
Structural Report

Brock Keep, 571 Oxford Road, Reading

For

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Structural Report

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1.0 Introduction

Michael Aubrey is a practice of consulting engineers who have been instructed to assist the client in obtaining heritage lottery funding to ensure the long-term maintenance and upkeep of Brock Keep, whilst considering future café space as an additional source of income to the client, giving the property a sustainable future.

A visual condition survey of the property was carried out by Mark Lovell Design Engineers (MLDE) in November 2013. So firstly, it was considered important to evaluate the key points highlighted in the MLDE report and to verify whether any defects highlighted have since worsened or to highlight any other observations. To carry out this assessment John M Staves BSc(Hons) CEng FIStructE and Oliver Goodyear MEng(Hons) undertook a visual inspection at the property on 17th January 2018. Michael Aubrey also carried out a visual inspection of the outer elevations of the roof and turret parapets, which were accessible via the scaffolded crash deck surrounding the outer roof perimeter of the building. This part of the building was not surveyed during the initial MLDE report; thus a more detailed condition survey of this area was carried out.

Therefore, the purpose of this report is to highlight the key points derived from this evaluation and indicate the next steps required to obtain the technical package suitable for Listed Building Consent and HLF funding application.

It should be noted that a visual inspection is limited to assessing readily observable parts of the structure and finishes for signs that may indicate underlying structural problems. No “opening up” of the structure is carried out. Any dimensions taken are purely for descriptive purposes.

It should be noted that this report is for the sole use of the named client and is confidential to them and their professional advisors. Any other persons rely on the report at their own risk.

2.0 Description

The existing building is a 4 storey keep building, built in 1877 as a part of Sir Edward Cardwell's Army reforms. The building consisted of early clinker type concrete spanning between wrought iron beams which were configured in a repeated grid across all floors and supported by 4 internal cast iron columns and external solid brick walls.

A more detailed description of Brock Keep is contained within the MLDE report, appended to this report (Appendix E).

It is understood that the building was initially intended as a local landmark to encourage enlistment, whilst also acting as an armoury and regimental store. Ownership has since passed to Reading Borough Council and since 1980 has been leased by OpenHand OpenSpace. The building was listed as grade II in 1975.

The roof and perimeter parapets have been scaffolded for a considerable amount of time to ensure a safe accessible crash deck is positioned around the full roof perimeter, to catch any falling debris from defective masonry elements. In order to fulfil the long-term plans for the keep, it is essential for all scaffolding to be taken down, therefore appropriate repairs to be undertaken to ensure there is no longer a risk of falling debris.

Furthermore, the building has 2 turrets over the stair cores situated on the North-East and South-West corners of the building. The top sections of these turrets contain a cast iron water tank, which are in fairly poor condition. It is understood the client is keen to evaluate options for keeping these tanks or re-using them elsewhere.

3.0 Parapet Survey

Access was safely obtained to the crash deck where the following observations were recorded. This section of the report should be read in reference with the following appendices

Appendix A - Reference Elevations

Appendix B - Photographs

Appendix C - Roofing enquiries

Appendix D - Crack Monitoring Schedule

Appendix E - Mark Lovell Report

3.1 Parapet Observations

Whilst inspecting the parapet the following repeat observations were noticed;

- A. Spalled or Damaged Brickwork and Stonework
- B. Eroded Mortar Joints
- C. Use of Cement Mortar
- D. Erosion to Bathstone
- E. Cracking to Bathstone or Brickwork
- F. Delamination of underside of Bathstone drip piece
- G. Vegetation growing in the wall
- H. Corrosion to ferrous materials
- I. Detached fixings and brackets

Elevation layouts have been marked with the listed references to indicate where these defects occurred.

3.2 Parapet Discussion

To summarise these defects, it was clear that the top section of the building has been repointed at some point with cement mortar. This building would have initially have been built using a traditional lime mortar, which would have been more suitable for the types of bricks used. Traditional brick walls rely on the lime mortar to breathe and let moisture out of the wall, cement mortar in comparison is less permeable and traps moisture within the brickwork. Therefore, the use of cement was unsuitable for this application and its likely that the eroded bed joints and numerous spalled bricks are resultant of these works, as trapped water can break apart bricks and mortar, via free/thaw action (photograph 1). Within future years this effect will worsen and will lead to further segments of mortar or brick falling from the wall and as this is a risk to public using the area below, it would be prudent to repoint this area with a suitable lime mortar. It also makes sense to utilise the scaffolding whilst it is in place.

It was also clear that the bath stone features at the parapet drip, where the parapet meets the roof slab and at coping and edging details was beginning to erode. This is likely to be resultant of years of wind and driven rain to a highly exposed area of the building (photograph 2). The worst areas of erosion were directly beneath the castellation's, where storm water is collecting along the wall opening and has worn away a channel on the drip stone. These areas generally coincide with the areas where the bath stone is delaminating on its underside or cracking (photograph 3). Which suggests that water is getting to the underside of the detail via channels or joints in the drip stone and causing the stonework to delaminate and break apart. Eventually this will affect the stability of the wall, although currently the main concern is segments of stone falling on the public below. Therefore, its suggested that damaged stones are repaired by a bath stone repair specialist, with an appropriate repair mortar, to prevent water from collecting on the underside of the drip and to build up the areas delaminated. It would be useful to get a specialist to view these areas, so they can assist in specifying the appropriate repair mortar.

