

HERITAGE IMPACT ASSESSMENT -

To Support a Scheduled Monument Consent Application for:

The conservation-led redevelopment of the Patternmakers & Carpenters Workshop, including reinstatement of the roof structure, extensive fabric repairs and new visitor interpretation facilities.

Background:

The standing remains of the Patternmaker's and Carpenters Workshop in conjunction with the Foundry and Blast Furnace No1 represents the core grouping of buildings and the original location of Brymbo Ironworks (The Plasnewydd Works). The objective of this Brymbo Heritage Trust commissioned project is to repair and reinstate lost building elements and details to the Patternmaker's and Carpenters Workshop whilst also seeking to accommodate new interpretation installations as part of a larger conservation-led redevelopment project that will become an integral component of the visitor journey and understanding of this site of high heritage value. The proposals seek to reinstate lost elements of the building fabric by utilising the evidential value gained from documentary sources and photographic records to avoid conjecture. The application for Scheduled Monument Consent also relates to a range of maintenance, safety and masonry repairs that are necessary to consolidate the standing remains of the Foundry and to Blast Furnace No1, but also structural repairs at the base of the existing cupolas. The submission includes details of a new surface to receive visitors, but also to protect and conserve the archaeological potential of the earlier floor surfaces to the Foundry. Future details and information associated with the interpretation strategy and any permanent installations will need to be submitted at a future date.

Summary Statement of Significance:

Cadw Reference ID – DE202

Location - Easting: 329455 Northing: 353526

Brymbo Ironworks – Designated SAM

Date of Designation – 07.11.91

Background

The Former Brymbo Ironworks, (now referred as Brymbo Heritage Area) occupies approximately a fifth of the original Brymbo Steelworks site at the time of its closure in 1990, but retains at its core the buildings, structures and artefacts of greatest historic significance, together with a legacy of industrial innovation and opportunity that began in 1792 when John 'Iron Mad' Wilkinson (1728-1808) purchased the 500-acre estate of Brymbo Hall and utilised the raw materials available locally to produce iron and steam power to provide 'blast' for the furnaces. During the 1840's Henry and Charles Edward Darby, descendants of Abraham Darby of Coalbrookdale managed the works, which was under the ownership of Scotsman, Robert Roy. He in turn appointed Henry Robertson in 1842 to appraise the works and produce plans that also concluded that a railway was essential for the continuing development of the works. The Brymbo Mineral and Railway Company was established in the same year, while the North Wales Mineral Railway Act of 1844 facilitated its construction. Numerous process and product developments and efficiencies were made in subsequent years and in 1883, an experimental Open-Hearth Steel Furnace was erected before The Brymbo Steel Company was incorporated and steel production commenced in 1884 at this location.

The significance of change to the topography and its impact on the setting during the last 300 years cannot be underestimated. This has been a very dynamic landscape where the buildings and structures of the site have changed because of technological innovation, the refinement of processes together with the economic fluctuations in the National and International demand for iron and steel.

Notwithstanding the heritage values associated with the wider post-industrial landscape setting the standing remains, together with the hidden evidence of human activity on the site is **High** and of **National Significance** and in many ways of **International Significance**. This is already reflected by the Scheduled Monument designation afforded to The Heritage Area and the Grade II* Listing that has been placed on The Agent's House.

As the impact of the heavy industry has diminished, so nature has gradually encroached to recolonise areas of the site, to an extent that the wildlife and ecological value is also increasing in significance with **Nationally Protected Species** now occupying the ponds, woodland and open areas of vegetation vacated by previous uses. During 2005, the remains of a Fossilised Forest of **Outstanding International Geological/Palaeontological Significance** was exposed within the boundaries of the site.

Brymbo Ironworks –

The Patternmaker's and Carpenters Workshop, The Foundry and Blast Furnace No.1

Following an initial phase of activity, following the purchase of Brymbo Estate in 1792 and the creation of The Plasnewydd Ironworks that saw the construction of a Blast Furnace, Charging House, Cast House, Blowing Engine House and Puddling Forge. The business experienced a number of peaks and troughs, through until 1840 when 'The Brymbo Company' was formed, with William and Charles Darby, descendants of Abraham Darby, taking over the site's management. Charged with managing and developing the ironworks, the Darby brothers, commissioned a new Foundry and Machine Shop (now the Carpenters and Patternmakers Workshop) in 1843, which remain today. This work made material alterations to the Cast House, removing the gabled south elevation and inserting new archways onto the east and west walls. In 1847 a new blowing engine was installed, raising the output of the blast furnace from 50 to 84 tonnes per week.

The Patternmakers and Carpenters Workshop

The Patternmakers and Carpenters Workshop is located to the rear of the lower site, adjoins and forms the south wall of the Foundry. Sits to the west of the 1921 Machine Shop. The building is divided into the smaller western unit, being used by the carpenters, and the larger eastern storeyed unit, in use by the patternmakers.

The building is constructed on a split level, cut into the hillside to the west. The western end of the upper floor being founded on the higher ground level. Access to the building can be made to the lower level from the north and east, and the upper levels from the south and west. In 2015, the roof was removed due to the collapse of several trusses.

The eastern elevation, also being the principal, has a large arched central entrance and a smaller stone lintelled doorway at ground-floor level with a brick-blocked window above; to the opposite side of the central doorway a sill and higher lintel remain; at first floor level the elevation has a central arched loading door and square fixed-light windows to either side, an ocular window is located under the apex of the gable. The gable is finished with decorative string, running into kneelers. The large arched doorway allowed machining equipment to be easily installed into the building.

The north elevation is shared with the Foundry. This elevation has a single entry at the midway point, which allows access between the Patternmakers Workshop and Foundry; this being a later insertion, made evident by the cut to the stones of the reveals. At ground floor level, an inserted brick-arched doorway once gave access to the east end but was latterly bricked up. Over this, an original window to the first floor has been similarly blocked. To the west of the doorway, an arch at ground level suggests that there may be an unknown lower level to the Patternmakers Workshop. A further brick-arched doorway to the east of the central doorway, has been blocked. The west of the elevation is formed of three arches at ground floor level; the eastern two once housing machinery/ventilation equipment, the western most serves as an outlet for a mining adit; large steel doors hang to the central archway. To the wall tops scars help identify where the bearings of the 1960s steel roof once rested. Patches of red brick beneath

the wall tops may indicate the location of previous tie beams for the earlier roof. Layers of limewash survive to the elevation. The southern runway of the south crane runs in front of the elevation.

The south elevation has been altered with an extension to the first-floor (although at a ground-floor level), which has four 12 pane square windows, two either side of central doorway, and four later 6-pane windows in the later phase. The doorway was once a window, with the original dressed stone reveal of the window remaining in place; as this doorway is at first floor level a small run of steps once provided access. An inserted doorway to the ground floor has a red brick head and later red brick blocking, is not partially covered by a raised ground level or possibly backfilling to small set of steps. To the top left of the blocked doorway is a similarly formed and blocked window(?). Evenly spaces at mid-height level to the east end of the elevation are three red brick patches, likely caused by the replacement of several transverse beams to the second floor. To the east end, a large iron tie has been added to stabilise the end of the building. To the same end, brick scars to the corner give evidence of a later extension to the south of the elevation. A large iron bracket is attached at mid-height beneath the eastern most window, supplied a line shaft drive to the working area. From the south elevation projects a sandstone, red brick and concrete structure, which steps to its top.

The west elevation has a double central doorway.

At ground floor the building is entered from the north and south; a single doorway to the north elevation provides access to the Foundry; the smaller doorway to the east elevation provides access to changing/locker rooms. The large entrance provided access into a passage with caged storage, with stairs to the first floor, to the south and washroom(?) ahead, the passage then passes to the south of this and into a rear chamber. From this rear chamber, doorways to the south of this area provide access into storage rooms; to the north doorways provide access into the Foundry and to a tearoom(?). A large cast concrete block has been added to the north-west corner of this area to stabilise a subsiding wall, alongside a machine base. Timber and acrow props currently support the first and second floor throughout.

As a result of continued decline, in 2015, the roof was removed, and remedial works undertaken to stabilise the masonry. This entailed the removal of the roof, the dismantling of unstable secondary brickwork from a number of locations on the wall heads, extensive wall head capping, the reduction of the gable to the dividing wall, the rebuilding of some collapsed ashlar above the western doorway and extensive bracing works to the east and south elevations.

The Foundry

The Foundry, also referred to as 'Top Foundry', was added to the south end of the Cast House in c.1844 to provide space for castings to be made. It was commissioned by the then managers of the works, Henry and Charles Edward Darby, descendants of Abraham Darby of Coalbrookdale. Its construction is coeval with the Machine Shop, which forms its southern elevation. In 1943, two overhead travelling cranes fabricated by Joseph Adamson & Co. Ltd. were installed to lift crucibles of molten steel, produced from scrap, to be cast into ingots for further processing.

The building is constructed of large, dressed sandstone blocks, bonded in lime mortar beds, with brick archways to later, or possibly enlarged openings and repairs. The corrugated iron roof of the Foundry collapsed under heavy snow in 2013 and the building has been roofless since it was carefully removed, and the wall heads consolidated in 2015.

The north elevation exists only to the eastern end, the remained being open into the Cast House, and is the only external elevation to the Foundry. This elevation is obscured at low level by a red brick control/fuse room (B14), which once served the travelling cranes in the Foundry. To the wall top, four courses of red brick remain after the eaves were raised to accommodate the new roof in 1943.

The north internal elevation is a reflection of its external face, albeit with four joist pockets of unknown use. Part of the northern travelling crane runway passes in front of this wall. The east end of the wall is of brick, which has been used to tidy the wall end after the original elevation of the Foundry was removed.

The south internal elevation is shared with the Machine Shop and as such forms its north elevation. This elevation has a single entry at the midway point, which allows access between the Machine Shop and Foundry; this being a later insertion, made evident by the cut to the stones of the reveals. At ground floor level, an inserted brick-arched doorway once gave access to the east end but was latterly bricked up. Over this, an original window to the first floor has been similarly blocked. To the west of the doorway, an arch at ground level suggests that there may be an

unknown lower level to the Machine Shop. A further brick-arched doorway to the east of the central doorway, has been blocked. The west of the elevation is formed of three arches at ground floor level; the eastern two once housing machinery/ventilation equipment, the western most serves as an outlet for a mining adit large steel doors hang to the central archway. To the wall tops scars help identify where the bearings of the 1960s steel roof once rested. Patches of red brick beneath the wall tops may indicate the location of previous tie beams for the earlier roof. Layers of limewash survive to the elevation. The southern runway of the south crane runs in front of the elevation.

The west internal elevation is largely dominated by the two bricked archways to the cupola furnaces. A third archway to the north of the elevation, now bricked up, has doorway accessing a vaulted storeroom. A doorway between southern and middle archways provides service access to the sides and rear of the cupolas. From the Foundry floor, a doorway, to the south of the north archway, provides access via concrete steps to the raised level to the west of the Foundry. Two buttresses of brick have been added at different periods to provide stability to the wall, presumably as a cause of inward movement after the addition of the first cupola furnaces; a large iron bracket secures the frame of the overhead crane to the northern buttress.

The floor of the Foundry is now covered in a temporary surface of Terram and quarry stone to cover the uneven floor surface and casting pits below. This has enabled the structure to be bought back into use as an outdoor venue.

Blast Furnace No.1

Old Number One of approximately 1820 is constructed to the rear of the lower part of the site, with sufficient rise behind for the construction of its Charging House, which obscures its west elevation; the north elevation is partially covered by the Winding Slope. Measures c. W 11mxD 11m x H 14.5m. Latterly used as a hopper for green sand.

The furnace is constructed of large, dressed sandstone blocks, bonded in lime mortar beds, with an interior lining of fireclay brick; the lining usually being replaced at 5 year intervals. The furnace tapers as it rises over the first 8.7m in height, before continuing vertically to its apex at 14.5m.

There are four arches at ground level, three of which (north, east and west) enabled blown air to the furnace through three tuyeres (pronounces 'tweer'). The fourth arch (south) faces into the cast house, where the molten iron was tapped into pig iron beds.

The east elevation has a large repair of black slag bricks. The arch to the east elevation has a red brick lining. 10 large iron ties to each corner provide support to the structure. To the top of the elevation are iron brackets, which support the remains of the bell-top. A stone 'pillar' forms the lower quarter of the south-east corner.

The north elevation is largely obscured by the Winding Slope. 10 large iron ties to each corner provide support to the structure. To the top of the elevation are iron brackets, which support the remains of the bell-top. The top 12 courses of the stonework are bulging.

The south elevation faces into the Cast House. The sandstone arch is supported by a brick arch, and once allowed access to the tapping hole to cast the molten iron into the pig iron beds; this is now blocked with cement blocks to create a storage room. 10 large iron ties to each corner provide support to the structure. To the top of the elevation are iron brackets, which support the remains of the bell-top. The scar of the Cast House roof can be seen. The lower south-west corner has been repaired in red brick. A vent pipe runs from the store to roof level. This elevation was whitewashed within the foundry.

The west elevation is obscured by the former Charge House. Large iron ties to each corner provide support to the structure. To the top of the elevation are iron brackets, which support the remains of the bell-top.

Internally the firebrick lining is covered in iron slag. An iron lintel sits above the southern archway, which is likely to have been water cooled. Greensand remains in the bottom of the furnace from its time as a sand hopper to the Foundry.

(the above descriptions are taken from the Phase 1: Version 2 Archaeological Assessment and gazetteer prepared by ArchaeoDomus in December 2019)

There is a high potential of encountering archaeological deposits beneath the current working surface of the Foundry. Whilst there is a poured and slabbed concrete floor beneath the current surface, it is not known whether this has disturbed the original foundry floor and casting troughs. As such, any works within the Foundry should be subject to an archaeological evaluation in advance of any development, to explore the potential for survival of earlier surfaces. The Archaeological Potential of No1. Blast Furnace is derived from the structure itself, though there is the potential that the foundations were reused from Wilkinson's original furnace. There is a moderate potential of encountering features of both buried and structural archaeological of historical significance within the Patternmaker's and Carpenters Workshop and within the fabric of the building there is the potential for the uncovering of industrial artefacts pertaining to the buildings original use, such as machine bases, industrial deposits associated with machining, or evidence of their means of power.

The Proposals:

The project objectives are to reinstate known elements of the building fabric to the Patternmaker's and Carpenters Workshop that were temporarily removed in 2015 for reasons of safety, because of the very poor condition of the existing roof covering and structure and the collapse of the adjacent Foundry roof structure that had occurred prior to this date. It is intended that the focus will be on repairing the building fabric including windows, doors, finishes and fittings where practicable on a 'like for like' basis. The roof structure can be reinstated accurately as a result of the photographic record that is available and from the retention and storage on site of some key items, such as the roof trusses from the east end of the building and the modified truss at the chamfered apex detail at towards the west end of the building. The proposals seek to provide a new beneficial use for the Patternmaker's and Carpenters Workshop, by becoming an integral component to describe and to, convey the main stories, history and interpretation for the site of Brymbo Iron and Steel works – 'Stori Brymbo'. These proposals seek to provide access, both physically and intellectually to the building and will ensure that the recognised heritage values of significance are better appreciated

Ultimately, the works to the Patternmaker's and Carpenters Workshop, will allow enhancements to be made that will make a positive impact on the setting of the other buildings/structures of high significance that are associated with the Scheduled area of Brymbo Ironworks. It is anticipated that the repairs will enhance the interpretation of the Evidential value of Brymbo Ironworks but will also enhance the Aesthetic and Communal Values that are directly linked to the experience of visitors.

