Historic Building Investigation

Crumpwood Weir Pump House, Denstone Parish, Staffordshire

Client:
Environment Agency

Technical Report:
Chris Wild

Report No:
SA/2019/7

Crumpwood Weir Pump House, Denstone Parish, Staffordshire

NGR:	Centred at NGR 409322 342540
Internal Ref:	SA/2019/7
Planning Ref:	-
Prepared for:	Environment Agency
Document Title:	Crumpwood Weir Pump House, Denstone Parish, Staffordshire
Document Type:	Historic Building Investigation Report
Version:	Version 2.1

Author:	Lewis Stitt & Chris Wild
Date:	March 2018

Approved By:	Chris Wild BSc
Position:	Project Manager (Built Heritage)
Date:	April 2019 Signed:

Contact: Salford Archaeology, Centre for Applied Archaeology, Peel Building, University of Salford, Salford, M5 4WT

Telephone: 0161 295 2542 Email: c.m.wild@salford.ac.uk

Contents

Summary

Crumpwood Pump House represents the earlier of a pair of pump houses that formed the Crumpwood Pumping Station. The pump house was built between 1922 and 1928 in order to increase the supply of clean water from natural springs at Crumpwood to the town of Uttoxeter, Staffordshire, also supplying smaller villages along the route. The initial pumphouse was augmented by a second structure in 1937/8, but only the earlier building retains *in situ* remains of the pumping apparatus, comprising three vertical turbines.

The inclusion of an oil-fired engine, initially coupled with a more traditional belt-driven crankshaft for the pumps, provides a fine visual reminder of this period of transition of power sources, from steam, through gas and oil, to diesel and electrical supply. All such forms of power supply were being incorporated into pumping stations constructed around the same time as that at Crumpwood. However, Crumpwood Pump House is very unusual in that it incorporates hydraulic water ram technology, taking advantage of the pre-existing adjacent Crumpwood Weir to provide a head of water for a race through the structure, the tail race exiting below the weir.

Pumping stations formed an integral part of the network of water supply in the South Staffordshire region, largely created by the South Staffordshire Waterworks Company, formed in 1853, and which finally acquired the responsibility for water supply to Uttoxeter in 1968.

As part of a river-wide scheme to improve habitats for Salmon along the River Churnet, the Environment Agency developed a scheme to insert a fish pass at Crumpwood Weir, and in order to minimise impact to the nineteenth-century Grade II-designated structure, it will be routed through the earliest part of the Crumpwood Pump House. In order to mitigate any damage to this locally significant monument, a Level-2 historic building survey was undertaken by Salford Archaeology in February 2018, with an associated watching brief, monitoring silt removal within the headrace, being undertaken in November 2018.

1. Introduction

1.1 Planning Background

As part of a river-wide scheme to improve habitats for Salmon along the River Churnet, the Environment Agency are developing a scheme to insert fish passes at particular 'pinch-points' along the water course, including at the Grade II-listed Crumpwood Weir (centred at NGR 409323 342540), which acts as a barrier to fish moving upstream. In order to preserve the designated heritage asset, a scheme was devised to use an existing culvert, which runs beneath an undesignated pump house on the northern side of the weir. The pass will enter beneath the pump house from the south before rising in stages to exit over the historic spillway to the west of the pump house and leading into the river channel above the weir. As part of this work a narrow slot will be cut into the western end of the listed weir.

In order to secure archaeological interests, Staffordshire County Council has produced a Written Scheme of Investigation (WSI) detailing mitigative recording works to be undertaken within the affected pump house and adjacent culvert and sluice gates. The WSI includes the following aims:

To carry out a Level 2 photographic, written and drawn survey of the pump house (and contents), the culvert entrance and sluice gates at Crumpwood Weir;

To carry out a limited archaeological intervention to determine the nature and survival of structural elements of the spillway to the west of the pump house;

The WSI was prepared by Staffordshire County Council in March 2017, and the work was undertaken by Salford Archaeology in February and November 2018.

1.2 Methodology

The Historic Building Investigation of Crumpwood Weir Pump House will be conducted following the CIfA Standards and guidance for archaeological building surveys. The survey will be undertaken commensurate with an Historic England Level 2/3-type standard. The detached pigsty structure within the south-eastern part of the complex (Plate 1) is excluded from the present survey.

Historical Research: any relevant documents held within Environment Agency records will be examined to enhance the historical context for the building investigation. A full map regression will also be undertaken, in order to examine changes within the plan-form of the complex over this period.

Photographic Archive: a comprehensive photographic archive for the building will be produced utilising a high-resolution digital camera (>13MP). All frames, excluding general contextual views, will incorporate a graduated metric scale. A plan showing the view point directions will be produced, together with a full photographic index. The archive will comprise the following:

- the external appearance and setting of the buildings, including a mixture of general shots and detailed views taken from perpendicular and oblique angles;
- general shots of the surrounding landscape;

- the general appearance of principal areas, and those pertaining to differing functions within the building;
- any external or internal detail, structural or architectural, which is relevant to the design, development and use of the building, and which does not show adequately on general photographs;
- any internal detailed views of features of especial architectural interest, fixtures and fittings, or fabric detail relevant to phasing the building.

Site Drawings: measured ground floor plans of the buildings, annotated with archaeological detail (historic features, fixtures and fittings) will be produced from data generated by laser scan survey provided by the client. Additional measured survey will be undertaken, if required, utilising manual survey techniques.

Written Description: a description of the buildings will be maintained Historic England Level 2/3 standard. The record will be undertaken digitally as field notes and will be essentially descriptive and provide a systematic account of the origin, development and use of the building, which will include a description of the plan, form, fabric, function, age and development sequence. External and internal elevations will be described, as well as internal rooms, circulation areas, and roof spaces. The written description will comprise:

- an account of each building's past and present use, with the evidence for the interpretation;
- an account of the fixtures, fittings, plant or machinery associated with the building, and their purpose;
- identification of key architectural features, including fixtures and fittings;
- a discussion of the relative significance of each individual component structure within the complex;
- identify any inaccessible / unsafe areas where there is a requirement to undertake a second phase survey (via a watching brief) once those areas are made secure or opened out.

Health and Safety: full regard will be given to all constraints during the course of the project, and all relevant Health and Safety legislation, and codes of practice will be respected. The University of Salford provides a Health and Safety Statement for all projects and maintains a Safety Policy. Salford Archaeology is advised on its Health and Safety matters by the University of Salford, who provide ongoing advice on health and safety matters to all departments in the organisation. All site procedures are in accordance with the guidance set out in the Health and Safety Manual compiled by the Federation of Archaeological Employers and Managers (FAME), and in accordance with current legislation, including:

- The Health and Safety at Work Act (1974);
- Management of Health and Safety at Work Regulations (1999);
- The Construction (Design and Management) Regulations (2015);
- The Control of Asbestos Regulations (2006);
- Construction (Health, Safety and Welfare) Regulations (1996);
- The Health and Safety (Miscellaneous Amendments) Regulations (2002);
- The Control of Substances Hazardous to Health Regulations (2002);
- The Health and Safety (First-Aid) Regulations (1981);

- The Regulatory Reform (Fire Safety) Order (2005);
- The Provision and Use of Work Equipment Regulations (1998);
- Lifting Operations and Lifting Equipment Regulations (1998).

A risk assessment and method statement was produced by the archaeological contractor prior to the commencement of any on-site archaeological works. Salford Archaeology undertakes to safeguard, so far as is reasonably practicable, the health, safety and welfare of its staff and of others who may be affected by our work. This applies in particular to providing and maintaining suitable premises, and providing all reasonable safeguards and precautions against accidents. The University of Salford will also take all reasonable steps to ensure the health and safety of all persons not in their employment, such as volunteers, students, and members of the public.

Archive: the results of the archaeological investigation will form the basis of a full archive to professional standards, in accordance with current Historic England guidelines (*The Management of Archaeological Projects, 2nd edition, 1991*), the *Guidelines for the Preparation of Excavation Archives for Long Term Storage* (UKIC 1990), and current CIfA standards and guidance for the creation, compilation, transportation and deposition of archaeological archive (published December 2014). The project archive represents the collation and indexing of all the data and material gathered during the course of the project. The deposition of a properly ordered and indexed project archive in an appropriate repository is considered an essential and integral element of all archaeological projects by the CIfA in that organisation's code of conduct. Given that the project is unlikey to yield an artefactual archive, and the lack of a receiving museum within Staffordshire, the archive will be submitted entirely in digital format, in PDF and TIFF format. As part of the archiving process, the on-line OASIS (On-line Access to Index of Archaeological Investigations) form will be completed.

The initial result of the fieldwork stage will be the site archive, which will be prepared in accordance with the '*Management of Archaeological Projects*' (English Heritage 1991). The site archive will be so organised as to be compatible with the other archaeological archives produced in Staffordshire. All drawn records to be transferred to and stored in digital format, in systems which are easily accessible. The integrity of the site archive will be maintained upon completion of the archaeological works with the aim of the archive ultimately being deposited via the Archaeology Data Service (ADS).

The information will be finally disseminated through the deposition of the archive with ADS, and a digital and paper copies of the final report with the Staffordshire Historic Environment Record, accompanied by a CD containing the full photographic archive. In the event of significant remains being encountered, however, a higher level of dissemination may be required.

2. The Setting

2.1 Location and Topography

Crumpwood Weir pump house (centred on NGR 409323 342540) lies to the immediate north of the Grade II-designated structure Crumpwood Weir (1391416), on the River Churnet, near Denstone, Staffordshire (Fig 1; Plate 1). The complex is placed within a rural setting within the Quixhill Estate.

Plate 1: Recent aerial view of Crumpwood Weir, footbridge, and pump house complex (red) to the north

3. Historical Background

3.1 The Construction of Crumpwood Weir

The Froghall to Uttoxeter Canal was first approved in 1797, although the route was not finalised until 1802. It was built within the Churnet Valley, in part to transport copper and brass from Oakamoor and Alton (respectively) and coal from Cheadle and Kingsley Moor. The canal also carried limestone and flint to the lime kilns at Froghall Wharf (historicengland.org.uk/listing/the-list/list-entry/1391416).

Crumpwood Weir was constructed within the River Churnet between 1807 and 1811 as part of the construction of the canal. By raising the water level within the river, and thus creating a pool of consistent depth above the weir, the canal could be carried across the River Churnet without the need to construct a viaduct (Fig 2; Plate 2).