Furthermore, cracking to brick and stone work was noted throughout the parapet and turrets. Typically, these were around castellation's (photograph 4) and to the

turret walls. On the main parapet walls the direct cause of this cracking is unknown, although it's possible causes are thermal movement, where cement mortar is brittle and susceptible to cracking from thermal expansion and shrinkage effects, which normally occurs around openings where the wall is at its weakest. Its also possible that water accumulation or corrosion from nearby embedded ferrous elements are linked to this defect. The turrets brickwork had noticeably bad cracking especially on the west elevation of the North east turret where the ladder is embedded into the brickwork (photograph 5). In this area it is clear that the expansion effects caused by the corrosion of iron ladder, is jacking apart the brickwork and causing the cracking noted. The cracking also extends to the stone corbel detail (photograph 6) and in some instances causing the faces of the stone work to delaminate. This defect was clear on other elevations of both turrets (photograph 7) and there are signs in some area of the bridging stone being repaired (photograph 8), suggesting this has been a continuing problem. These areas coincide with the base of the cast iron water tank and its assumed that the tank is embedded in the wall at some point and the wall is subject to corrosion jacking effects from the expansion of the cast iron tanks.

The condition of the tanks appears aged and there are signs of corrosion due to the tanks being exposed to the elements. It's understood that this section was originally covered, therefore the corrosion may only have occurred since the roof was removed. There was also a small gap between the brickwork parapets and the sides of the water tank where debris is likely to be accumulating (photograph 9). Its assumed the water tank is either built into the turret wall at its base, or packed tight to the wall so that any expansion caused by corrosion is pushing the brickwork out and causing the cracking observed. Its critical to ensure the longevity of the turrets that the cracked brickwork and stonework is repaired by appropriate crack stitching and repointing. Although there is no guarantee that further corrosion to the water tank will not cause the next weakest part of the turret to crack further down the line. Therefore, it is recommended that the water tanks are broken apart in-situ and safely removed, prior to repairing these areas. This will allow the space to be used as a viewing platform as a part of the proposed development. Its understood that removing theses tanks is a difficult decision to be make, as the

tanks are a part of the of the original fabric of the building and if the option of keeping them in is to be pursued further, it is recommended that opening works are carried out to confirm the condition of the tank bearing detail, to gauge an idea of the repair work required. Alternatively, there is scope to rebuild it within the keep grounds for a new purpose.

Furthermore, a section of chimney appears to have locally collapsed into the North East water tank (photograph 10). It would be prudent to safely remove these elements from the water tanks and if required rebuild this area to match the South West turret.

4.0 Comparison with Mark Lovell Survey Report

The Mark Lovell Survey report appears comprehensive and it is unintended to repeat this information in a separate report, therefore it is decided that key extracts are taken from the report and commented on accordingly, based on the visual survey carried out by Michael Aubrey. These points have been divided into the following areas based on the location reference

4.1 Roof top and existing reserve store

With reference to the inner faces of the parapet walls it was observed that these areas were generally in better condition than the outer face, due to the more sheltered exposure. It was clear that the walls had generally been repointed with cement mortar, which will lead to the deterioration of the brickwork and mortar beds further down the line. In some areas there was some loose beds and spalled brickwork, which will need repairing under the initial works to protect the bathstone underneath. Eventhough it would be prudent to repoint throughout with a suitable lime mortar, it is understood that any crumbling brickwork in this area is not at risk of falling onto the road and as access is good to all walls, it may be more appropriate with regards to the budget to repair these walls when deterioration worsens.

Generally the asphalt membrane is in quite good order with only a few tears or cracks and probably dates from the late 1970's (8&9). In a limited number of places the upstand has pulled out from the parapet wall (10) and needs repairing. However, the long term function of the waterproof membrane and concrete roof slab has been very severely compromised by the insertion of numerous eye bolt fixings (11 & 12) installed into the concrete roof slab to secure the scaffolding down to the roof.

Its agreed that the asphalt has been compromised by scaffold fixings and its likely that water has penetrated the finish and worked its way into the structure, which is indicated by the damp marks to the ceiling below (photograph 11, 12 and 13).

The asphalt upstand was in poor condition, exposing the bathstone to rainwater run off. These areas appeared to be linked to the defects highlighted in the parapet survey (photograph 14) and are in need of repair.

The proposed solution needs to be suitable and functional for the intended roof top finish. Following design team discussions with input from Bauder, it is anticipated that the existing asphalt will need to be stripped off and the condition of the concrete surface assessed and repaired. The new roof waterproofing will likely be a durable bitumen membrane laid over the existing slab. Inverted insulation is intended over the roof waterproofing, to improve the thermal properties to the ground floor. With either a composite deck, paving slab or resin bound finish over the insulation.

It is useful to have various options for this matter. Design flexibility, for the roof slabs conditions and load capacity needs to be allowed at this stage, as the proposed system should not be heavier than the current system. This will become clearer when current asphalt thickness is confirmed.

