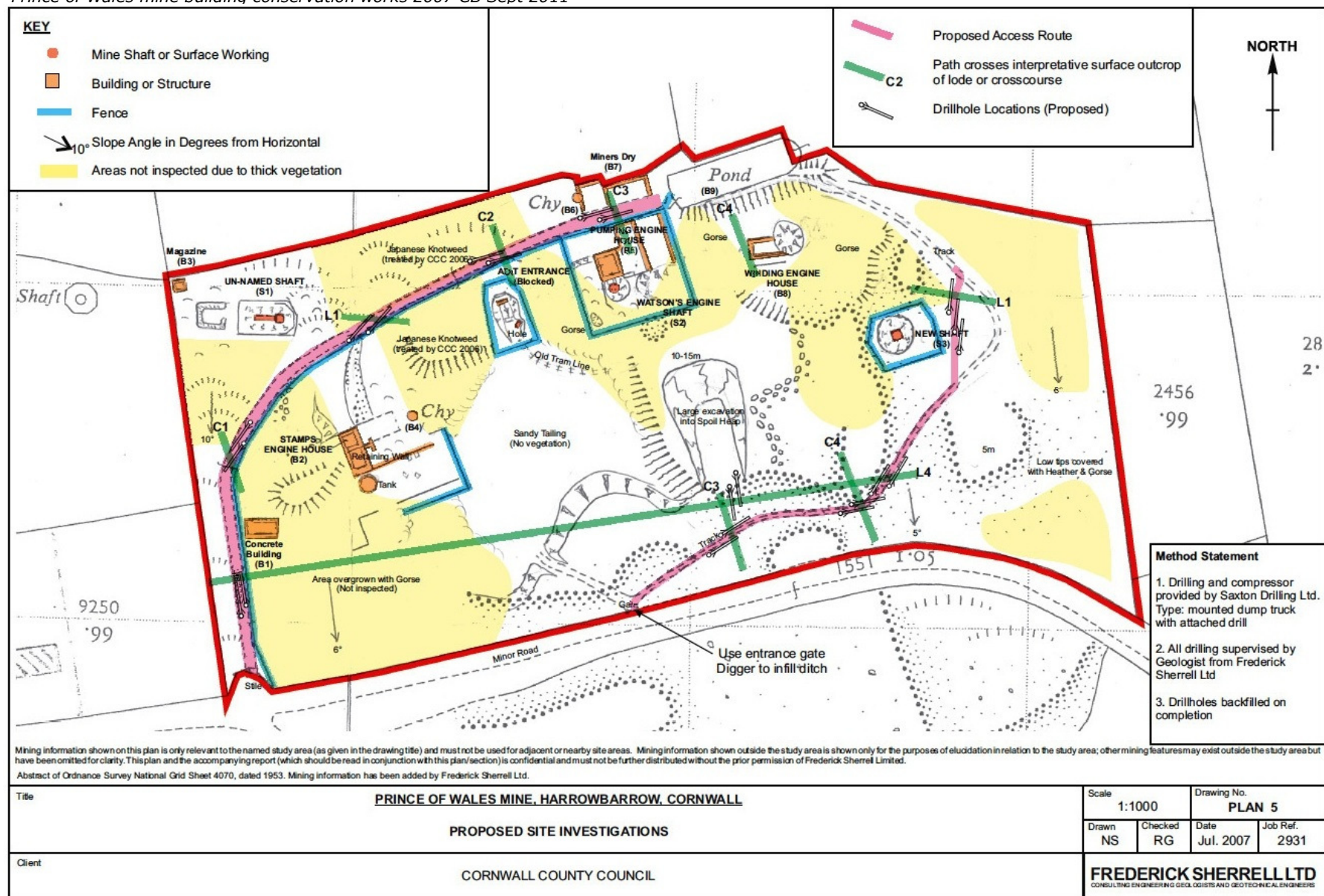


Figure 3 Geotechnical site plan of drilling site investigations (Sherrell 2007)

Table of sites and summary of conservation works undertaken (2007-2008)

| Site No. | Feature | NGR (SX) | Conservation works summary |
|----------|-------------------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Prince of Wales Mine | | PRN 42142 |
| 3 | Pumping Engine Boiler House Chimney | 40069 70627 | Following erection of scaffolding some ivy/vegetation removal. Repointing of masonry with lime mortar where appropriate. Installation of a lightning conductor and earth rods/mats at base. |
| 4 | Miners Dry | 40082 70630 | After ivy/vegetation removal – focussed structural building conservation works (and wall capping), to sections of the remaining walls. |
| 5 | Pumping engine House | 40078 70609 | After ivy was removed – general building conservation works to the extant building. Removal and replacement of rotted lintel timbers on three sides of the building (with tanalised wood or untreated oak). Wall ‘capping’ and repointing with lime mortar was undertaken where appropriate to masonry. Small-scale clearance of the cataract pit and ground around the cylinder bedstones. Erection of internal safety fence in front of deep cataract pit. |
| 4.1 | Miners Dry extension | 40074 70627 | Refer to Site 4 |
| 6 | Pumping engine boiler house | 40084 70612 | After ivy/vegetation removal, repointing and capping of walls where necessary and tops of walls partially rebuilt and rebbed with lime mortar. |
| 10 | Winding engine house | 40120 70612 | After ivy was removed, conservation works to the site. Removal and replacement of rotted lintel timbers on the north and west elevations (with tanalised wood). Wall ‘capping’ and repointing with lime mortar was undertaken where appropriate. |
| 10.2 | Winder drum loadings | 40121 70606 | Clearance of fallen masonry from winder drum pit. Repointing and capping of walls, with rebbed of upper wall surface |
| 21 | Stamps Engine House | 40002 70548 | After external ivy was removed, external scaffolding erected, then dismantling of inwardly leaning wing walls, before internal scaffolding. Removal and replacement of rotted lintel timbers on three sides of the building (with tanalised Douglas Fir). Wall ‘capping’ and repointing with lime mortar was undertaken where appropriate to masonry. Small-scale clearance of the cataract pit and ground around the cylinder bedstones. Erection of internal safety fence in front of deep cataract pit and access walkway through to former |

| Site No. | Feature | NGR (SX) | Conservation works summary |
|----------|--------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | 1940s dressing floor. |
| 22 | Stamps Engine House chimney | 40017 70561 | Erection of scaffolding. Repointing of masonry with lime mortar where appropriate. Collapse partially rebuilt at top of chimney. Installation of a lightning conductor and earth rods/mats at base. |
| | Geotechnical drilling investigations | (see Figure 2) | Lodes under the access routes were investigated by deep drilling. |
| | Drainage/Track works | (see Figure 2) | Track remediation works were undertaken to facilitate increased public access, and to promote effective drainage of the site (and adjacent fields) – without impacting upon the sites character/archaeology. |
| | Site safety fencing | (see Figure 2) | Following the building conservation scheme, the hazardous areas (shafts/steep drops), were fenced (with timber post and rail) and site boundaries (in proposed CC ownership) for access. |

3 Site description

3.1 Location and setting

The Prince of Wales Mine (centred SX 4010 7055) is located on the southern side of the A390 (from Tavistock to Callington), 1000m south west of St Ann's Chapel (north of Harrowbarrow), on the southern flank of the granite ridge extending from Kit Hill to the Tamar Valley.

The mine is truncated by an east/west link road from the eastern part of the later linear development of Harrowbarrow to the road from the main Harrowbarrow settlement to the A390. The northern part of the mine (containing the engine houses and shafts) is within the project area (see Figure 2), however, the southern part of the mine (siting the main 1870s dressing floor), is below the road and has in the past 50 years been progressively destroyed by industrial and storage units.

Within the project area, the site slopes from north to south with the three clusters of engine houses sited north of the main lode (see Figure 2). There are pockets of tree cover to the west and east, with the ground for the most part covered by large amounts of dressing floor material – much of it from the last working phase of the mine in the 1940s, and earlier dumps of rock mine waste, although some of the earlier mine waste was re-processed. Gorse, bramble and heather have taken hold across the entire site except over the dressing floor waste which has for many years been subject to local children using the site for their bikes. The Duchy of Cornwall landowners in the past five years have securely fenced the main mine shafts and buildings.

With the exception of its mainly extant engine houses, the remainder of the (upper) former mine site is still visible, but parts are overgrown with gorse, brambles, and some heather. The site is also partly wooded, all of which hides surface evidence for past mining activity. Much of the flat ground in the central southern part of the project area (formerly siting the 20th century dressing floors), has substantial deposits of dressing floor waste – too toxic for vegetation growth, which has been used by local children as a bike scrambling course. The less contaminated mine dumps (in the eastern part of the site) have been used by badgers to create a number of setts.

3.2 Designations

3.2.1 International

The Cornish Mining World Heritage Site (WHS) seeks to demonstrate the international importance of the developments within mining and allied technologies which took place within Cornwall and West Devon during the last half of the 18th century and into the 19th century, establishing beyond doubt the contribution of this region to the development of the modern, industrialised world.

The World Heritage Site Management Plan 2005-2010 (2005, 12), statement of Outstanding Universal Value states that: *'The Cornwall and West Devon Mining Landscape was transformed during the period 1700-1914 by early industrial development that made a key contribution to the evolution of an industrialised economy and society in the United Kingdom, and throughout the world. Its outstanding survival, in a coherent series of highly distinctive cultural landscapes, is testimony to this achievement'*.

The formal WHS bid to UNESCO for World Heritage Site status (non-statutory) was submitted to UNESCO in February 2005 by the Cornish Mining World Heritage Site Bid Partnership and has now been approved. This demonstrates the far reaching effects of the technological changes on the society, economy and landscape of the area, and identified a number of areas within Cornwall and West Devon where the results of these processes are still well-preserved. The WHS areas, representative of the period of Cornish dominance of the mining world (c.1700-1860), includes the project site within the Tamar Valley Area and Tavistock (Area 10). *'Area A10 is the most easterly and the second largest of the WHS Areas, this mining district A10 (i) lies in the Tamar Valley Area of Outstanding Natural Beauty and comprises both valley and upland settings for tin, copper, silver-lead and arsenic mining, ore-processing and smelting'*.

3.2.2 National

Prince of Wales Mine was recommended for 'New scheduling as proposed at Step 3' (English Heritage Step 4 Report 1998) by English Heritage's **Industrial Monuments Protection Programme** (due to the quality of its mine building remains for a copper mine). The mine was duly Scheduled in late March 2007 (the area covered by the scheduling is shown in outline on Figure 2) as Scheduled Monument No. 36035. Scheduled Monument Consent from Department of Culture, Media and Sport was given in November 2007 for a range of building conservation works. The undertaking of site works within the SM site boundaries complied with the Scheduled Monument Consent conditions as stated by the Department of Culture, Media and Sport.

3.3 Brief site history of Prince of Wales Mine

(Summarised excerpt. For a more detailed history of the site see Buck, 2006, Section 2.2)

In 1850 Wheal Fortune, Wheal George, Wheal Barnard and West Edward copper and tin mines were combined into Calstock United mining company's Prince of Wales Mine (the previous site of Wheal Pleasant). Mining began in 1863 and continued until 1914. A 6.6m water wheel and small 25" pumping engine worked the site until the late 1860s when the mine closed. It re-opened in 1866 and invested in a larger 50" pumping engine, a new 24" steam whim and new dressing floors. The lower section of the mine (south of the road) housed the arsenic calciner, large reservoir ponds and a waterwheel. Years later as tin became more profitable than copper, in 1889 the mine invested in a stamping engine and new tin dressing floors. Copper processing seems to have been relocated to the lower section of the mine, and in the 1940s a milling plant was erected to process ore taken from surface dumps of other nearby mines. From 1863 to 1914 the mine produced 10,845 tons of copper ore, over 1000 tons of black tin and 7,720 tons of iron pyrites which yielded arsenic.

