Cotswold Archaeology

Lower Neuadd Reservoir, Powys

Historic Building Recording

Report prepared for:
Skanska Construction UK Ltd

On behalf of:
DWR Cymru Welsh Water

CA Project: CR0169

CA Report: CR0169_1

Andover Cirencester Exeter Milton Keynes Suffolk

Lower Neuadd Reservoir, Powys

Historic Building Recording

CA Project: CR0169

CA Report: CR0169_1

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SUMMARY

Project Name: Lower Neuadd Reservoir
Location: Powys
NGR: SO 03052 18107

In August 2019, Cotswold Archaeology (CA) was commissioned by Skanska Construction UK Ltd, on behalf of DWR Cymru Welsh Water, to undertake a Level 3 Historic Building Recording of the buildings and structures at Lower Neuadd Reservoir, located within the Brecon Beacons National Park in Powys.

The building recording work related to the Lower Neuadd Reservoir Dam (RCAHMW: 246468) and Valve Tower (RCAHMW 246469) as both will be directly impacted by the redevelopment proposals. The Filter House (CPAT HER 21248); the Old Filter House (RCAHMW 84832/ 246464); the Spillway (possibly curtilage listed); and the reservoir keeper's cottage (RCAHMW 246465) are also discussed within this building record for context, but were not themselves subject to the Level 3 Historic Building Recording.

Although the complex lacks the complexity and grandeur of similar reservoir complexes of the same period (i.e. Upper Neuadd Reservoir) it was clearly intended to be imposing within its landscape with clear attempts to design buildings that, although mostly practical and built for purpose industrial buildings, still show signs of aesthetically pleaseing design efforts.

The survey revealed that the buildings and structures are in advanced state of disrepair but their stylistic integrity has survived remarkably well with several of their oldest features and details surviving.

CRYNODEB

Enw'r Prosiect: Cronfa ddŵr Neuadd Isaf
Lleoliad: Powys
NGR: SN 03052 18107

Ym mis Awst 2019, cafodd Cotswold Archaeology (CA) ei gomisiynu gan Skanska Construction UK Ltd, ar ran Dŵr Cymru Welsh Water, i ymgymryd â Chofnod Adeiladau Hanesyddol Lefel 3 o'r adeiladau a'r strwythurau yng Nghronfa Ddŵr Neuadd Isaf, sydd wedi'i lleoli ym Mharc Cenedlaethol Bannau Brycheiniog ym Mhowys.

Roedd a wnelo'r gwaith cofnodi ag Argae Ddŵr Neuadd Isaf (RCAHMW: 246468) a'r Tŵr Falfiau (RCAHMW 246469) gan y bydd y cynigion ailddatblygu yn effeithio'n uniongyrchol ar y naill a'r llall. Mae'r Tŷ Hidlo (CPAT HER 21248); yr Hen Dŷ Hidlo (RCAHMW 84832/ 246464); y Gorlifan (o bosibl fod y cwrtil wedi'i restru); a bwthyn ceidwad y gronfa ddŵr (RCAHMW 246465) hefyd yn cael eu trafod yn y cofnod adeiladau hwn fel cyd-destun, ond nid oedden nhw eu hunain yn rhan o'r Cofnod Adeiladau Hanesyddol Lefel 3.

Er nad oes i'r safle yr un cymhlethdod a mawredd ag sy'n perthyn i safleoedd cronfeydd tebyg o'r un cyfnod (h.y. Cronfa Ddŵr Neuadd Uchaf), mae'n amlwg ei bod yn fwriad creu rhywbeth urddasol o fewn y dirwedd a bod ymdrech glir wedi'i gwneud i ddylunio adeiladau mewn modd deniadol yn esthetig, er mai adeiladau diwydiannol ymarferol, wedi'u codi i bwrpas ydynt ar y cyfan.

Datgelodd yr arolwg fod yr adeiladau a'r strwythurau wedi dadfeilio'n sylweddol ond mae eu cyfanrwydd o ran arddull wedi goroesi'n syndod o dda ac mae nifer o'r nodweddion a'r manylion hynaf yn dal i fodoli.

1. INTRODUCTION

1.1. In August 2019, Cotswold Archaeology (CA) was commissioned by Skanska Construction UK Ltd, on behalf of DWR Cymru Welsh Water, to undertake a Historic Building Recording of the buildings and structures at Lower Neuadd Reservoir, Powys (hereafter referred to as 'the Site'). Located within the Brecon Beacons National Park in Powys (NGR: SO 03052 18107; Fig. 1).