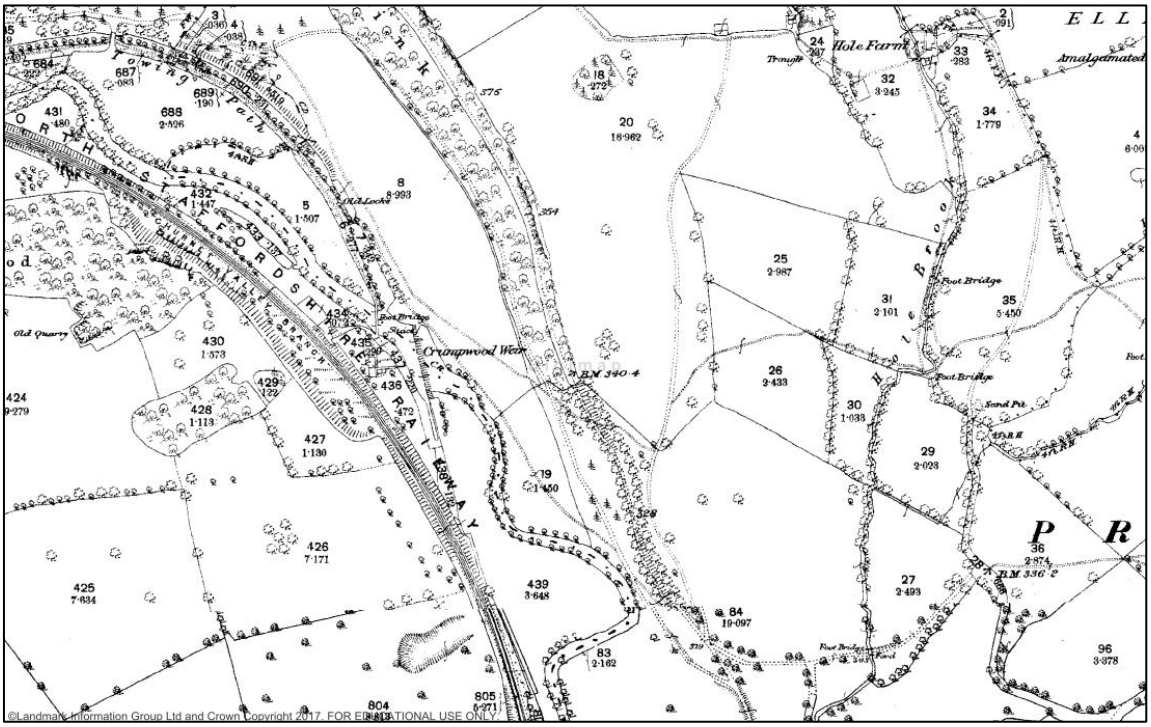


Plate 2: Extract from the Ordnance Survey 1:2,500 edition of 1881, showing Crumpwood Weir and the Froghall to Uttoxeter Canal

The weir comprises a rubble core with an ashlar façade, and measures approximately 30m in length, placed at an angle of approximately 60° across the River Churnet. It has an inclined plane with a vertical drop of approximately 1.5m, with rectangular abutments at either end possessing a degree of architectural embellishment. The northern abutment includes steps to a footbridge, placed perpendicular to the river, and providing access directly to Crumpwood Farmhouse, itself a grade II-designated structure (1190916), which predates the construction of the weir. However, the extant footbridge is of late-twentieth century date and is excluded from the designated monument.

3.2 Water Supply in South Staffordshire

Although pumping engines were developed in the eighteenth century, pumping stations became prominent features of the nineteenth-century landscape, as both population and infrastructure grew with industrialisation. They were used for land drainage within low-lying areas (particularly the Lincolnshire Fens), to maintain water supply into canals, and subsequently for groundwater and sewerage schemes, in an attempt to improve the health of the increasingly urbanised population. This was encapsulated in the 1848 Public Health Act, which required the provision of pure drinking water, improved drainage, and the provision of sewers.

Within Staffordshire, much of this improvement was undertaken by the South Staffordshire Waterworks Company, formed in 1853, mainly focused on providing clean water to the rapidly growing industrial towns of Walsall, Bilston, West Bromwich, Wednesbury, Darlaston, Great Bridge, Dudley, Willenhall, Oldbury, Tipton, and Wolverhampton, as well as the city of Lichfield. By 1850, the population of this area was in excess of 200,000, mostly employed within mining and other heavy manufacturing industries. Crumpwood lay outside South Staffordshire Waterworks Company control until 1968, when works within Uttoxeter District were acquired (Van Leerzem and Williams, 1989).

Initial reservoirs were dug in Lichfield, starting in 1856, and creating Stowe and Minster Pools, completed two years later. A pumping station, containing two 150HP steam engines supplied by James Watt & Co, Birmingham, was erected to the south-west of the town, at Sandfields, opening in October 1858. The South Staffordshire Waterworks Company also proposed to take advantage of a large water aquifer that exists within the underlying Triassic Sandstone throughout much of the region. This involved driving a tunnel from the enlarged Stowe Pool below the city of Lichfield to the newly-built pumping station at Sandfields, approximately a mile in length, and 18ft (5.5m) in diameter, collecting groundwater directly from the sandstone through which it was cut. A further reservoir at Moat Hill Walsall, was completed late in 1858, whilst supply was achieved to Wednesbury and Darlaston the following year, and to Tipton in March 1860 (*ibid*). An additional pumping station, was erected at Wood Green, Wednesbury, in 1871, and as at Sandfields, housed an engine Supplied by James Watt.

Prior to the completion of the water mains, many of the towns within the region relied heavily on private springs, dug into the aquifer. In Dudley, it was recommended as early as 1800 that inhabitants pumped water under the direction of commissioners. A plan for supplying the town with water from springs was formulated as early as 1810, but only came into effect in 1834, when the Dudley Waterworks Company was formed, with boreholes being sunk at Ashfield and Parkes Hall, each with pumping stations supplying a new central reservoir at Shavers End. Despite additional pumping from mines, the supply was ineffective, with supply being intermittent in poorer areas into the 1850s (*ibid*). The company was taken over by the South Staffordshire Waterworks Company in 1862, by which time, the large Coneygre Reservoir, Tipton had been completed to boost supply to Dudley and West Bromwich. This included a pumping station with two 50HP pumping engines powered by four Cornish boilers, pumping water from the reservoir or the main to the higher-level reservoir at Shavers End, Dudley (*ibid*). By August 1863, in the 10 years since its foundation, the company had laid 20 miles of main pipe, 70 miles of service pipe, and made 9,600 supply connections for consumers (*ibid*).

The Burton Waterworks Company was taken over by the South Staffordshire Waterworks Company in 1864, with water being supplied to the town from the reservoirs at Lichfield to the south-west. The smaller town of Tamworth, located to the north-east of the major Black Country conurbation, did not offer a commercially viable incentive to the South Staffordshire Waterworks Company, with the outlay required for infrastructure unlikely to be recouped. The supply here remained independent until 1962, under the auspices of the Tamworth Waterworks Joint Committee from 1878, and between the following year and 1881 a borehole was sunk into the aquifer at Hopwas (*ibid*), with an accompanying pumping engine house. By this date further pumping stations had also been built by the South Staffordshire Waterworks Company at Huntington and Morse Green, serving a new reservoir at Hednesford, sourcing water from beneath the 36 square-mile Cannock Chase, and used to augment the supply of the entire district.

The South Staffordshire Waterworks Act of 1893 authorised the construction of 'new reservoirs and other works', with the company's priority being the construction of additional pumping plant. The first of these, planned as early as 1891 at Fradley, near Burton-on-Trent, was completed in 1894, with a second compound horizontal tandem type engine added two years later. The pumping station at Shenstone, south of Lichfield, was completed the year before the 1893 Act, but was then upgraded by 1896. A further pumping station erected at Bourne Vale, Walsall, in 1894 housed two vertical compound engines.

The sinking of a large borehole on the Ashwood Estate, Kingswinford, in 1884, created the first large-scale supply in the south-western part of the South Staffordshire area. Following the 1893 act, the site was expanded, and by 1904, three pumping engines supplied four million gallons of water per day from six boreholes (*ibid*).

The first record of gas engines being used within the pumping houses of the South Staffordshire Water Company was to pump water from Shavers End reservoir, to a new reservoir dug at Sedgley in 1893 (*ibid*). Two gas-powered engines were supplied by Crossley Brothers of Manchester, at a cost of £305.

Company records for 1896 show that at this date, the company owned 15 reservoirs and 11 pumping stations, housing 25 engines powered by 39 boilers. The engines in use were of various types, including vertical and horizontal engines, with the boilers mostly of Lancashire type.

The South Staffordshire Water Order of 1901 prompted a further round of pumping station construction within the region, with new stations built at Hinksford (1901), Springsmire (1901), Trent Valley (1901), Brindley Bank (1907), Pipe Hill (1910), and Maple Brook, only completed in 1914. A marine-type steam engine was installed at Hinksford, with two tandem horizontal engines installed at Springsmire, Trent Valley, and Pipe Hill, whilst only a single engine of similar type was installed at Brindley Bank. The later station at Maple Brook housed two vertical Corliss engines, which ran until 1971, representing the last surviving steam power plant on the South Staffordshire Waterworks network. Although Maple Brook was not electrified until the 1970s, the station at Springsmire was electrified as early as 1928.

By this date, new power-plant technologies were being embraced, with a small pumping station built in 1911 at Hunnington, near Halesowen, being powered by two Tangye oil-fuelled engines, with the plant being electrified in 1931. The Somerford Pumping Station,

close to Wolverhampton, and completed in 1923, represented the first station to embrace diesel engine technology, which provided sufficient power to pump 750 gallons per minute (*ibid*). Yet even at this date, steam engine technology had not been completely abandoned, with the new pumping station at Slade Heath, Brewood, built in 1924 and housing a triple expansion vertical engine.

Despite the development of the infrastructure, by 1925, the number of pumping engines had only increased from 25 to 27 since 1896. Capacity however, had almost doubled, from a recorded daily peak of just over 12 million in May 1896, to an average of 22 million per day in 1925.

3.2 The Crumpwood Pump House complex

The site of Crumpwood Pumping Station lies within the catchment of the town of Uttoxeter, which prior to its acquisition by the South Staffordshire Waterworks Company in 1968, was managed by the Uttoxeter Urban and Rural District Council.

Uttoxeter's early water supply was sourced from Bramshall Springs, and channelled into a reservoir on the western edge of the town. From here it was piped to underground tanks in the streets, and cellars of the larger houses and drawn to the surface by means of hand pumps (*ibid*). Following the Uttoxeter Water Act of 1892, a large reservoir was constructed at Bramshall, and water was piped from there into the town via an 8" gravity main. By 1896 the Urban District Council had acquired a borehole, situated by the railway near Bridge Street, which yielded 45,000 gallons per day. This was abandoned in 1926 due to poor water quality.

Crumpwood Springs, which comprise a series of chambered springs were purchased by the Uttoxeter Urban and Rural District Council in 1922. A pump well was sunk, around 200m to the south of the springs, and a pumping station, cited adjacent to the weir, following the disuse of the canal, was completed in 1928 (ibid). Engineering drawings relating to the construction of the pump house, produced on behalf of Uttoxeter Urban District Council (Appendix 2), show the proposed layout of the pump house and head race (Plates 2 and 3). It contained three 11 horse-power vertical turbines manufactured by Messrs Gilbert Gilkes & Gordon Ltd, of Kendal, and comprising treble ram reciprocating pumps, which gave a total output of 15,000 gallons per hour, when the river conditions were suitable, the pumps being driven by a headrace from the River Churnet (Fig 2; Plate 2). The pumps were powered by a 25BHP oil-powered engine, the fuel tank of which was placed against the north wall. A belt drive on the northern side of the engine powered the main drive shaft on the western side of the pumps, with pinion wheels coupling with the gear wheels of the crankshaft to each pump (Plate 3).