4 Archaeological recording results

General recording methodology is detailed in Section 2.3.2 above and Figure 2 shows the sites on plan:

- EDM plan and elevation surveys of the engine houses (with ivy covering), and plans of other buildings were produced by Team Surveys of St Austell in 2007. These primary surveys were then checked by the Historic Buildings Consultant (C Buck), and after approval given to the Structural Engineer for use in the project specifications tender documents (and to gain SMC).
- The structural engineering consultancy (including contract management), for this and other ECRP sites was tendered and won by Knevitt Consulting Engineers of Wadebridge (Andrew White). A structural report (B6148.1) with building conservation recommendations (annotating the survey elevations/plans) for each engine house building was produced by Knevitts in June 2007.
- A set of tender and then working survey drawings detailing the nature and extent of the works were produced in August 2007 by the structural engineer (Andrew White) which accompanied the Contract documents, works specification and Bills of Quantity. Again, the nature and extent of the works was approved by the Historic Buildings Consultant.
- Given the nationally important designation of Prince of Wales Mine (as a Scheduled Monument), the Historic Environment projects team, Cornwall Council, was requested to produce an Impact Assessment Report (Buck 2007, Rep No. 2007R045), detailing the impacts and mitigation measures in advance of the building conservation scheme.
- Contractors were tendered for the high priority consolidation works to the main mine buildings in August 2007. Darrock and Brown of Bodmin won the tender for these works.
- Site clearance of dense vegetation, trees and fly-tipped debris were undertaken in late October 2007, prior to groundworks starting. Any small tree stumps that had been affecting the buildings were cut down and the stumps treated with 'Round-up'.
- A geotechnical mine survey assessing the location of underground mine hazards and a risk assessment was undertaken in January 2007 (Sherrells Ltd 2007a). Site drilling to locate the possible hazards was undertaken in September 2007 and other soil/water testing for metal ore contaminants, following approval by EH of the air percussion method statement. Figure 3 shows the locations of the lodes and the site drilling locations (reproduced from Sherrell Ltd 2007b). No shallow sub-surface features were found that would impinge upon site safety, and no archaeology uncovered nor impacted upon.
- For the buildings consolidation part of the works, it was decided at an early stage to hold bi-weekly progress meetings on site with the CC project funding manager (Chris Hariades), the site archaeologist (Colin Buck), the Structural Engineer (Andrew White of Knevitt Cons. Engineers) and the site manager for the contractors (Arthur Britton). These site meetings were also held throughout the scheme to view and comment on the works that had been carried out and to iron out any problems that occurred during the works.
- A condition of the EH AGLSF grant was that an accredited historic buildings consultant be employed for supervising the works on the pumping engine house only. David Scott & Co. a Chartered Building Surveyor was subsequently employed. Site meetings and consultation with all other members of the project were undertaken during works to this building.

- The archaeological watching brief record and historic building consolidation consultancy for all of the safety works at the site took place from October 2007 to July 2008, although consultancy time had been spent prior to groundworks starting to ensure the detailed project specifications followed English Heritage guidance for the conservation of historic buildings. 'Before' and 'After' external and internal surveys (based on the original 2007 surveys) are reproduced as part of this report for each elevation of the winding engine house and water wheel pit, etc (see Figs 4 - 7, 10 - 11, 14, 19 - 20, 25 - 26, 31 - 33).

This section of the report details and selectively illustrates the archaeological information uncovered during the watching brief stage for building consolidation or other groundworks. See Figure 2 for the location plan of sites within the project area, and the summary table of remediation works (Section 2.3.4). Site investigation and watching brief details were sketch surveyed and photos taken at all sites before, during and after works had taken place.

Inventory of archaeological mitigation recording

Note:

- Cornwall Sites and Monuments information (SMR) is only given if different from the preceding site.
- The Archaeological assessment report (Buck, December 1998), describes the historical and functional background for each of the sites and a descriptive survey. Site numbers given below refer to the 2006 assessment report.
- The mitigation recommendations given in the impact assessment report (for the 2007 works only), for each site are reproduced below and precede the mitigation results.
- The conservation works needed an Impact Assessment Report in order to gain Scheduled Monument Consent. The latter was produced by HE Projects, CC (Buck, 2007, Report No. 2007R045). Site impact descriptions for the 2007 works are given below.
- The Pre-Contract meeting was held on 1st October 2007 with the site works planned to start on 15th October 2001. The main contractors compound was subsequently sited west of the Stamps Engine House (see Fig 2), with a smaller mixing compound close to each of the two engine houses (during works). Unfortunately, the site was not scaffolded as promptly as was expected, so work did not proceed until mid November. Ivy was cut from each of the buildings after the scaffolding was erected. This allowed a revised structural assessment to proceed, an ecological survey to proceed, and for the building survey to be revised (if necessary).
- The inventory list is given in order of completion.

Building conservation works (2007/8)

4.1 Winding Engine House

Civil Parish: Calstock

Site name: Prince of Wales Mine

PRN: 42142

NGR : SX 40120 70612

Site No: 10

Recommendations (Buck 2006, 29):

In the short term emergency remediation works are necessary to temporarily infill the undercut base of the south wing wall. Removal of the dense ivy would also permit a visible survey of the entire building to assess the need for further remediation work to restrict further outwards movement of the walls. The engine house will need to be fully scaffolded and parts of the side walls and all the tops of the walls repointed. A detailed survey by a structural engineer should be undertaken. It is likely that consolidation works will take the form of repointing the upper sections of wall and replacement of the remaining timber structural components. Removal of the rubble from the engine house outside south wall would aid public interpretation of the building.

Expected site impact (Buck 2007, 10):

The impact of the proposed scheme on the building is simply to replace the rotting timber lintels, to rebuild small-scale localised masonry collapse (above the lintel collapses), and to repoint the walls where necessary. The remaining section of the south wall footing will need to be rebuilt to effectively support the remainder of the wall.

It is the intention of the project to make the building structurally safe by consolidating the two main walls, and reconstructing the undercut footings of the south wall. In order to access the tops of the walls, scaffolding will be erected. Access for both scaffolders and site contractors is likely to be from the west side of the building. It should be noted that there will be a physical survey of the existing ivy growing on the walls (using a Hi-lift machine), of the building to assess whether there are any roosting bats, prior to removal of the ivy. The overall impact of the proposed works on this feature can be defined as '*Minor positive*'. The works will provide more structural stability and a higher degree of Health and Safety for at least another generation.

Conservation works (2007-8):

Three lime mortar aggregate test panels were used to demonstrate a variety of aggregates and sands. Following a site meeting attended by English Heritage (Rebecca Child, Shane Gould and Keith Weston) and Colin Buck, confirmed the combination described below. Natural Hydraulic Lime (NHL) 3.5 was used for repointing walls whilst the more exposed sections of the site used NHL 5. Both were mixed in the ratio of 1 : 2.5 (Lime : Aggregate). Cornish Lime Sand (CLS) No 26 was used at the exterior face with CLS 24 used inside the wall.

This winding building housed the bob internally, a relatively rare design; all the walls were originally built up to their full height to meet the hipped roof (see Buck 2006, Fig 13 photograph). Unfortunately, by the time of the conservation project, there were only two extant walls; the west gable end and the north wall. The masonry over the top of the rotted timber lintels was carefully replaced with fallen stone from the building after the new sections of tanalised Douglas Fir had been inserted to mimic the original timber specification. The top of the remaining walls were 'capped' and repointed. The walls were only repointed where there was a structural need to do so (mainly in the upper sections). It was evident that there were areas of original internal plastering still visible on the western internal wall – a rarity amongst buildings of this age. These were left *in-situ*.

Figures 5 to 7 are 'as-built' internal and external measured survey elevations of the engine house and a site plan (Fig 4). Each drawing has detailed annotations relating to the works that have been undertaken on each wall. Relevant representative photographs of the works are also reproduced in the text (Figs 8 and 9). By mid January 2008 all the major conservation works to the engine house (and adjacent winder drum loadings - see Section 4.2), had been completed, with the scaffolding removed a few weeks later.

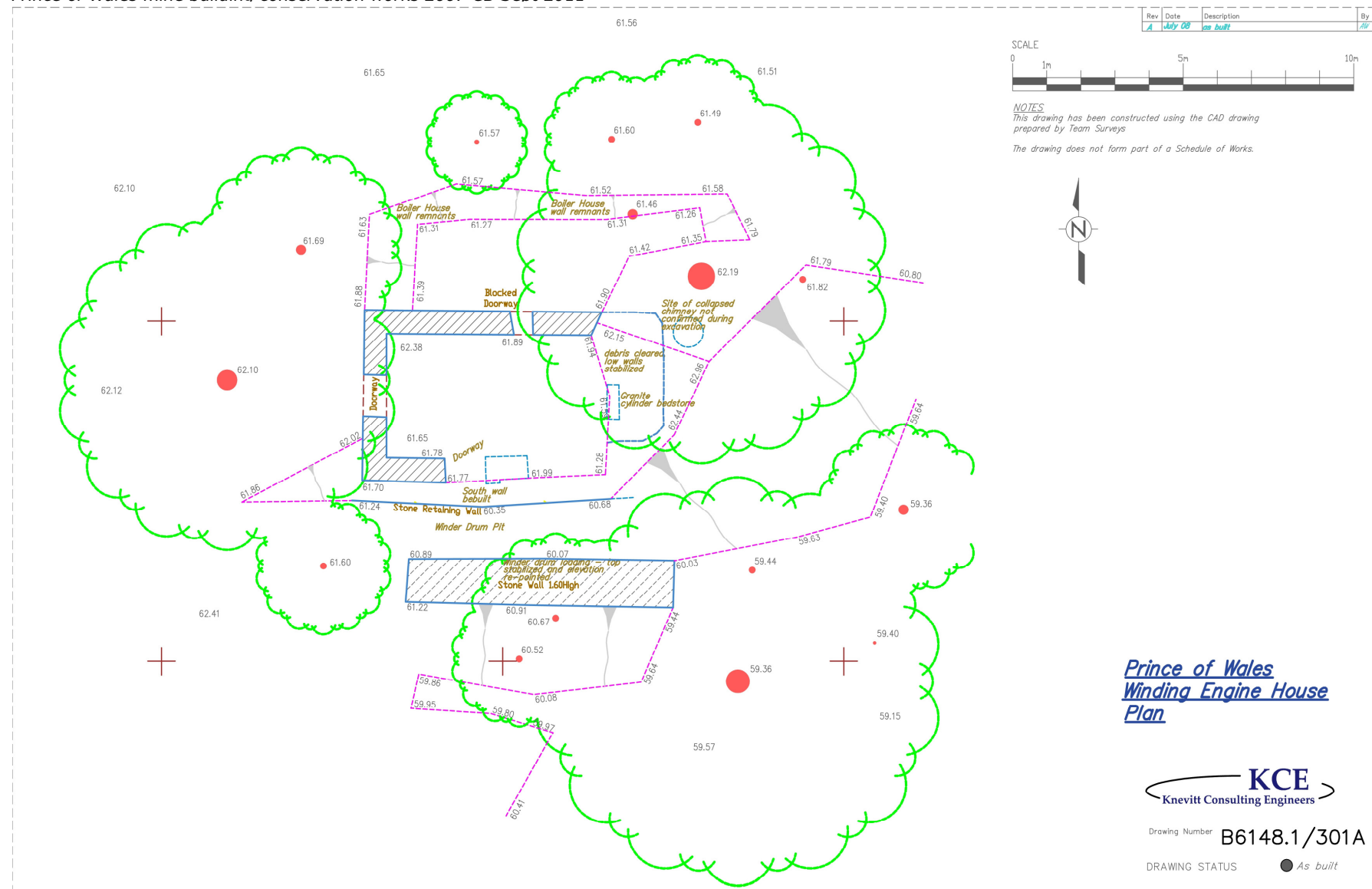
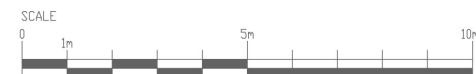
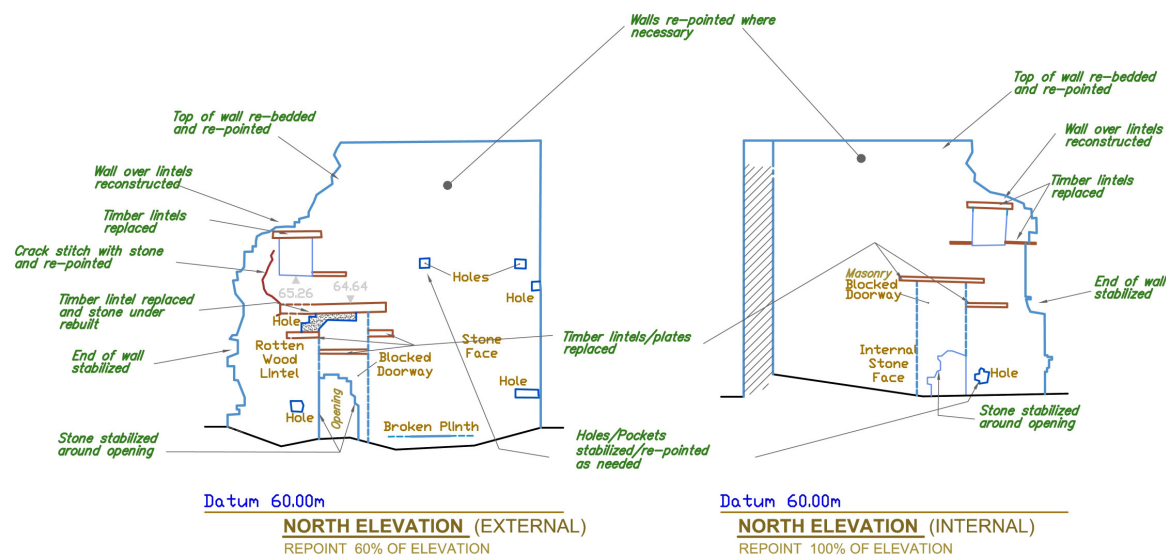


Figure 4 'As built' survey plan of the winding engine house, winder drum loadings/pit after works (Knevvitt Cons. Engs. 2008)

| Rev | Date | Description | By |
|-----|---------|-------------|----|
| A | July 08 | as built | AW |



NOTES
 This drawing has been constructed using the CAD drawing prepared by Team Surveys
 The drawing does not form part of a Schedule of Works.