The photographic record that exists of the Patternmaker's and Carpenters Workshop, prior to the temporary removal of the roof covering and structure in 2015 is sufficient to ensure that it can be replaced with historical accuracy. The evidence within the documentation, contemporary oral accounts and the retention of some roof trusses and roof covering materials on site will enable existing details, to be reconstructed or replicated without conjecture. It is intended that the best of the existing slates and clay ridge/hip tiles will be reused and supplemented where necessary with new that match in dimension, style, colour and texture with that of the existing. The photographs taken, prior to the removal of the existing roof structure implies that no rainwater goods were fitted to elevations of the Patternmaker's and Carpenters Workshop originally therefore, this detail will be retained. Allowing rainwater to discharge directly to ground on this occasion will also reduce the archaeological impact and need for excavations to be created for the installation of. It is intended that the underside of the slates will be torched with a haired, lime render and ventilator and flue details will be reinstated.

The existing trusses where practicable (following a detailed structural inspection) and the associated cast iron connector plates and shoes, together with the wrought iron tie-rod will be reused. It is likely that the cast iron fittings will be reused in their entirety and will all be refitted in their original locations at the east end of the building. In addition, and as a strategy to reduce the

outward thrust of the roof construction on the outside walls, it is proposed that new yoke fittings will be designed and fabricated to introduce an eaves beam as opposed to a ridge board into the structural design of the future roof construction. It is perceived that the material change to the roof design will have little evidential and aesthetic impact on the whole, (particularly as most of the existing roof construction is being renewed in the first instance), but will provide benefit to the retention of the original perimeter wall details, its evidential value and the integrity of the whole by reducing the risk of more invasive structural intervention being necessary for the purpose of these repair and redevelopment proposals, but also in the future. Lintels at window and door openings will be replaced on a 'like for like' basis.

The proposals will reintroduce the part-timber boarded linings that are visible in photographs that were taken prior to the closure of the steelworks in 1990, together with the lifting beams that are visible with their associated metal straps and fittings.

In many instances, it will be necessary for the head of the perimeter walls to be built up in either solid brickwork or sandstone on a 'like for like' basis, that in turn will accommodate the large wall plate that was present. It is important that details are reinstated accurately, and it is noted that the wallplate to the angled gable at the south west corner of the building is triangular in section. In the same location, the modified truss where the footprint of the plan tapers has been retained on site and can be reused or repaired on a 'like for like' basis. Since the collapse of the original roof structure to Patternmaker's and Carpenters Workshop, temporary structural steel support/props have been fixed to the external walls in the same location. Further to a structural review of the overall condition of the building on completion of the works, it is proposed that these temporary support measures will be removed, and the fixing locations will be made good. In conjunction with these proposals, designs have been developed to introduce tie rods into the construction of the building above the vaulted, brick-lined ground floor spaces and the upper ground floor accommodation towards the west end of the building. It will be necessary for the repairs to be undertaken with Archaeological supervision on site as the sub-floor construction, and/or the likely nature of the fill material is yet to be determined and may contain information (though out of context) that relates to the earlier phases of development at the site of the Plasnewydd Ironworks. Whilst the proposal is an invasive structural intervention, it is proposed that these concealed details will assist with the overall stability of the remaining stonework at the west end of the building.

It is also proposed that the temporary structural steel propping will be removed from the east facing gable elevation. The steelwork is currently spanning between the Patternmaker's and Carpenters Workshop and the later Machine Shop to stabilise the freestanding masonry of the gable. It is proposed that the existing lifting beam component should be retained as this is a detail that was present, prior to the closure of the works.

The scope of the maintenance tasks and more significant building fabric repairs will include brickwork and stonework repairs, prior to the repointing of all four elevations where mortar has eroded or has failed and the rebuilding of a stonework intermediate wall that will again carry and stabilise the design of the roof structure. Windows and doors will be repaired on a 'like for like' basis. It will be necessary for most windows to be temporarily removed from site to be overhauled and repaired and the cast iron profiles, details and fittings where applicable will need to be cleaned back to bare metal, before a detailed inspection is made and the final scope of repairs is approved. Historical ironwork fixtures and fittings that are embedded in the walls of the Patternmaker's and Carpenters Workshop will be retained in-situ, cleaned and protected. Details for the reinstallation of the external steps, together with the internal staircase are still to be developed and refined.

The currently very poor condition of the building is reflected in the extent of the structural repairs that are now required to the internal floor structures, fixtures, fittings and finishes. Significant work is proposed to repair the intermediate floor structures within the building. Materials, dimensions and cross-sectional profiles should be replicated on a 'like for like' basis. At this stage, it is not

anticipated that significant change is proposed to the building interior, other than to stabilise its condition, to make safe and to return into beneficial use as a 'watertight shell'. Where known fixtures have temporarily been lost, it is anticipated that these will be reinstated incrementally.

As the roof structure was removed from the building some years ago, the timber block floor finish to the workshop at the west end of the building has expanded, distorted and deteriorated considerably. A programme of repair is proposed where it is hoped that the position of the existing blocks can be recorded, carefully lifted and gradually dried under controlled conditions. It is likely that some replacement blocks will be required (percentage not currently known) and will need to be refinished, before being reinstated on a prepared base construction. Despite early enquiries having been made, further investigations are required before a detailed methodology can be finalised and agreed with key stakeholders.

As part of the process for returning the Patternmaker's and Carpenters Workshop to a beneficial use, it is proposed that the building will be integral to conveying the interpretation of the Scheduled Heritage Area in the context of the 'Stori Brymbo' offer to visitors. The building will also be utilised and developed as a site archive and in time will accommodate the collection of 'timber patterns' that are retained on site. It will be a focus for visitors to learn about the site and to enhance their understanding or Cultural Value of the context. The design proposals will be developed to incorporate some building services that will include, lighting, small power, data, fire detection, heating, hot + cold water and ventilation. A coordinated strategy is yet to be produced as the priority is to ensure that the existing structure and building fabric is consolidated and repaired. The approach being adopted will mean that the 'new' services will stand independently of the 'old' building fabric or discreetly concealed in order that this distinction will be clearly identifiable within the detail and use of materials that is proposed and will therefore not significantly interfere with the understanding and appreciation of the building to visitors. Where fixings might/will be required, these will be made on each occasion into masonry joints. The proposals are not perceived to have a significant impact on the existing. No further historical material will be lost and the new is always an addition that can be changed or removed at a later date without damaging the historic building fabric.

Natural building materials that are vapour permeable and generally contain low levels of embodied energy will be selected, to ensure that the conservation of the existing Patternmaker's and Carpenters Workshop will remain the highest priority. Materials will be sourced responsibly with care taken to limit extended supply chains. Certified suppliers will be used to ensure that materials and products used are sourced of manufactured ethically, particularly where it can be demonstrated that environmental impact can be minimised.

Efforts are proposed, and measures taken to responsibly and objectively manage energy use. Whilst significant changes to the historic building fabric is not feasible without altering the character and therefore the significance of Patternmaker's and Carpenters Workshop, the interior will be heated to varying degrees by means of an air source heat pump. Alternative servicing strategies have been considered with a Low Carbon Option Appraisal, and the selected approach providing the best balance between retaining the heritage values of the site, whilst considering future energy performance, running costs and emissions. A detailed installation strategy has also been considered, to ensure that services are only attached to the new elements of work being introduced.

Beyond the immediate works to repair the Patternmaker's and Carpenters Workshop a range of repairs and a new surface finish it proposed to the standing remains of the Foundry, the supporting structure to the Cupolas, and to No.1 Blast Furnace. The main scope of work at this time is focussed on the structural repairs that are required to the steel structure that support the cupolas beyond the west wall to the foundry. Please refer to the proposals that has been developed, where new supplementary steels and bearing points are introduced to support the

existing concrete roof structure (upper ground slab) above the furnaces used latterly within the foundry. An Archaeological Watching brief will be provided in accordance with the archaeological specification that is set out in Appendix – D, specifically in relation to recording the existing and making a record of the works available for archival purposes in the future. A range of masonry consolidation and repointing repairs are proposed to the existing walls of the foundry, the remains of the cast house and to No.1 Blast Furnace. Please refer to Appendix – E for outline specification details. Some metalwork repairs are also proposed to the cast iron tie plates and to the ironwork at the top of the blast furnace. It is proposed that the secondary safety fixings will be designed discreetly with low visual impact. The purpose of the fixings would be to reduce the risk of the fittings from falling away from the masonry, should the tie rods have corroded. The ironwork, including steel plate and the need for repairs to be undertaken to metal gallows brackets will occur on a 'like for like' basis. Access has not been possible to date and a full schedule of repairs can only be developed and agreed once a safe working platform can be made available. The scope of work will include the removal of vegetation the archaeological recording of the existing architectural detail before developing the repair methodology for approval purposes.

During the last decade, a layer of clean stone has been placed within the Foundry and the remains of The Cast House to protect earlier surfaces. It is proposed that the surface will be replaced with a bound aggregate finish on a geotextile layer that would offer barrier free access to a wider range of people. The earlier floor surfaces within this area of the site are of high significance and the relatively undisturbed nature of this location determines that it is also of high archaeological potential. The scope of the work will require the careful removal of the existing clean stone, without disturbing the finishes/surfaces and features beneath; before introducing a layer of geotextile as a demarcation line and the new bound aggregate surface as described within the TACP hard landscaping proposals. With the correct supervision and the implementation of an archaeological watching brief while the works are being undertaken, the risk of damage to earlier floor surfaces is low, therefore the risk of devaluing the evidential and historical values of this location is also low. It is imperative that the archaeological potential of the site is not diminished because of the works being undertaken to repair the standing structures.

Access Statement:

The nature of the works to provide a new beneficial use for the Patternmaker's and Carpenters workshop does seek to provide barrier free access to the building to access the visitor experience offering. A broader strategy to provide access to this terraced and undulating site is being considered to ensure that sufficient provisions or adaptations are offered to better align with The Equality Act 2010. The enhancements will have a neutral impact on the building and setting with aspects of significance such as the aesthetic and communal values being significantly improved due to improvements being made to both physical and intellectual access. Signage and information boards will have a minimal impact on the aesthetic value. Where required for statutory and wayfinding purposes it will always be offered bi-lingually. A similar approach will be offered in respect to interpretation, with the use of braille, audio guides or the use of other media and apps. where choice will be available for visitors to access information on various platforms and different ways.

Please refer to the specific section and to the broader site strategy of the Access Statement prepared by TACP that is to be found in Appendix C.

Assessment of Heritage Impact:

The maintenance, repair and redevelopment proposals have been aligned to either offer a Neutral or a Positive impact to the historic remains of the building fabric and to the setting to The Patternmaker's and Carpenter's Workshop within the Scheduled Area of Brymbo Ironworks as a whole, together with the wider landscape setting. The reinstatement of the lost roof coverings, chimneys and structure will be a significant milestone that will significantly enhance the evidential value and current understanding of the buildings. The proposals will assist to safeguard the future of these otherwise vulnerable buildings. Long-term this is an initiative to broaden the access opportunities available to visitors, where, it is hoped that the aesthetic and communal values of the setting will be enhanced, in tandem with a greater appreciation of the evidential and historical values as building safety is possible. The proposed approach and methodology to the works will not conflict with nor undermine the evidential values of the setting, due to the measures outlined previously. The risks associated with any potentially negative outcomes will be reduced by the presence on site of an archaeologist for the duration of the works together with the attendance of key advisors.

Where new interventions are proposed, they have been developed to provide 'a buffer' and to protect the unseen areas and details of high archaeological and significance value e.g. the new floor surface to the foundry. In all cases, the new proposals are reversible and will endeavour not to conflict with, nor to confuse the visitor understanding of the site, together with an understanding of its historical, aesthetic and communal values.

These investigations, recording exercises and management methodologies proposed either prior to or during the execution of the works themselves demonstrate that the risk of damaging any features of significant evidential value is very low. Where new accommodation is being introduced within the Patternmaker's and Carpenters Workshop, it is being designed to stand independently on the existing structure and will all be reversible and could be altered or removed in a flexible and reversible manner without damaging the historic fabric or details of high significance. The process of reinstatement could be continued during later phases of work, but at this time, the proposals are not removing any more evidential information than has been lost already. On balance, the off-set of the renewed or new building elements in these locations has been considered against the benefits and potential enjoyment for visitors from being able to view and understand the heritage values of these important buildings and structures at the heart of Brymbo Ironworks and the Stori Brymbo project as a whole.

General Bibliography / References

Documents referenced during the assessment include –

- Heritage Impact Assessment in Wales – Welsh Government, Cadw 2017
- Guidance on Heritage Impact Assessments for Cultural World Heritage Properties – ICOMOS 2011
- Conservation Principles for the Sustainable Management of the Historic Environment in Wales - Welsh Assembly Government, Cadw 2011
- Technical Advice Note 24: The Historic Environment – Welsh Government, Cadw 2017
- Managing Change to Listed Buildings in Wales, Welsh Government Cadw 2017
- Managing Scheduled Monuments in Wales – Welsh Government, Cadw 2018
- Setting of Historic Assets in Wales – Welsh Government, Cadw 2017
- Informed Conservation – English Heritage 2001

Summary of Heritage Impact for the Former Agent's House

Proposed Work Nature of Impact	Your Objective	Significance of affected building	Assessing Beneficial Impact	Assessing Harmful Impact	Proposed Solution
Reinstate the existing roof structure and covering to the Patternmaker's and Carpenters Workshop	To reinstate the existing building details that were temporarily dismantled in 2015 because of safety issues resulting from the fragility and condition of the building at the time.	Scheduled Monument of National Significance (DE202) and of High Heritage Value	Work will have a positive impact to reinstate known evidential value, to safeguard and stabilise the structural performance of the masonry and to improve the aesthetic and communal values that will enable visitors to better understand the original form and material finish of the building.	There would be no harmful impact to the fabric of the building nor to its Heritage Values from the reinstatement of the existing roof structure and covering.	No solutions required
Reinstatement of lost details, fixtures and fittings internally and externally.	To provide means of escape and to complete the representation of The Patternmaker's and Carpenters Workshop as a means of reinforcing the Aesthetic value and Cultural understanding of the building. The reinstatement of original fittings will improve the Evidential and Historical value and understanding	As above	These elements of work seek to represent the building with details of a known nature and are not conjectural. They will improve the future understanding of this historical area of the site	There would be no harmful impact to the fabric of the building nor to its Heritage Values	No further measures required. But a clear location to be identified and a record made of the works undertaken to assist with the Evidential and Historical understanding of the whole. All interventions will still remain reversible.
Introduction of new structural support and ties to the external walls of the building but requiring sub-floor excavation internally to facilitate the removal of the temporary, steel propping that was introduced in 2015	To stabilise the existing external walls and to retain as much of the original masonry in-situ, therefore not reducing its heritage values from requiring much more of the walls to be rebuilt.	As above	Works will ensure that the existing masonry and a significant proportion of the remaining evidential value can be retained.	The introduction of the tie rods and plates between the north and south walls at the upper (west) end of the building will require sub-floor excavation. With the correct management procedures in place to address archaeological concerns, the interventions will be of low impact on the existing building, are concealed in the main and would enable more significant evidential value of the standing remains to remain undisturbed and intact. It is necessary that the existing floor finish above is temporarily removed to facilitate the repairs and should anything of significance be identified during the excavation then an alternative position or configuration of the ties could be developed, leaving the item of significance in-situ	Archaeological input at design stage and understanding of the building in its context to be developed further. Archaeological attendance also to be provided to ensure that Evidential and Historical values are not diminished. Where applicable, fixings will be made into the mortar joints of the existing fabric and the interventions will either be concealed so that the visual impact is reduced and the Aesthetic, communal values are not diminished.