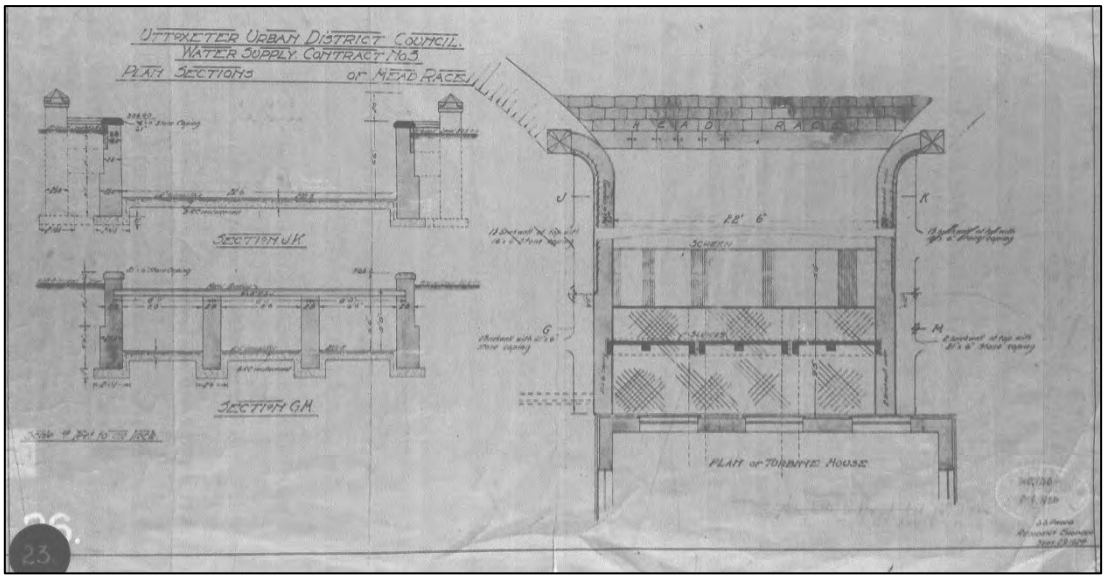


Plate 2: Undated engineer's plan of head race by Uttoxeter Urban District Council

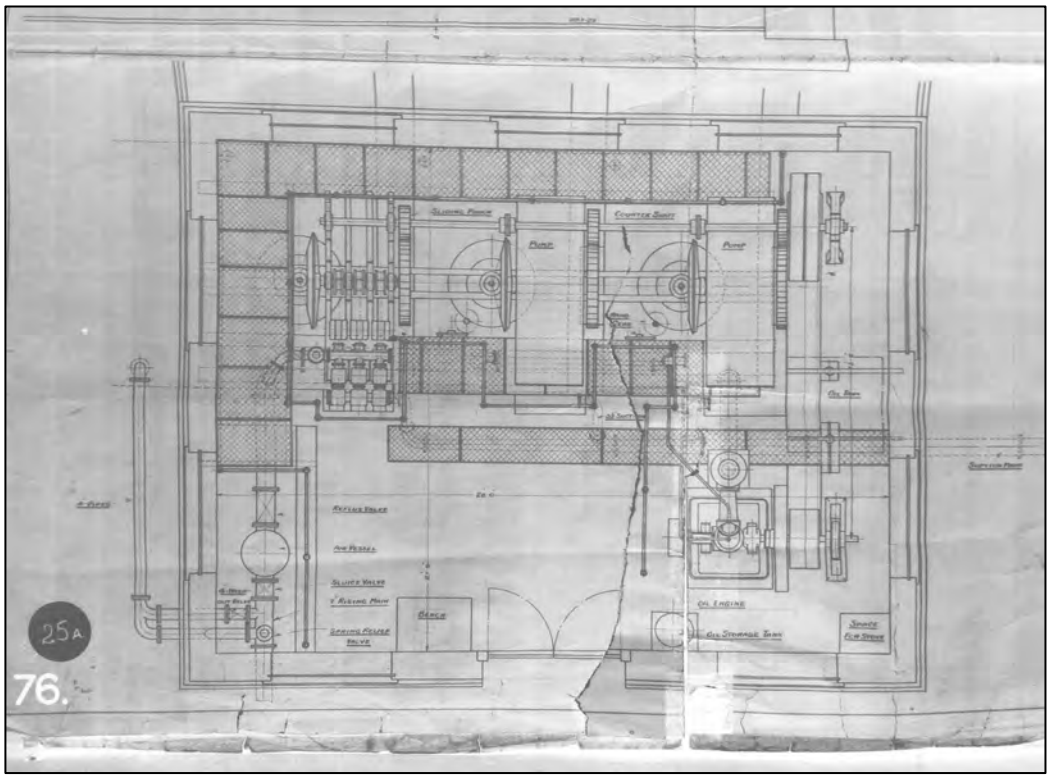


Plate 3: Engineer's plan for pump house

Water was pumped from Crumpwood through a 7" main to a small reservoir at Prestwood, approximately half a mile to the south east, from where the water was gravity fed to Bramshall Reservoir, supplying Denstone, Rocester and Stramshall *en route*, and a branch gave a direct supply to the elevated portion of the town at its southern end.

Supply was increased by 15,000 gallons per hour in 1938, following the completion of the No 2 Pump House, in a rectangular structure adjacent to the original pump house (Fig 2). This housed a 32 horse-power, slip ring, rotor-induction electric motor, driving a high lift

turbine pump, although this was removed subsequently, with the building being used solely as a garage, and being excluded from the present survey.

An undated drawing within the Uttoxeter Urban District Council archive (Plate 4), shows proposals for the removal of the 25 horse-power engine and crankshaft within the original pump house, and its replacement with a 32- horse powered motor and suction pump, with an electrical power supply. Although the drawing is undated, the referral to the building as Pumphouse No 1, demonstrates that the addition of 1938 had already been completed. This second motor survives within the present structure, but presumably predates the increase in production of the complex to up to 2 million gallons per day, following its acquisition by the South Staffordshire Waterworks Company in 1968, when new drawings were prepared for upgrading the network (Appendix 2).

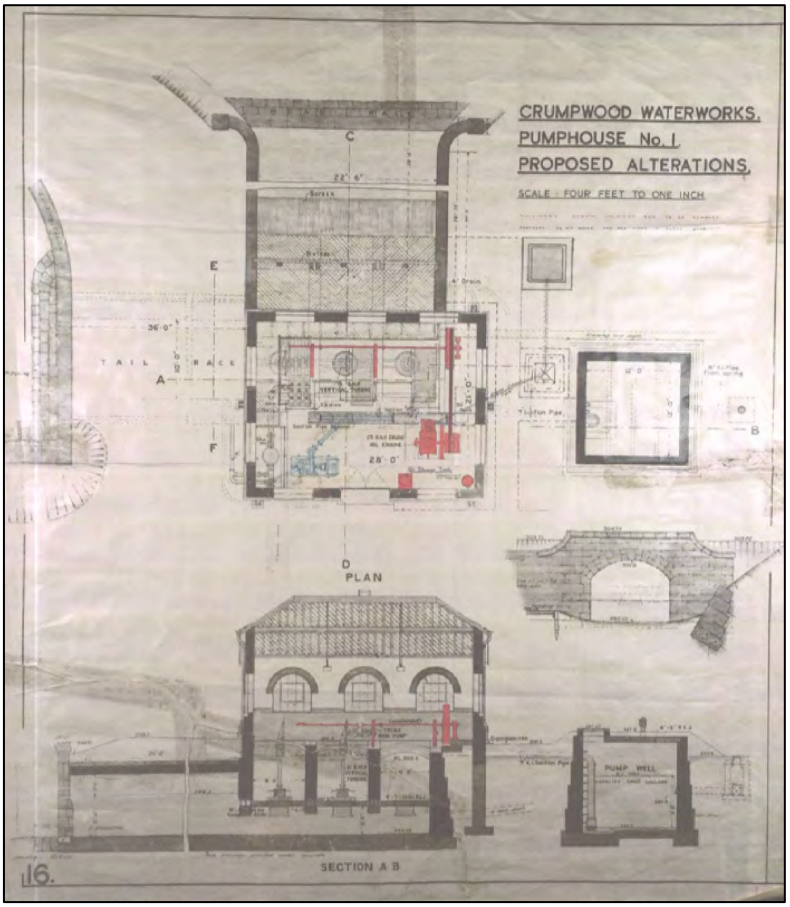


Plate 4: Engineer's drawing showing proposed changes to the power supply for the pump house

The exact date of closure of the pumping station is unclear, due to increasing episodes of pollution within the supply, but a demolition works was produced by the company in October 1980, suggesting that it was closed earlier that year, or in the very late 1970s (Appendix 2).

4. Historic Building Investigation

4.1 Introduction

A programme of historic building investigation was undertaken to Historic England Level II standard at Crumpwood Weir pump house on 15th February 2018.

The site lies to the immediate north of the Grade II-designated Crumpwood Weir, on the River Churnet, Staffordshire, and comprises three structures; the original early-twentieth century pump house, a detached extension to the north, and a small square structure placed between the two larger buildings (Figs 1 and 2; Plates 5 and 6).

Plate 5: Original pump house (left) with later extensions to the north

Plate 6: Crumpwood Weir, footbridge, and pump house complex, from approach road

The original pump house has a silted head race on its western side, and a tail race within a culvert covered with scrub vegetation to the south. The ashlar façade of the tail race survives, and trees encroaching on the entrance have been felled (Plate 7). The earthwork of a pump well is maintained to the north of the building (Plate 8), with the later single-storey rectangular structure placed on its eastern side. Neither structure, nor the small 1.9m² brick infill cell are to be affected by the proposed works to the pump house and were omitted from the survey.

Plate 7: Ashlar opening of tail race, with overgrown boundary fence to the rear

Plate 8: Earthwork of well head, with No 1 Pump House to right, and No 2 Pump House on left

The complex is contained within an iron rail fence (Plate 8), which is probably original, but is heavily overgrown on the southern side of the pump house (Plate 6). Access is from a metalled track to the east of the complex within the Quixhill Estate (Plate 6).

4.2 External Description

Eastern Façade: the eastern elevation forms the principal façade of the single-storey pump house, and is of three bays (Fig 3), in English Bond construction, comprising machine-made brick bonded in a pale cementitious mortar (Plate 9). The central 6' (1.83m) wide doorway has a round-headed arch, formed of slightly-tapering voussoir bricks, below a projecting decorative hood-mould, almost certainly formed of cement, but coloured to a pale buff finish, giving the impression of it being of sandstone. The mould continues to form a string course across the elevation, also forming hood moulds to the flanking windows. These are of similar construction and proportions, with projecting concrete sills, again in a buff colour, giving the appearance of sandstone from a distance. Each houses an original 20-light window with metal frame, and central six-light, horizontal tilt opening (Plates 9 and 10). The door is almost certainly an original feature, comprising a plank and batten door with ornate *fleur-de-lys* strap hinges (Plate 11), and is accessed via a plain concrete step.

Plate 9: Principal eastern façade of the pump house

Plate 10: Detail of window in eastern façade

Plate 11: Detail of entrance doorway

Three courses below window-sill level, the façade has a plinth, the offset being formed by two courses of chamfered brickwork (Plate 12). Either end of the elevation retains what appear to be original cast-iron down pipes, clamped to iron wall plates, and with angled sections around the plinth and from the projecting original timber guttering, which is attached to the roll-moulded eaves board by wrought-iron clips (Plate 13). The roof above is half-hipped, comprising uniform courses of welsh slate below a half-round ceramic ridge (Plate 14). This has ball finials to both ends and a central galvanised metal sheet cupola (Plate 14), which presumably served as a vent above the internal pumps and engine.

Plate 12: Detail of chamfered plinth, and cast-iron down pipe and attachment brackets

Plate 13: Detail of timber gutter and moulded eaves board

Plate 14: Detail of cupola, ridge tiles and finial

The elevation also has two modern security lights and associated ducting, but these detract little from the original appearance of the building (Plates 9 and 11).

Western elevation: the western elevation forms the rear of the building, but was of similar decorative construction, with each of the three bays housing a 6' (1.83m) wide window, again with hood-mould and 6-light tilt opening (Fig 4; Plate 15). The angled plinth was also continuous from the gable walls (Plate 15). Below ground, the western elevation was open-fronted, with three 6'6" (1.98m) wide arches, with 18" (0.46m) wide piers forming chambers for each of the three internal pumps (Plate 16). Each chamber appears to be of Staffordshire Blue brick construction, with three-rowlock arches to the elevation (Plate 16), mainly obscured externally by the lattice cast-iron grid gantry across the head race, carried on I-section steel beams (Plate 17).