These works will raise the current roof level so that the threshold between the North East access tower and the roof will no longer be level. To ensure that this step is safe for foot-fall through to the roof, relevant Building regulations will need adhering to. It is understood that in future phases, when lift access is installed in the South West tower, that the top tower landing level will be made level with the roof, to improve wheelchair access.

Upon the roof there is a small room formed from 9" brick walls with a monopitch 7" thick concrete slab roof over (13). The concrete slab is constructed from unreinforced concrete and is now badly fractured (14) and is in an unsafe condition. It has been propped with small timber sections in an adhoc manner.

Its agreed that this area is in poor condition and should be condemned unless appropriate propping and deck system is installed. As a part of the upgrade works the roof in this area will need demolishing and replacing with a lightweight timber roof. The key works will be the temporary measures involved with safely taking down this roof.

4.2 Third Floor and Underside of roof slab

The central portion of the roof slab has been upgraded in the last twenty years by the insertion of some secondary transverse and longitudinal steel and blockwork splitter structures (40).

There are numerous cracks visible to the underside of the concrete roof slab (45), signifying that the slabs are in a weakened and degraded condition. The formation of cracks will also mean that the rate of degradation of the slabs will accelerate

It was clear that the ironwork supporting the barrel roof has been upgraded in this area, by the insertion of steel elements. It's assumed that these works were carried out for a structural reason and possibly due to issues with the roof slab. It's clear that cracking is present to the underside of the roof, however it's unknown whether this has been successfully remedied by the strengthening works carried out. Cracking was present beneath the barrel-vaulted arches (photograph 15 and 16), which if recent is a concern as arches work in compression, therefore cracking should not occur unless the arch is slipping. To confirm this, it is recommended that these cracks are monitored to indicate whether the strengthening works have been successful.

There is evidence of significant water ingress through the roof slab (41 & 42) into the building fabric.

The water ingress has resulted in some corrosion of the wrought iron beam bearings to varying degrees of severity. Surface corrosion is evident and varies from minor surface pitting to the initial onset of local delamination of the body material of the members at their ends.

The full extent of the degradation and condition of the wrought iron and cast iron members will require further investigation by ultra sonic NDT techniques to confirm their quality and soundness.

It's agreed that water ingress is likely to be corroding the iron elements and ultrasonic testing is required to confirm the extent of corrosion.

A return visit was carried out on 24/02/2018, during which it had rained for most of the day. During this visit the walls were damp in areas, especially on the East elevation by the turret (photograph 17). This area coincides with a roof gulley and it's suspected that there is a drainage issue. This area was directly beneath a wrought iron beam and therefore needs investigating and repairing to ensure the beam is not subject to additional corrosion.

4.3 First and Second Floor

The floor slabs appear in general terms, apart from the first floor slab, to be in

reasonable order, being constructed from what appears to be sound concrete with some lightweight aggregates. The unreinforced slabs have developed top joints/cracks along the supporting beam lines (46). There are a few areas of local damage that will need some limited repair.

It's agreed that the floor slabs seemed in reasonable condition. A load assessment has not been made, but the proposed usage of the floors will not differ from current. Cracks were generally on beam lines, which suggests that joints have formed at some point where the slab has 'hogged' over the bearing. The slab is therefore still supported, and these types of cracks are not concerning, but should be filled.

Cracking was noticed to the underside of the 3rd floor slab and top of the 2nd floor slab near the adjoining North east tower (photograph 18). This crack suggests that the floor is potentially inadequately supported at the tower walls, alternatively this could be a joint or a crack could have been formed long ago and the building has stabilised since. Therefore, it is unknown whether this is an issue, to confirm this it is recommended the crack is monitored.

Some local investigation will be required to ascertain the bearing condition of the roof slab and floor slabs at the chamfered corner sections of the building, experience of other Keep structures has shown some places where roof and floor slabs have very limited bearings at the supports in some local areas.

There were no obvious signs of the floor slab having inadequate support at the chamfered edge, although knowledge of similar buildings should be respected, and it would be prudent to confirm this statement.

There was cracking to the brickwork bed joints, one brick course below the slab bearing at the chamfered corner section, especially in the North West corner of the first floor (photograph 19). The cause of this is unknown and the crack was damp suggesting water is seeping in. It would be sensible to monitor this to verify whether the crack is progressing, otherwise a suitable repair should be made. The outer face of this wall has a climbing vine type plant growing up the North west corner of the building and over the arched entrance. Some climbers which root in mortar beds can be very damaging to brickwork, meaning the type of plant should be identified and cut back if found to be detrimental to the wall

4.4 Ground Floor

At ground floor level four two feet square stone columns support the main cast iron columns. The capitals to these stone columns which also pick up the wrought iron first floor beams have extensive horizontal cracking which would indicate that some advanced and advancing corrosion jacking of the iron work is taking place (48, 49, 50, 51 and 52). These capitals and the incoming beams will need to have extensive repair and upgrading in due course.