Proposed Work Nature of Impact	Your Objective	Significance of affected building	Assessing Beneficial Impact	Assessing Harmful Impact	Proposed Solution
Introduction of new interpretation proposals and building services, fixtures and fittings within the building	To provide new visitor interpretation and site orientation presentations that will enhance their appreciation of the site	As above	As above, but also to state that the new	New accommodation will be independent of the historic fabric, therefore no long-term harm to the historic fabric. Fixings into historic fabric will be limited and will be made into mortar joints only.	No loss of historic fabric and therefore evidential value. The new fixtures, fittings and installations are reversible. No further action required. Neutral impact only
Changes to internal environmental conditions	As above but also to avoid the deterioration of what remains of older surfaces, surface finishes and the condition of the masonry internally and evidential value	As above	As above	Selection of materials and constructions to be vapour permeable. Temp + RH to be controlled to avoid salt damage etc.	Controls and some environmental to be provided to manage and control environmental conditions
Structural repairs and fixings within the Foundry, to the Cupolas and to No.1 Blast Furnace	To maintain the structural integrity of the floor/ceiling that supports the cupolas and for safety reasons and to prevent fittings from falling away from the No1 Blast Furnace	As above	To maintain the integrity of the existing structure and therefore its evidential and historical value but also for H&S purposes to provide a safer visiting environment	The introduction of the new steelwork to support the cupolas will be invasive and some existing masonry will need to be moved to create a beading for the new structure.	There is some unavoidable negative impact from the repair process, but much more significant heritage and H&S benefit from abating the current rates of decay.
New bound aggregate floor surface for visitors within the Foundry, and part of the Cast House	To improve visitor accessibility, to provide 'barrier free' access and to provide a more permanent means of protecting earlier floor surfaces during the history of the ironworks.	As above	Will improve accessibility and will protect the archaeology of the earlier and very significant floor surfaces of the Foundry and Cast House	With appropriate management or archaeological supervision, the impact will be low	No further actions necessary, other than to ensure further. Archaeological attendance is provided to ensure that Evidential and Historical values are not diminished.

Statement of Heritage Impact:

The proposed works to The Patternmaker's and Carpenters Workshop will have a positive impact on its significance by virtue of the evidential information being reintroduced with the reinstatement of known elements, building components and details from primary reference sources and records and by the management/quality control measures that will be applied during the implementation of the works. Where it is necessary for any new elements and components to have a neutral value in the sense that they will be reversible and will be distinct, so as not to significantly distort the continuity of the historical record. On balance the proposals are deemed to have a positive impact on the 'group value' of the whole, and the works will abate the current risks and vulnerabilities from continued deterioration by returning the Patternmaker's and Carpenters Workshop to beneficial use. The general maintenance and masonry repairs proposed within the Foundry, to the Cupolas and at Blast Furnace No1 will have a Neutral Impact on the value of the standing remains as they will enable the Evidential Values to remain unchanged, but in combination, the impact of the proposals will offer significant Positive Benefits to the heritage values of the Brymbo Heritage Area and for those of the visitor experience in the longer-term.

Appendices

Appendix A – Pattern Shop Existing Photographic Record and Reconstruction Notes

Appendix B – Cadw Scheduled Monument Description

Brymbo Ironworks: Early Blast Furnace, Cast House and Foundry

- Scheduled Monument Description
- Scheduled Monument Location Map

Appendix C – Access Statement prepared by TACP for the site

Appendix D – ArchaeoDomus, Specification for an Archaeological Archaeological Assessment and Programme of Investigation, (September 2019) + Map of Archaeological Potential Across the Brymbo Heritage Area Site

Appendix E - Outline Description of Repair Materials

Sketch Design Proposals - Pattern Shop Existing Photographic Record and Reconstruction Notes



Timber windows to be carefully removed and like for like repairs undertaken, piecing in new timber when necessary

Note truss position

Metal windows to be deglazed, removed and overhauled before being refixed on a like for like basis

Between 4-5 additional courses of stonework need to be rebuilt over the head of the existing windows to realign with the gable and the rest of the elevation



Brymbo Heritage Trust - Proposed Regeneration Project

0 m 1 m
Scale +/- 1:20 @ A3

GERAINT ROBERTS ASSOCIATES

ARCHITECT AND HISTORIC BUILDINGS CONSULTANT

2 MAES DERW, LLANFECHAIN, POWYS, SY22 6XN.

Ref: SK-01 Scale: +/- 1:20 Date: 14.09.19

Sketch Design Proposals - Pattern Shop Existing Photographic Record and Reconstruction Notes



This is the same modified roof truss and runs parallel with all other roof tresses, though it will be picking up the hips to the adjacent pitches

Intermediate wall to be rebuilt fully in two faces of uncoursed random stone-work and core material



Note triangular shape of wall plate here

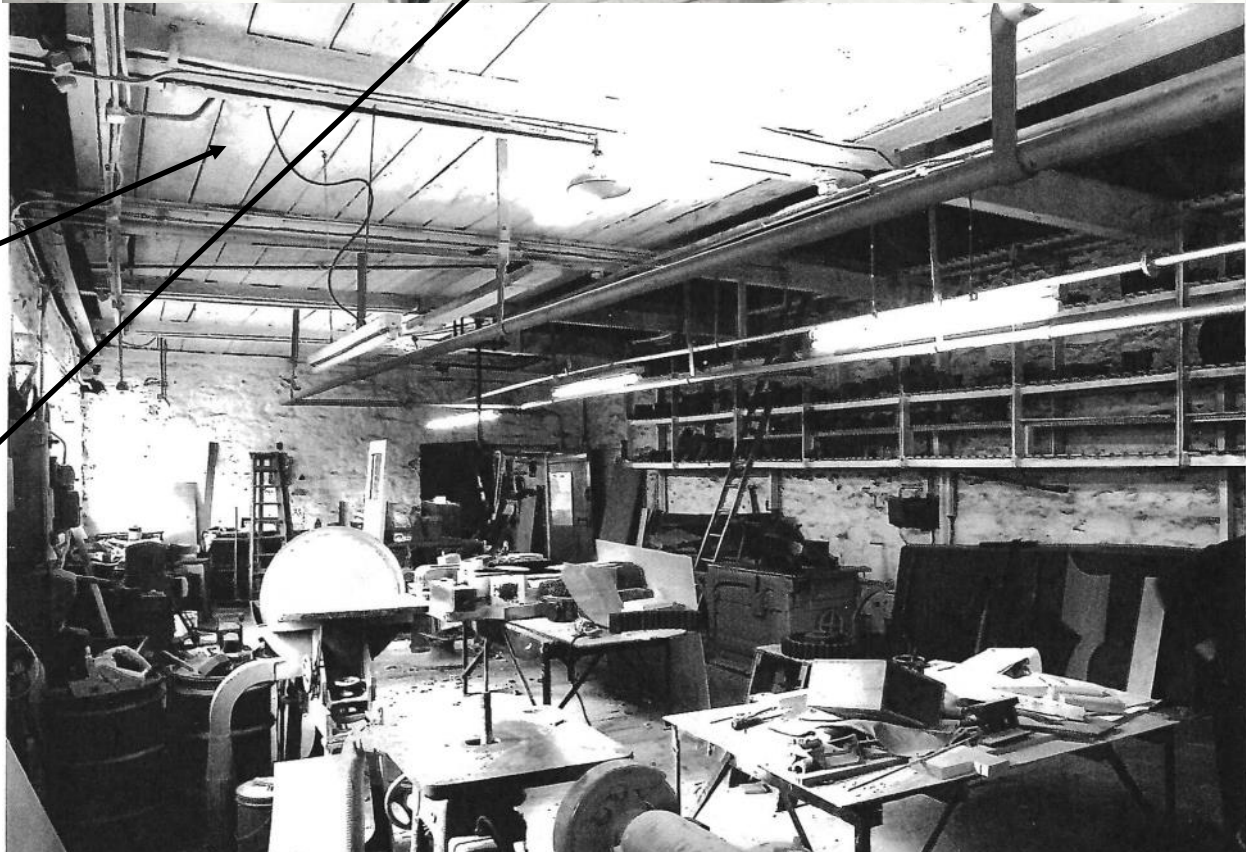
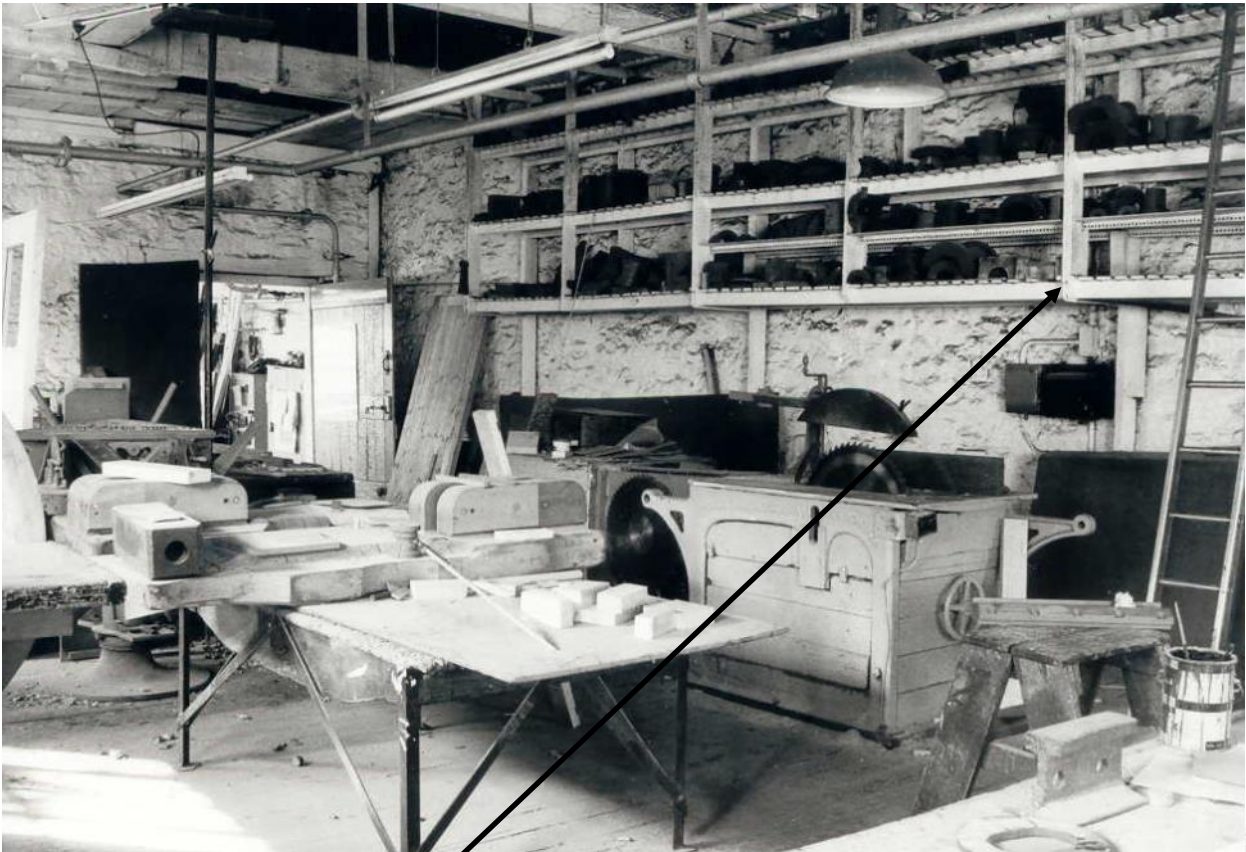
Sketch Design Proposals - Pattern Shop Existing Photographic Record and Reconstruction Notes



Note heating pipework and light fittings used originally

Note ceiling fitted between the cords to the trusses

Design detail and extent of existing shelving for reinstatement could be indicated on the drawings for SMC purposes



Brymbo Heritage Trust - Proposed Regeneration Project

0 m 1 m
Scale +/- 1:20 @ A3

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Ref: SK-01 Scale: +/- 1:20 Date: 14.09.19

Sketch Design Proposals - Pattern Shop Existing Photographic Record and Reconstruction Notes



Brymbo Heritage Trust - Proposed Regeneration Project

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Ref: SK-01 Scale: +/- 1:20 Date: 14.09.19

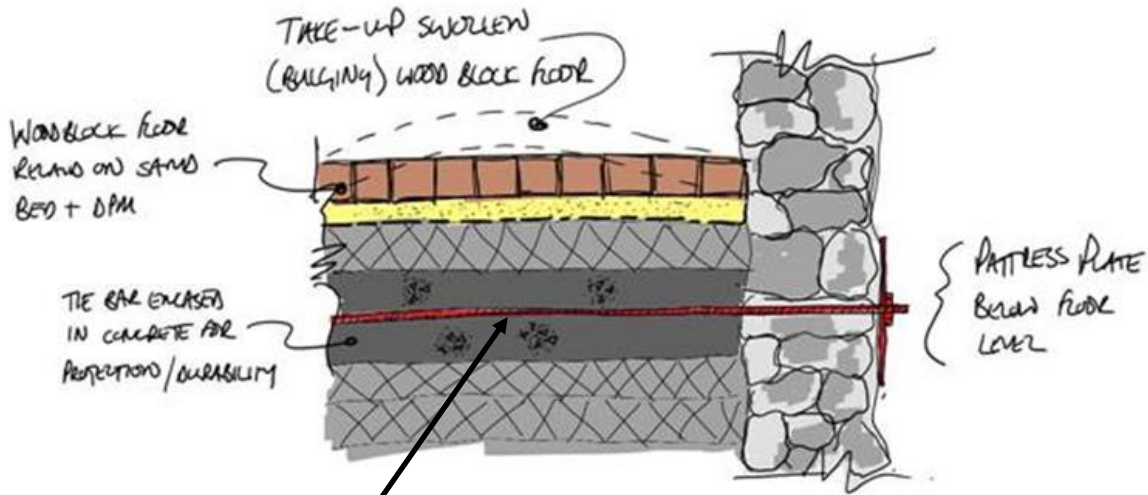
Sketch Design Proposals - Pattern Shop Existing Photographic Record and Reconstruction Notes



Note lifting beam and fixing details of elements that should be reintroduced under the SMC as the evidential information is available to do so.

Note side by side positioning of the purlins at this end of the building

Strategy to be developed for the recording, lifting and air drying of the existing timber block floor. Floor to be lifter and palletised before cleaning and air drying. Floor to be re-laid on like for like basis on completion of the structural repair works.



See floor plan for the insertion of ties beneath the existing floor construction. See above WSP details



Sketch Design Proposals - Pattern Shop Existing Photographic Record and Reconstruction Notes



Stonework to be rebuilt to the underside of the roof construction

Walls to be rebuilt in panels of facing brickwork and stonework to match existing

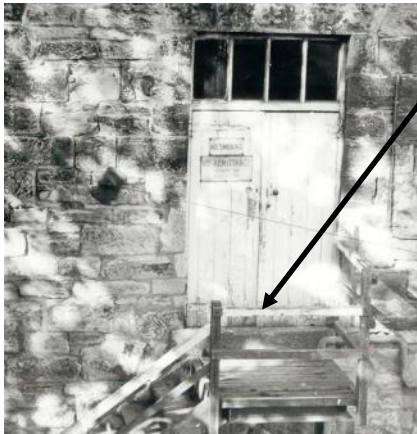
Nature and composition of the block floor is yet to be determined as access has not been permissible for Health and Safety reasons



Detail of the existing metal and timber windows



Simple timber balustrade could be considered to replicate the existing



Reinstatement of the outward opening door detail.



Brymbo Heritage Trust - Proposed Regeneration Project

0 m 1 m
Scale +/- 1:20 @ A3

GERAINT ROBERTS ASSOCIATES

ARCHITECT AND HISTORIC BUILDINGS CONSULTANT

2 MAES DERW, LLANFECHAIN, POWYS, SY22 6XN.

Ref: SK-01 Scale: +/- 1:20 Date: 14.09.19

Scheduled Monuments- Full Report



Summary Description of a Scheduled Monument

Reference Number	Name	Date of Designation	Status
DE202	Brymbo Ironworks: Early Blast Furnace, Cast House & Foundry	07/11/1991	Designated

Location

Unitary Authority	Community	Easting	Northing
Wrexham	Brymbo	329455	353526

Broad Class	Site Type	Period
Industrial	Industrial monument	Post Medieval/Modern

Description

Summary Description and Reason for Designation

The following provides a general description of the Scheduled Ancient Monument. The monument consists of the remains of an industrial monument, dating to the 18th or 19th century, particularly a blast furnace which is on the site of earlier industrial remains. The furnace consists of a rectangular masonry stack enclosing the furnace interior where the iron was smelted. To the south are a contemporary cast house, a foundry and beyond that a stone building known as the pattern maker's shop. The monument is of national importance for its potential to enhance our knowledge of 18th or 19th century industrial practices. It retains significant archaeological potential, with a strong probability of the presence of associated archaeological features and deposits. The structure itself may be expected to contain archaeological information concerning chronology and building techniques. An industrial monument may be part of a larger cluster of monuments and their importance can further enhanced by their group value. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive.