Plate 15: Rear, western elevation of pump house

Plate 16: Arched opening into pump chamber

Plate 17: Opening into pump chamber beneath gantry

Southern elevation: the south elevation forms the southern gable of the building, with a flat wall-head to the half-hipped roof above (Plate 18). It is of similar style and construction to the long walls, with the plinth and string course being continuous across the wall (Fig 5; Plate 18). Two windows, placed either side of a central down pipe match those of the east and west walls, but are smaller, being of only 5' (1.52m) width, but retaining smaller 20-light windows of similar style (Plate 18). The cast-iron down pipe serves a short gutter to the hip, all elements being similar to those described on the eastern

façade, and presumably representing original features. A notice board attached to the western side of the elevation appears to be a later addition.

Plate 18: Southern elevation of pump house

Northern elevation: the northern elevation of the pump house was constructed to match the south elevation (Fig 6; Plate 19). It was latterly partially overlain by the single-storey brick structure erected between the original pump house and a later structure offset to the north-east (Plate 19). The hopper for the centrally-place down pipe is raised above ground, adjacent to concrete shuttering for a suction pipe linking the internal pump motor with the pump well immediately to the north of the pump house.

Plate 19: Northern elevation of pump house

Head race: the head race to the west of the pump house was heavily silted at the time of the initial survey (Plate 20). The lower levels of the head race are described in greater detail within the Watching Brief results, below (*see Section 5.2*). The head race comprises two side walls, each of two-brick, 1'6" width (0.46m), in English Bond construction below chamfered sandstone copings placed six courses (0.55m) below the base of the plinth of the west elevation of the pump house (Fig 4; Plate 20). The walls are set 22'6" (6.86m) apart, to form a head race of 28'6" (8.69m) length, with both walls curving outwards onto the river bank, and terminating in 2'² (0.61m) brick piers capped within chamfered pyramid stone copings (Plates 20 and 21).

Plate 20: Silted head race from river bank

Plate 21: Detail of piers at end of head race wall

At its eastern end, the head race has a screen formed of narrow-set iron bars, forming a filter to a set of sluice gates placed outside the pump house, to the west of the pump chambers. This was heavily overgrown at the time of the initial survey, but had been cleared for a width of approximately 0.5m along its northern edge (Plate 22). This

clearance also revealed the lattice gantry plates to the west of the sluice gate mechanism (Plate 22).

Plate 22: Iron screen and gantry to sluice gate control

Each pump chamber had a sluice gate, controlled by a valve mounted onto a timber frame. Each of the three valves comprises a timber stem, with cast-iron ratchet bar controlled by a vertically, rather than horizontally-set wheel, attached to a cast-iron yoke and gear wheel (Plate 23). The wheels are stamped '*GILKES*' (Plate 23) referring to the company Gilbert Gilkes & Co Ltd, Kendal, who installed the pumps.

Plate 23: Detail of sluice valve

4.3 Internal Description

Elevations: the internal elevations of the pump house are of rendered brick construction, with the lower 4' (1.22m) having a dark-brown glazed tile facing, to give the impression of salt-glazed brick construction (Plate 24). This is clearly evident around the eastern window in the north wall, where several tiles have become displaced within the window jamb, not only revealing individual dislodged tiles (Plate 25), but also exposing the thin tile facing on the main wall (Plate 25). The partial survival of an indented stamp within the wall plaster revealed the tiles to be produced by well-renowned local manufacturer of Minton Hollins & Co. The upper row of tiles forms a moulded cornice (Plate 25), and the internal arches are also picked out with glazed tiling within the painted plastered upper wall (Plate 24).

Plate 24: Interior of pump house, looking south

Plate 25: Missing tiles within window jamb, and partial stamp imprint in plaster

Roof and flooring: the roof is carried on two lattice trusses of L-section steel, with angled three-piece ties, and with all joints fixed with gusset plates (Plates 24 and 26). The ends of the trusses were concealed within the wall thickness, but are probably mounted on concrete or sandstone pads within the brick wall. The trusses clasp a single timber purlin to each pitch, which carry common rafters that butt a slender ridge board (Plate 26). Short valley ridges carry the narrow hips to either gable (Plate 26), and two short noggin timbers between the central rafters of either pitch form the framing for the cupola vent above (Plate 26). The rafters carry angled sarking boards, with all the timbers painted black, contrasting with the red-leaded trusses (Plate 26).

Plate 26: Detail of roof

The extant flooring is predominantly of small rectangular quarry tiles, laid in herringbone pattern (Plate 27). This current arrangement appears to date from the replacement of the original 25 horse-power engine, with a 32 horse-powered motor, placed on an extant concrete base in the south-eastern corner of the building. The original engine was placed adjacent to the northern pump chamber, with no mountings visible within the extant tile floor. It is probable, however, that the secondary floor represented a renewal of the original floor surface, with elements of the floor probably being original. Gang plates within the floor cover a channel that housed the suction pipe from the pump well to the north of the building.

Plate 27: Detail of herringbone tiled floor

Pump machinery: the remains of three pumps survive within the pump house, fenced within *in*-situ iron railings, and set on a concrete base within the floor, each placed above a pump chamber (Fig 7; Plate 28). Each represents a Gilbert Gilkes 11 horse-power vertical suction pumping turbine, with a crankshaft powering three pistons (Plate 28). The drive shaft, placed on the western side of the three turbines has been removed, but the fixings for its bearings remain visible (Plate 28), and the associated gear wheels on each crankshaft survive (Plate 28). Each also retains a ratchet valve and hand wheel, as well as the pump shaft (Plate 28).

Plate 28: Crankshaft bearing bolts, crankshaft and pistons of central turbine pump

Each chamber retains an access ladder, typically much corroded (Plate 29), with an *in-situ* diaphragm obscuring the base of the pump within the partially-silted chamber (Plate 29).

Plate 29: Detail of pump chamber

In the south-eastern corner of the pump house the outflow valve survives *in situ*, although it has been disconnected (Plate 30). The large air vessel rises above the floor as does the horizontal hand wheel for the sluice valve, manufactured by Glenfield, an established hydro-engineering company based in Prestwick, Ayrshire.

Plate 30: Outflow valve, with large air vessel

5. Watching Brief

5.1 Introduction

An archaeological watching brief was maintained during the excavation and removal of the silted deposits to the south-west of the pump house. The results of this are discussed below.

5.2 Watching brief results

A small trench measuring 7m long by 5.23m wide was excavated to the south-west of the sluice gates at the rear of the pump house (Fig 2; Plate 31). The deposit comprised 1.1m of a dark brown silt that had been accumulated directly on top of a concrete base (Plate 32) and was flanked by two brick retaining walls of 2m height, which had oversailing chamfered sandstone copings (Plates 32 and 34).

Plate 32: General view of the watching brief area

Plate 33: Concrete base directly below the silt deposit, forming the base of the weir

Plate 34: The retaining wall to the rear of the pump house

Plate 35: The wrought-iron grate of the weir

The chamfered wrought-iron grate of the weir had been obscured for much of its height with this silt deposit. Excavation of the silt revealed that the grate comprised full-length narrow bars, placed on 1” (25mm) spacings, and set at an angle of 25° into the concrete base (Plates 33 and 35).

The archaeological watching brief did not reveal any artefacts of archaeological significance.

6. Discussion

6.1 Discussion

The Crumpwood Pump House represents a good example of an early-twentieth century pumping station and was associated with the improved water supply for the nearby town of Uttoxeter. Its rarity and importance are increased by the retention of the three original vertical turbines, and evidence for the power transfer from the original oil-fired engine, which was replaced with an electric motor sometime after 1938.

Pumping stations formed an integral element of the organised supply of clean water to homes and businesses in South Staffordshire, that began in the second half of the nineteenth century. The region is blessed with a significant freshwater aquifer within the natural Triassic sandstone, and this was used to provide water within the regional on an individual pumped basis into the twentieth century within some parts of the region. However, it was the formation of the South Staffordshire Waterworks Company in 1853, in response to the 1848 Public Health Act, that heralded the beginning of organised, consistent water supply to an ever-increasing percentage of the population within the region. This was based on the expansion of existing pools within Lichfield to form reservoirs, the water from which could be pumped around an expanding mains network by steam-powered engines.

Progress was piecemeal, generally prompted by the passing of local legislation granting powers to the company to raise funds for the construction of new infrastructure, and by the acquisition of smaller local water providers right up until the second half of the twentieth century. The number of pumping stations within the South Staffordshire region grew steadily through the second half of the nineteenth century and reflected many of the technological advances in power plant technology, driven by the textile industry, and including the adoption of single, then tandem horizontal steam engines, and Lancashire boilers to generate the steam.

A major episode of pumping station construction was undertaken from the 1890s, largely stimulated by the South Staffordshire Waterworks Act of 1893. This work continued well into the twentieth century, by which time alternative power sources were being explored, with oil-fired engines, as at Crumpwood, being installed at 1911, and the first diesel-power pumping station being completed in 1923, several years before the completion of the Crumpwood site. The electrification of the Springsmire pumping house in 1928 represented the beginning of a process that was not completed until 1972, but also suggests that Crumpwood No 1 Pump House was one of the last non-electric pumping stations built, itself being converted sometime after 1938, by which time the electric motors within the newly-constructed No 2 Pump House, had proved successful.

One of the reasons that the Crumpwood pumping station required such a relatively low-powered oil-fired engine, compared to the dual engines required at the small pumping station at Hunnington, for example, was due to the majority of the power being supplied

by a water ram, taking water from the River Churnet above the pre-existing Crumpwood Weir.

6.2 Conclusion

Although the proposed fish-pass scheme does impact on the pump house, this will only lead to the removal of a relatively minor portion of the structure below floor level and will allow for the refurbishment of one of the pumps into working order, offsetting this slight loss.

The watching brief revealed a relatively rough concrete slab forming the base of the head race, which is of low archaeological significance, and requires no further mitigation.