*Prince of Wales
 Winding Engine House
 North Elevation*



Drawing Number B6148.1/302A

DRAWING STATUS ● As built

Figure 5 'As built' annotated North elevation survey of the winding engine house after works (Kneivt Cons. Engs. 2008)

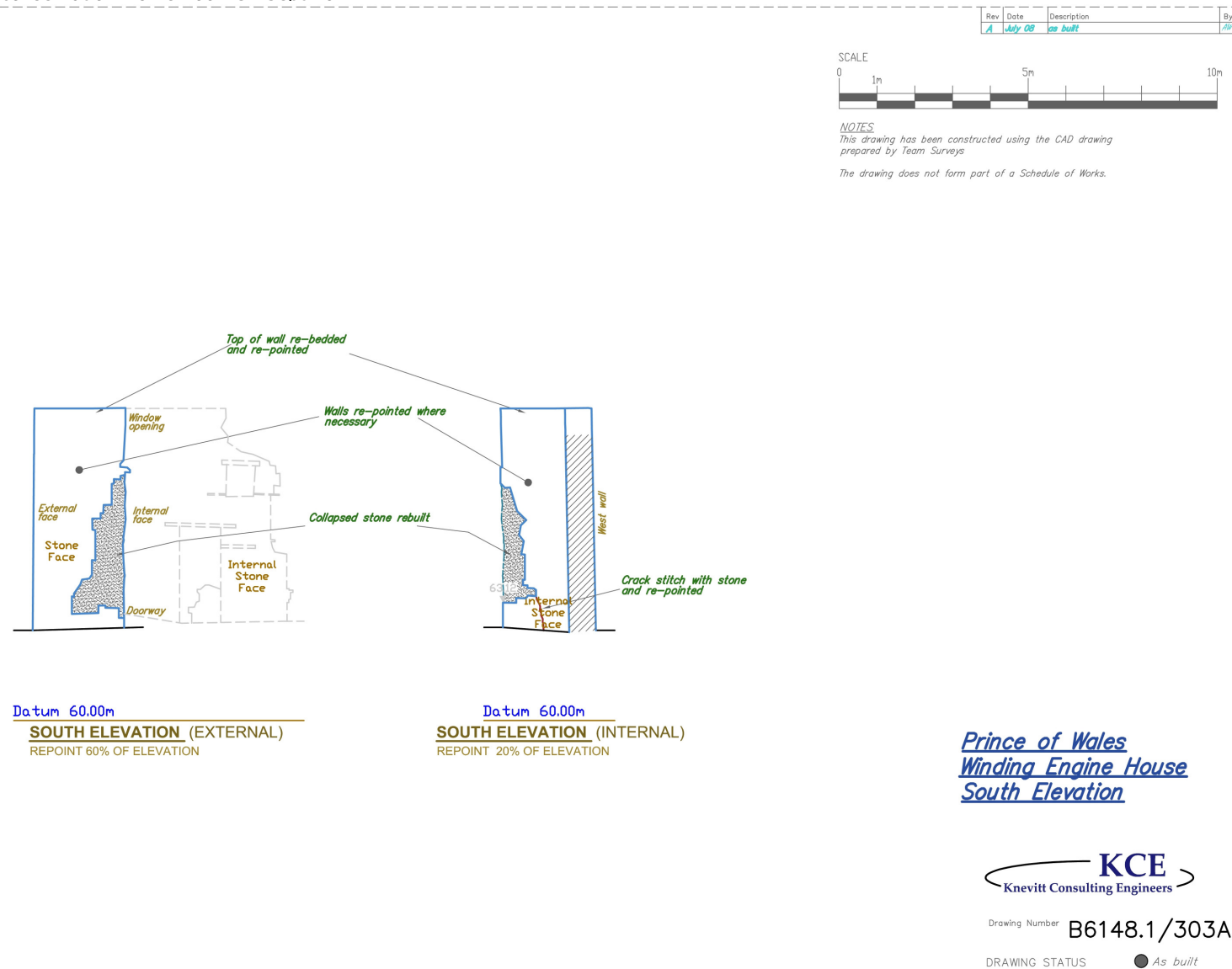


Figure 6 'As built' annotated South elevation survey of the winding engine house after works (Kneivitt Cons. Engs. 2008)

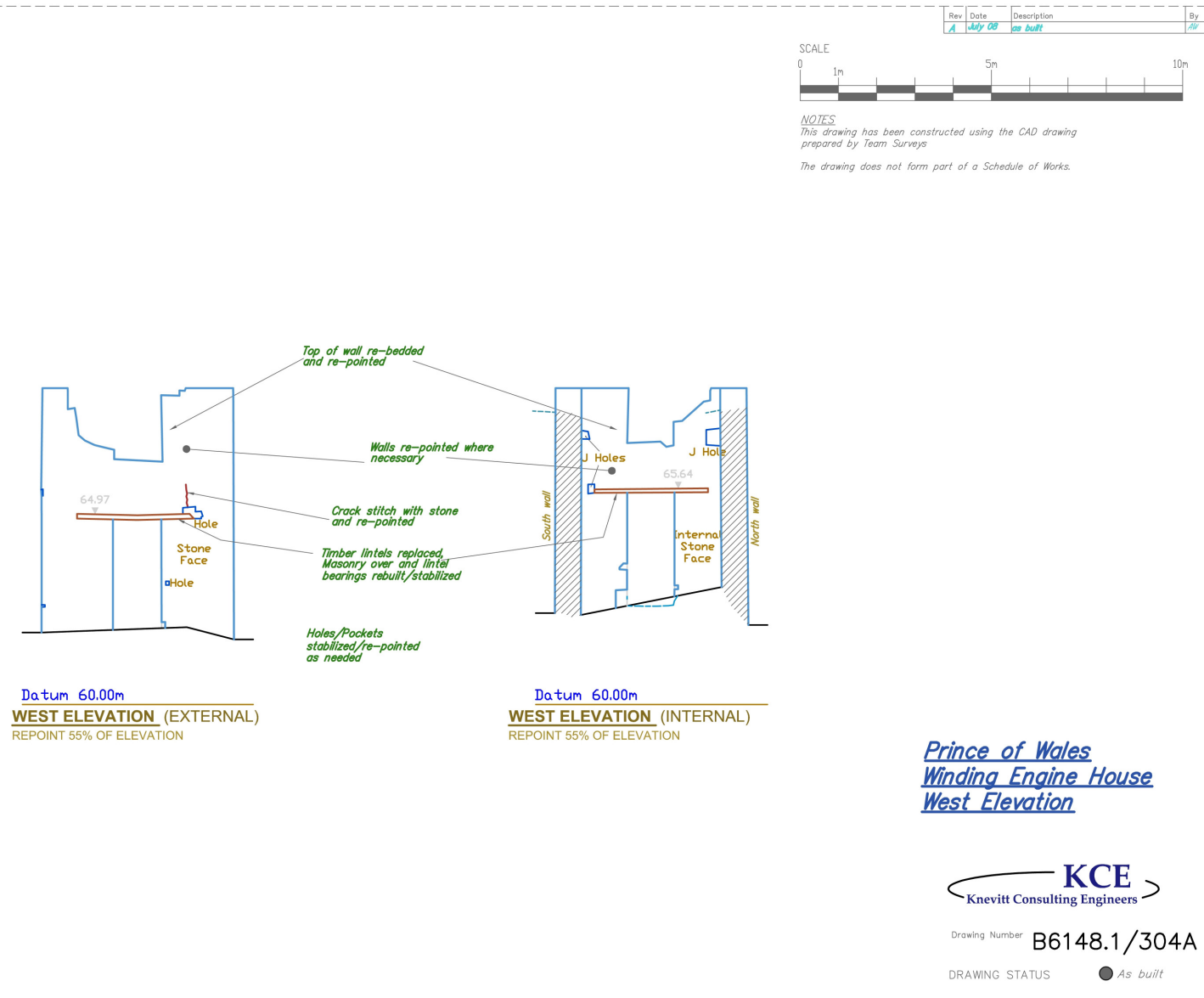


Figure 7 'As built' annotated West elevation survey of the winding engine house after works (Knevvitt Cons. Engs. 2008)



Fig 8 External view of the winding engine house before works © CC HE Projects 2007

Fig 9 External view of the winding engine house after works © CC HE Projects 2008



4.2 Winder drum loadings/pit

NGR : SX 40121 70606

Site No: 10.2

Recommendations (Buck 2006, 29):

Refer to recommendations given in Section 4.1.

Expected site impact (Buck 2007, 10):

Refer to site impact description given in Section 4.1.

Conservation works (2007-8):

The agreed mortar specifications for the engine house were also used for the adjacent winder pit. A substantial amount of fallen masonry stone (from the winding engine house south wall), was removed from the interior and vicinity of the winder drum pit, to enable the conservation works to proceed, and placed nearby. The top of the remaining walls were 'capped' and repointed. The walls were only repointed where there was a structural need to do so (mainly in the upper parts of all walls).

Figure 4 is an 'as-built' measured survey plan of the winder drum loadings, with annotations detailing the extent of the conservation works. By mid January 2008 all the major conservation works to winder drum loadings had been completed.

4.3 Pumping Engine House

NGR : SX 40078 70609

Site No: 5

Recommendations (Buck 2006, 23):

Removal of the dense ivy would permit a visual survey of the entire building to assess the need for further remediation work to restrict further outwards movement of the wing walls. The engine house will need to be fully scaffolded and parts of the side walls and all the tops of the walls repointed. A detailed survey by a structural engineer should be undertaken. It is likely that consolidation works will take the form of repointing the upper sections of wall, replacement of some timber structural components, and rebuilding of masonry above lintels where they have collapsed. A fence will need to be built across the top of the cataract pit (due to the 2.8m drop), in front of the granite cylinder bedstone (which should be repaired as will the collapsed section of the cataract north wall).

Expected site impact (Buck 2007, 10):

The impact of the proposed scheme on the building is simply to replace the rotting timber lintels, to rebuild any small-scale localised masonry collapse (above the lintels), to ensure the wing walls are structurally sound, and to repoint the walls where necessary. The east (bob) wall elevation shows that the lower part of the engine house is suffering structurally as a result of its missing large timber lintels.

The impact of the conservation scheme on the fabric of the building will be to remove old and crumbling mortar and replace with new lime mortar. This may well entail repointing parts of the outside and a moderate percentage of the upper inside and surface of the four walls to retain structural strength to the building which lost its roof many years ago. It is the intention of the project to make the building structurally safe by consolidating the four main walls. Access for both scaffolders and site contractors is likely to be from the adjacent track on the north side of the building.