Scheduled Monument : Brymbo Ironworks: Early Blast Furnace, Cast House & Foundry

Reference Number : DE202

Unitary Authority : Wrexham

Community : Brymbo

Each official record of a scheduled monument contains a map. This digital map has been drawn from the official record and is believed to be an accurate depiction. If you wish to see a copy of the original, legally definitive, map please contact the Historic Environment Service (Cadw). This map was delivered electronically and when printed may not be to scale and may be subject to distortions. All maps and grid references are for identification purposes only and must be read in conjunction with other information in the record.

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Stori Brymbo

Access Statement RIBA Stage 3

Introduction

Stori Brymbo aims to provide a fully accessible facility without restriction. The nature of the industrial site and protected status of many of the structures and buildings creates some challenges and conflicts in achieving this aim. The site has complex topography and is steeply sloping in many areas. The site has a number of terraces and retaining walls with leading edges. The terrain is variable with a range of surfaces and features. Significant consideration has been made to afford safe and engaging access for those with both physical or sensory limitations. This document relates primarily to the context of the site and buildings, access to interpretation is covered elsewhere.

For simplicity this document follows the typical route of a visitor around the site with supplementary information for non-visitor areas.

Access to site

The site is located adjacent to New High Street, Blast Road and Brake Road. Accessible and young family parking is located adjacent to the Machine Shop main entrance off New High Street along with a drop off area. This location affords level access to the main entrance to the facility.

Machine Shop

The Machine shop provides the main entrance to the site via the lower ground floor, the initial area has free access to the public. This provides access to ticket purchasing, café, small retail units as well as a changing places toilet to be available to the wider public and local community. The entrance is level with protected automatic doors. The reception/ticket counter will be clear to distinguish and supported with an induction loop and braille facilities. The ground floor area is level throughout with clearly defined zones supplemented with contrasting colours for orientation and clarity. The upper terrace, known as the ground floor, is accessed by both stairs and an accessible lift. The ground floor is served by a wide landing area overlooking the ground floor. Direct level access is afforded to the individual retail units.

From the machine shop lower ground floor visitors with tickets move through to exit the Machine shop to the left, and travel to access the Fossil forest. The exit is level with wide accessible doors.

Fossil Forest

The fossil forest can be accessed by 2 external routes. Neither route is level however the clockwise route is less steep. The routes are defined by bound gravel pathways. These will be regularly inspected and maintained to address any rutting. The visitor viewing area for the fossil forest building is on the upper terrace. Level access and egress will be provided. The viewing area is a single level with sightlines down over the fossil excavation area. Viewing windows will have low level sills to enable all to experience the activities. Induction loops will be provided. The fossil forest area is protected as a SSSI.

From the Fossil Forest building visitors move externally towards the Agents House. The route is defined by bound gravel pathways.

Agents House

The Agents House is 2* Listed and provides an important interpretation point along the visitor journey around the site. The building has separate access and egress points both of which have level access and suitably operated doors. These will have level stone flag external approaches. The building is single storey and provides a large open area for interpretation. This includes areas for people to sit and be immersed in the interpretation experience, including areas for wheelchair users. Induction loops will be provided.

From the Agents House, visitors will move externally towards the Pattern Shop. This pathway follows a long-established pedestrian route through the site which traverses the slope to reduce the path gradient. The pathway will be surfaced with bound gravel

Pattern Shop

The Pattern Shop is 3 storeys and provides a range of facilities and is a SAM. Due to the topography of the ground adjacent to the Pattern Shop the upper and lower levels are both accessible externally from ground level. The intermediate floor is accessed via an internal stair. The uses of the floors have been considered in response to the accessibility of each floor. The ground floor provides a visitor interpretation area. Access is level from the pathway to the rear of the machine shop. The existing floor is generally level and the materials are to be retained where possible. There are sections of raised floor which will be provided with short ramps to improve access. The exist for visitors is to the rear of the pattern shop directly into the foundry area. Existing doorways will be retained and doors will generally be retained open during visiting times.

The middle floor will provide archive space with access by arrangement only. Special arrangements to view stored items will be made for those who are unable to access the stairs. Further examples of the artefacts will be visible in other areas such as the machine Shop. The entrance will be level. The new stair will be designed in accordance with building regulations requirements. Due to the limited area and constraints within the protected structure a lift is not considered viable.

The upper floor is accessed from the rear upper terrace adjacent to the Cupolas. This floor provides flexible, multi-function space for various activities and events. Level access is provident to the entrance. The door ways are level and wide to provide unrestricted access.

Induction loops will be provided to the pattern shop in key locations.

Accessible Toilets facilities are proposed adjacent to the cupolas. This facility affords access to all visitors at a midpoint on the heritage route and accommodates any activities within the upper floor multi-function area.

Foundry area and No1 Furnace

Accessed from either the Pattern Shop or pathway to rear of the Machine Shop, the foundry area is an external space with level access throughout. The surface will be bound gravel and the large open space allows unrestricted access. The proposed interpretation includes sound and visual elements. The foundry area leads to the No1 Furnace at the northern end. It is intended that visitors will be able to pass through the base of the furnace. Induction loops will be provided in key locations.

From the No1 furnace area, visitors will be able to move via a ramp to the lower level. This area affords access to Charging Wall North and the Story of Steel and events space.

Events space

The event space is large gently sloping area with the remains of various bases and foundations of former structures. The surface is bound gravel and provides general open space for day visitors to use. It also provides occasional event space for a range of activities. For events it is anticipated that direct access will be provided from the frontage car park area. This will be level and specifically signed and marshalled for events. Induction loops will be provided in key locations. In the north east corner is the story of steel.

Story of Steel

The Story of steel is a permanent exhibition covering Brymbo's importance as a major steel manufacture and innovator. The exhibition is located within a container structure which has level access. The facility is single story with level access throughout. Induction loops will be provided.

Wider Site areas

The wider site area is accessed via external paths. These areas include: -

- Blast Colliery: external access only
- Dipping Ponds: with board walks for inclusive access
- Railway: various locations with ramped access to platforms
- Coke chute: external access only
- Ecology Areas: external access only

Leaving the site

Egress is via the ground level of the machine shop. Visitors will access via the upper external level adjacent to the foundry. This is via the landing serving the retail units. Stairs and a lift are provided to enable access to the Machine Shop lower ground level. Final exit is via the automatic main entrance doors.

Other site areas

The site also supports proposed non tourist visitor areas. These areas are listed separately below however the same project aims for inclusion apply. These areas include: -

Machine Shop workshop area

The work shops are flexible to support a range of training and demonstration aimed at, but not exclusively for, heritage skills. The space is accessed via large existing doors with level access. The main workshop area is generally level however the flooring is uneven and will be improved where appropriate. Supporting facilities are provided on a mezzanine level. This area is accessed via new stairs and a lift. These spaces include a flexible learning/meeting area, toilets and welfare facilities. All will be detailed to be fully accessible.

Railway Carriages Business Units

The railway carriage units are located on upper terraces adjacent to Blast Road. These are serviced independently of the main site with separate access from Blast Road. Level car parking is proposed with accessible spaces. Pathways link the car park to the carriages. Four railway carriages are proposed to house small business units. These will be provided with ramped and step access. The units will be self-contained with accessible welfare provision. All carriages are proposed to be accessible for wheelchair users.

Workshops

The workshop building provides 2 small units with a covered flexible area. The units will double up for parking site vehicles. The units will have level access and appropriate welfare facilities.

Staff facilities and ancillary accommodation

It is proposed that support staff will access the site from Blast Road where dedicated level access and parking is provided. This will include accessible parking spaces. The offices will be contained in existing purpose mobile offices. Ramped access will be provided.

During Stage 4 the detailed design will be developed to deliver the accessibility aims and objectives. Detailed consideration will be applied to all areas and include lighting, signage, and wayfinding. The detail design will be developed with specific reference to:-

BS 8300-2:2018 Design of an accessible and inclusive built environment Buildings. Code of practice

Building regulations: Approved Document M: access to and use of buildings, volume 2: buildings other than dwellings

First issue Nov 2019

**Brymbo Ironworks,
Wrexham County Borough**

**Specification for an
Archaeological Assessment
and Programme of Investigation**

Scheduled Monument No.: DE202

NGR: SJ 29454 53526

Planning #: N/A

Project #: AD079-R1

September 2019



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Archaeological Assessment and Watching Brief, Brymbo Ironworks, Wrexham

Written Scheme of Investigation

Summary

ArchaeoDomus has been commissioned by the Brymbo Heritage Trust to carry out a scheme of archaeological investigation to include an Archaeological Assessment and a Programme of Investigation and Recording at Brymbo Ironworks a Scheduled Monument (DE202). Brymbo Ironworks is a nationally important Scheduled Monument with the potential to enhance our knowledge of 18th and 19th century industrial development. This Specification lays down the aims and methods of the archaeological project.

The Archaeological Assessment will, for the first time, draw together into a gazetteer all the historic and archaeological assets surviving as part of the Scheduled Monument and heritage area. It will seek to identify and document the evolution of the site buildings, machinery and infrastructure surviving from the late 18th century ironworks to the closure of the steelworks in 1990.

The Archaeological Programme of Investigation and Recording will seek to identify and record any deposits, features and assets that will be affected by any landscape or remedial building works.

All ground excavations and any alteration and/or removal work to the buildings and structures on site, both within and outside the schedule area, will be monitored by a suitably qualified archaeologist.

This Written Scheme of Investigation has been produced at the request of the Brymbo Heritage Trust to support a round 2 HLF bid and to provide mitigation for any ground or building disturbance. This Specification has been prepared by Ross Cook.

1 Introduction

- 1.1 ArchaeoDomus Archaeological & Heritage Services have been commissioned by the Brymbo Heritage Trust (BHT) to undertake an archaeological programme of works. This work includes this Specification, which will set out the methodology for an Archaeological Assessment and ongoing Archaeological Programme of Investigation and Recording. The latter may occur through the planned and unplanned schedule of works at Brymbo Ironworks (SAM DE202).

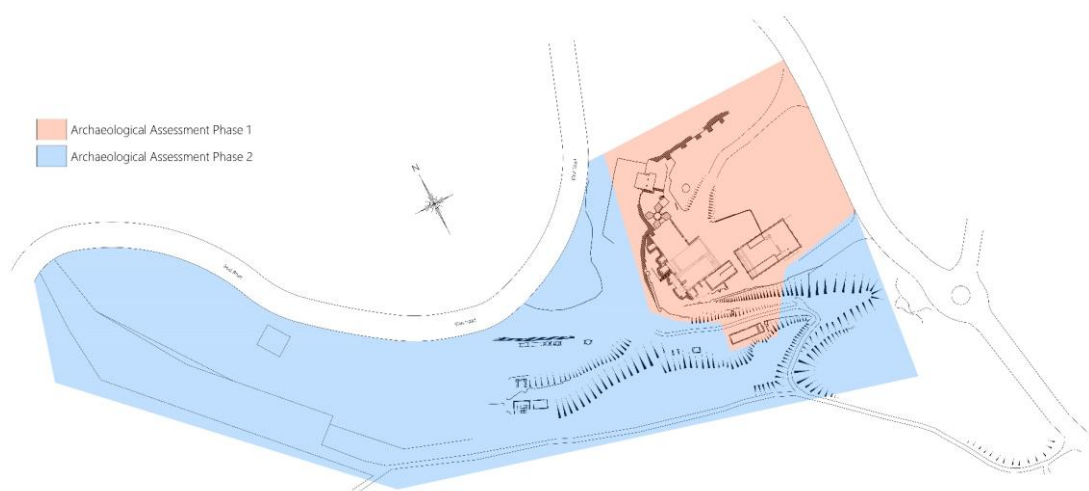


Fig. 1 – Brymbo Ironwork Archaeological Assessment Phase 1 and 2 Areas.

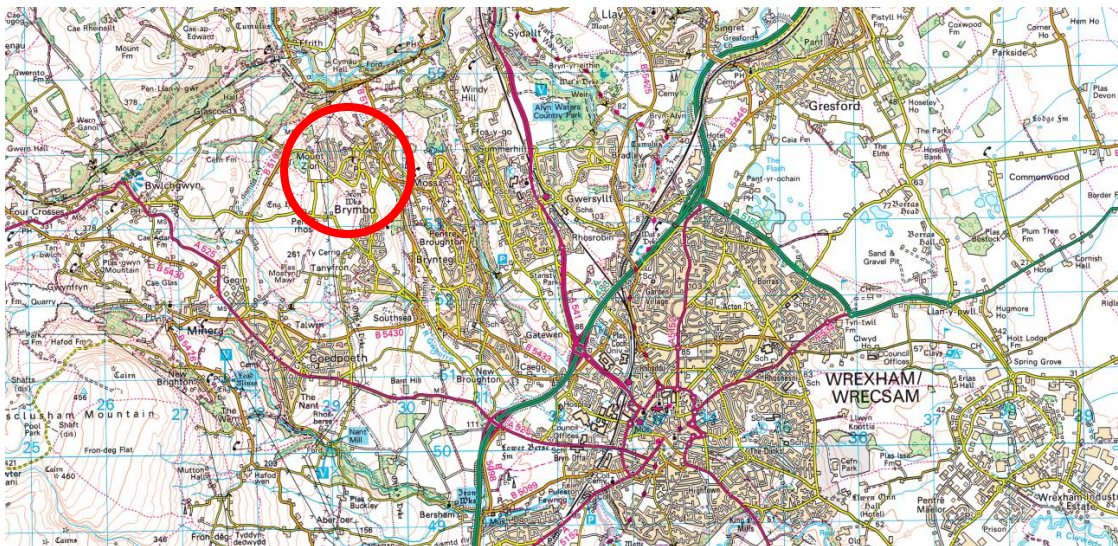
- 1.2 The production of the Archaeological Assessment will be undertaken in two phases (Fig. 1 & 4). Phase 1 (red) will focus on the lower site, up to the Agents House. Phase 2 (blue) will cover the upper end of the site, from the Agents house onward.
- 1.3 The commissioning of an Archaeological Assessment by the BHT is designed to enhance our understanding of the site's development. The work will gather information on archaeological assets, such as buildings, machinery and infrastructure, to produce a document to lend support to a Phase 2 Heritage Lottery Bid.
- 1.4 A programme of Archaeological Investigation and Recording shall be implemented for all ground excavations and any alteration and/or removal work to the buildings and structures on site, both within and outside the schedule area. This work will be monitored by a suitably qualified archaeologist.
- 1.5 The commissioning of this work comes as part of ongoing investigation works at Brymbo Ironworks, first begun the RCAHMW in 2013 and continued by ArchaeoDomus since 2014.
- 1.6 The Consenting Authority for the Scheduled Monument is Cadw, the historic environment service of the Welsh Government, and Wrexham County Borough Council for the undesignated areas.
- 1.7 This Specification has been prepared by Ross Cook, Buildings Archaeologist and Surveyor at ArchaeoDomus at the request of the Brymbo Heritage Trust. Its aim is to provide information on the methodology and archaeological practice used by ArchaeoDomus during the Archaeological Assessment and ongoing programme of Investigation and Recording.
- 1.8 Requirement for programmes of archaeological works are laid out in *Planning Policy Wales, Section*

6.1 (Edition 10, Dec 2018). Further guidance is provided by *TAN 24: The Historic Environment* (2017). This framework ensures that designated and undesignated heritage assets, archaeological remains and deposits are fully investigated, recorded and catalogued if they are to be affected as a result of activities associated with the development.