The defects highlighted were noticed and cracking was present to the underside of the first floor slab around the 2 internal columns located on the Southern half of the building (photograph 20). In this area, it was clear that cracking was present on the stone capitals around the incoming ironwork beam bearings (photograph 21). The cracking on the capitals was generally to the side of the beams, which suggests outwards pressure from the beam bearings. The areas directly beneath the beams were in better condition, which suggests the beam bearing has not been compromised. It is suspected that the cracking around the capital and potentially to the underside of the floor slab is caused by expansion pressures from corrosion to the beams. This type of beam is working hardest at midspan and stresses are generally less at the bearing, meaning there is often excess material near the bearing because beams are rolled uniformly. Therefore, it is unlikely the corrosion damage is reaching the point where failure is imminent, based on the defects observed. However, it is recommended that NDT is considered within the next 5 years in the worst-case locations, to put together a maintenance plan for the long term. In the meantime, it is strongly recommended that the worst-case crack locations are monitored, in order to assess the movement rate and indicate the worst areas that need critical testing or more immediate remedial action.

The brick walls at ground floor level are quite damp and damaged, the extent of which has been compounded by the application of cement render (53 & 54). The render needs to be removed and the walls allowed to breathe properly.

For corrosion to occur at internal capital heads, it suggests the environment is damp at ground level. It's assumed that this area is used less frequently and may be less exposed to heating and ventilation, furthermore the external walls were clearly damp from the outside on all sides of the buttressed walls and the bricks appear to change colour from first floor upwards (photograph 23). Future ventilation and damp proofing is worth considering to minimise the risk of further corrosion to the ironwork and damage to the brickwork.

4.5 Condition of Ironwork and supporting walls

There are a variety of small cracks in the walls caused by the expansion forces associated with the corrosion jacking of the iron beams at the bearings. The extent of the corrosion within the embedded ferrous elements needs to be investigated in more detail. A percentage of the beams will need to be repaired at the bearings

The iron work which supports the second and third floor concrete slabs appears to be in marginally better condition than the roof slab and first floor slab levels.

It is agreed that the expansion effects from corrosion are causing the brickwork to crack around the beam bearings (photograph 22). As discussed previously, the extent of cracking does not indicate immediate risk of failure, however the worst of these areas should be investigated with NDT methods within the next 5 years to verify the extent of iron lost.

The external walls would benefit from the non-breathable paint being removed which would allow the elements to breath more effectively which in turn will reduce their background moisture content levels and hence improve the life expectancy of the embedded iron structure.

To prevent the iron bearing from continually corroding, its recommended that the bearings are repainted with an appropriate system. Its quite likely that this deterioration is due to the age of the building and as the building is regularly in use, moisture is trapped within the building and condenses on to the cold walls. To help the building breathe, the ventilation could be improved by as suggested. Interestingly the similar keep building in Devizes, has exposed brickwork in some areas, based on the estate agent photographs.

4.6 Condition of Towers and Stairs

The cantilever sandstone landings and treads are degrading and would benefit from local dressing by a stone mason to remove slip and trip hazards.

The stair cases were generally in reasonable condition. The MLDE comments with regards to treads should be considered and upgraded if more regular access to the keep will result from the proposed works. At the least appropriate warning signs should be present warning users of potential hazards with regards to the treads

The roof beam directly beneath the water tank on the North East tower was corroding and causing the supporting wall to crack (photograph 24). This area was also scaffolded and propped. This area is being upgraded as a part of the proposed works and the turret floor is to become a new viewing point with a walk on glass panel. Therefore, the existing slab and iron beam will be removed and replaced. There is scope to repair the iron beam and re-use in the proposed works.

Furthermore, some of the brickwork over the doorways into the main building from the NE tower had dislodged out of plane (photograph 25). This was quite an unusual defect and it would be prudent to bed the brickwork back into place and monitor over the next few years to see if this effect reoccurs.

4.7 Condition of Veranda

The currently unglazed verandah structure (55) needs to have the iron structure refurbished and repainted, the elements within the walls are likely to need upgrading and once carried out the glass replaced and new lead flashings appended.

Michael Aubrey agree with these observations. The cast iron columns appeared in reasonable condition but require repainting. This work is potentially hazardous, depending on the lead content of the paint, for which appropriate testing should be carried out prior to works. The timber posts supporting the end of the veranda was damp and should be replaced with a steel equivalent (photograph 26).

The header beam was in questionable condition and there were signs of damp. It would be appropriate to replace this element during the works as well. The veranda mullions will likely need individually taking down, brushed back and re-coating.

A new gutter will need to be added with a repaired rain water pipe connection. Currently the rain water pipe runs via a shallow gulley out to the road. To prevent ponding and water building up around the existing brickwork, it would be prudent in the long term to take all storm water to a soakaway, located beneath the car park. There is scope to retain a portion of the storm water to use for gardening purposes.

4.8 Rain water goods

The cast iron rainwater goods need to be completely replaced through the building on a like for like basis and at ground level suitable soakaways need to be formed (60,61,62).

Its agreed that ironworks have corroded and become damaged at connections. Bracket fixings have come away from the wall or caused cracking to the brick. Given the damp condition of the bottom storey of brickwork, it would be prudent to divert all storm water to a suitable soakaway.

5.0 Summary

The key points have been listed below to confirm the areas that need attention or further investigation.