In addition other impacts include clearance of debris, fly-tipping and vegetation from the interior of the engine house and cylinder bedstone to permit safe public access and

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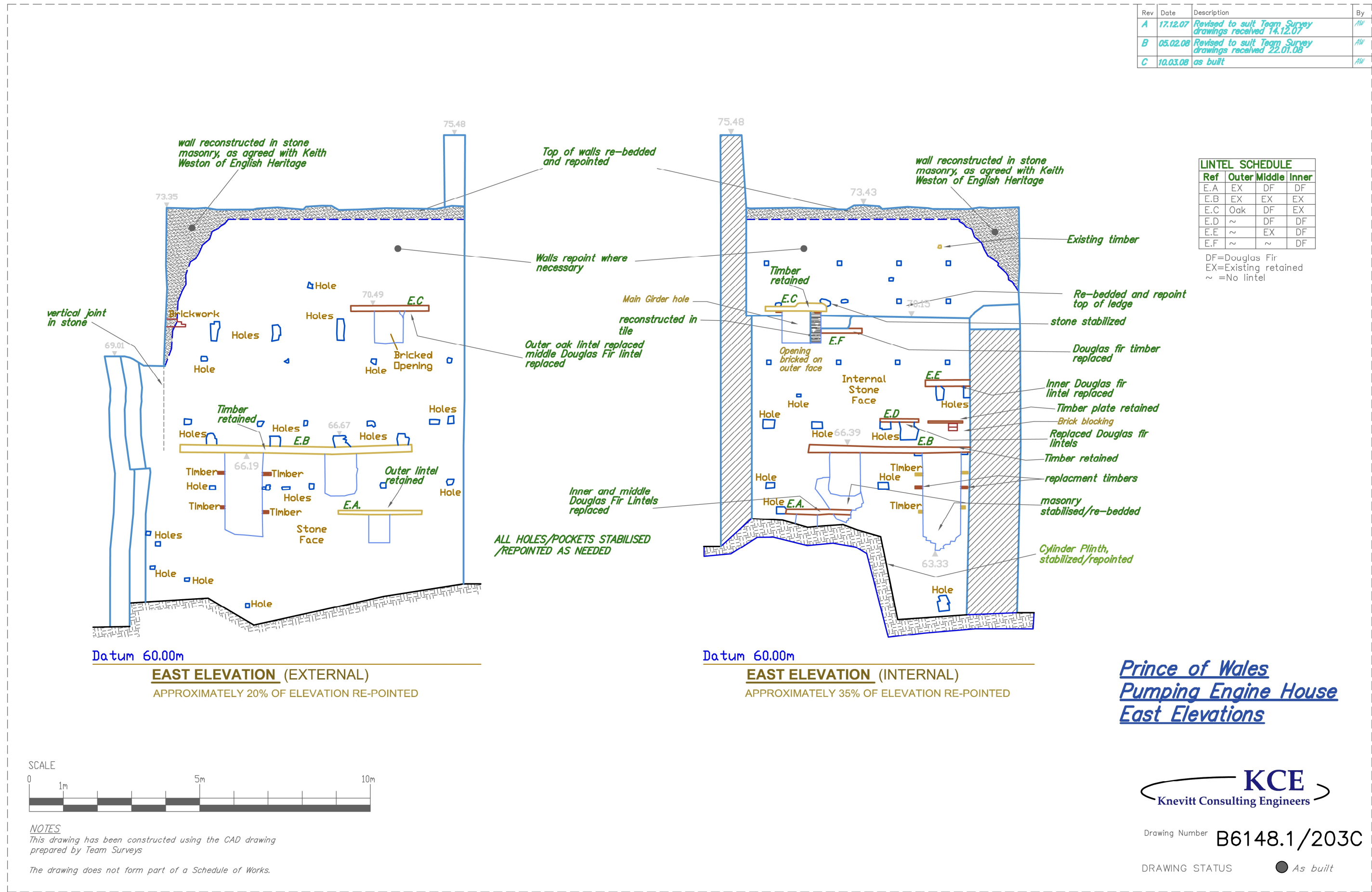


Figure 11 'As built' annotated East elevation surveys of the pumping engine house after works (Knevvit Cons. Engs. 2008)

the provision of a safety railing (to restrict access down to the Cataract pit). The existing barbed wire fence restricting access to the engine house will be removed from the adjacent track, although new fencing will be erected around the open shaft (post and barbed wire with sheep netting) and between the southern end of the engine house and the adjacent east and west (post and wire) boundary fences. The overall impact of the proposed works on this feature can be defined as '*Minor positive*'. The works will provide more structural stability and a higher degree of Health and Safety for at least another generation, for what is an iconic site.

Conservation works (2007-8):

A grant of £50,000 from an ALSF (administered by EH), funded the pumping engine house building conservation works. A condition of the grant was that an accredited historic buildings consultant be employed for advising the contractors for works to this building. David Scott (of Lemon Street, Truro), was employed for this work.

Three lime mortar aggregate test panels were used to demonstrate a variety of aggregates and sands. Following a site meeting attended by English Heritage (Rebecca Child, Shane Gould and Keith Weston), David Scott and Colin Buck, confirmed the combination described below. Natural Hydraulic Lime (NHL) 3.5 was used for repointing walls whilst the more exposed sections of the site used NHL 5. Both were mixed in the ratio of 1 : 2.5 (Lime : Aggregate). Cornish Lime Sand (CLS) 3 parts CLS 26, 2 parts CLS 32 and 2 parts NHL 3.5 (for walls), or 2 parts NHL 5 (for wall tops).

Clearance of vegetation from the sides and tops of the wing walls (see Fig 12) followed after scaffold erection (inside and out) by 29/11/07. This permitted a close detailed structural and ecological survey. In addition, the building surveyors returned to accurately survey the top edges of the building (prior to rebuilding and rebedding the tops of the walls). To summarise the conservation works; the masonry over the top of the rotted timber lintels was carefully replaced with fallen stone from the building after some new sections of tanalised Douglas Fir or oak (depending on supporting evidence of the original timber), had been inserted to mimic the original timber specification. Some original timbers were left *in-situ*. The top of the wing walls and bob wall were 'capped' and repointed. Figure 17 shows the sheets of iron and timber that were used to level and form the bob wall correct height upon which the large original timber lintels (and iron bob), was set. The walls were only repointed where there was a structural need to do so (mainly in the upper parts of all walls), in fact, the dense ivy had mainly grown against the walls, protecting the masonry and lime mortar pointing.

Cracks in the upper section of the brick lined cylinder doorway were remediated by using similar second hand brick to replace the missing sections, and stitching with stone the crack above. Other details of specific structural remediation are shown on the relevant 'as-built' internal and external measured survey elevations (Figs 10, 11, 14, 19 and 20) of the engine house. Each drawing has detailed annotations relating to the works that have been undertaken on each wall. Relevant photographs of each elevation are also reproduced in the text following each survey plan (Figs 12 - 13, 15 - 18, and 21 to 24).

From an ecological perspective, the bat survey had not confirmed the presence of bats originating from the engine house (rather adjacent trees, etc). In addition, an endoscope survey of the exterior and interior of the building had also failed to identify any bat roosts. Small openings were left in the masonry for bat/bird nests, etc. An oak nesting box for owls was built and placed in the Main Girder opening (east side). Internally, a build up of earth above the original floor level was removed to leave the ground at approximately its original height. Unfortunately, the granite cylinder bedstone had been partially removed long ago (probably when the engine was removed for re-sale), and part had fallen into the Cataract Pit. This section was raised from the pit but unfortunately it did not fit with the remaining intact section. By late February 2008 all the major conservation works to the engine house had been completed.

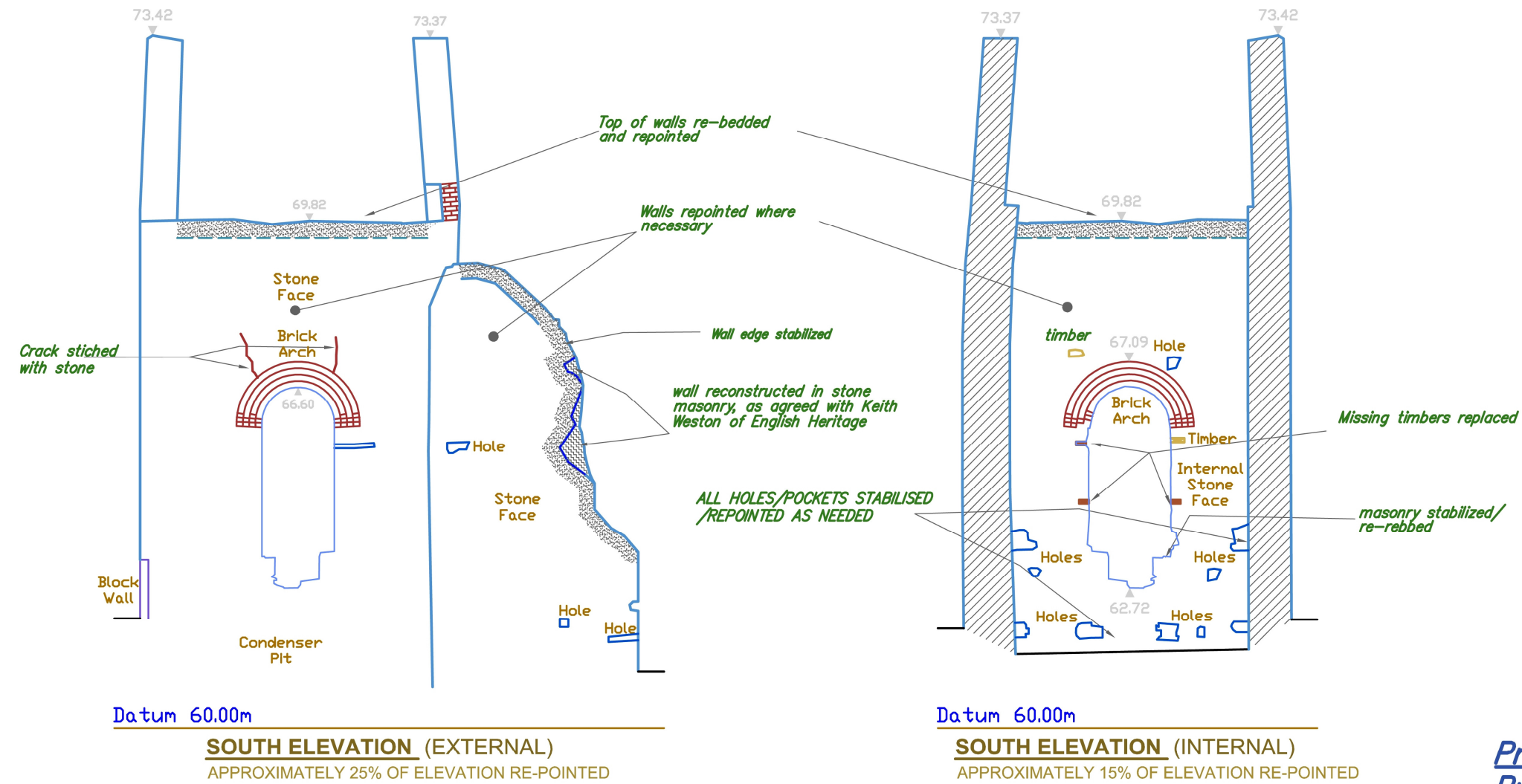


Fig 12 External view of the pumping engine house before works © CC HE Projects 2007

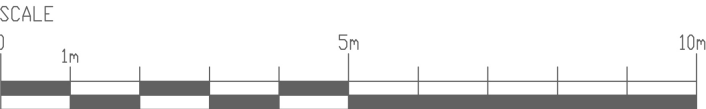


Fig 13 External view of the pumping engine house after works © CC HE Projects 2008

| Rev | Date | Description | By |
|-----|----------|--------------------------------------------------------|----|
| A | 17.12.07 | Revised to suit Team Survey drawings received 14.12.07 | AW |
| B | 05.02.08 | Revised to suit Team Survey drawings received 22.01.08 | AW |
| C | 10.03.08 | as built | AW |



Prince of Wales
Pumping Engine House
South Elevations



NOTES
This drawing has been constructed using the CAD drawing prepared by Team Surveys
The drawing does not form part of a Schedule of Works.