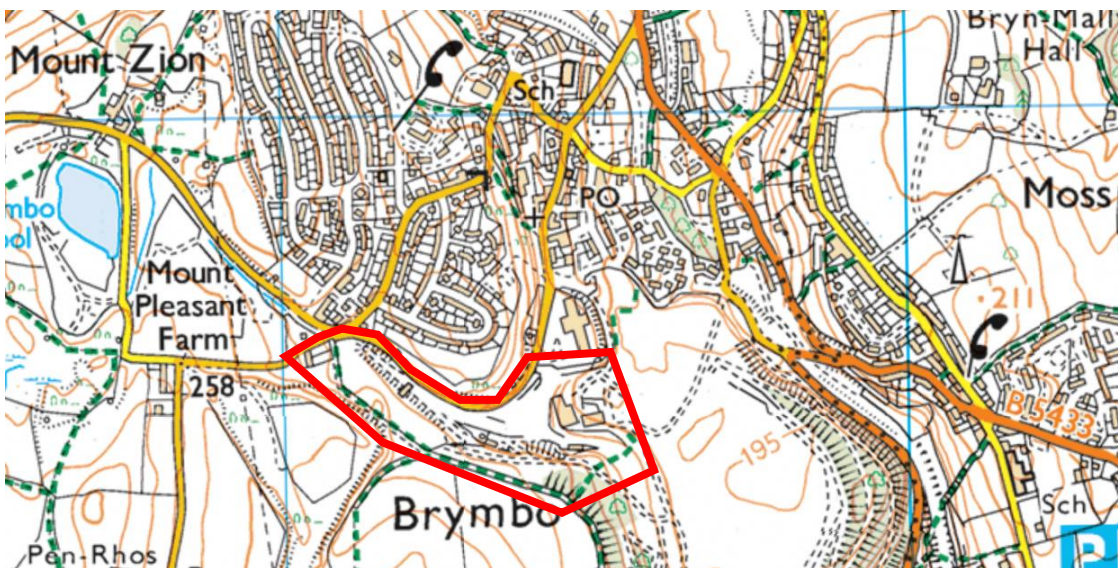
- 1.9 All work will be undertaken by qualified staff and in accordance with the standards and guidance laid down by the Chartered Institute for Archaeologists (CIfA).

2 Site Location

- 2.1 Brymbo Ironworks is located at the southern edge of the village of Brymbo, in the County Borough of Wrexham, historically being Denbighshire. The site runs uphill from east to west, with the lowest and most level part of the site bounding the western edge of an unnamed road (leading from Phoenix Drive). The lower part of the site sits within a cut into the hillside, with Blast and Charge Walls bounding the site to the north and west; the Brymbo Enterprise Centre is located above the site to the north. Blast Road bounds the site to the west (lower site) and north (upper site), with the south bounded by a track, with sparse woodland and fields beyond. The Ironworks sits at an elevation of *circa* 330m and at NGR SJ 29454 53526 / 53°04'27.9"N 3°03'15.3"W.



*Fig. 2 – Location – Brymbo.
Contains Ordnance Survey OpenData © Crown copyright and database right 2019.*



*Fig. 3 – Location – Brymbo Ironworks Site
Contains Ordnance Survey OpenData © Crown copyright and database right 2019.*

- 2.2 The underlying geology is formed of the Pennine Lower Coal Measures Formation and the Cefn Rock sandstone formation mudstone (BGS) with no superficial deposits recorded (BGS). The local soil type is unclassified (UKSO).

3 Archaeological and Historical Background

3.1 Introduction

- 3.1.1 Brymbo Ironworks was Scheduled on 7th November 1991 under ID DE202 as a site of national importance for its potential to enhance our knowledge of 18th and 19th century industrial practices.

‘The monument consists of the remains of an industrial monument, dating to the 18th or 19th century, particularly a blast furnace which is on the site of earlier industrial remains. The furnace consists of a rectangular masonry stack enclosing the furnace interior where the iron was smelted. To the south are a contemporary cast house, a foundry and beyond that a stone building known as the pattern maker's shop. The monument is of national importance for its potential to enhance our knowledge of 18th or 19th century industrial practices. It retains significant archaeological potential, with a strong probability of the presence of associated archaeological features and deposits. The structure itself may be expected to contain archaeological information concerning chronology and building techniques. An industrial monument may be part of a larger cluster of monuments and their importance can further enhanced by their group value. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive.’

- 3.1.2 The former Ironworks site has one Listed Building, the Grade II* Agents House (ID 1731).
- 3.1.3 The Monument is registered in the National Monuments Record Wales under NPRN 34054 and with the Regional HER under PRN 104422.
- 3.1.4 In 2013, the RCAHMW began work at the site and produce measured plans, photographic record and written account of the ironwork's history and development.
- 3.1.5 Since 2014, this work has been continuing on a project-by-project basis with ArchaeoDomus. To date this work has included three contracts:
1. **AD006** – Measured survey and photographic record of the east elevation of the Cast House and Foundry prior to dismantling of roof and ironwork front to foundry, and photographic record post-works.
 2. **AD031** – Photographic record and measured survey of the Agents House, prior to roof removal.
 3. **AD065** – Laser scan of the Pattern Store for the production of archaeological and architectural plans.

3.2 Brymbo Iron Works

- 3.2.1 In 1792 John ‘Iron Mad’ Wilkinson purchased the 500-acre estate of Brymbo Hall for the sum of £14,000, with the intention of developing an iron works using the mineral and coal deposits that were known to exist on the site. With the invention and development of the steam engine Wilkinson

was able to found an iron works away from running water as steam power could provide blast for blast furnaces.

- 3.2.2 Brymbo Hall became Wilkinson's primary residence, where he spends considerable money to upgrade the house, including new paneling, windows and carpets (likely referring to rugs) for the chambers and principle rooms.
- 3.2.3 A letter sent by James Watt Jr. soon after Wilkinson's acquisition of the Brymbo estate states that Wilkinson has spent £20,000 on levelling the site, constructing parapet walls and building a puddling furnace (Soldon 1998: 73). An estate map produced in 1798, though likely surveyed *circa* 1796-8 by T. Williams, names the site as Plasnewydd Works and demonstrates the extent of the site during this early period; the Puddling Forge can be seen at the east of the site and a blast furnace with attached Cast House, Blowing Engine House and Charge House, which post-dates Watts account, located west of the Puddling Forge he describes; whilst there appears to be several other buildings on site at this time they do not represent what remains today. By *circa* 1795 the core of the site; Blast Furnace (original dem.), Casting House, Blowing Engine House (dem.), Charge House (dem.) and Coke Ovens (dem.); had not been fully developed as no output of iron has been recorded, however, by the following year, 1796, Brymbo's first output of iron is recorded at 884 tonnes (Riden & Owen 1995: 49), thus commencing Brymbo's one hundred and ninety-four year association with metalworking. The cartouche in the lower right corner shows the ironworks as it appeared when the map was completed in 1798. Within this initial development the site Wilkinson's blast furnace is depicted in both plan and cartouche form as being cylindrical, not square as Old Number one is seen today, helping to confirm its rebuilding.
- 3.2.4 Further development under Wilkinson's management included the building or alteration of at least two further buildings, the Agents House and Number 2 Blast Furnace with associated Cast House, with works likely to have taken place between 1800 and 1808. In the years between 1792 and 1798 Wilkinson had begun sinking mines near to the site to provide coal and ironstone for his planned works, with a total 8 reported by 1808. A plan of the Brymbo Colliery, dated 1809 and produced by William Rowe, shows the expansion of mining in the Brymbo area, but importantly shows the ironworks as it is in 1809, clearly showing the addition of a second blast furnace.
- 3.2.5 During his oversight of the Brymbo Hall estate Wilkinson expanded it to almost 800 acres, to include new farmlands and mineral deposits.
- 3.2.6 When Wilkinson died in 1808 at the age of 83, the works passed into trusteeship for the next two decades under the guidance of Ann Lewis (his mistress and mother to his only children), William Smith of Birmingham, James Adams and Samuel Foreday of Ettingshall. To survey the wealth of coal seams at Brymbo the trustees commissioned plans of Brymbo Colliery in 1809, then again in 1812, when a long section was also produced, all showing the contemporary ironworks. In the period following the Battle of Waterloo in 1815, the ironworks saw a slump in its production, resulting from the declining need for weaponry and the continued disputes over Wilkinson's Will. The decision was made to lease the ironworks for a 10-year period and by 1818 John and James Thompson were renting the iron works for a yearly sum of £1,500, with the Wilkinson estate taking in a total of £9,758.16.8d from rents and lets (Brymbo Steel Works Ltd, 1975: 5). In 1820 the original blast furnace was decommissioned by the Thompson brothers and a new furnace commissioned on the same footings, remaining in situ to this day.

- 3.2.7 By the late 1827 the Ironworks was in receivership, with a two-year period passing with minimal production taking place. Several years of financial instability and mounting legal costs from the disputed Will led the Chancery to insist that Wilkinson's estate should be sold in order to meet claims. In 1829 a public auction was held at the Wynnstay Arms in Wrexham over the 23rd and 24th April, with all Wilkinson's land acquisitions being sold until the Brymbo Hall estate was back at its 1792 size of 500 acres. John Wilkinson Jr. remained in residence at Brymbo Hall and in late 1829 decided to restart the works using the money gained from the sale of estate lands earlier that year. However, lacking the production and business abilities of his father, the works were again in financial trouble by 1837, when Wilkinson Jr. left overseas. The works continued under the trusteeship of William Rowe until a buyer was found in 1840, a Scotsman by the name of Robert Roy, being financially backed a Scottish bank. In 1842 Henry Robertson, with high recommendations, was appointed to undertake an appraisal of the works, concluding a railway was essential to the works continued development. In the same year Robertson, along with Robert Roy, Alexander Ross and William Betts formed the Brymbo Mineral and Railway Company, with the 1844 North Wales Mineral Railway Act being passed to allow construction. Initially this section of the railway was powered by horses, but by 1850, with the desire for greater output, a locomotive was purchased.
- 3.2.8 In 1846 'The Brymbo Company' was formed, with William and Charles Darby, descendants of Abram Darby, taking over the site's management. In 1847 a new blowing engine was installed, taking the blast furnace output from 50 to 84 tonnes per week, with the Foundry being added to the end of the Cast House at this time to allow mould castings to be made. It was also Robertson and the Darby's that built the machine shop (Pattern Store) that stands joined the foundry and provides its southern lateral wall. Between 1856 and 1880 the iron works underwent a large amount of development with new hot air stoves to help improve the blast, bell tops were added to the furnaces, alterations to the foundry and in 1872 blast furnace number three was erected with a Haigh Blowing Engine to increase output.
- 3.2.9 Communications were improved in 1877 with the installation of a Wheatstone Telegraph and by 1880 telephones had made their way to the iron works.
- 3.2.10 Towards the end of the 19th century steel started becoming a production priority and in 1883 an experimental Open-Hearth steel furnace was erected, with the results being so successful that Robertson made the decision to found a steel plant. On June 4th 1884 The Brymbo Steel Company was incorporated and its operations began the following year. In 1894 Number Four blast furnace was constructed to replace Number Three, and was equipped with three Cowper stoves, a dust catcher and three Lancashire boilers blown by a Davy Engine. In the same year, Old Number One blast furnace was damped down for the last time after ninety-eight years of work. By the 1930's the demand for iron had decreased sufficiently that it became a minor part of the works, with steel the focus at Brymbo.
- 3.2.11 In 1973, Brymbo Hall was demolished to make way for an open cast mining operation.
- 3.2.12 Today the site comprises of several early buildings from the Plasnewydd Works period at Brymbo as constructed by Wilkinson in the 1790's; the Cast House, Agents House, and Parapet Wall; Thompson's rebuilding of the blast furnace in 1820, and the additions made by the Darby's and Robertson in the 1840's; Foundry, Machine Shop, and Blast Walls; the 1920's Fitter's Workshop (NPRN: 418933) also remains.

4 Site Specific Objectives

4.1 Archaeological Assessment

- 4.1.1 The aim of the archaeological assessment is to produce a gazetteer of the known archaeological assets on site, such as buildings, machinery and infrastructure. This work will highlight areas of potential archaeological sensitivity and support the development of subsequent programmes of works on site.
- 4.1.2 The above inform the production and maintenance of a zoned site plan detailing the archaeological sensitivity of buildings and potential for below ground remains.
- 4.1.3 The record will use CIfA's guidance for recording historic buildings as a guide, which states:

A programme of archaeological building investigation and recording will determine, as far as is reasonably possible, the nature of the archaeological resource associated with a specified building, structure or complex. It will draw on existing records (both archaeological and historical sources) and fieldwork. It will be undertaken using appropriate methods and practices which satisfy the stated aims of the project, and which comply with the Code of conduct, Code of approved practice for the regulation of contractual arrangements in archaeology, and other relevant by-laws of the CIfA. The programme will result in the production of drawings, an ordered accessible archive and a report

- 4.1.4 The record will also use Historic England's *Understanding Historic Buildings; a guide to good practice* (2016) as a guide when producing the record and description.
- 4.1.5 Onsite work will aim to record each asset by photography, and written accounts, which will determine its development, significance, archaeological potential and condition, with recommendations made for future archaeological input. Each of these will in turn form a part of the gazetteer record for each asset.
- 4.1.6 To produce the gazetteer as a 'living' record, to allow for records to be updated and amended as the BHT project progresses. This will also enable the creation and addition of new records as unknown archaeological assets are uncovered and to expand our knowledge of the known buildings and features of the former ironworks.
- 4.1.7 To deposit, on completion of the assessment, a gazetteer for archive with the NMRW and Regional HER.

4.2 Programme of Archaeological Investigation and Recording

- 4.2.1 The aims of the Investigation and Recording, as defined by the CIfA (2008; revision 2011), are:

'To allow a rapid investigation and recording of any archaeological features that are uncovered during the proposed groundworks within the application area.

To provide the opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological find has been made for which the resources allocated to the watching brief are not sufficient to support the treatment to a satisfactory or proper standard.'

4.2.2 The aims of the watching brief at the Brymbo Ironworks is to identify and record any potential archaeological deposits during all excavation and clearance works, which risks moving industrial materials, debris or remains that may shed light on the site's development.

4.2.3 The results of each watching brief will be written as interim reports, which will be drawn together in a final report, at the conclusion of such works, to the standards laid down by the CIfA.

4.3 **Report and Archive**

4.3.1 To communicate the results of the Archaeological Assessment to the client in the form of an illustrated gazetteer, illustrated reports, and to provide digital copies to Cadw, Brymbo Heritage Trust, the NMRW and Regional HER.

4.3.2 To prepare a digital archive of the projects report, photographic archive, all drawn elements for deposition with, Cadw, the National Monuments Record of Wales, Regional Historic Environment Record held by Clwyd-Powys Archaeological Trust.

4.3.3 To safely store all material finds in a secure location on site for future detailed recording and analysis, and specialist reporting.

5 Method for an Archaeological Assessment

- 5.1 The Archaeological Assessment will seek to record and understand, in gazetteer format, the buildings, machinery and infrastructure surviving on site to determine their archaeological significance, evolution and further potential. This will use as guidance the EH Level 2 record:

‘...a descriptive record, made in similar circumstances to Level 1 but when more information is needed. It may be made of a building which is judged not to require a more detailed record, or it may serve to gather data for a wider project. Both the exterior and interior of the building will be seen, described and photographed. The examination of the building will produce an analysis of its development and use and the record will include the conclusions reached, but it will not discuss in detail the evidence on which this analysis is based. A plan and sometimes other drawings may be made but the drawn record will normally not be comprehensive and may be tailored to the scope of a wider project.’ (EH 2016: 26)

- 5.2 A visual investigation will be made of the assets, looking for and identifying key phases and evidence of alterations, which will provide the descriptive record.
- 5.3 A photographic record will be made of the assets using a Canon 760D, where safe to do so. This will seek to provide enough detail to identify each asset and document the materials, alterations and construction methods used, where these are visible and safely accessible. The record will be made using a standard 18-50mm EFS lens and, where suitable, a 10-22mm EFS Wide Angle lens will be used to provide record photographs where the 18-50mm lens is not sufficient; this will be logged. Where possible, a tripod will be used for all photos, with a ranging rods of 2 x 1m or 1 x 2m used for scaling.
- 5.4 Existing plans will be used to locate each asset, with each asset provided with an ID, which has previously been identified (TCAP 2019).
- 5.5 The resources of the regional HER and other readily available resources will be consulted during this process.
- 5.6 The results of this work will be an illustrated report and photographic archive. These will be produced, within 12 months, and provided to both the client, Cadw, Regional HER and deposited with the NMRW.