1. Its appreciated that the key requirement is to get the roof scaffolding removed so the rooftop can be developed, for which the following works are required
 - a. Damaged and delaminating bath stone to both the main parapet and turret coping detail will need a suitable repair mortar and reinforcement. As this is a specialist material, it may be worthwhile consulting a specialist contractor to assess these areas pre-tender, to assist with preparing a suitable specification.
 - b. All cracked brickwork, will need suitable crack repair and stitching works, with helical bars grouted into mortar beds, especially around the tower areas.
 - c. The outer parapet brickwork will need repointing with a suitable lime mortar. Spalled brickwork will need replaced with suitable units
 - d. All embedded ferrous elements such as rain water pipes and ladders will need to be replaced or repaired and re-fixed to the walls.
2. Due to the maintenance required to keep the water tanks in place and the potential corrosion issues imposed on the surrounded brickwork, it is recommended that the existing tanks are safely cut apart and removed by crane. Once removed the condition of the existing turret slab can be confirmed and the relevant upgrade works can be carried out to suit the proposed plans. Its appreciated that these tanks are a part of the building's heritage and its understood that these are going to be rebuilt, repaired and re-used on the surrounding grounds to the keep. To facilitate removal works, it is anticipated that opening up works will be required to confirm how the tank sits on the supporting turret.
3. Once points 1 and 2 have been carried out the scaffold can be removed, and the following items need to be discussed with regards to proposed roof works.

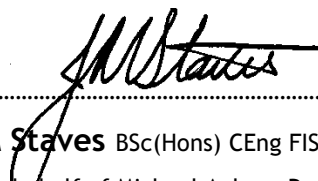
- a. Roof Finish - Due to damage from eyebolts and deteriorating upstand details the current asphalt finish will need to be stripped off and replaced. From advice sought from Bauder flat roof systems, several options have been given (see Appendix C), although the final decision on the proposed finish is yet to be made.
 - b. Proposed roof development - The current concrete ammunition store roof will need safely demolishing and replaced with a light weight timber roof. It is understood that the current building is to form the new café area.
4. Throughout the building there were areas of wall and slab showing signs of cracking. It is unknown whether this cracking is historic and has since stabilised or whether movement is still occurring. To confirm this and therefore be able to specify and carry out the appropriate repairs or identify further investigation required, it is recommended that the worst case locations are monitored with Avongard Tell-tales for a 6-month period.

These areas have been indicated in the crack monitoring schedule contained in Appendix D

5. There were signs of corrosion to iron elements, which is causing expansion type cracking to supporting walls and capitals and potentially reducing the capacity of the beams. As discussed in the report, corrosion appears to be worst at the bearings. The beam bearings are generally less susceptible to material reduction from corrosion in comparison to further down the span of the beam, where stresses are higher. Based on the defects observed, the extent of corrosion does not appear to be at a point where the structural integrity of the element is flawed. However, this defect will get worst and NDT investigation works in the worst-case areas should be considered within the next 5 years. This will verify the extent of damage and enable the client to plan and programme when critical repairs will need to be made. This will also assist with the long-term cash forecast. In the meantime, crack monitoring shall be carried out and if this investigation proves to be adverse, NDT investigations may need to be carried out sooner, to assist with urgent repairs.

6. There are signs of damp throughout the building, especially in the top and bottom storeys. Excessive moisture is damaging to the ironwork and needs better regulation to control this. Re-roofing works and replacing or redressing existing rain water goods will reduce water damage within the top storey. Otherwise passive ventilation needs to be considered especially at ground floor, where the sloped walls appear to absorb a higher proportion of water. Other options such as stripping back moisture barriers such as render and internal painted brick, may also be considered, to improve the air flow in the walls.
7. With regards to the veranda. Timber elements will need to be replaced with corrosion protected steel. Otherwise other elements should be temporarily removed, assessed for re-use and repaired accordingly. It is anticipated that ironworks will need brushing back and repainted
8. Dislodged bricks over door lintels to be repaired
9. Storm water chutes to be taken to a suitable soakaway via gulley's, to keep water away from the building.

We trust you find the report self-explanatory and look forward to discussing in further detail next Monday, however if we can offer any further advice or assistance, please do not hesitate in contacting the undersigned;

Signed: 

John M Staves BSc(Hons) CEng FStructE

For and on behalf of Michael Aubrey Partnership Ltd

Date: 09th March 2018

Signed: 

Oliver R Goodyear MEng(Hons)