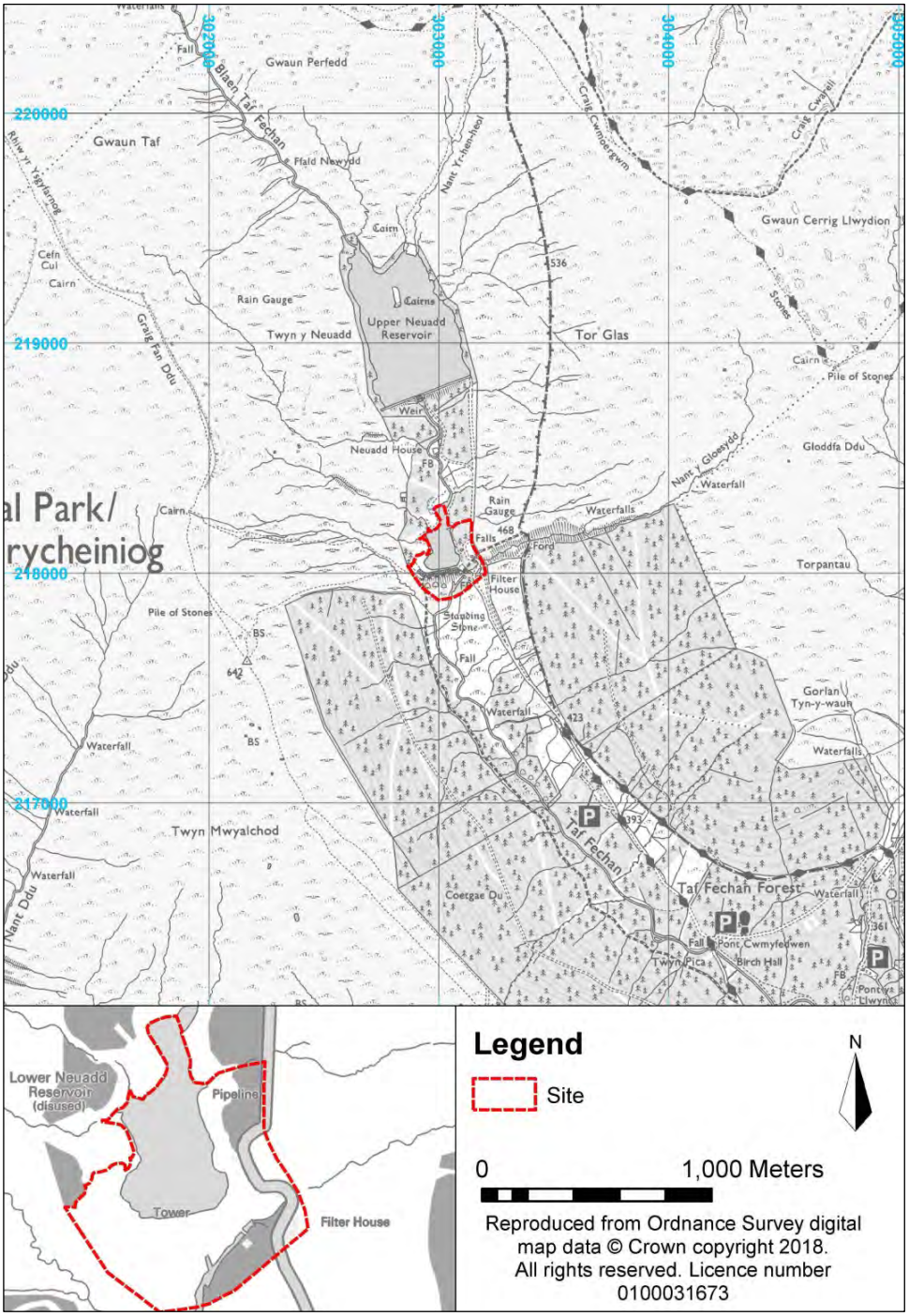

Fig. 1 Site location plan

1.2. Planning permission for the discontinuance and removal of the Lower Neuadd Dam was granted by the Brecon Beacons National Park Authority (BBNPA; planning ref: 19/17211/SO), conditional on a programme of archaeological work. The scheme was submitted for EIA screening with the conclusion that significant effects on the historic environment might be reduced and managed by the implementation of appropriate programmes of archaeological field work and assessment. As per Schedule 3, 3, (h) EIA was less likely to be required for the proposal under section 38 of the Welsh Office Circular 11/ 99.