Drawing Number **B6148.1/204C**

DRAWING STATUS **As built**

Figure 14 'As built' annotated South elevation surveys of the pumping engine house after works (Kneivt Cons. Eng. 2008)



Fig 15 External view of the pumping engine house before works © CC HE Projects 2007



Fig 16 External view of the pumping engine house after works © CC HE Projects 2008



Fig 17 External view of the top of the bob wall during works © CC HE Projects 2007



Fig 18 External view of the top of the bob wall after works © CC HE Projects 2008

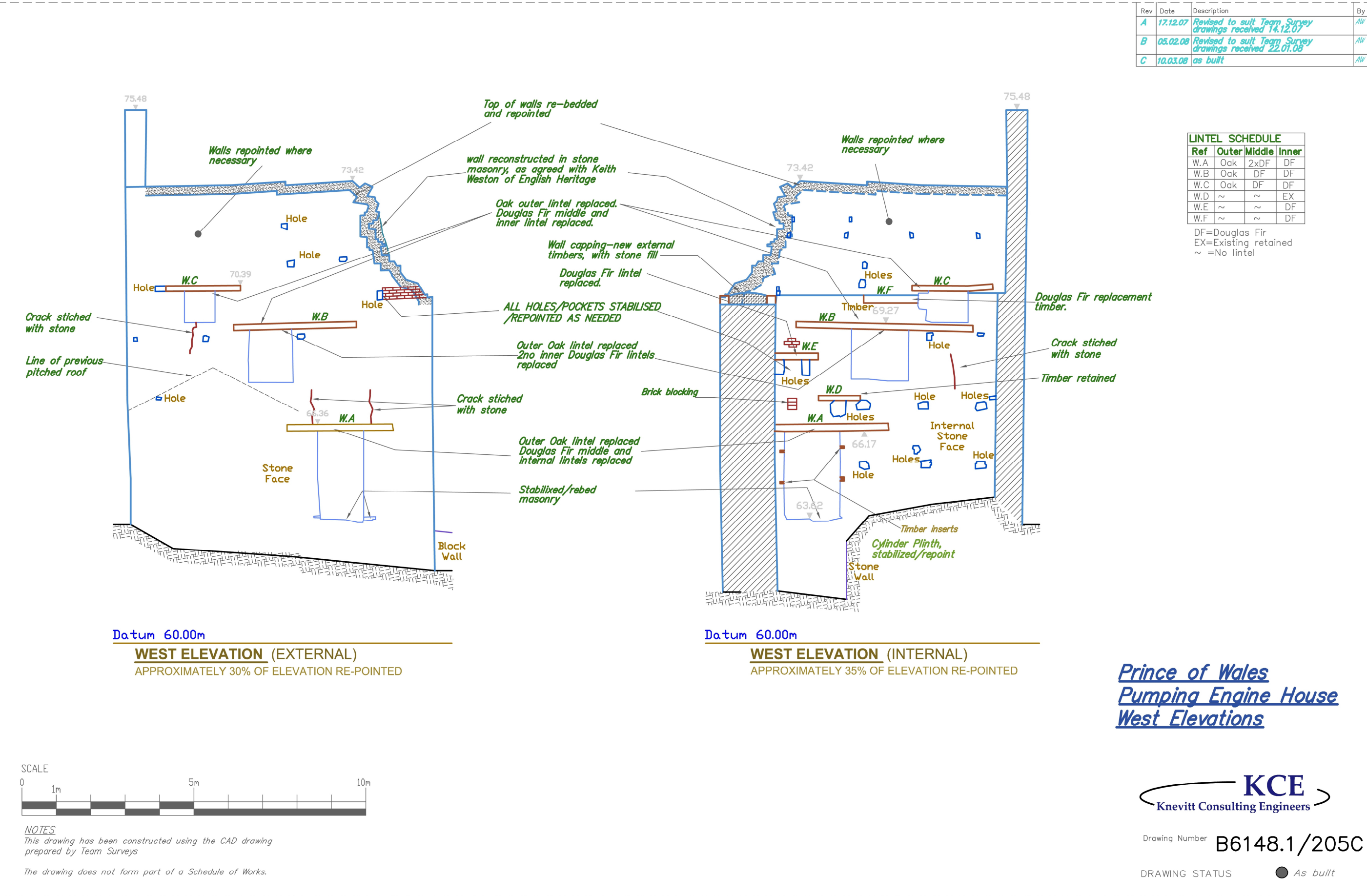


Figure 19 'As built' annotated West elevation surveys of the pumping engine house after works (Kneivt Cons. Engs. 2008)

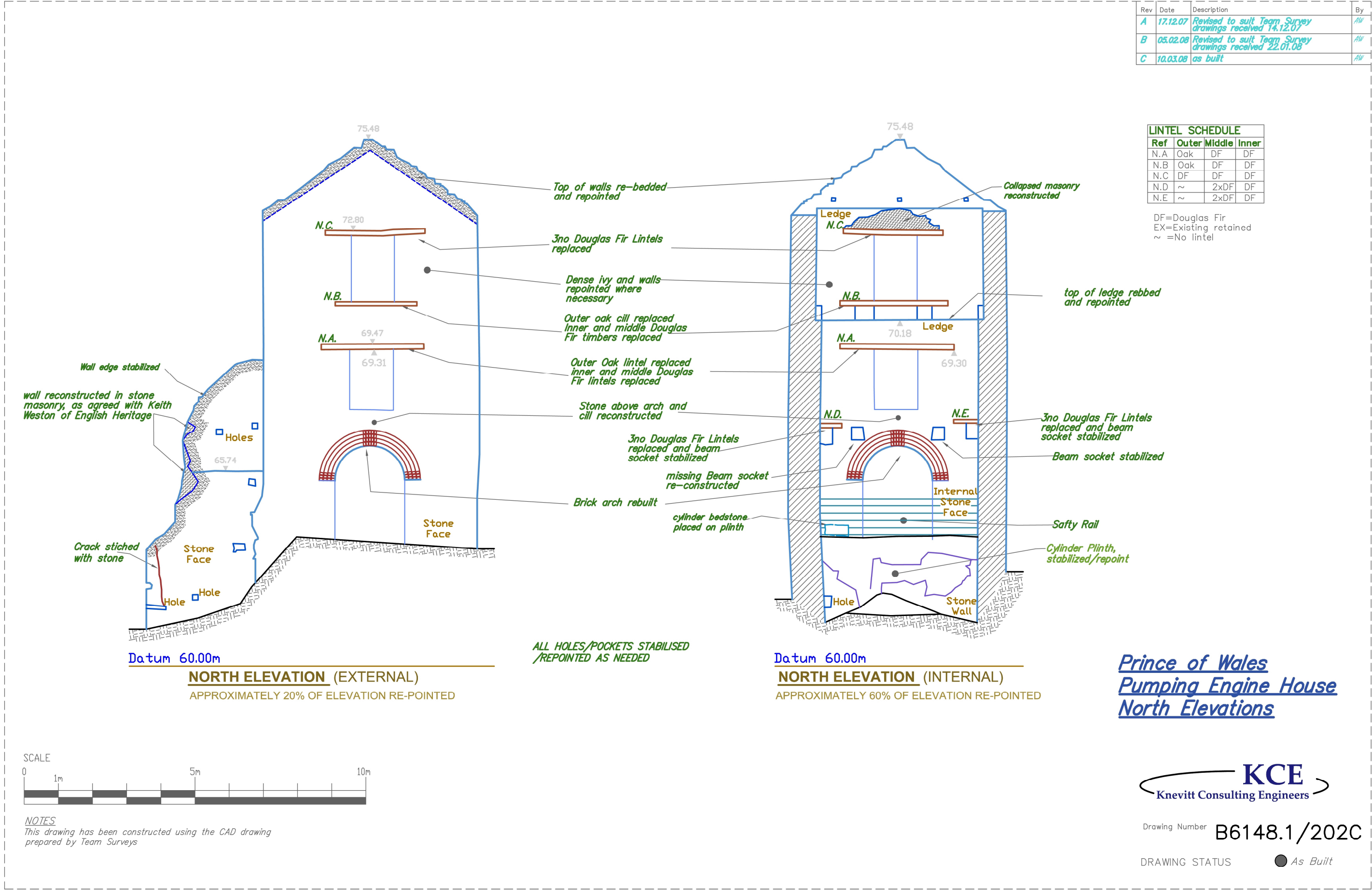


Figure 20 'As built' annotated North elevation surveys of the pumping engine house after works (Knevvit Cons. Eng. 2008)



Fig 21 Internal view of the gable wall before works

© CC HE Projects 2007

Fig 22 Internal view of the gable wall after works
© CC HE Projects 2008



4.4 Pumping engine boiler house

NGR : SX 40084 70612

Site No: 6

Recommendations (Buck 2006, 26):

It is likely that there will be public access within this building and so it is recommended that the fly-tipping is removed as well as some of the rubble masonry at the north end of the building. The structural condition of the tall section of the southern and western wall should be assessed after the dense ivy has been removed. The remaining walls should be repointed where necessary and the tops of the walls capped and repointed with lime mortar.

Expected site impact (Buck 2007, 10):

The main impact on the fabric of the building is likely to focus at the top of the walls where weather erosion is more likely to have affected the stability of the masonry, but more particularly the lime mortar. Soft and crumbling mortar will be removed (to a maximum depth of 40mm), from the masonry walls following a detailed site assessment of the feature by the site contractors. Prior to erection of scaffolding for repointing and capping of the walls, the fly-tipping will need to be removed and a relatively large amount of rubble removed from the north end of the building where the north gable wall collapsed, to ensure a stable surface for the scaffolding and public access. Any loose crumbly mortar (old and new) that has accumulated on the ground as a result of the works will be carefully cleared from the site.

Steps with timber risers (see detailed specifications) will be cut (under archaeological supervision), into the west earth bank of the boiler house (north east of the engine house) to permit public access to the boiler house and winding engine house. The overall impact of the proposed works on this feature can be defined as '*Minor positive*'. The works will provide more structural stability and enhance the site's visual authenticity for at least another generation.

Conservation works (2008):

This was one of the two sites which had a great deal of fly-tipping, including an old car, sheets of asbestos and other metal items. There was a lot of ivy and vegetation covering the remains of the boiler house east and north walls. Once this was removed (and the thick ivy stems treated with a root killer), the tops of the walls were rebbed with mortar, and the sides of the walls repointed where necessary. At the west end of the north wall (sections not visible at surface), a lintelled opening was repaired, which may have been the flue which went under the adjacent track. However, it may have been another unrelated feature. It was not considered necessary to cut steps into the earth mound at the north-west corner, as the ground was slightly re-profiled to reduce the steepness of the slope. Figure 10 is a plan survey with annotations describing the summary extent of the conservation works. These works were completed by the end of February 2008.

4.5 Pumping Engine boiler house chimney

NGR : SX 40069 70627

Site No: 3

Recommendations (Buck 2006, 22):

Following removal of the ivy and a structural assessment, it is recommended that the chimney is repointed with a lime mortar where necessary and a lightning conductor attached.

Expected site impact (Buck 2007, 8):

The main impact on the fabric of the building is likely to focus at the top of the chimney where weather erosion is more likely to have affected the stability of the masonry, but more particularly the lime mortar. Soft and crumbling mortar will be removed (to a maximum depth of 40mm), from the masonry walls following a detailed site assessment of the feature by the site contractors. This may entail renewing the mortar pointing of the top 'capping' of the chimney (approximately 15m high) – which has not been closely surveyed due to the dense ivy.

If steplejacks are to be employed, it is likely that a ladder access up the side of the chimney will be constructed by fixing it to the chimney by using small screws fixed into the mortar joints. When consolidation work has finished the screws will be removed and the small holes repointed with mortar. It may be preferable for photographs of the condition of the top of the chimney to be taken by the site contractors for discussion with the site archaeologist and EH (if appropriate) concerning the nature and extent of the conservation works. In addition the site contractors will install copper lightning conductors. The main copper conductor will be attached down the inside of the chimney (in masonry joints) to exit through a small hole drilled at the base of the west side and then be attached to either earthing rods or an earthing mat (depending on the localised earth impedance level), sited nearby. An earthing mat will require excavation of the ground to a depth of approximately 0.3m – 0.4m depth, for an area of approximately 1m x 4m. If this form of earthing needs to be undertaken, then an archaeologist will be present to record any visible or disturbed archaeological features. Any loose crumbly mortar (old and new) that has accumulated on the ground as a result of the works will be carefully cleared from the site.

The overall impact of the proposed works on this feature can be defined as '*Minor positive*'. The works will provide more structural stability and enhance the site's visual authenticity for at least another generation.

Conservation works (2008):

Ivy and vegetation covered and obscured most of this chimney (see Fig 12). Once scaffolding was erected only the top part of the ivy was removed. The sides of the chimney were repointed with mortar, and rebuilt (especially at the brick top) where necessary, although some small openings were left for bat roosting and bird nests. Figures 23 and 24 show the top of the brick cornice both before and after works. Given the state of the brickwork, the top fifteen brick courses needed to be entirely rebuilt, with three layers of stainless steel reinforcement added for additional strength (each 2.5m x 6mm). This chimney did not have an elevation survey, although it can be seen on plan in Figure 10, and a number of photographs taken before, during and after works. The conservation works were finished by mid April 2008.