For and on behalf of Michael Aubrey Partnership Ltd

Date: 09th March 2018

6.0 Appendix A - Reference Elevations

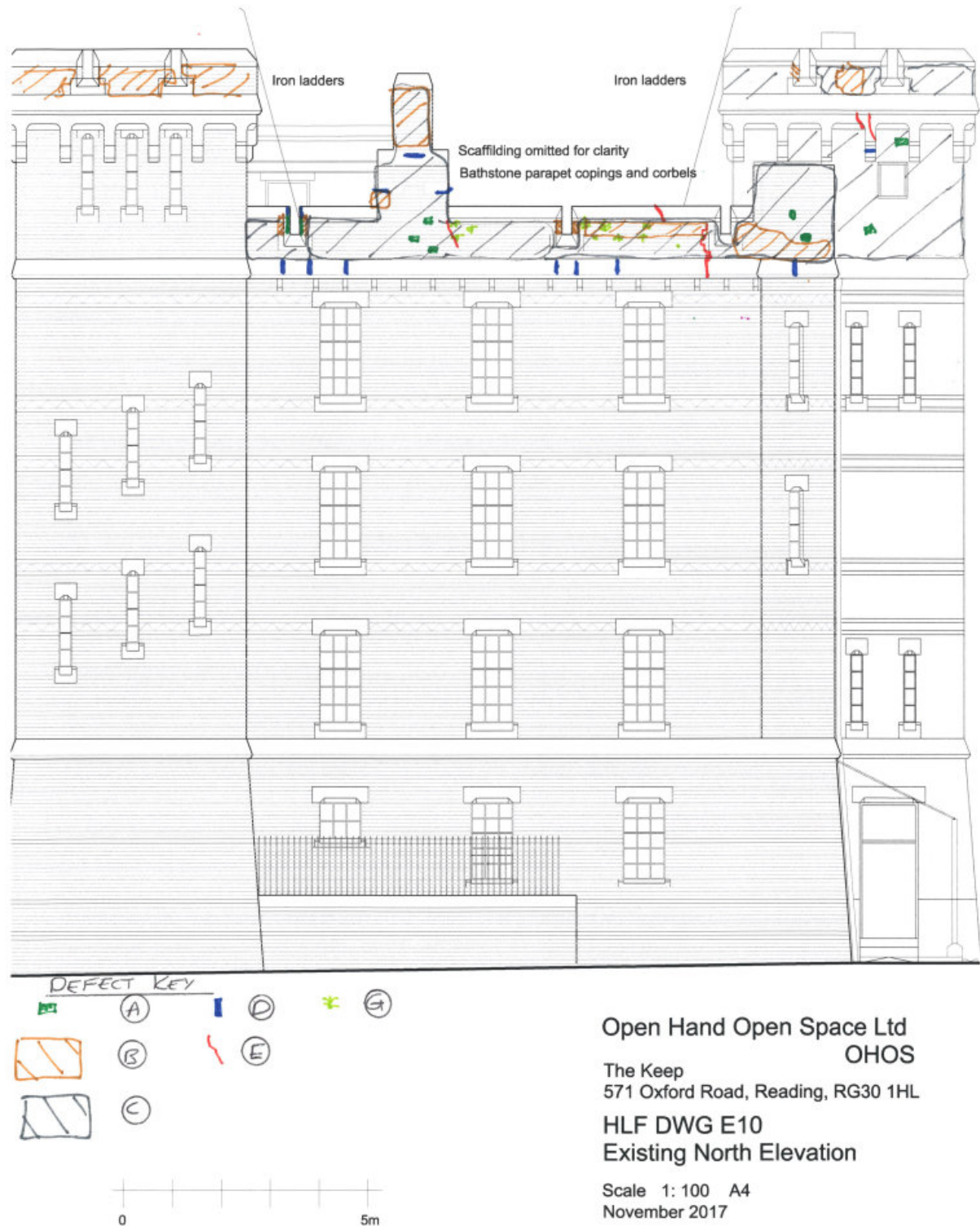


Figure 1 - North Elevation

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Brock Keep, 571 Oxford Road, Reading