6 Method for a Watching Brief

- 6.1 All ground excavations and any alteration and/or removal work to the buildings and structures on site, both within and outside the schedule area, will be monitored by a suitably qualified archaeologist.
- 6.2 A watching brief complying with the *CIfA Standards and Guidance on Watching Briefs* (1994; revised November 2014) will be completed during the groundworks phase of construction.
- 6.3 The Watching Brief is intended to ensure that all archaeological remains are investigated and recorded, should they be uncovered. As defined by the CIfA (1994; revised November 2014)

‘The Watching Brief will provide an opportunity for the archaeologists present to signal to all interested parties, before the destruction of the material in question, that an archaeological find has been made for which the resources allocated to the watching brief itself are not sufficient to support treatment to a satisfactory and proper standard’.

- 6.4 **The architect, owners or agents will provide notice for an archaeologist to be present to record and document any such changes, and to monitor for new information that may add to the interpretation of the building.**
- 6.5 If the dismantling or masonry should be required, ArchaeoDomus should be contacted in advance to produce a methodology for recording and dismantling of said masonry in accordance with best practice.
- 6.6 During excavation a 360° tracked machine with **toothless bucket** or hand excavation will be used to remove any topsoil, overburden or ground reduction, under the supervision of a qualified archaeologist. Machine excavation will continue to the depth of foundations/trenches, archaeological features, burials or *in-situ* sub-soil/natural geology, whichever is encountered first. Should archaeological features or palaeoenvironmental remains be uncovered, machining will stop to allow the archaeologist to investigate, record and sample such deposits.
- 6.7 If in the process of excavation archaeological features are identified, manual excavation will commence. All features exposed during the work will be investigated and recorded in plan and section to scale, with reference to the national grid.
- 6.8 Survey will be undertaken with RTK-GPS or using traditional methods, whichever is deemed most appropriate for the site. Drawings will be produced at 1:1 scale using AutoCAD 2013 or Rhino 3D, and plotted to 1:20, 1:50 or 1:100 for reporting purposes.
- 6.9 Should human remains be disturbed and are required to be excavated, this may be done so under the correctly obtained Coroners Licence from the Ministry of Justice. Iulia Rusu of Black Mountains Archaeology will be contacted to assist with the appropriate recording and removal of said remains. Human remains will be appropriately stored on site until reburial, for which the local parish priest will perform the appropriate rights. If skeletal remains are not to be removed, their physical security will be ensured. Bone analysis will be undertaken by osteoarchaeologist Iulia Rusu.
- 6.10 During the course of the watching brief if any finds or palaeoenvironmental deposits are uncovered that require further investigation, the appropriate specialist will be contacted and samples taken or appropriate measures taken to record, remove and preserve such findings. Representative samples will be taken of the feature(s) by Ross Cook, these will be recorded, located on a site plan and stored in suitable and stable conditions, before being sent to the appropriate specialist. The environmental strategy will adhere to the guidelines of Historic England’s *Environmental Archaeology; A guide to*

the theory and practice of methods, from sampling and recover to post-excavation (2011)

- 6.11 Archaeological sample analysis will be contracted to University of Wales Archaeological Service (UWLAS). Metal and precious small finds requiring specialist recording and identification will be sent to Richard Henry, finds specialist, for identification and processing. Animal bone identification or disarticulated human remains will be assessed and identified by Ros Coard, UWLAS. Other finds (pottery, building debris, etc.) will be processed in house.
- 6.12 If during the course of archaeological investigations further specialist expertise is required, a suitably qualified contractor will be sought to undertake said work.
- 6.13 Should significant find be made, the Brymbo Heritage Trust, Cadw, CPAT, and the Local Planning Authority will be informed and, if appropriate, a site meeting arranged. If a decision is made for further work to be undertaken, i.e. excavation of area, all further plans are to be made in conjunction with David Harris to undertake this.
- 6.14 A digital camera (Canon EOS 760D) will be used during the watching brief to keep a record of works and to record any archaeological features uncovered, or lack thereof. Should archaeological feature be uncovered, these will be planned, recorded and drawn for inclusion within the watching brief report. Any finds will be recorded in in context, where possible, and included within the report, and in the appendix of the report in tabled form.
- 6.15 A draft report will be produced, within 6 months, and provided to both the client, CPAT, Regional HER and the NMRW.

7 Reporting

- 7.1 The Archaeological Assessment, Phase 1 and Phase 2, will remain a 'living' gazetteer, to be updated and amended as the project progresses and new information, both physical and written, is uncovered.
- 7.2 For inclusion within funding applications, the archaeological assessments will be compiled on completion of each Phase. The report will include:
1. Non-technical summary
 2. Introduction
 3. Site Location
 4. Archaeology and History
 5. Aims and Objectives
 6. Methodology
 7. Site Overview
 8. Results
 9. Archaeological Potential
 10. Archive Location
 11. References
 12. Appendices - Illustrations
 13. Appendices - Gazetteer
- 7.3 The Watching Brief interim reports will be produced to collate the written, graphic, and recorded information outlined in the Section 6. The reports will include plans of any features, their location, description of the features, phasing, artefacts and their interpretations. These will be drawn together in a final archaeological report on completion of works at Brymbo Ironworks. These interim reports will include, but not be restricted to, the following:
1. Non-technical summary
 2. Introduction
 3. Site Location
 4. Scope
 5. Methodology
 6. Results
 7. Conclusions
 8. Appendices
- 7.4 The interim reports will be submitted within 6 months of completion of the fieldwork - dependant on production of any specialist reports that may be required, in which case this may exceed this

period.

- 7.5 On completion of the assessment and reports, copies will be submitted to the client and to the regional HER, NMRW, and a copy with the finds will be deposited with Wrexham County Museum. A copy of the report will also be made available on the ArchaeoDomus website at www.archaeodomus.co.uk following its submission to the regional HER.
- 7.6 Small finds will be cleaned, processed and documented, which will be included in the appendix of the report. Finds will be numbered, using prefix AD079-0X-FNXX.
- 7.7 The project archive will comprise all field notes and documents, photography, finds, associated reports, and drawings. The archive will be compiled and deposited following *The National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales 2017*.
- 7.8 The report will be deposited with the Regional HER following the *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs) (2018)*.
- 7.9 On completion of the report and its acceptance the clients will have fulfilled their archaeological planning conditions.
- 7.10 ArchaeoDomus shall retain the copyright of any commissioned reports, tender documents, plans and photographs, under the *Copyright, Designs and Patent Act 1988*, with all rights reserved, excepting that a licence is granted to the client for the use of such documents by the client in all matters directly relating to the project.

8 Publication

- 8.1 A summary of the results of this work will be published in Industrial Archaeology, the publication of the Association of Industrial Archaeology, and Archaeology in Wales, the journal of the Council for British Archaeology Wales Group. The summary will be submitted to Cadw for approval prior to submission to the next available publication.

9 Monitoring

- 9.1 The consenting authority in relation to the Scheduled Monument in this instance is Cadw the Welsh Government's historic environment service, the heritage arm of the Welsh Government. Any areas outside the Scheduled Monument fall under Clwyd-Powys Archaeological Trust (CPAT). The appropriate authority will be contacted prior to the commencement of the specified archaeological works and once the work is begun.
- 9.2 Any changes to this Written Scheme of Investigation that ArchaeoDomus may wish to make after approval will be communicated to Cadw for approval.
- 9.3 Representatives of Cadw will be given access to the site so that they may monitor the progress of the building record, watching brief, and excavation.
- 9.4 Cadw will be informed of any developments during the programme of archaeological works and a

combined report will be submitted to Cadw for approval before submission to NMRWales and the regional HER.

- 9.5 If significant archaeological remains are uncovered, all works will cease and a meeting will be convened with Cadw, the Brymbo Heritage Trust, CPAT and Steve Greuter (WCBC) to discuss the most appropriate way forward.

10 Resources and Timetable

10.1 Standards

- 10.1.1 The field work will be undertaken by using current best practice as laid down by the CIfA and Historic England Guidance.

10.2 Staff

- 10.2.1 The project will be undertaken by a Ross Cook of a staff member of ArchaeoDomus. Additional support will be provided by Richard Lewis of Black Mountains Archaeology Ltd.

10.3 Equipment

- 10.3.1 The project will use equipment supplied and maintained by ArchaeoDomus.

10.4 Timetable of Archaeological Works

- 10.4.1 A timetable for works is to be agreed with the Brymbo Heritage Trust for the commencement and completion of works. On arrangement, the timetable will be communicated with all parties.

10.5 Insurance

- 10.5.1 ArchaeoDomus holds insurance provided by Wessex Business Hub Insurance.

10.6 Health and safety

- 10.6.1 All members of the team will adhere to the requirements of the Health & Safety at Work Act, 1974. For further information please request our *Health and Safety Policy*.

10.7 Facilities

- 10.7.1 All site facilities for storage and welfare will be met by the client. Details of which will be passed to ArchaeoDomus prior to commencement of works.

10.8 Security

- 10.8.1 Site security and the security of storage, will be arranged by and the responsibility of the client. Fencing for the restriction of access to areas of work (Heras) will be provided by the client.

11 Sources

- 11.1 Historic England 2016, *Understanding historic Buildings; A guide to good practice*
- 11.2 English Heritage 2010, *Measured and Drawn: Techniques and practice for the metric survey of historic buildings.*
- 11.3 Welsh Government 2017, *Planning Policy Wales: Technical Advice Notice 24: The Historic Environment.*
- 11.4 Welsh Government 2016, *Planning Policy Wales*
- 11.5 CIfA 2014, *Standards and guidance for the archaeological investigation and recording of standing buildings or structures*
- 11.6 CIfA 2014, *Standard and guidance; Archaeological Watching Brief*
- 11.7 Soldon, N. C., 1998, *John Wilkinson (1728-1808), English Ironmaster and Inventor*, Edwin Mellen Press Ltd.
- 11.8 Riden, P. & Owen, R. J., 1995, *British Blast Furnace Statistics 1790-1980*, Merton Priory Press Ltd.
- 11.9 Brymbo Steel Works Limited, 1975, *The Story of Brymbo*, GKN.

Thank you to the Brymbo Heritage Trust for commissioning ArchaeoDomus to undertake this series of projects.

APPENDIX I

Brymbo Ironworks Plan

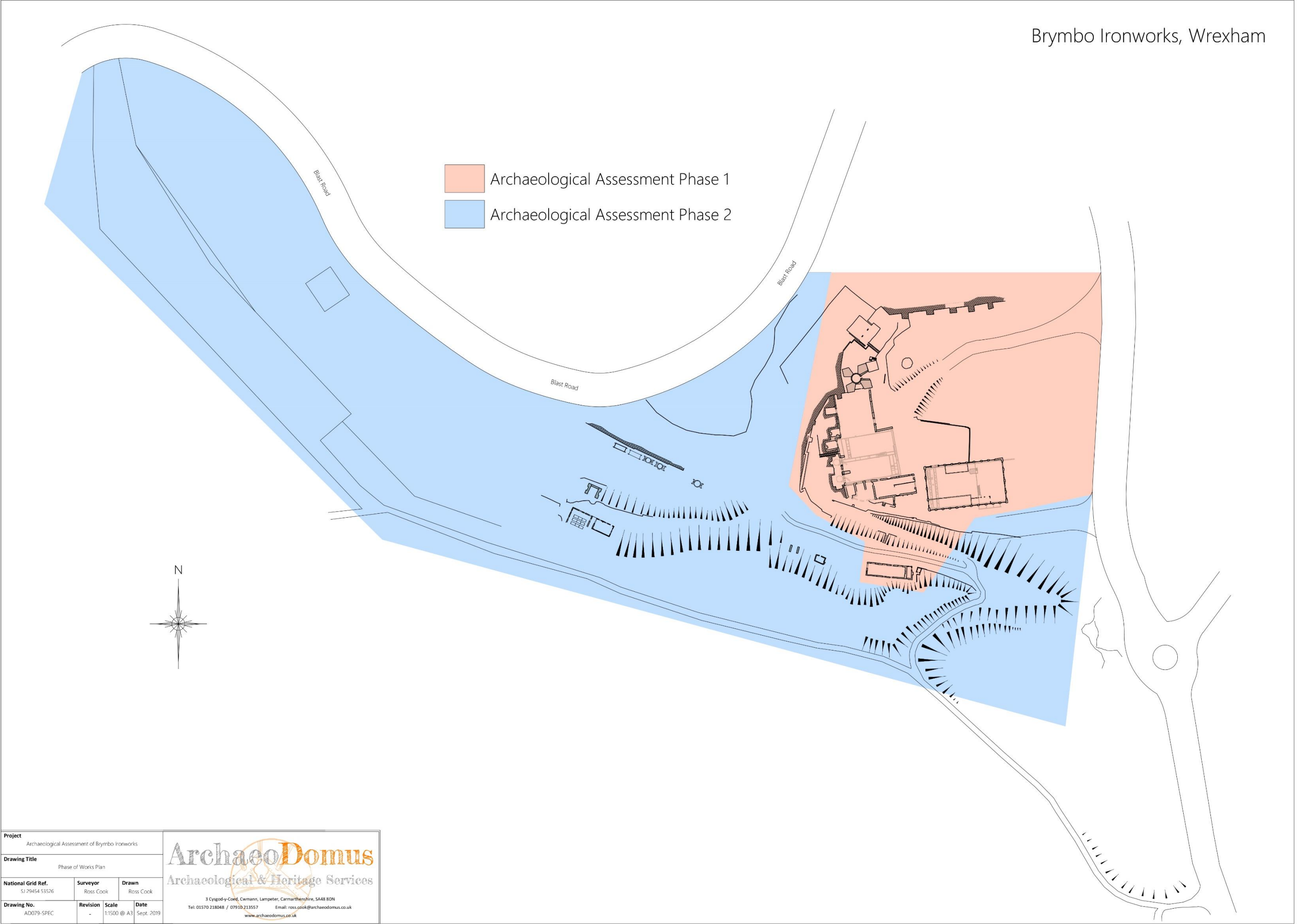


Fig. 4 – Archaeological Assessment Phase 1 and Phase 2 Areas.