Sources

Maps

Ordnance Survey 1:25", Staffordshire Sheet XX.10. Surveyed 1880, published 1881

Ordnance Survey 1:25", Staffordshire Sheet XX.10. Revised 1898, published 1900

Ordnance Survey 1:25", Staffordshire Sheet XX.10. Revised 1920, published 1922

Ordnance Survey 1:10560, County Series, Staffordshire, published 1955

Secondary Sources

Department for Communities and Local Government, 2012 *National Planning Policy Framework*

Historic England 2008 *Conservation Principles, Policies and Guidelines* London

Historic England 2016 *Understanding Historic Buildings: A Guide to Good Practice* E-book https://historicengland.org.uk/images-books/publications/understanding-historic-buildings/ Accessed 07.08.2017

Van Leerzem, J and Williams, B 1989 *The History of the South Staffordsdhire Waterworks Company 1853-1989.* http://southstaffswaterarchives.org.uk/SSHISTRY2.pdf. Accessed 19.11.2018

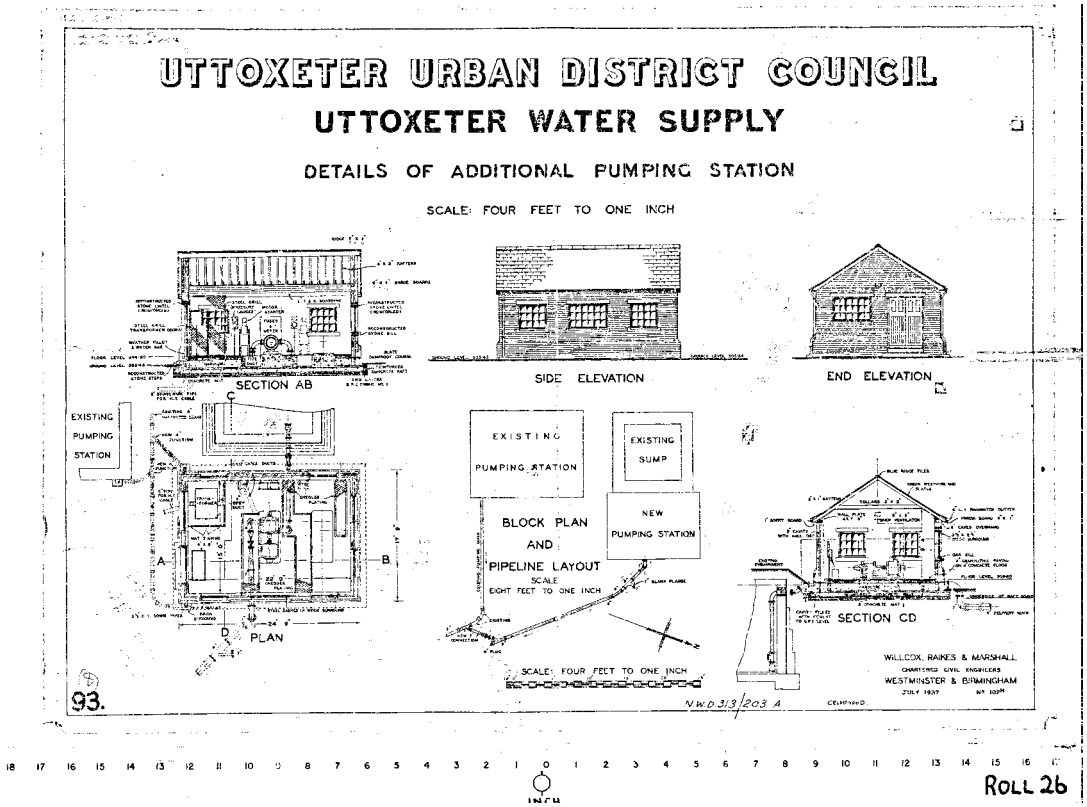
Acknowledgements

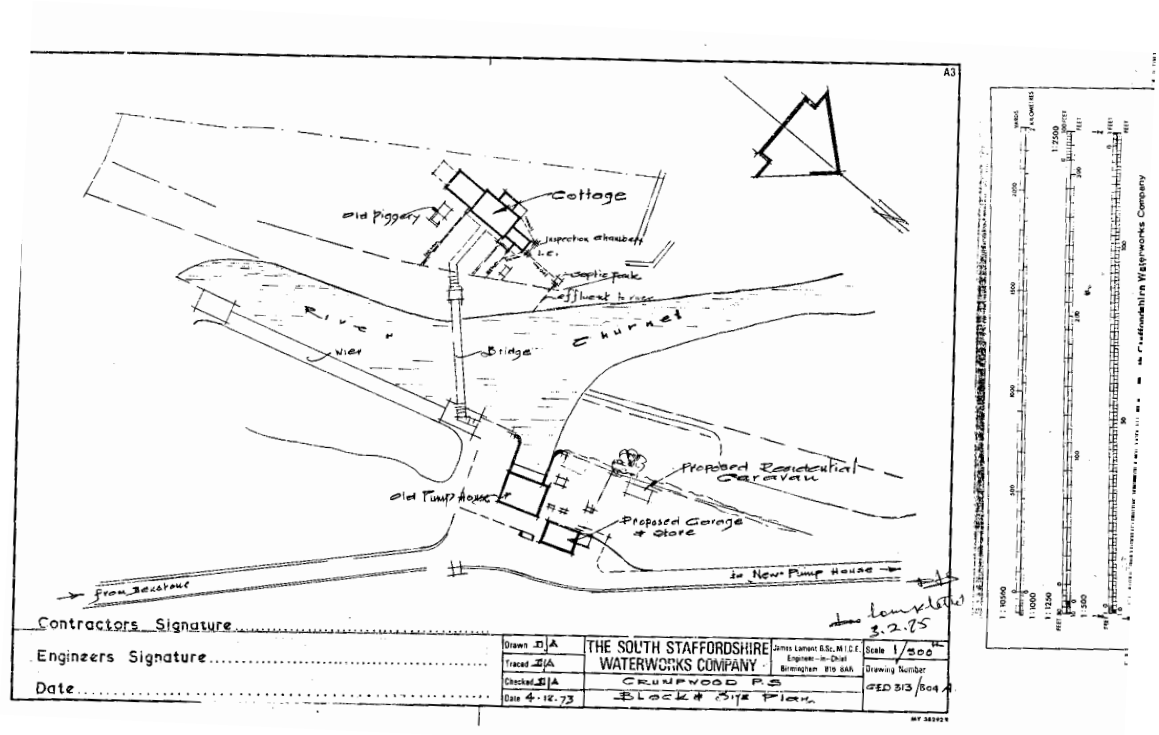
Salford Archaeology would like to thank Christopher Grzesiok of The Environment Agency for commissioning the programme of archaeological works, and for providing logistical support.

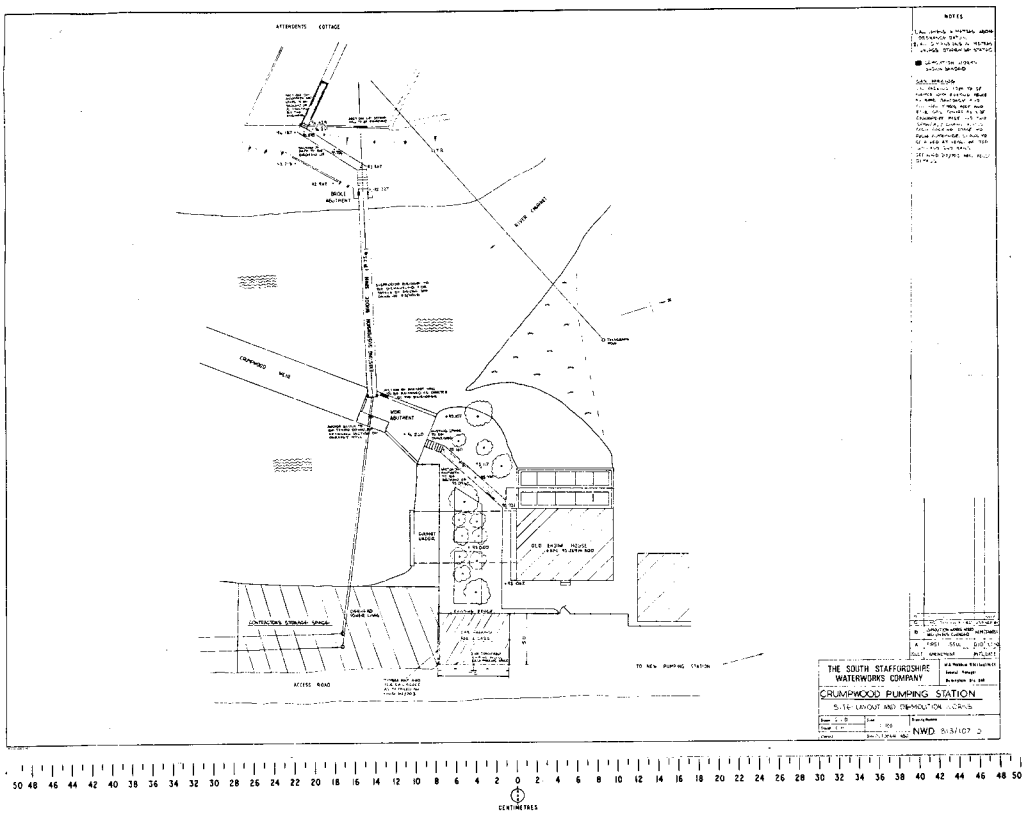
The on-site works, report compilation, and illustrations were produced by Lewis Stitt and Chris Wild. This report was edited by Chris Wild, who was also responsible for project management.

Appendix 1: Illustrations

Appendix 2: Archive Drawings of Crumpwood Pump House





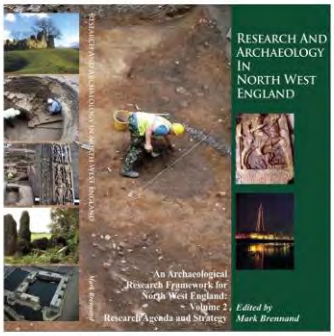

ATTENDENTS COTTAGE
NOTES
THE SOUTH STAFFORDSHIRE WATERWORKS COMPANY
CRUMPWOOD PUMPING STATION
SITE LAYOUT AND DEMOLITION WORKS
NWD 8/3/107 D
CONTRACTORS STORAGE SPACE
ACCESS ROAD
TO NEW PUMPING STATION
CENTIMETRES