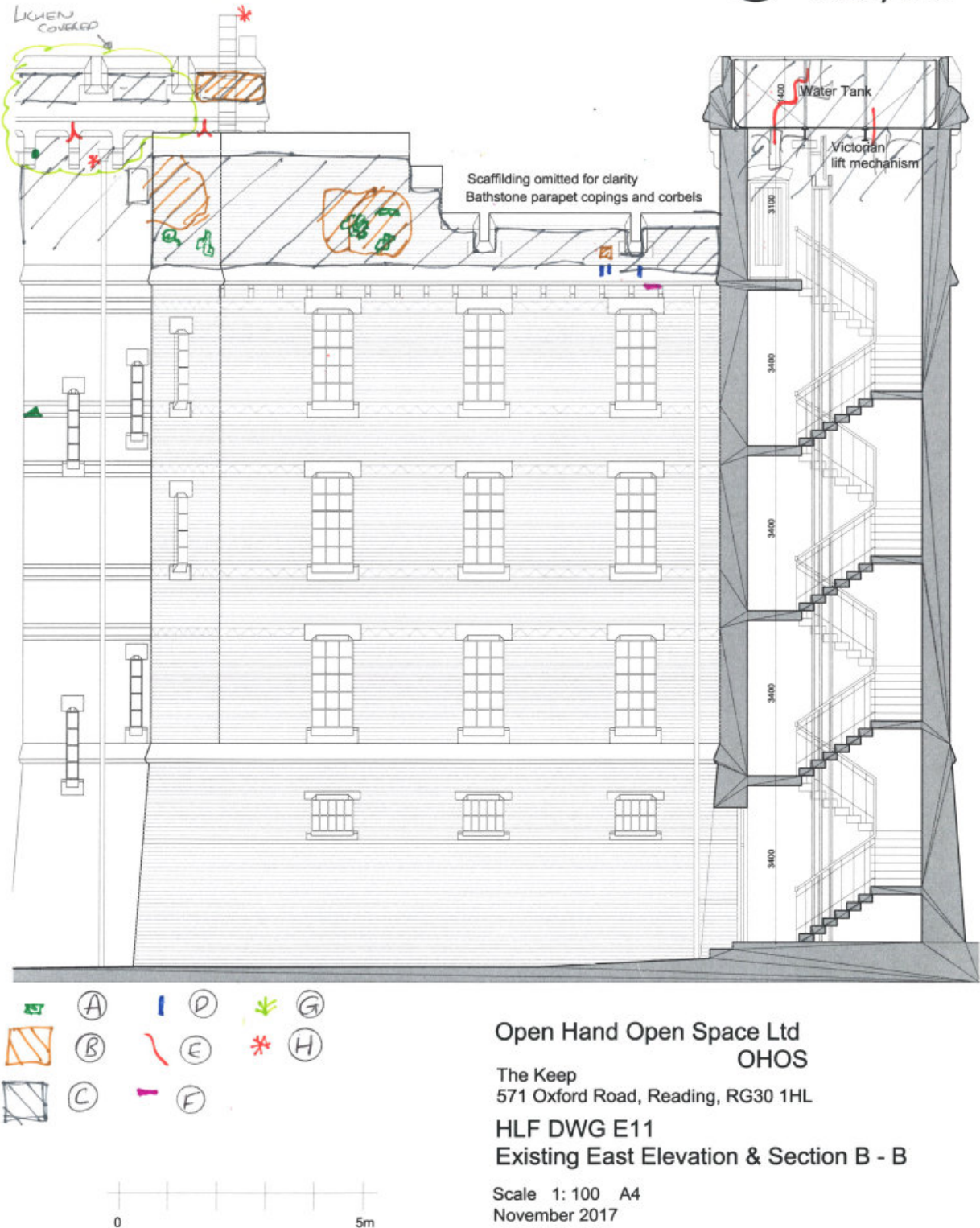


Figure 2 - East Elevation

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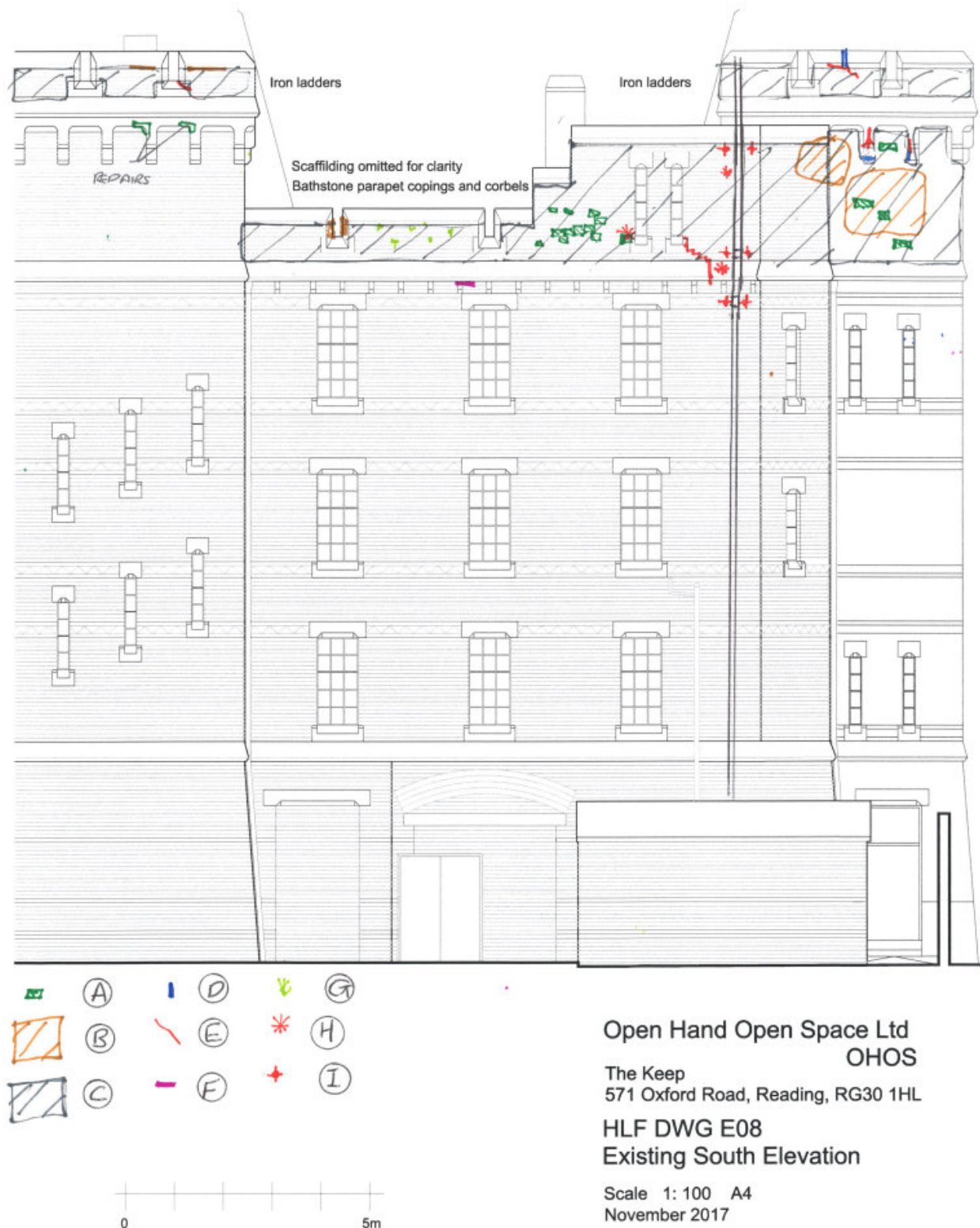