Before the scaffolding was removed, a copper lightning conductor was fixed around the top brick course, and connected to a copper tape that was fixed vertically into the internal side of the chimney, exiting through a small hole that had to be cut/drilled through the south-west side of the chimney. Excavation for the lightning conductor earth plates took place on 9/05/08, after the scaffolding had been removed. A small digger excavated a trench 0.9m deep, 0.8m wide and 5m long, extending from the south west side of the chimney. Three galvanised steel plates, each 0.75m wide and 1.25m long, and each interconnected with copper tape, were placed in the bottom of the trench. The excavated soil profile was approximately 0.2m of topsoil/grass/earth, 0.3m of roots and buried stone/brick/mortar, and 0.4m of light brown coloured clay/shillet with earth/stone inclusions. There were no substantive archaeological finds.



Fig 23 View of the top of the chimney (Site 3 - before works) © CC HE Projects 2008



Fig 24 View of the top of the chimney (after works) © CC HE Projects 2008

4.6 Miners Dry (and extension)

NGR : SX 40082 70630

Site No: 4 & 4.1

Recommendations (Buck 2006, 23):

Following a structural assessment, it is recommended that the entire building is repointed with a lime mortar where necessary to achieve structural competency. Of priority; however, is removal of all trees and bushes growing on the walls or that which is affecting structural stability.

Expected site impact (Buck 2007, 9):

The main impact on the fabric of these adjoined buildings is likely to focus at the tops of all of the walls where weather erosion is more likely to have affected the stability of the masonry, but more particularly the lime mortar. Soft and crumbling mortar will be removed (to a maximum depth of 40mm), from the masonry walls following a detailed site assessment of the feature by the site contractors. The overall impact of the proposed works on this feature can be defined as '*Minor positive*'. The works will provide more structural stability and enhance the site's visual authenticity for at least another generation.

Conservation works (2008)

Once the ivy and vegetation covering the remains of the former Miners Dry building and extension was removed (and the thick ivy stems treated with a root killer), the tops of the walls were rebedded with mortar, and the sides of the walls repointed where necessary. Figure 10 is a plan survey with annotations describing the extent of the conservation works. A number of photographs were taken before, during and after works. The conservation works were finished by mid April 2008.

4.7 Stamps Engine House

NGR : SX 40002 70548

Site No: 21

Recommendations (Buck 2006, 37):

Removal of the dense ivy would also permit a visible survey of the entire building to assess the need for further remediation work to restrict further inwards movement of the remains of the wing walls. A detailed survey by a structural engineer should be undertaken. The engine house will need to be fully scaffolded and parts of the upper wing walls taken down and rebuilt. It is likely that consolidation works will take the form of repointing the remaining upper sections of walls, replacement of some timber structural components, and rebuilding of masonry above lintels where they have collapsed. A fence will need to be built across the top of the cataract pit (due to the 2.1m drop), in front of the granite cylinder bedstone. In the short term emergency remediation works may be necessary to reduce the height of the collapsing wing walls (by approximately 0.7m) to enable safe working inside the building. However, detailed EDM measured building surveys (elevations and plans) are being commissioned before any works take place.

Expected site impact (Buck 2007, 11):

The impact of the proposed scheme on the building is simply to preserve the structural integrity of the building by consolidating the wing walls that are falling inwards by partial rebuilding, replacing the rotting timber lintels, to rebuild small-scale localised masonry collapse (above the lintel deterioration), and to repoint the walls where

necessary. The schedule of works shows detailed internal and external elevations of the building with annotated notes summarising the conservation works.

In order to access the walls, scaffolding will be erected. Access for both scaffolders and site contractors is likely to be from the west side of the building. It should be noted that there will be a physical survey of the existing ivy growing on the walls (using a Hi-lift machine), of the building to assess whether there are any roosting bats, prior to removal of the ivy as part of an ecological bat survey. In addition other impacts include clearance of masonry debris (c0.8m), fly-tipping and vegetation from the interior of the engine house and cylinder bedstone to permit safe public access and the provision of a safety railing (to restrict access down to the Cataract pit). The existing barbed wire fence restricting access to the engine house will be removed from the adjacent track, although new barbed wire fencing will be erected between the south western corner of the engine house and the adjacent north and south (post and barbed wire) boundary fences.

The overall impact of the proposed works on this feature can be defined as '*Minor positive*'. The works will provide more structural stability and a higher degree of Health and Safety for at least another generation.

Conservation works (2008):

Three lime mortar aggregate test panels were used to demonstrate a variety of aggregates and sands. Following a site meeting attended by English Heritage (Rebecca Child, Shane Gould and Keith Weston), David Scott and Colin Buck, confirmed the combination described below. Natural Hydraulic Lime (NHL) 3.5 was used for repointing walls whilst the more exposed sections of the site used NHL 5. Both were mixed in the ratio of 1 : 2.5 (Lime : Aggregate). Cornish Lime Sand (CLS) 3 parts CLS 26, 2 parts CLS 32 and 2 parts NHL 3.5 (for walls), or 2 parts NHL 5 (for wall tops).

Conservation works to this building had quite a long gestation (from early February 2008), given the parlous state of the building. Initially scaffolding was erected around the outside of the building, which allowed ivy removal and the opportunity to dismantle both of the inwardly leaning upper wing walls (after permission for this was gained from EH - Keith Weston and Rebecca Child, after approving detailed survey drawings and specifications). Following the initial removal of the upper walls – the site was safe to be scaffolded internally. However, upon closer structural inspection (from the internal scaffolding), a further recommendation was made to EH by submitting detailed survey drawings and specifications by the project structural engineer (Andrew White), to remove an additional amount of masonry. A second site visit by EH (Keith Weston and Rebecca Child) subsequently approved this additional request, and the lime mortar specification described above.

The reason for the building's structural instability was the nature of its masonry stone. This building was constructed much later than the other two engine houses, and appears to have used stone from a different quarry. It is coloured slightly pink/red and unfortunately much of it is fractured both along its bedding layer and from top to bottom. Thus, when the wing walls were dismantled, a high proportion of the stone could not be re-used – as it simply broke up or disintegrated. Given that the dismantled sections of masonry would need to be rebuilt to the same specification, new stone (of similar colour) would need to be found. Fortunately, similar stone was found at Drakewalls Mine (St Anne's Chapel), and approximately five tons transported to this site for use in the building.

To summarise the conservation works; the masonry over the top of the rotted timber lintels was carefully replaced with fallen or imported stone from the building after some new sections of tanalised Douglas Fir or oak (depending on supporting evidence of the original timber), had been inserted to mimic the original timber specification. However, some original timbers were left *in-situ*. After substantial rebuilding, the top of the wing walls and bob wall were 'capped' and repointed. New timbers were inserted onto the top of the bob wall – with an original timber kept in the middle of the wall. The walls

were only repointed where there was a structural need to do so (in fact, much of the wall). Other details of specific structural remediation are shown on the relevant 'as-built' internal and external measured survey elevations (Figs 25 - 26, 29 - 30, and 33) of the engine house. Each drawing has detailed annotations relating to the works that have been undertaken on each wall. Relevant photographs of some of the elevations are also reproduced in the text following each survey plan (Figs 27 - 28, and 31 to 32).

From an ecological perspective, the bat survey had not confirmed the presence of bats originating from the engine house. In addition, an endoscope survey of the exterior and interior of the building had also failed to identify any bat roosts. Small openings were left in the masonry for bat/bird nests, etc. Internally, a build up of earth above the original floor level (and much rubble from the walls), was removed to leave the ground at approximately its original height. Fortunately, following ground clearance, the granite cylinder bedstone was revealed intact and is now a significant feature of the building.

In order to provide public access to the east side of the engine house and the stamps boiler house chimney (and the opportunity of a nice view of the surrounding countryside south of the site), a metal galvanised footway was designed and installed to take people through the engine house, over the cataract pit and out through an existing doorway. Incorporated with this structure was a metal fence to stop people falling into the deep cataract pit (see Fig 25). By late June 2008 all the major conservation works to the engine house had been completed.

4.8 Stamps Engine boiler house chimney

NGR : SX 40017 70561

Site No: 22

Recommendations (Buck 2006, 38):

Following removal of the ivy and a structural assessment, it is recommended that the chimney is repointed with a lime mortar where necessary, sections of the upper brick courses rebuilt in order to minimise further collapse, the flue entry opening repaired (an in-set grille added), and a lightning conductor attached.

Expected site impact (Buck 2007, 12):

The main impact on the fabric of the building is likely to focus at the top of the chimney where weather erosion of the lime mortar has affected the stability of the masonry. Soft and crumbling mortar will be removed (to a maximum depth of 40mm), from the masonry walls following a detailed site assessment of the feature by the site contractors. Given the collapse of the top brick course on its west side, this will entail a limited amount of rebuilding the recently collapsed brick course to ensure that the top of the chimney is structurally sound.

If stepladders are to be employed, it is likely that a ladder access up the side of the chimney will be constructed by fixing it to the chimney by using small screws fixed into the mortar joints. When consolidation work has finished the screws will be removed and the small holes repointed with mortar. It may be preferable for photographs of the condition of the top of the chimney to be taken by the site contractors for discussion with the site archaeologist and EH (if appropriate) concerning the nature and extent of the conservation works. Refer to detailed comments given above (Site 3) for proposed works (lightning conductor, etc). The overall impact of the proposed works on this feature can be defined as '*Minor positive*'. The works will provide more structural stability and enhance the site's visual authenticity for at least another generation.

Conservation works (2008):

The sides of the chimney were repointed with mortar, and rebuilt (especially at the brick top which had successively collapsed) where necessary, although some small openings were left for bat roosting and bird nests. Figures 27 and 28 show the chimney

from the south east before and after works. Given the state of the upper brickwork, the top thirteen brick courses needed to be entirely rebuilt, with two layers of stainless steel reinforcement added for additional strength (each 2.5m x 6mm). This chimney has elevation surveys (Figs 31 to 33), and is on plan in Fig 25. Photographs were taken before, during and after works. The conservation works were finished by early June 2008.

Before the scaffolding was removed, a copper lightning conductor was fixed around the top brick course, and connected to a copper tape that was fixed vertically into the internal side of the chimney, exiting through a small hole that had to be cut/drilled through the north-west side of the chimney. Excavation for the lightning conductor earth plates took place on 7/05/08, after the scaffolding had been removed. A small digger excavated a trench 1m deep, 0.8m wide and 3.5m long, extending from the north-east side of the chimney. Two galvanised steel plates, each 0.75m wide and 1.25m long, and each interconnected with copper tape, were placed in the bottom of the trench. The excavated soil profile was approximately 0.2m of topsoil/grass/earth, 0.3m of roots and buried stone/brick/mortar with pink coloured shillet backfill, and 0.2m of mixed pink/orange coloured clay/shillet with earth/stone inclusions overlying 0.2m depth of orange shillet to the base of the trench. There were no substantive archaeological finds.

4.9 Site safety fencing

Conservation works (2008)

Figure 2 shows the extent of site fencing at a number of locations around and within the site. The exterior boundary fencing (often to replace damaged/missing fencing) varied from tanalised timber post and barbed wire or straight wire (for field fencing), to post and rail in places (to match the existing fence style). All tanalised posts are 1.3m high above ground level. In addition, for fencing steep drops within the site (for example on the east side of the stamps engine house), post and rail (1.3m high), with steel netting (0.6m high above ground level) was also used. Other internal fencing (post and barbed/straight wire) was for site safety within areas for public access close to the newly conserved mine buildings and to define the areas which are to be purchased from the Duchy of Cornwall.

4.10 Drainage/track works

Conservation works (2008)

Given the probable increased use of the mine access tracks around the site by members of the public – remediation works to the track surface and a more efficient drainage were both considered necessary. The latter was especially important as water run-off from the large field north of the site, appeared to fall into the main mine track on the north and west part of the site, washing out the track and causing problems at the nearby road. Figure 2 shows the location of track regrading sites where '803' stone/dust from Hingston Down Quarry was laid and levelled across the track to a depth of approximately 100mm. A deeper layer of 200mm was laid in the section of track north of the pumping engine and boiler house. With the exception of two sections of off-path drainage on the east side of the site (see Fig 2), most of the track drainage schemes are on the north and west side of the site. The largest site impact was the construction of a concrete/granite water bar. This was formed with angled granite stones (2.5m long) to trap water run-off from the adjacent field. This was then fed from the water bar under the adjacent track via two 225mm UPVC pipes set under the track (1m deep), in a granular bed. The pipes emerged on the south side of the track (3m beyond the edge of the track), to drain in the ground beyond. There are two other dished drain depressions (formed by concrete and stone) which cut across the track to drain into a sump pit in the ground beyond. No archaeological features were impacted nor uncovered. These final works ended in August 2008.