University of Salford MANCHESTER

The Centre for Applied Archaeology

REGISTERED ORGANISATION IfA

CONSULTANCY



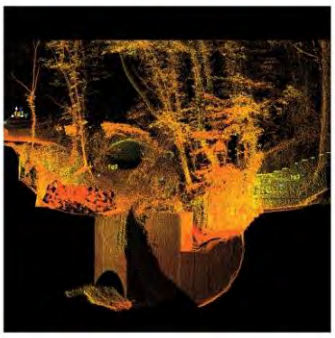
DESK BASED ASSESMENTS

WATCHING BRIEF & EVALUATION

EXCAVATION

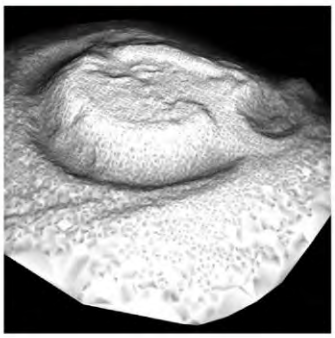
BUILDING SURVEY

3D LASER SCANNING



COMMUNITY INVOLVEMENT

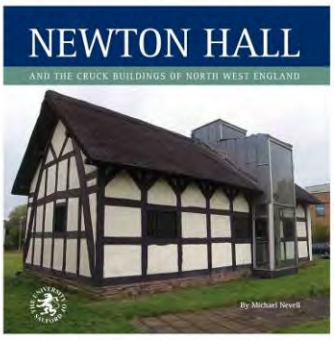
LANDSCAPE SURVEYS



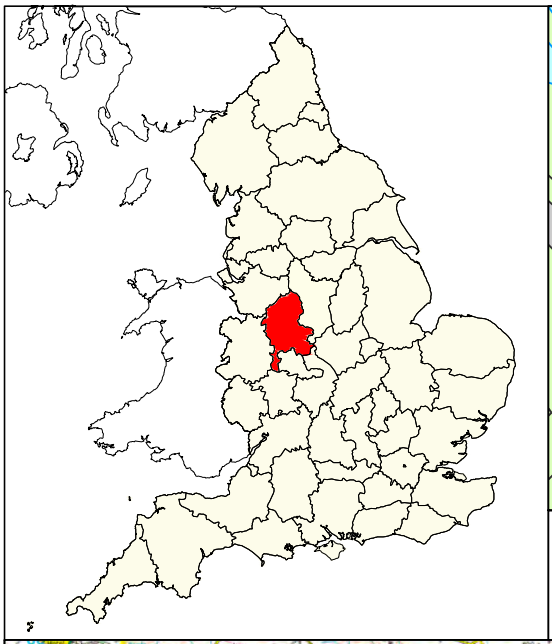
GEOPHYSICAL SURVEYS

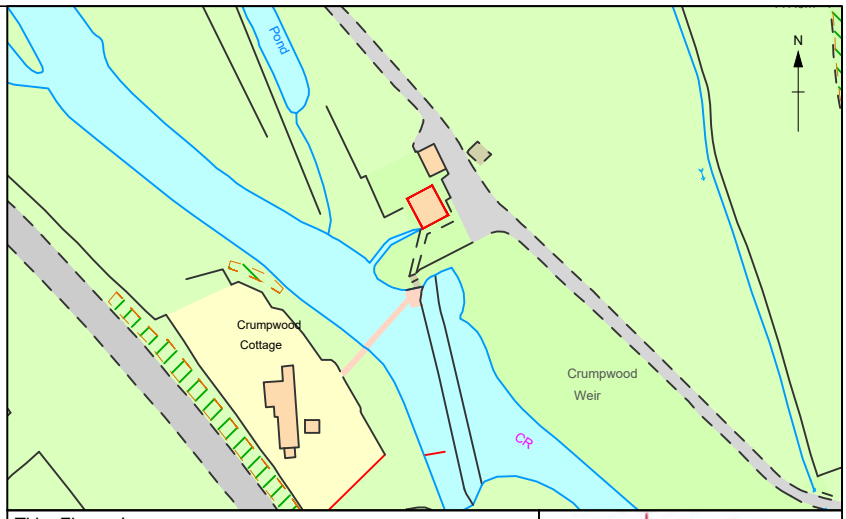
WORKSHOPS & VOCATIONAL TRAINING

RESEARCH PUBLICATIONS



SEMINARS, DAYSCHOOLS CPD EVENTS

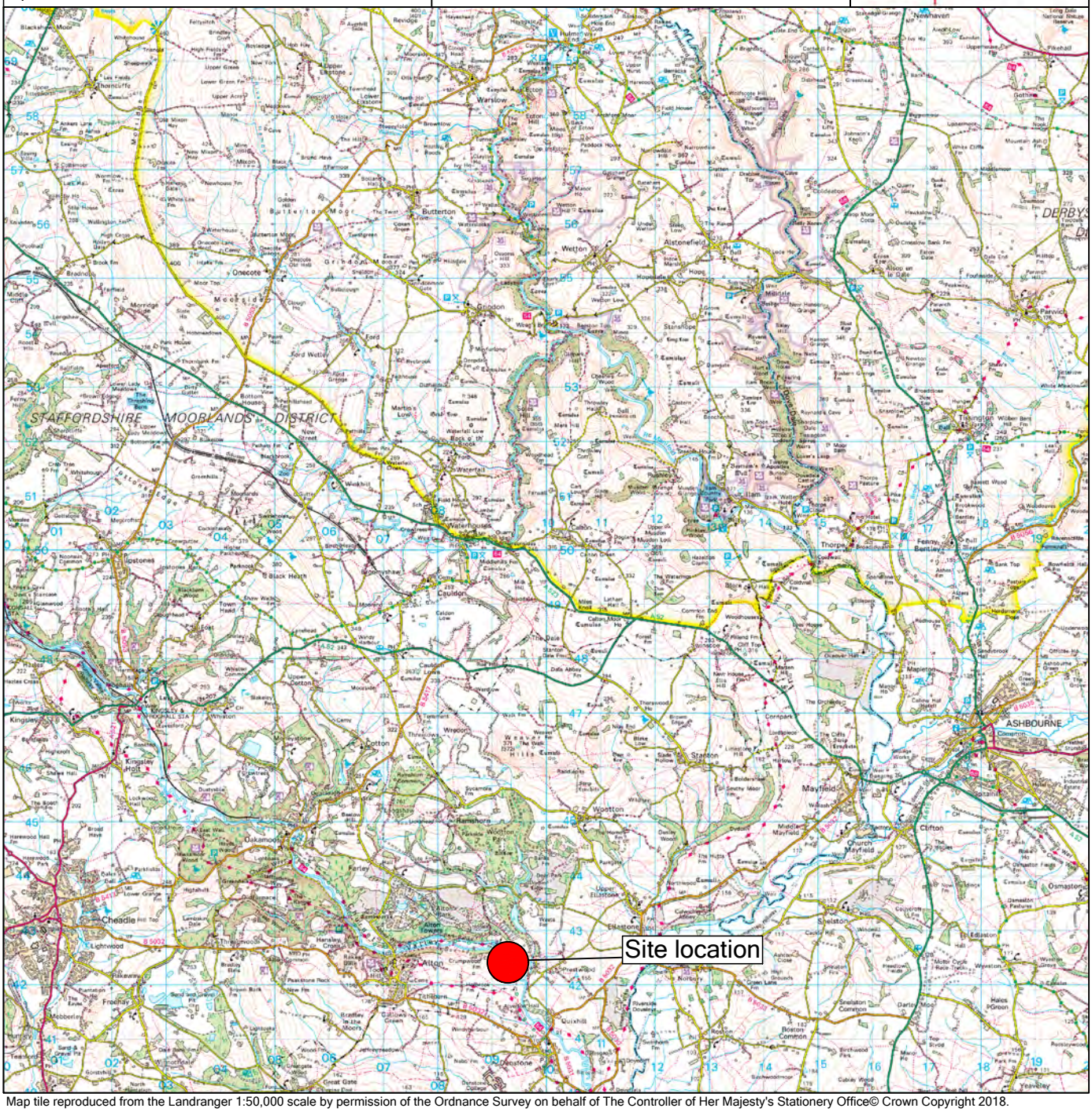




Title: Figure 1
Crumpwood Weir, Denstone Parish, Staffordshire
Site Location

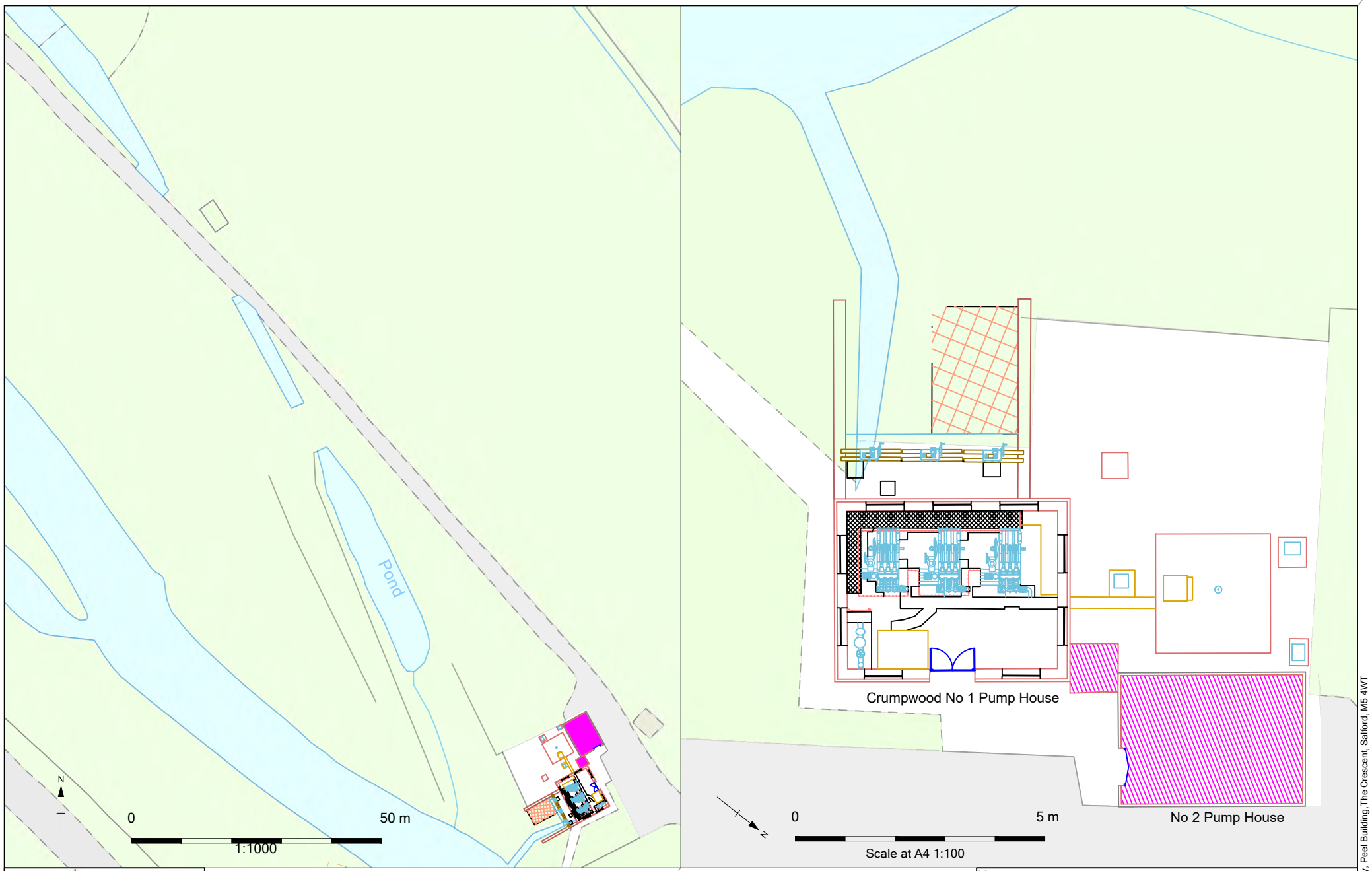
University of Salford MANCHESTER

SA SALFORD ARCHAEOLOGY



Map tile reproduced from the Landranger 1:50,000 scale by permission of the Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office© Crown Copyright 2018.