Figure 3 - South Elevation

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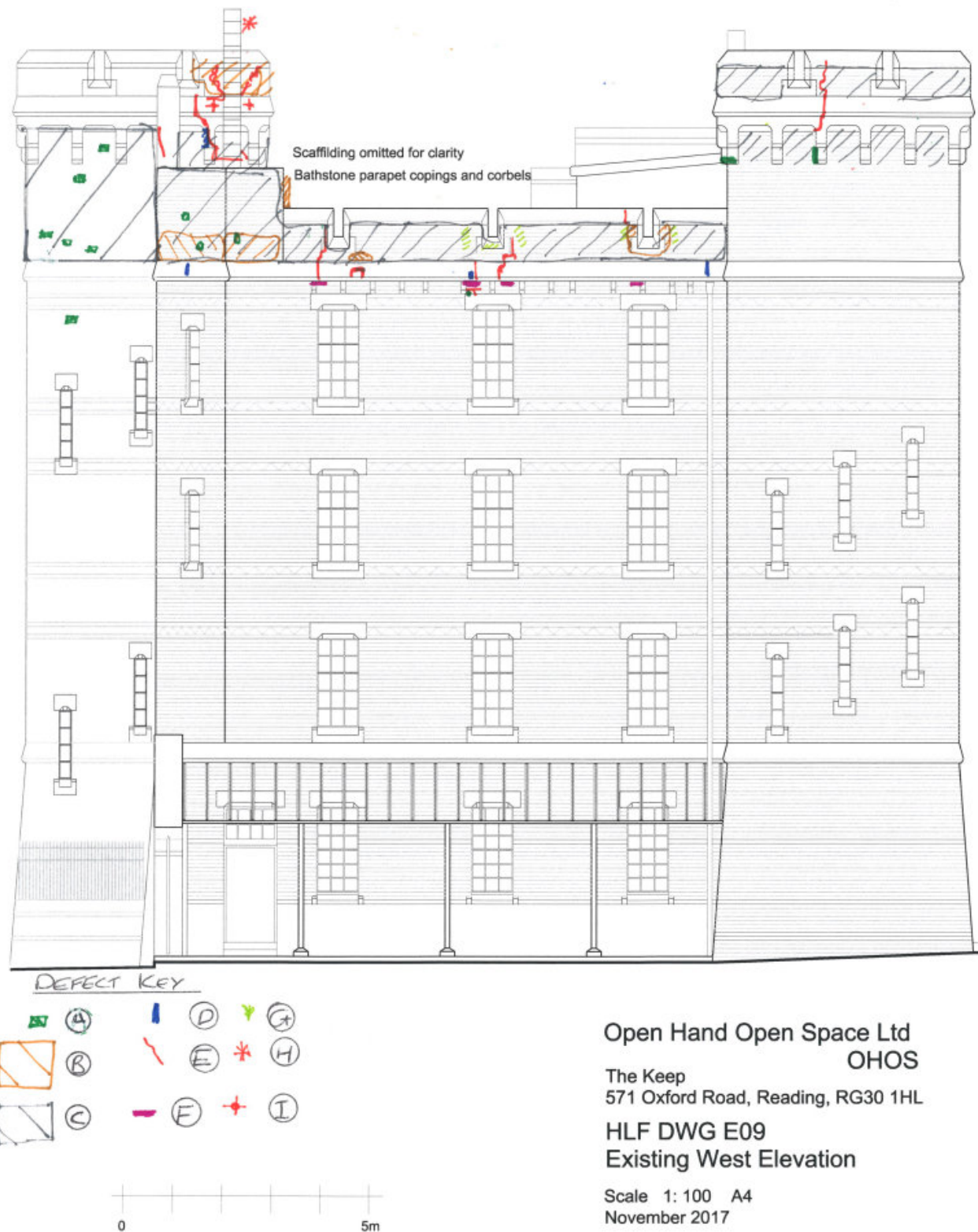


Figure 4 - West Elevation

7.0 Appendix B - Photographs



Photograph 1 - Brickwork erosion from cement mortar works



Photograph 2 - Bathstone eroded beneath castellation



Photograph 3 - Under side of bathstone delaminating beneath eroded cracked area



Photograph 4 - Cracking to parapet walls



Photograph 5 - Cracking to brickwork turret at ladder fixings



Photograph 6 - Cracking to bathstone corbel beneath turret parapet and delamination of corbel side



Photograph 7 - Cracking to bathstone corbel beneath turret parapet



Photograph 8 - Repair to bathstone



Photograph 9 - Gap between water tank and parapet



Photograph 10 - Collapsed chimney stack within water tank



Photograph 11 - Scaffold eye bolts penetrating the roof finish