45

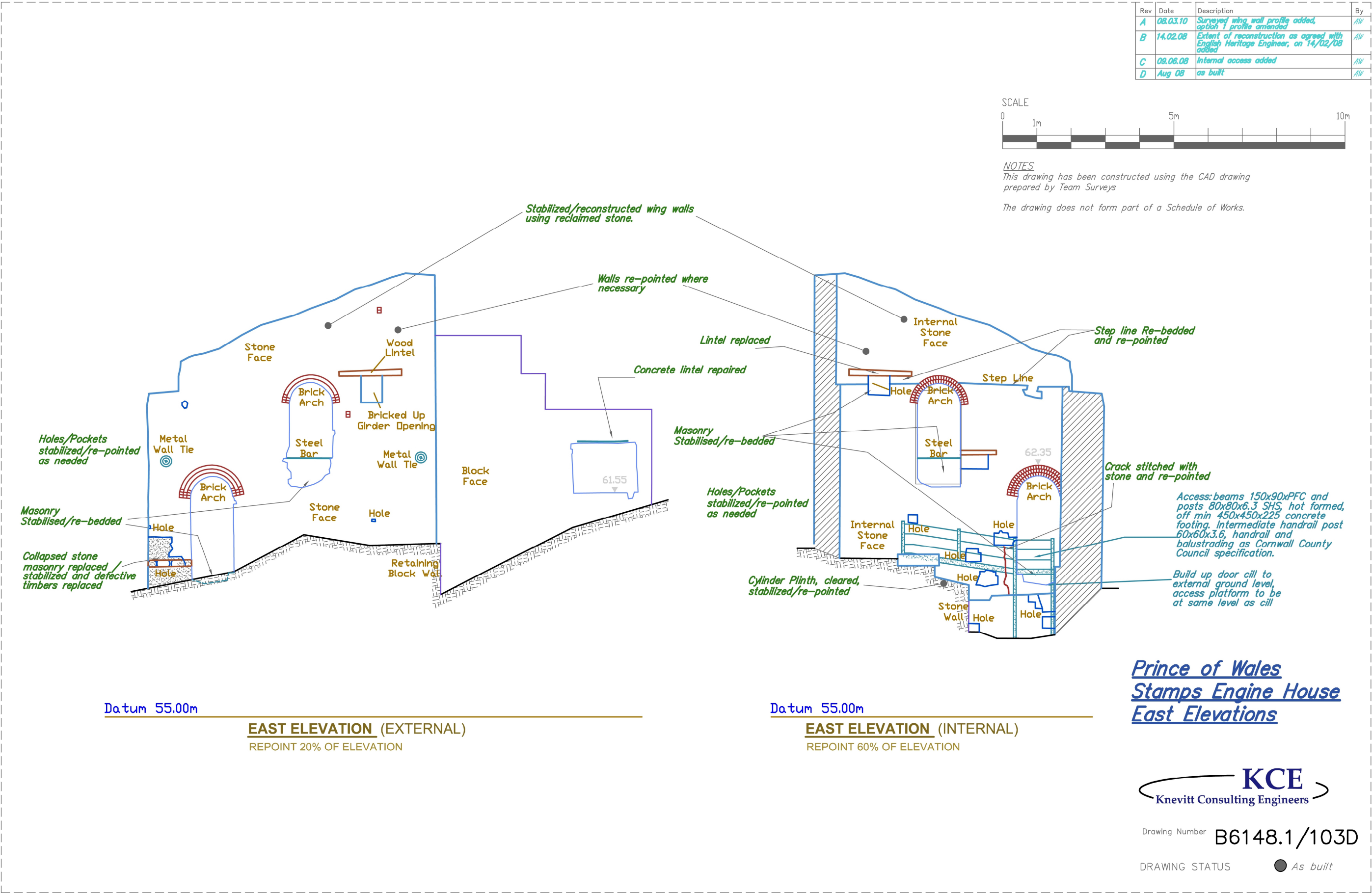


Figure 26 'As built' annotated East elevation surveys of the stamps engine house after works (Knevvit Cons. Engs. 2008)



Fig 27 External view of the stamps engine house before works © CC HE Projects 2007



Fig 28 External view of the stamps engine house after works © CC HE Projects 2008



Fig 29 Internal view of the stamps engine house north (gable) wall before works © CC HE Projects 2007

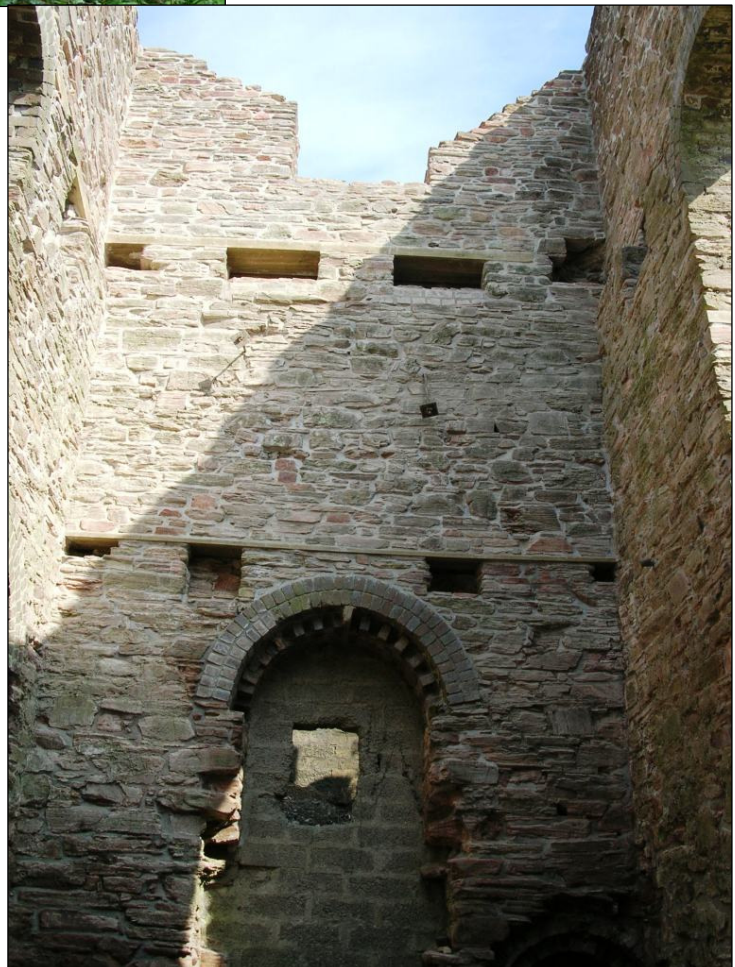
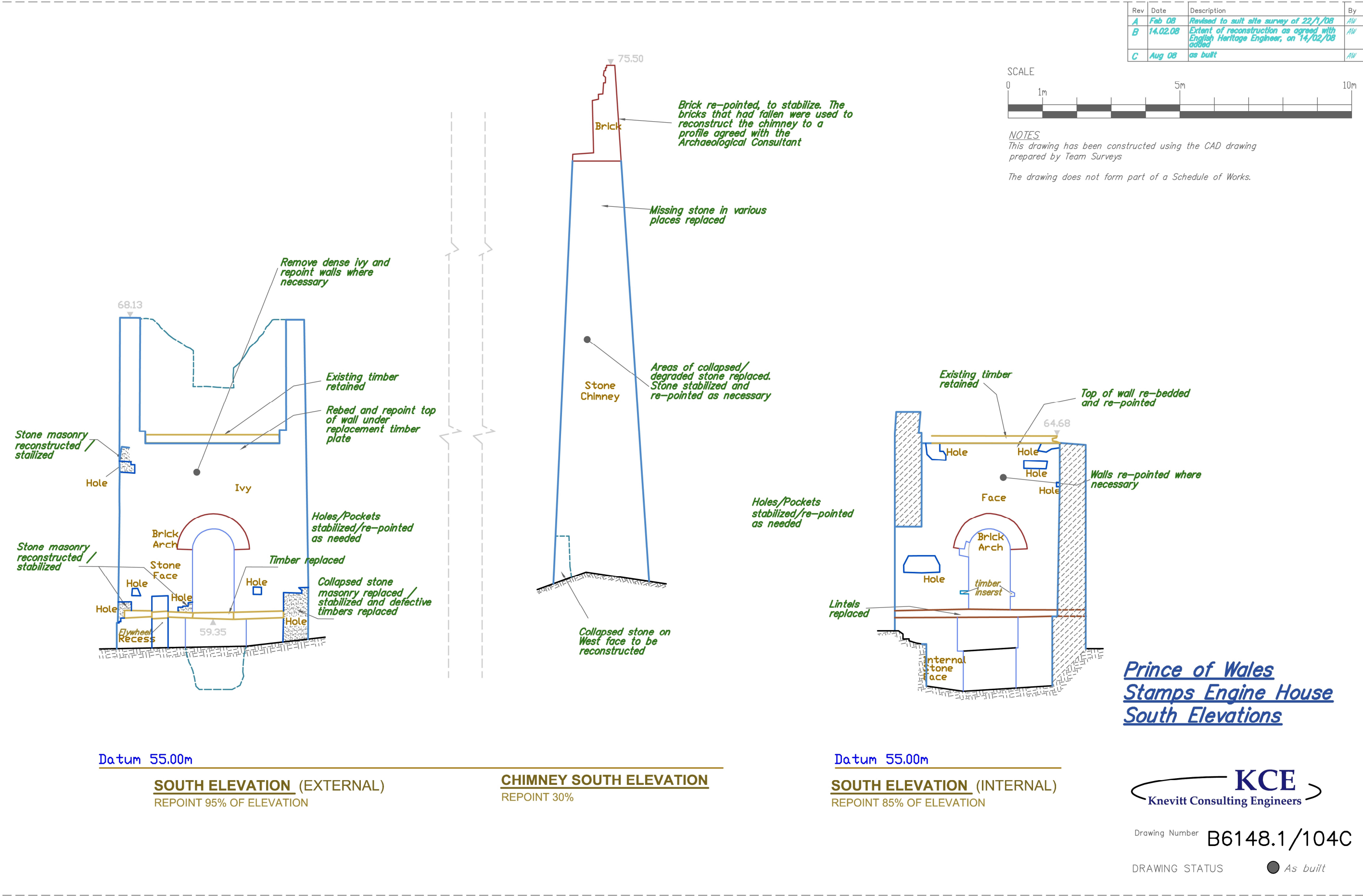


Fig 30 Internal view of the stamps engine house north (gable) wall after works © CC HE Projects 2008



Datum 55.00m

SOUTH ELEVATION (EXTERNAL)
REPOINT 95% OF ELEVATION

Datum 55.00m

CHIMNEY SOUTH ELEVATION
REPOINT 30%

Datum 55.00m

SOUTH ELEVATION (INTERNAL)
REPOINT 85% OF ELEVATION

Prince of Wales
Stamps Engine House
South Elevations

KCE
Knevvitt Consulting Engineers

Drawing Number **B6148.1/104C**

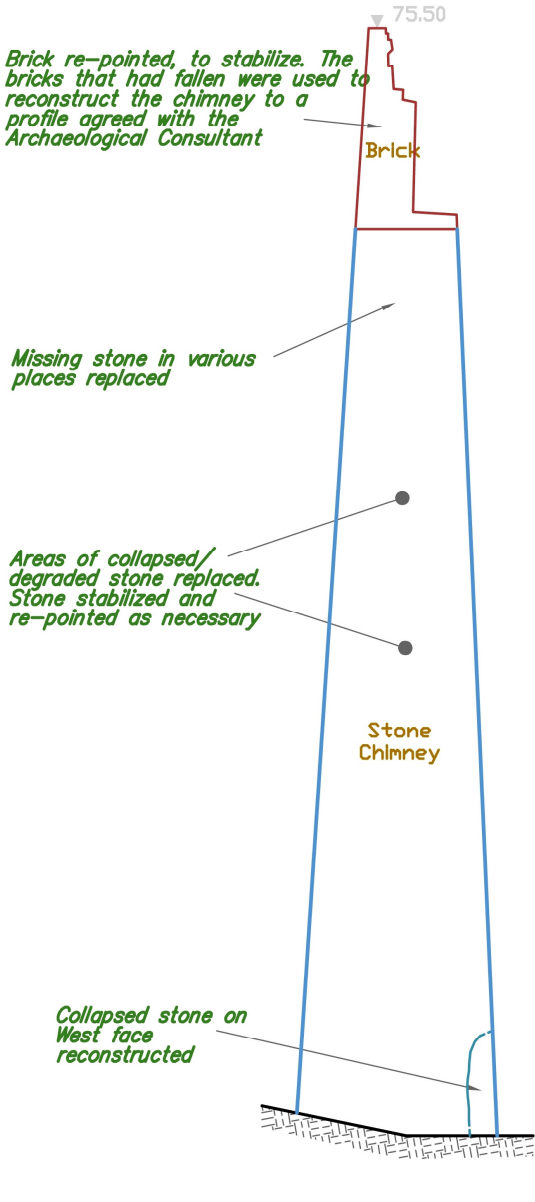
DRAWING STATUS **As built**

Figure 31 'As built' annotated South elevation surveys of the stamps engine house and chimney after works (Knevvitt Cons. Engs. 2008)