Salford Archaeology, Peel Building,The Crescent, Salford, M5 4WT

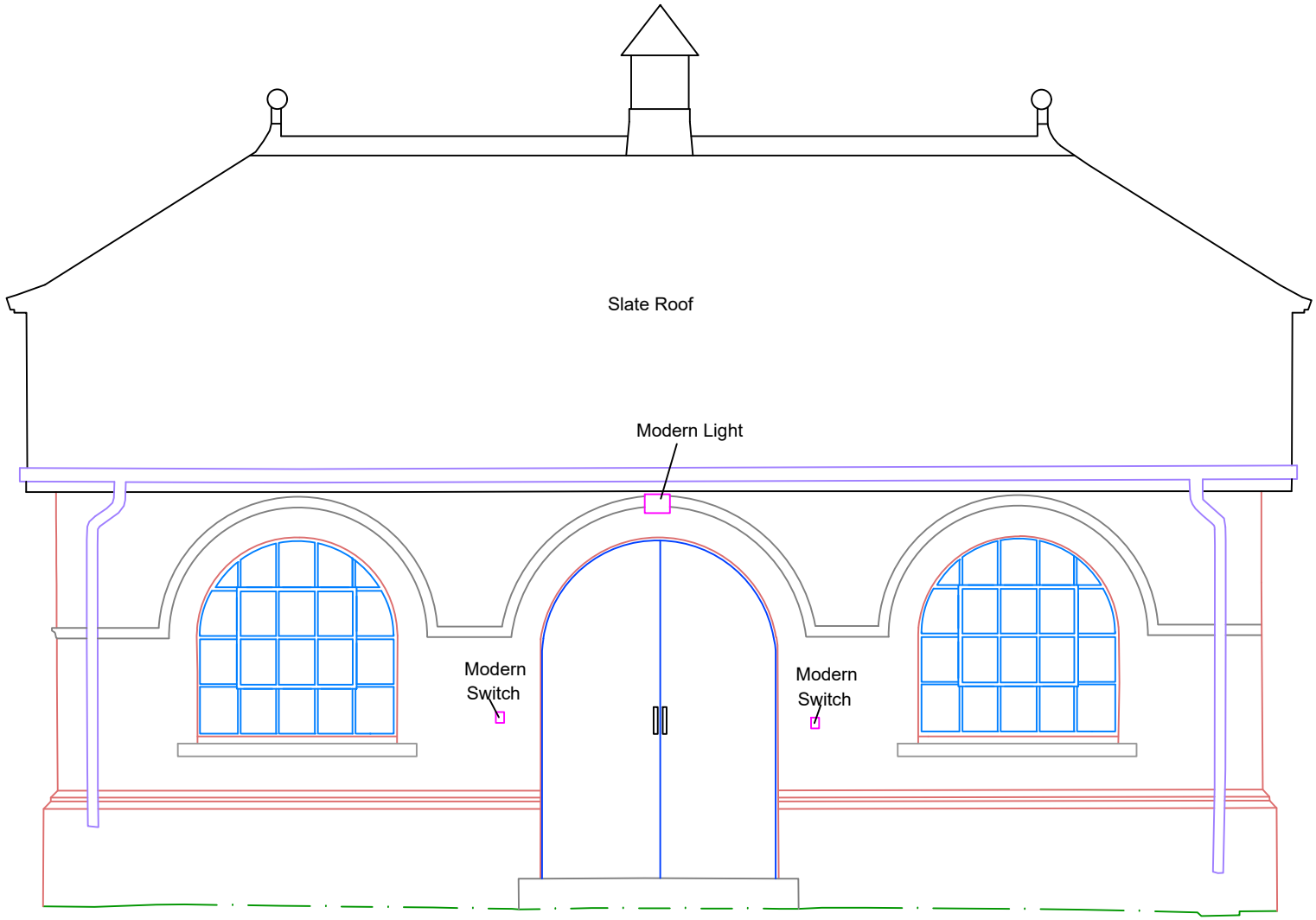


University of Salford MANCHESTER

SA SALFORD ARCHAEOLOGY

Figure 2:
Plan of Crumpwood Weir pumping station showing former canal (left) and No1 and No2 Pump Houses (right), with area of Watching Brief undertaken

Salford Archaeology, Peel Building, The Crescent, Salford, M5 4WT



SALFORD ARCHAEOLOGY

0 2 m

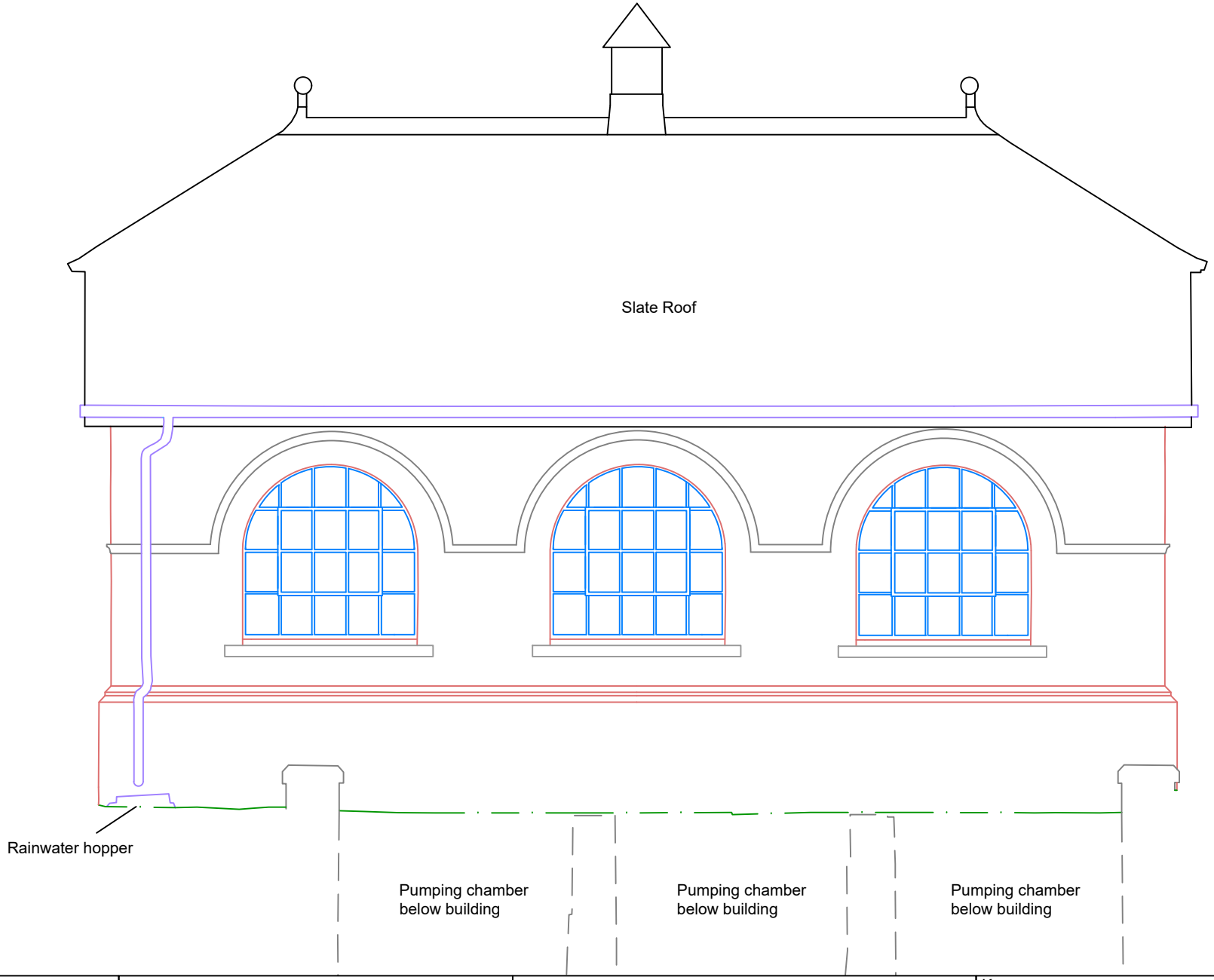
Scale at A4 1:50

Figure 3: Crumpwood Weir Pump House, eastern elevation

Key:

- Brick
- Slate
- Window
- Door
- Stone
- Rain Water Goods

Salford Archaeology, Peel Building,The Crescent, Salford, M5 4WT



SALFORD ARCHAEOLOGY

0 2 m

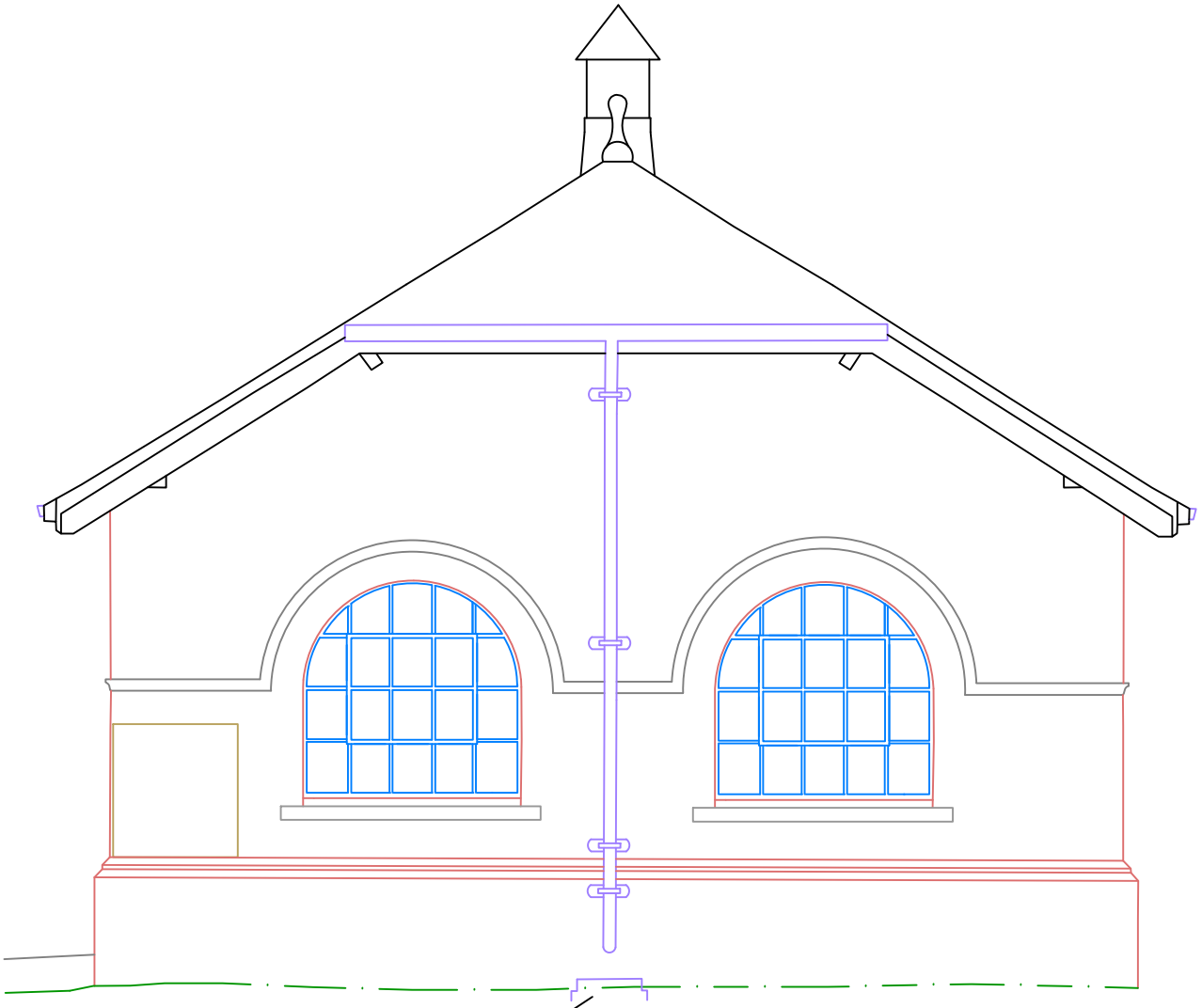
Scale at A4 1:50

Figure 4: Crumpwood Weir Pump House, western elevation

Key:

- Brick
- Slate
- Window
- Door
- Stone
- Rain Water Goods

Salford Archaeology, Peel Building,The Crescent, Salford, M5 4WT



SALFORD ARCHAEOLOGY

0 2 m

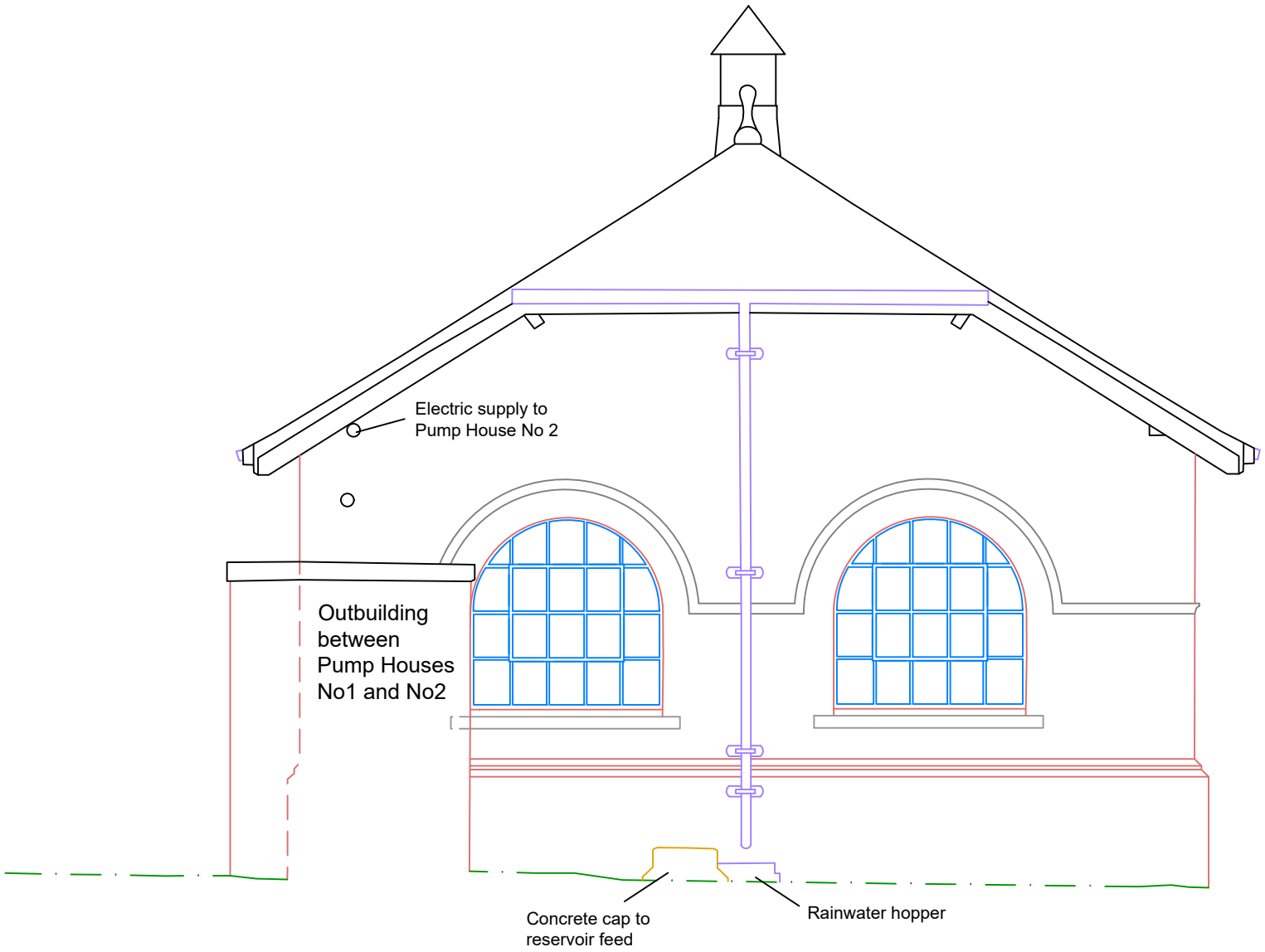
Scale at A4 1:50

Figure 5: Crumpwood Weir Pump House, southern elevation

Key:

- Brick
- Slate
- Window
- Door
- Stone
- Rain Water Goods

Salford Archaeology, Peel Building,The Crescent, Salford, M5 4WT



SALFORD ARCHAEOLOGY

0 2 m

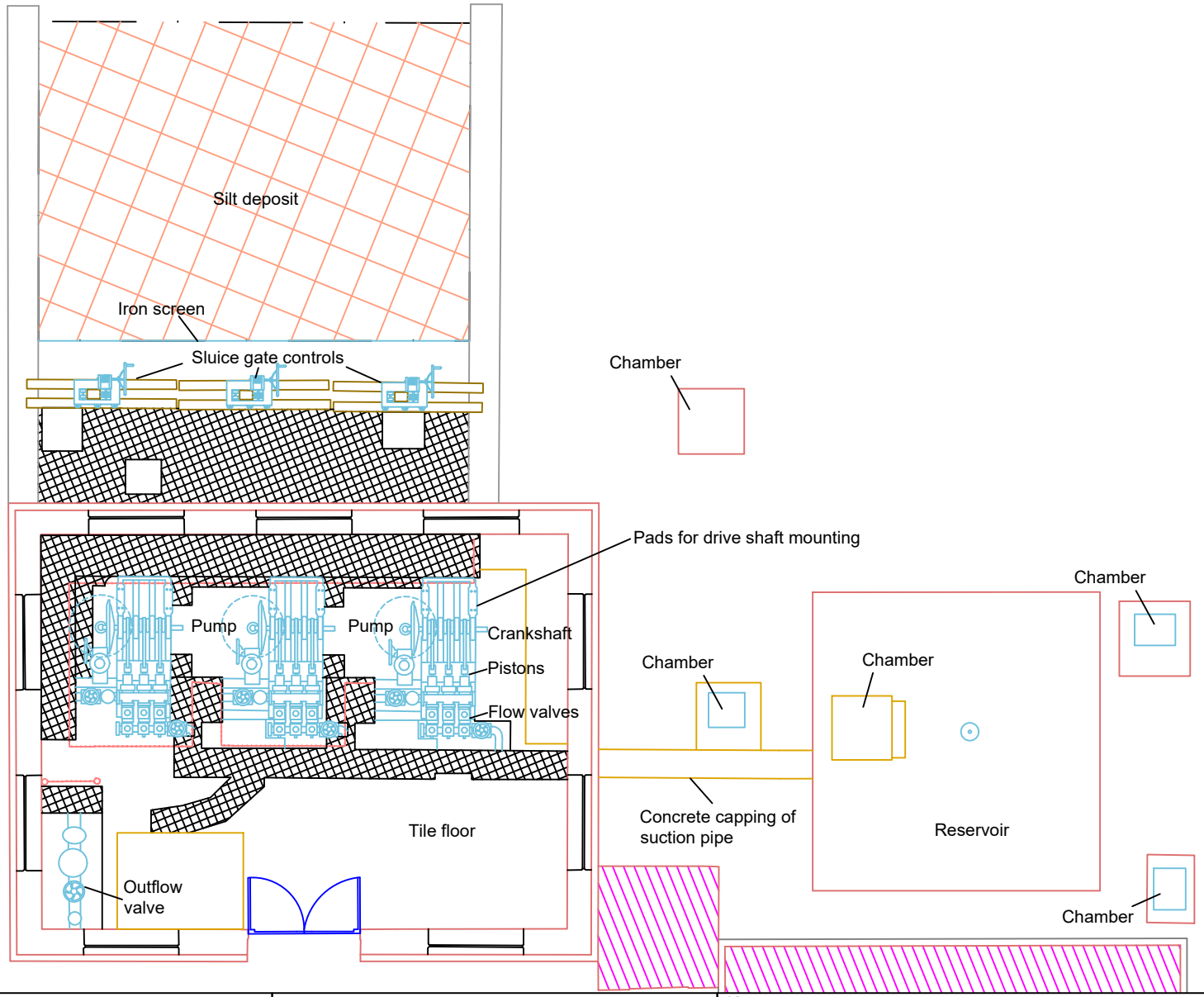
Scale at A4 1:50

Figure 6: Crumpwood Weir Pump House, northern elevation

Key:

- Brick
- Slate
- Window
- Concrete
- Stone
- Rain Water Goods

Salford Archaeology, Peel Building,The Crescent, Salford, M5 4WT



University of Salford MANCHESTER

SA SALFORD ARCHAEOLOGY

0 5 m

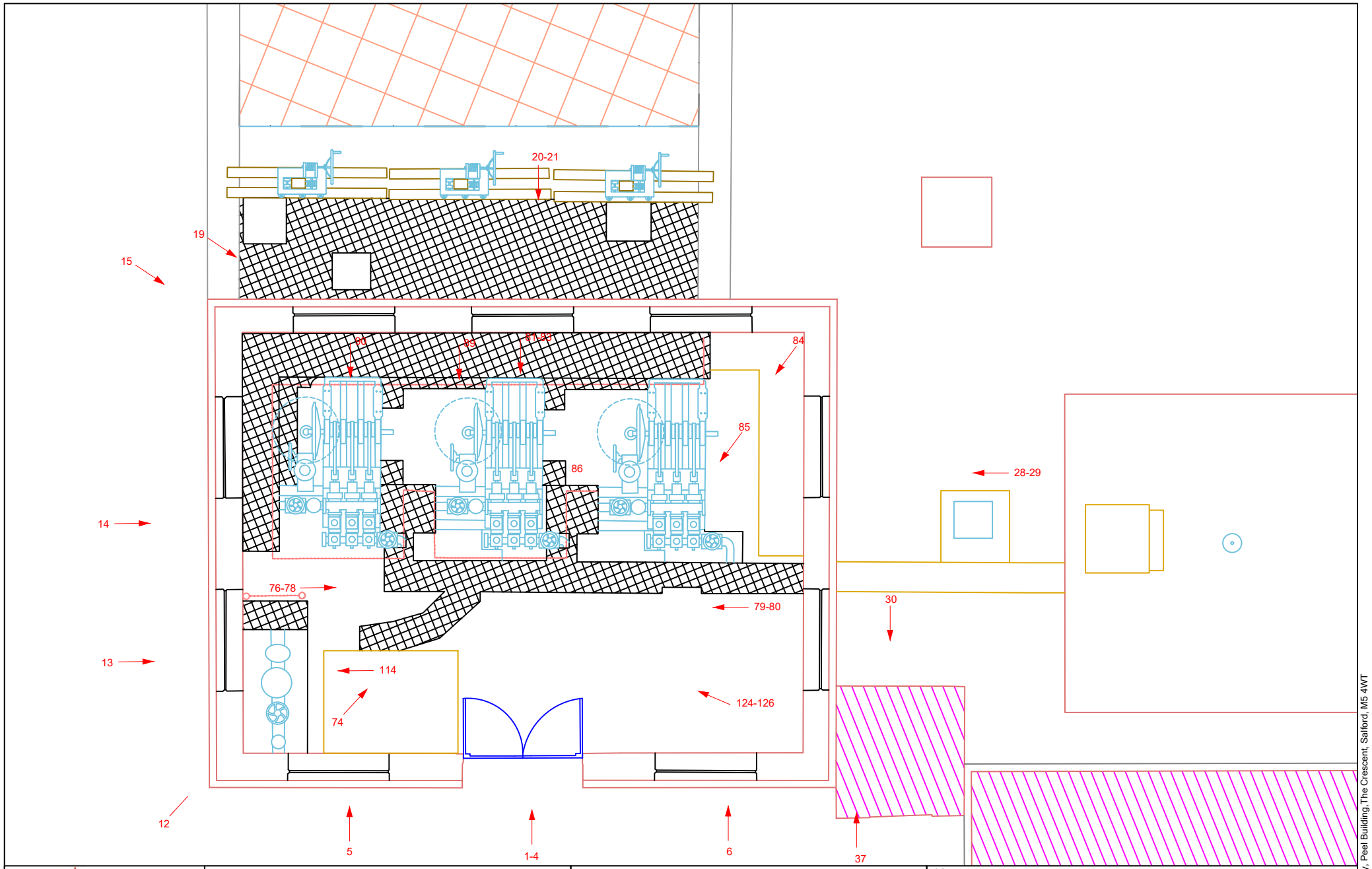
Scale at A4 1:100

Figure 7: Crumpwood Weir Pump House, floor plan

Key:

- Brick
- Door
- Window
- Hand Rail
- Floor Plates
- Pump machinery
- Timber
- Concrete
- Watching Brief Area

Salford Archaeology, Peel Building, The Crescent, Salford, M5 4WT



University of Salford MANCHESTER

SA SALFORD ARCHAEOLOGY

0 5 m

Scale at A4 1:75

Figure 8: Crumpwood Weir Pump House, photo location plan

Key:

- Brick
- Door
- Window
- Hand Rail
- Floor Plates
- Pump machinery
- Timber
- Concrete
- Watching Brief Area

Salford Archaeology, Peel Building, The Crescent, Salford, M5 4WT