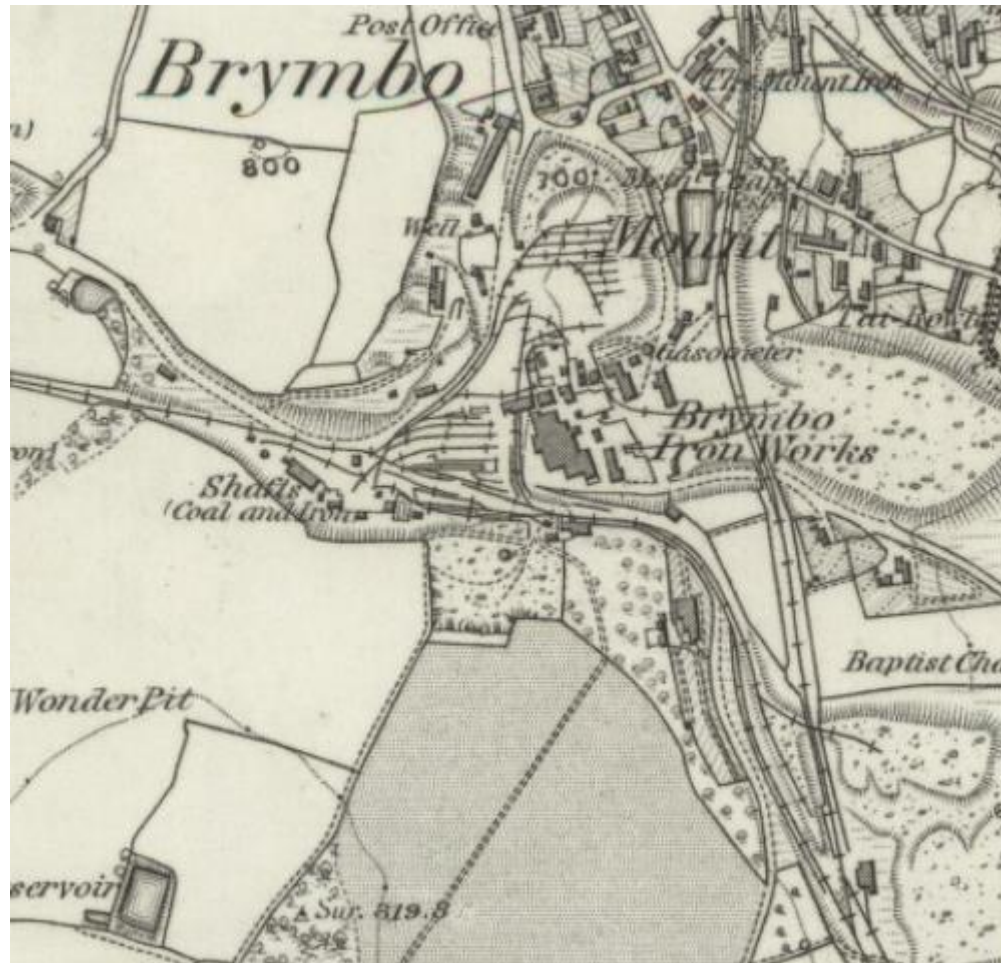


Fig. 5 – Six Inch to One Mile. 1872 (surveyed), 1879 (published). Denbighshire XXVIII.
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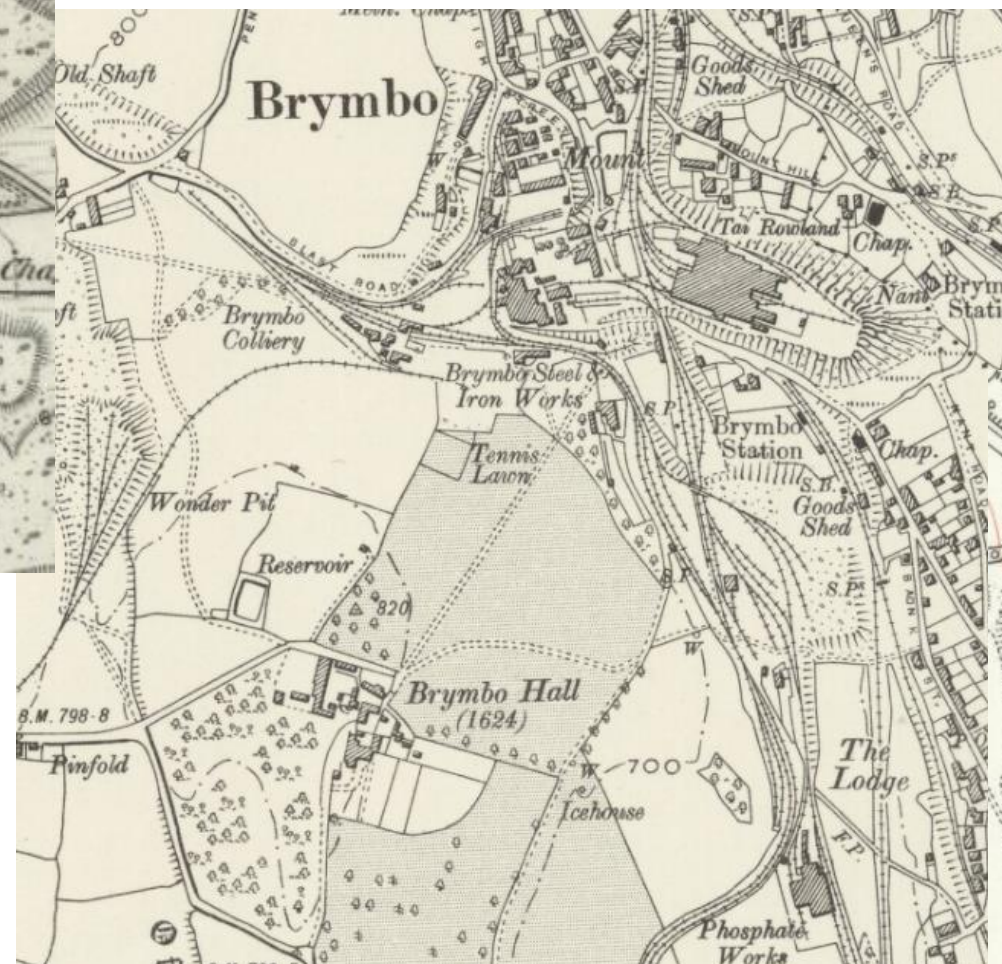


Fig. 6 – Six Inch to One Mile. 1898 (revised), 1900 (published). Denbighshire XIX.NW.
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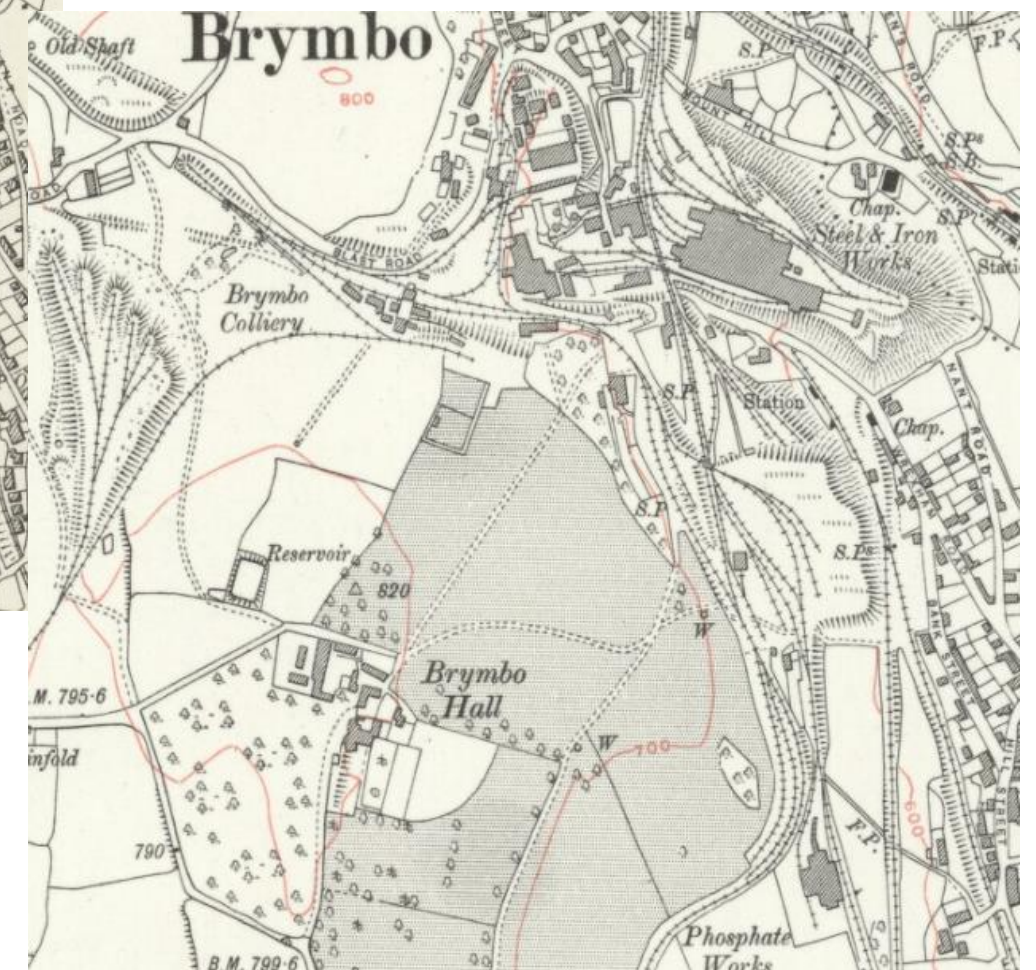


Fig. 7 – Six Inch to One Mile. 1909-10 (revised), 1914 (published). Denbighshire XXVIII.NW.
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Fig. 9 – Six Inch to One Mile. 1938 (revised), 1946 (published). Denbighshire XXVIII.NW.
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Fig. 8 – Six Inch to One Mile. 1949 (revised), 1954 (published). Denbighshire XXVIII.NW.
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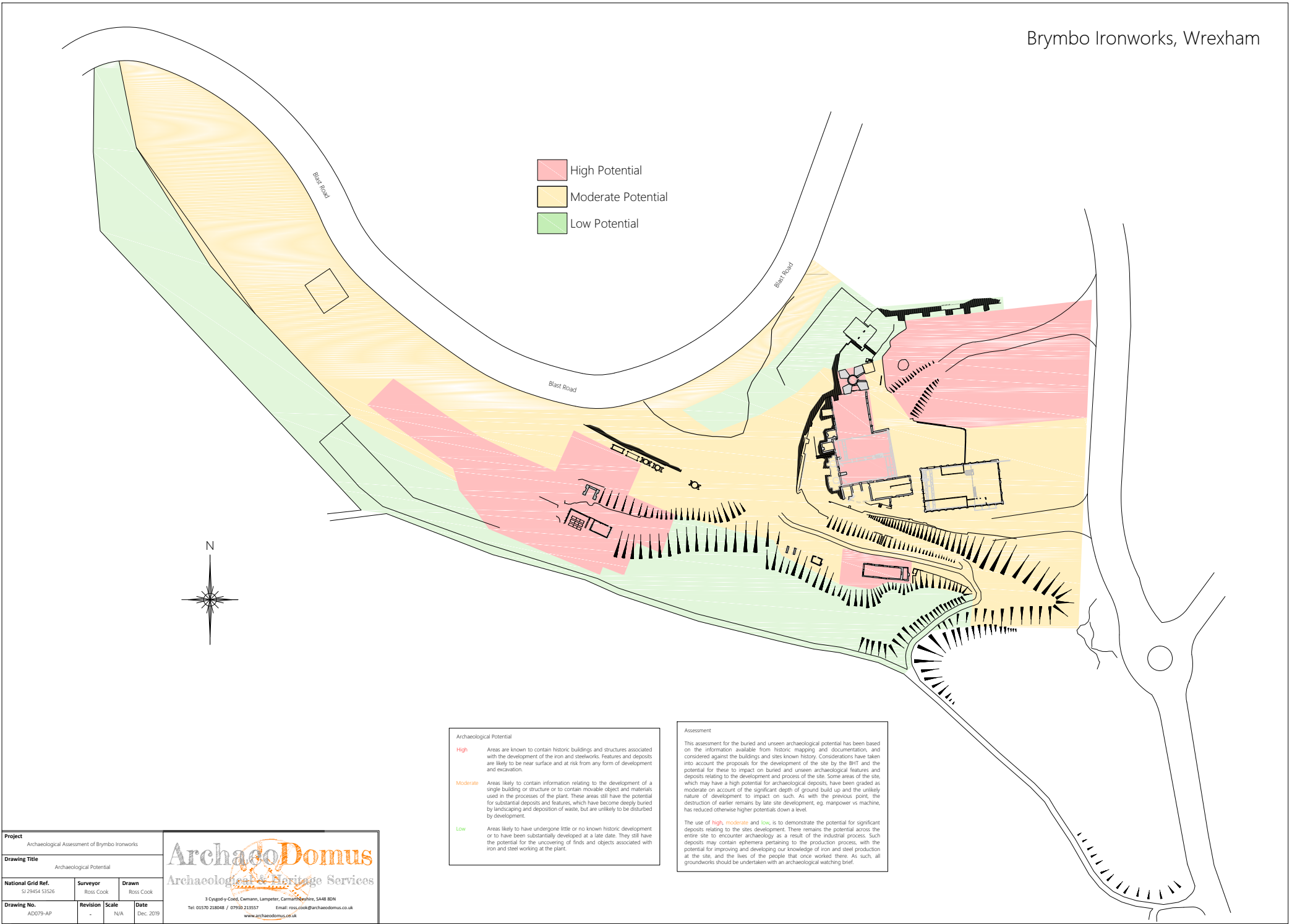
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OUTLINE MATERIALS SPECIFICATION -

To Support a Scheduled Monument Consent Application for:

The conservation-led redevelopment of the Pattern Makers & Carpenters Workshop, including reinstatement of the roof structure, extensive fabric repairs and new visitor interpretation facilities.

1.0 MATERIALS SAMPLES

- 1.1 Prior to the commencement of the repair works undertake a mortar analysis to determine the composition of the original bedding mix for the brickwork. Results to inform the specification of the sand/aggregate of the final mix.
- 1.2 Produce up to 10 no. mortar sample blocks (for pointing to the brickwork and stonework, to ridges & copings) using different combinations of lime and aggregate, from different sources. The mortar sample blocks are to be approximately 100mm square or diameter. Once dry, the blocks are broken in half and the revealed edge examined. Mixes to be based on 1:3 'hot mix' lime and also NHL-3.5 lime in a 1:2½ mix.
- 1.3 Prior to the commencement of works, samples for the following building materials to be provided for inspection and approval by key stakeholders and Cadw –
 - Replacement slates to match size, thickness and character of the existing.
 - Replacement bricks where utilised within the main walls, unless reused.
 - Replacement squared, random and dressed stonework Provide up to 3no. stone samples from different sources, to achieve a good match for any replacement.
 - Sample of proposed replacement floor tiles to match existing.
- 1.4 Provide up to 4no. samples of replacement clear restoration glass for the windows and doors throughout e.g. Tatra P1 Restoration Glass.
- 1.5 Samples of proposed timber for general carpentry and for finer work to internal finishes, windows and doors.
- 1.6 Paint removal test areas on the east elevation to manage the application of proprietary paint removal products in combination with the use of surface cleaning systems such as Jos / Torc and where bitumen, grease and oil is present Doff.

2.0 SLATING

2.1 STRIPPING

- 2.2 Before any stripping commences, count and record the number of courses from existing record photographs and site related information on each roof slope and the slate lengths (i.e. from nail hole to tail), plus any special details including varying widths.
- 2.3 Carefully strip ridges and slates and set aside all sound material for re-use, including slates that can be dressed down in size. Slates that are laminating are to be rejected, unless they can be redressed. All slates are to be stored, neatly stacked, in a secure place, and off the ground.
- 2.4 Carefully de-nail and clean down all timbers and remove all loose debris from roof spaces.

TIMBERWORK

- 2.5 Replacement timber is to be dried to a moisture content of between 15 and 20% and be of matching size and species to that being replaced.

- 2.6 Softwood is to be pressure-impregnated with preservative and any cut ends liberally treated with insecticide/fungicide before being built in.

SLATING BATTENS AND FIXINGS

- 2.7 Fix 50mm x 25mm vacuum preservative treated, softwood slating battens with stainless steel screws. All butt ends are to meet over rafters.