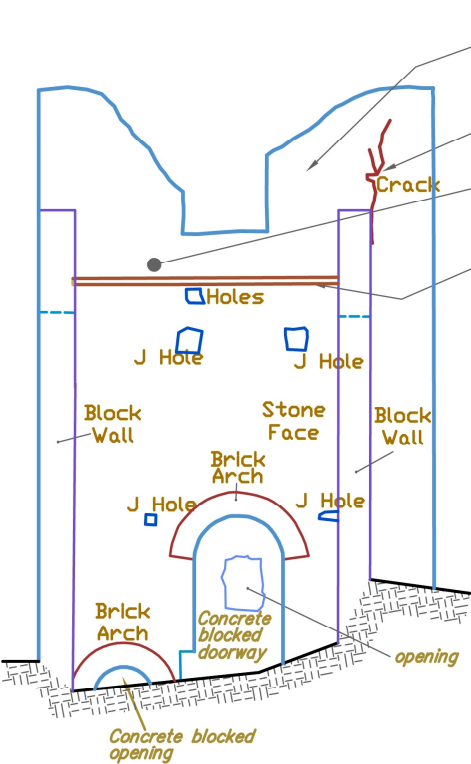
| Rev | Date | Description | By |
|-----|----------|--------------------------------------------------------------------------------------|----|
| A | 10.08.07 | Crack stitching noted revised | AW |
| B | Feb 08 | Revised to suit site survey of 22/1/08 | AW |
| C | 14.02.08 | Extent of reconstruction as agreed with English Heritage Engineer, on 14/02/08 added | AW |
| D | Aug 08 | as built | AW |

NOTES
This drawing has been constructed using the CAD drawing prepared by Team Surveys

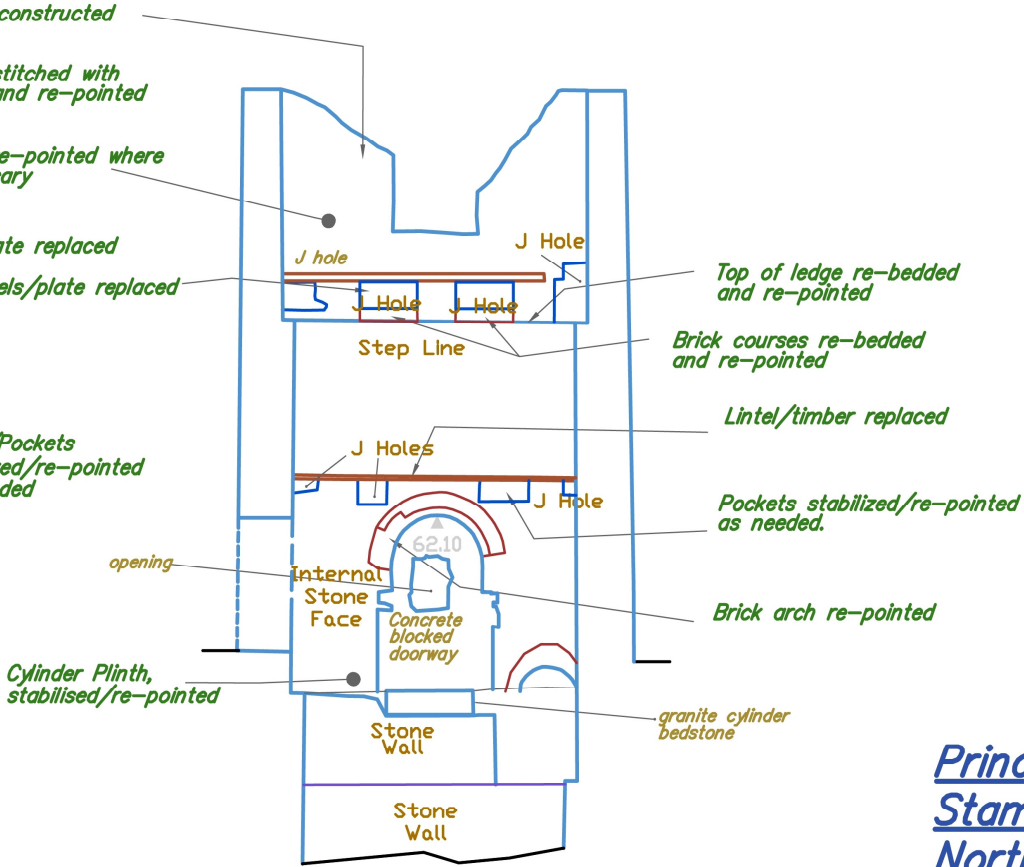
The drawing does not form part of a Schedule of Works.



Datum 55.00m
CHIMNEY NORTH ELEVATION
REPOINT APPROXIMATELY 30%



NORTH ELEVATION (EXTERNAL)
REPOINT 15% OF ELEVATION



Datum 55.00m
NORTH ELEVATION (INTERNAL)
REPOINT 100% OF ELEVATION

**Prince of Wales
Stamps Engine House
North Elevations**

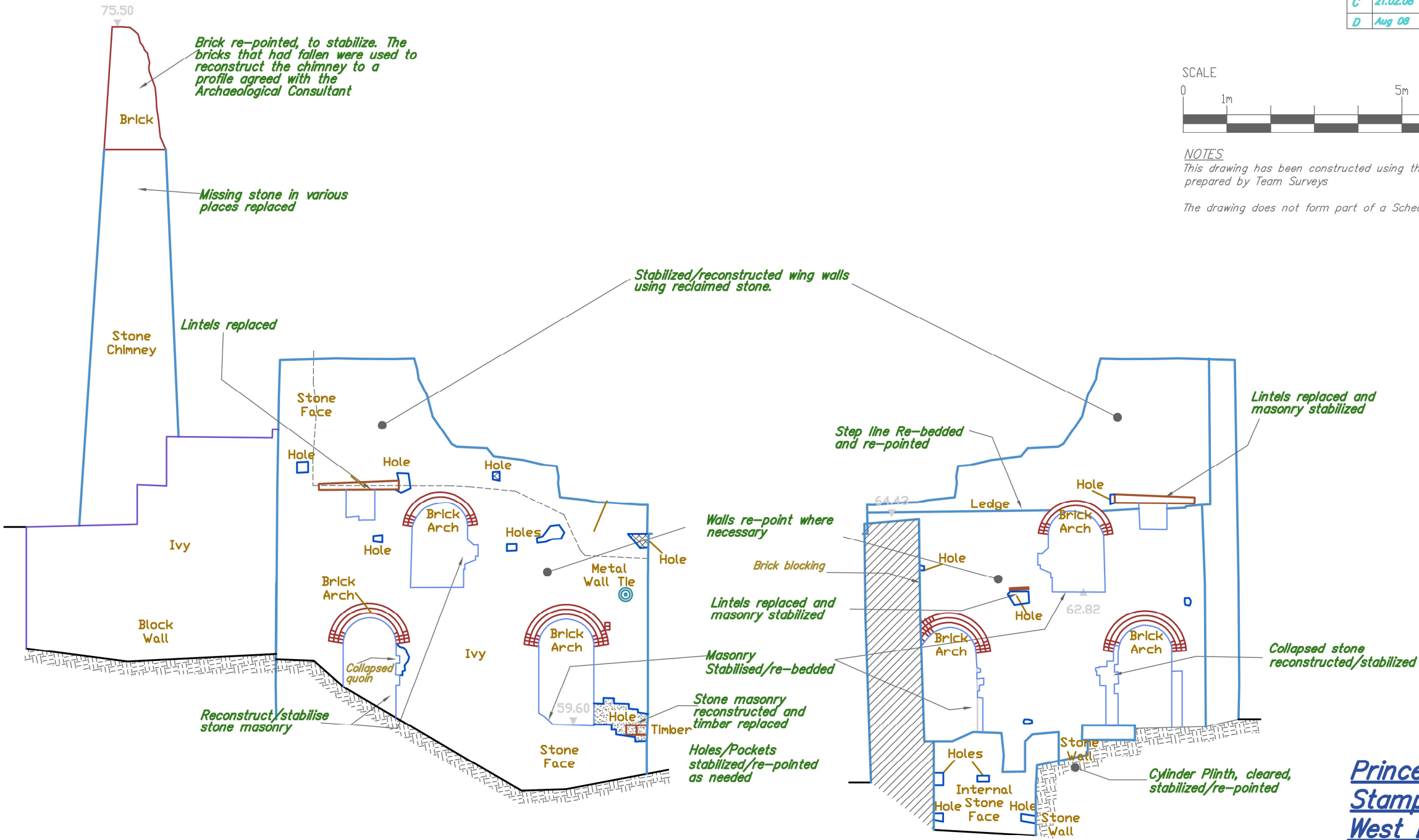


Drawing Number **B6148.1/102D**

DRAWING STATUS **As Built**

Figure 32 'As built' annotated North elevation surveys of the stamps engine house and chimney after works (Knevvit Cons. Engs. 2008)

| Rev | Date | Description | By |
|-----|----------|---------------------------------------------------------------------------------------------------------------|----|
| A | Feb 08 | Revised to suit site survey of 22/1/08. Walls to be taken down before English Heritage Engineer's visit added | AW |
| B | 14.02.08 | Extent of reconstruction as agreed with English Heritage Engineer, on 14/02/08 added | AW |
| C | 21.02.08 | Possible revised extent of wingwall to be taken down for safety reasons | AW |
| D | Aug 08 | as built | AW |



Datum 55.00m

WEST ELEVATION (EXTERNAL)
REPOINT 60% OF ELEVATION

Datum 55.00m

WEST ELEVATION (INTERNAL)
REPOINT 75% OF ELEVATION

**Prince of Wales
Stamps Engine House
West Elevations**

KCE
Knevvit Consulting Engineers

Drawing Number **B6148.1/105D**

DRAWING STATUS **As built**

Figure 33 'As built' annotated West elevation surveys of the stamps engine house and chimney after works (Knevvit Cons. Engs. 2008)

5 References

5.1 Primary sources

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5.2 Publications

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Bereton, C., 1991, *The repair of historic building—advice on principles and methods*, EH

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Sharpe, A., Johnson, N., and Lewis, R., 1996, *A Guide to Conserving Historic Mine Buildings in Cornwall*

6 Project archive

The HE project number is **2007085**.

The project's documentary and photographic archive is housed at the offices of Historic Environment, Cornwall Council, Kennall Building, Old County Hall, Station Road, Truro, TR1 3AY. The contents of this archive are as listed below:

1. A project file (2007085) contains site records and notes, project correspondence and administration.
2. **Site recording (Photographic):**

Photographs (Black/White: **GBP**,) and Digital images are archived under the following index numbers:

Black/White photographs:

Site before consolidation works: GBP 1905/1-30; 1924/1-16; 1924/17-29.

Site during consolidation works: GBP 1925/1-4, 1925/5-7; 1926/4-14, 25-32; 1927/26-28; 1926//15-24; 1927/8-9; 1927/18-22; 31-33; 1927/34-36.

Site after consolidation works: GBP 1927/1-7, 29-30; 2036/25-26; 2034/18-21; 2035/14-15, 20; 2036/24; 2034/17, 22-36; 2036/22-23, 27-28; 2035/8-13, 21-36; 2036/18-21; 2041/3; 2039/21-24.

Digital images:

(R:/HE Images/Sites M-P/Prince of Wales Mine Mine/PoW Mine WB 2007085)

3. **Site recording (Surveys):**
CAD surveys: .pdf copies of the original (2007) Team Surveys CAD survey and 'as built' survey files (created by Knevitts Cons. Eng.) are in the project file.
4. This report text is held in digital form as: G:\Historic Environment (Documents)\HE Projects\Sites P\Prince of Wales Mine\ Prince of Wales WB 2007085
5. EH OASIS No. cornwall2-110762