SLATING

- 2.9 Sound, salvaged slates are to be cleaned of all loose debris, sorted to length and thickness and arranged in stacks equivalent to each course length, stacked vertically on their heads (i.e. nail-holes downwards).
- 2.10 The roof is to be re-slatted using the sound slates previously removed where practicable, with deficiencies made up with new, sound slates brought on site to match in type, colour and thickness. Best of existing slates to be relaid and supplemented with new and/or approved matching second hand natural Welsh slates on 25x50mm graded and treated timber battens. Coursing and detailing to match that of the existing. Slates are to be nailed with large headed copper nails 8 gauge (minimum diameter 3mm) driven into the centre of the battens. Large slates to have two nails if necessary, in separate holes. Each course of slates is to have a minimum head and side lap of 75mm to ensure the roof covering will be waterproof. The gauge is to be reduced if a course of shorter slates is introduced, to ensure the minimum head lap. Battens to be fixed with 63mm ringed-shank stainless steel nails. No lengths to be less than 1200mm and all butt ends are to meet over rafters.
- 2.11 Lay a double course of slates at the eaves, with a minimum 75mm overhang, the under-eaves course being set to induce sufficient 'tilt' in the first few courses that only the tails of the slates rest on the courses below.
- 2.12 Slates are to lie evenly without rocking and be graded in thickness across the roof, to avoid sudden changes in thickness and gaps between courses.
- 2.13 Underside of slates to be fully torched with a well-haired, non-hydraulic hot mix lime coat between the battens, nom. 25-30mm thick or a pre-mixed, slaked alternative from an agreed supplier, though the hair should not sit within the premixed consignment for a period exceeding 21 days before use. The mix should be haired to give one hair per millimetre on the side of a trowel (25 hairs per inch). Alternatively, 20-30mm coat of Lime Hemp Plaster (medium) supplied premixed could also be used. Surface between the rafters and the rafters themselves could be finished with 4 No. coats of a proprietary or a site prepared, slaked/hot mixed and sieved limewash.
- 2.14 Existing, interlocking clay ridge tiles to be bedded in a 1:2.5 mix of NHL 5.0. and joints carefully finished with a minimum of exposed mortar. Tiles also to be mechanically (secretly) secured to the ridge timbers with a proprietary fixing as BS EN 5534.
- 2.15 Soakers used throughout to be code 4 sand cast lead with side lap as Lead Sheet Association guidance.
- 2.16 Against all vertical abutments, form 100mm min. upstands and protect with Code 5 sand cast lead cover flashing inserted 25mm into walling, new grooves being cut for the purpose where necessary. Cover flashings are to be secured with lead wedges at 450mm centres and dressed down at least 75mm over upstands. Sheets are not to exceed 1.5m length, to be lapped at least 100mm, and supported at intervals of not more than 750mm by means of lead or copper clips securely fixed to walling behind flashings and dressed up 25mm over outer face.

- 2.17 Patination oil may be applied to exposed leadwork on completion as manufacturer's instructions and guidance.

3.0 MASONRY REPAIRS

REMOVAL OF VEGETATION

- 3.1 Ivy growth and invasive seedlings within the masonry to be carefully removed from mortar joints, reveals and finished surfaces, ensuring that all roots and stems with the potential to regrow have been removed. Any remaining woody material to be treated with a proprietary 'brush-killer' paste or pellets that is drilled into the wood. Cut stems to be protected with plastic in accordance with manufacturer instructions until the chemicals have had an opportunity to act on the stems and roots before further masonry repairs or dismantling work is undertaken with care to remove the roots prior to rebuilding on a like for like basis.

REPOINTING

- 3.2 Patch repointing to both stonework and brickwork, throughout the heritage area to be a 1:3 hot mix lime mortar. Original lime rich mortars that remain in good condition to be left untouched. In preparation for repointing, rake out all loose jointing material to a depth of not less than twice the joint width. All raking/cutting shall leave a clean, square face at the back of the joint. Any sound pointing should be left undisturbed, even if it has weathered back behind the general wall face to as much as half the joint width. Under no circumstances should an angle grinder or similar tool be used. Where it is desirable to remove cement pointing, experiments should be carried out, for the approval of the Architect, to ascertain the most appropriate method of removal, to limit damage to existing work. Unless otherwise agreed, quicklime should be CL90 (high calcium lime), and should be powdered or kibbled lime, from an approved source. Calbux90, powdered quicklime from Tarmac, is an acceptable option. Mixing can be done manually but, for large quantities, a pan type mixer should be used. Mix quicklime and naturally moist aggregate at 1:3 and leave to 'dry-slake' for about 5 minutes or until super-fine dust begins to rise from the mix. Then incrementally add water sufficient to make mortar of the desired consistency. Leave for 10-15 minutes before use or set aside for later use, when a little more water may be added, and the mix beaten. The mix when made up can be stored in galvanised metal tubs. Pozzolanic additives may be desirable to aid the set and weather resistance. These should be added just before use and could either be organic ash or NHL based. Include for full preparation of the joints and for sufficient protection and aftercare of the work to be provided on completion.

NEW BRICKWORK

- 3.3 Rebuild with new approved or reused bricks. Wet brick and brickwork thoroughly before rebedding. In dry conditions keep it damp as work proceeds to prevent de-watering of the mortar. Ensure that the joints are kept full, especially the last joint which may be underpinning existing work. Set mortar back for future render or pointing. Follow original coursing and bonding as recorded. Ensure that joints are not widened during construction.

Keep mortar damp for first three days in summer and at least 1 week in winter by providing ventilated covers eg hessian sacking and spraying with water and covering with polythene sheets / bubble wrap. Rockwool building mats for winter use. Note: these times are minimum times and longer times are desirable. No mortar work to be carried out in frosty weather, when the temperature is below 5 degrees c on a falling thermometer

REPLACEMENT BRICKS

- 3.4 Repairs to the external brickwork to be undertaken in face bricks, in accordance with BS 3921: 1985 Specification for Clay Bricks.

The colour, size and surface texture of the replacement bricks are to match the existing accurately. Brick are to be free from deep or extensive cracks, from damage to edges and corners, from pebbles and from expansive particles of lime.

WEATHERING FILLET TO WALL TOPS

- 3.5 Remove all cement weathering with hand tools only as set out in 'cutting out' above. Bush off, collect and dispose of all loose material. Consolidate wall top or rebuild brickwork where specified on the drawings. Using NHL5 lime:sand mortar to the approved mix create a weathering fillet, avoiding feathered edges, that falls away from the parapet allowing rain water to run off. Reinforce mortar with Telling Brick Mesh. Bed overlapping 400mm x 250mm welsh slates onto mortar with drilled fixing holes at 85mm c/c

Mechanically fix tiles into mortar with stainless steel screws. Slates should protrude over internal brick face by 50mm. Install low modulus silicone fillet (Arbosil 1090 or similar approved) to back joint with stone parapet to prevent vegetation growth or water penetration. Silicone to be coloured dark grey.

STONework

- 3.6 Before dismantling any masonry, make detailed drawn and photographic records. The drawings should be used to record the numbering of courses and individual stones. Stones should then be marked (on a surface that will be hidden when rebuilt) with the number on the drawing. Further photographs should be taken during dismantling to record any special details (e.g. stones bedded at an angle). These records should be kept on site and be used in the repointing/rebuilding process. All the information collected should be handed to the Architect on completion of the work.
- 3.7 Where stonework needs to be dismantled, stones should be carefully lifted to prevent damaging edges, etc, and mortar removed from the bedding surfaces. Stones should be stored as close as possible to the section of wall they have come from, in rows, free from the ground and on separating battens where appropriate. Broken and damaged stones are to be set to one side for inspection by the Architect, in order to agree which can be repaired. Stones are not to be rejected or carted away from site without the Architect's prior agreement. A stone marked for replacement on a drawing may prove to be sound when removed, so should be kept until it can be inspected.

REPAIRS TO STONework

- 3.8 It is essential that blocks are thoroughly dampened before work commences, but no free water should be left lying on surfaces. The mortar should be kept relatively stiff, to reduce shrinkage, but must be wet enough to bed stones in.

Stonework to be rebedded in a 1:3 hot mix lime mortar to sharp sand with added ash pozzolan or NHL as the pointing mix described above.

Prevent damage to stonework, particularly arrises and projecting features. Protect with wooden slats, boards, etc., securely fixed. Remove at Practical Completion. Prevent staining and other disfigurement of stonework during construction.

- 3.9 If resin is to be used in the repair of stones, agree the type of resin to be used. Epoxy resins are commonly used, but polyester resins can be more effective if the stone is damp (although greater care is required in mixing). Resin must not be used across the whole face of a repair, as this can prevent the natural passage of moisture through the stone. It should either be used in 'dabs' or in drilled holes to secure pins and dowels. Generally, repairs should be executed using stainless steel, or other non-ferrous, pins and dowels, rather than relying on the adhesion of resin alone.

- 3.10 Where stone indent repairs are required, carefully cut out defective area of stone to minimum depth of 100mm, to vertical and horizontal joints, square to the face and with sharp arrises

Use light hand tools or, with prior approval, disc cutters to minimise vibration. Cut new stone sawn square to provide joint width no greater than 2mm, worked and finished to conform with existing detail. Fix stone into position with minimum 5mm diameter stainless steel threaded pins secured in annulus of polyester or epoxy resin. Avoid getting resin on adjacent stone faces. Point up with lime mortar finished flush with the face. Mortar colour to match stone as closely as possible.

4.0 JOINERY

- 4.1 To be subjected to controlled drying to achieve a moisture content at time of fixing not exceeding 12% for internal work and 18% for external work. The moisture content is to be correctly maintained until building is handed over.

Softwood is to comply with BS 1186-3:1990 and to be generally free from checks, shakes, pitch pockets, plugs, laminations, pith or pinholes. Types to be:

External use – European Redwood Class 1S

Internal use – European Redwood or Western Hemlock Class 1.

Oak to be European White Oak of a general quality not less than permitted in BS 1186-3:1990.

- 4.2 Apply organic solvent by double vacuum treatment to all external softwood joinery. Before application perform all necessary cutting and machining that is practical but do not assemble. Doors however may be treated after machining and final assembly. Ensure that moisture content is less than 18% before treatment and after treatment before fixing. Where evidence of bats is found, preservative chemicals are not to be used.

Nails to BS 1202: 2002 and screws to BS 1210:1963, each of suitable size and type. Adhesives where required, are to be WBP synthetic resin to BS 1204. Use 'Close-Contact' adhesive where the thickness will not exceed 0.13mm, and 'Gap-Filling' adhesive where it will exceed 0.13mm but not exceed 1.3mm.

- 4.3 Quality of workmanship is generally to be to BS 1186-3:1990. Pre-drill before screwing to avoid splitting. On surfaces that are to be exposed, countersink screw heads 6mm below timber, glue in grain matched pellets and finish flush with face.

Apply two coats preservative to all holes and cuts formed in treated timber.

Fixings to concrete and masonry to be with plugs and screws. Use durable proprietary plastic plugs let into drilled holes. Do not nail directly to masonry without approval. Do not use timber plugs. Packings and grounds are to be the same material as the element they support. Do not use hardboard packing.

- 4.4 External doors to be cleaned down and prepared to be overhauled (including the ironmongery). New matching timber to be pieced in, taking care to ensure that it is well seasoned and between 12% for sheltered internal use or up to 17% externally and to comply with BS 1186:1986: Part 1 and to be generally free from checks, shakes, pitch pockets, plugs, inserts, sapwood joints laminations, pith or pinholes. Where applicable, profile to replacement mouldings and beads to accurately match the existing. Repairs where applicable to be glued and s.s. screwed. Heads of screws to be countersunk where practicable by 6mm below timber surfaces. Glue in grain matched pellets not less than 6mm thick and cut from matching timber. Finish flush with face. Replacement glass in doors to be clear Tatra P1 3-4mm clear glass or similar, all putty fixed prior to decoration. Note, discussions may be necessary with Building Control to discuss and agree a strategy to address safety concerns that might be

raised in connection with a means of dealing with impact resistance. Apply knotting, where required, followed by a proprietary wood primer, one coat of undercoat and two top-coats in a satin finish, colours to be agreed.

- 4.5 Timberwork to be decorated with knotting where required prior to being primed with 1 coat Dulux Weathershield Preservative Primer prior to application of 2 coats Weathershield exterior flexible undercoat and 2 coats Weathershield Satin finish.

Decoration generally, Ironwork to be cleaned down to bare metal before being primed with Dulux Metalsheild zinc-rich primer before the application of two coats of Dulux or similar Metalsheild Satin.

- 4.6 Methodology to lift, dry, repair and reinstate the existing timber block floor to be developed.

5.0 PLAIN PLASTER FINISHES

- 5.1 Plain Plaster finish on lath consists of either a proprietary 1:3 haired lime putty to sharp sand pre-mix (and must be used within 2 weeks to prevent decay of hair reinforcement before carbonation). Alternatively, a site mixed 1:3 lime putty to sharp sand mix should be prepared, ensuring that only sufficient water is used to make the mix workable but not too sloppy. Ox, cow and/or goat hair should be used that is dry, clean and free from grease. Whilst mixing hair to be added so that 25 hairs per inch (hanging on the side of a trowel full) for ceiling work, and 20 hairs per inch for walls. Hair is not absolutely necessary when plastering on masonry but can help bridge over gaps and differing surfaces. It is assumed that the plastering between joists will be a single coat application, or 2-coat, should a more refined finish be desirable. Plaster to be applied to riven oak laths that are spaced off the underside of the floorboards to provide the space for nibs to form and to provide the necessary key. Wood laths are to be fixed using non-ferrous nails. They should be fixed a finger's width apart (about 8-10mm). Adequate time intervals must be allowed between the application of successive coats if applicable in this location to permit adequate hardening before application of the following coat. As a general rule, allow two weeks after applying the scratch coat, and a further week before applying the topcoat. Lime plaster sets/cures when moist. It is important to ensure the successive coats do not dry out too quickly. Allow for checking and wetting any areas that start to dry out after a day or two and hang damp hessian over areas likely to be affected by drafts (e.g. jambs of open windows).
- 5.2 Plain plaster wall finishes where applicable to be lightly cleaned down to remove only the plaster that has decayed significantly and/or has lost its key to the substrate. Whether the background is of solid masonry or riven oak lath, surfaces to be prepared and should be clear of dust and debris. Masonry points should be flush and gaps between laths should be clear to allow the new plaster to form nibs and a sufficient key to the finish. Localised brick and stonework repairs to be undertaken where damaged or eroded. As with the repairs to the ceiling plaster, it is assumed that the plaster finish consists of either a proprietary 1:3 haired lime putty to sharp sand pre-mix (and must be used within 2 weeks to prevent decay of hair reinforcement before carbonation). Alternatively, a site mixed 1:3 lime putty to sharp sand mix by volume should be prepared, ensuring that only enough water is used to make the mix workable but not too sloppy to form the 'coarse stuff'. Ox, cow and/or goat hair should be used that is dry, clean and free from grease. Whilst mixing hair to be added so that 25 hairs per inch (hanging on the side of a trowel full) for ceiling work, and 20 hairs per inch for walls. Hair is not absolutely necessary when plastering on masonry but can help bridge over gaps and differing surfaces. It is assumed that 3-coat work will be used. Finishing coats to be proportioned according to what is being matched, but nominally 1 part lime putty to 1 part sand by volume. If plaster to be applied to a background of riven laths, and if replacement lathing is required, new riven oak laths are to be spaced off the studs and background framing

to provide the space for nibs to form and the necessary key. Wood laths are to be fixed using non-ferrous nails. They should be fixed a finger's width apart (about 8-10mm). Butt ends must not exceed six laths in a line, to avoid joint lines forming in the finished plaster. Panels should be staggered. Background to be well wetted prior to the application of the first coat. Avoid trowelling over the newly applied wet plaster, as this can bring the 'fat' to the surface. Allow for scouring and working over all coats once they have stiffened up, to prevent cracking and to achieve a suitable finish, apart from the scratch coat. Adequate time intervals must be allowed between the application of successive coats if applicable in this location to permit adequate hardening before application of the following coat. As a general rule, allow two weeks after applying the scratch coat, and a further week before applying the topcoat. Lime plaster sets/cures when moist. It is important to ensure the successive coats do not dry out too quickly. Allow for checking and wetting any areas that start to dry out after a day or two and hang damp hessian over areas likely to be affected by drafts (e.g. jambs of open windows).