1.3. In relation to intrusive impacts related to site establishment works and other infrastructure (as detailed herein), Alice Thorne, Heritage Officer, BBNPA recommended that the programme of works comprise an archaeological watching brief and Level 3 Historic Building Recording. In accordance with *Brief For An Archaeological Works At Lower Neuadd Reservoir, Torpantau, Merthyr Tydfil, Powys* (BBNP 2019), the building recording work will specifically relate to the Lower Neuadd Reservoir Dam (RCAHMW: 246468) and Valve Tower (RCAHMW: 246471), including elements of their curtilage.

Objectives and professional standards

1.4. CA is a Registered Organisation with the Chartered Institute for Archaeologists (CIfA). This report has been prepared in accordance with the CIfA's 'Standard and Guidance for the Archaeological Investigation and Recording of Standing Buildings or Structures' (2019) and, in the absence of Welsh Equivalent, Historic England's 'Understanding Historic Buildings: A Guide to Good Recording Practice (HE 2016a).

1.5. The objectives of the building recording survey are to ensure that a Level 3 analytical record is created prior to any proposed demolition.

1.6. The survey, assessment and report were also carried out in accordance with a Written Scheme of Investigation (WSI) prepared by Cotswold Archaeology (CA 2019; Appendix 1) and approved by the Brecon Beacons National Park Authority's Heritage Officer. The finalised report will be issued to the Glamorgan-Gwent Archaeological Trust and the RCAHMW for deposition.

Extent of Survey

1.7. In accordance with *Brief For An Archaeological Works At Lower Neuadd Reservoir, Torpantau, Merthyr Tydfil, Powys* (BBNP 2019) and the approved WSI (CA, 2019), the building recording work specifically relates to the Lower Neuadd Reservoir Dam

(RCAHMW: 246468) and Valve Tower (RCAHMW 246469) as both will be directly impacted by the proposals.

1.8. Further buildings included within the report (for context), though not subject to Level 3 historic building recording, comprise:

- the Filter House (CPAT HER 21248);
- the Old Filter House (RCAHMW 84832/ 246464);
- the Spillway; and
- The reservoir keeper's cottage (RCAHMW 246465)

Listed Buildings within the survey area

1.9. Within the survey area there is one Grade II Listed Building (RCAHMW 84832/ 246464), described as the Octagonal building at Lower Neuadd Reservoir (Fig. 2).

1.10. The listing details that this building was built *c*.1900 for the Merthyr Tydfil Urban District Council. This two storey reservoir building is of rock-faced squared stone with cemented roof. It has a square tower with chamfered corners, corbelled parapet and recessed octagonal roof to centre chimney. It is built in pink stone with some sandstone ashlar. The main elevation has a large arched doorway, blocked, with pink stone voussoirs, and the first floor has 3-light ashlar mullioned window. The parapet has a small raised shouldered pediment over the window. The right side has a blocked 3-light mullioned window below and a blocked roundel above. The parapet coping is stepped up.

1.11. This building has been listed for '*its special interest as a water-industry building of definite quality and character'*.

303000

Lower Neuadd Reservoir (disused)

Pipeline

Tower

Filter House

D

218000

218000

303000

N

Legend

Site

Grade II Listed

0 100m

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PROJECT TITLE

Lower neaudd Reservoir, Powys, Historic Building Recording

FIGURE TITLE

Site location plan showing designated heritage assets

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CHECKED BY	JR	DATE	06/09/2019	2
APPROVED BY	AB	SCALE @ A4	1:2,000	

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2. METHODOLOGY

Data collection, analysis and presentation

2.1. This assessment has been informed by a proportionate level of information sufficient to understand the historic development of the Site, as required for a Level 3 Historic Building Recording. Please see *Limitations of Assessment* (2.9 - 2.11).

2.2. The assessment has involved the consultation of readily available archaeological and historical information from documentary and cartographic sources. The major repositories of information consulted include the following:

Source	Data
Cadw	List of World Heritage Sites; Listed Buildings; Scheduled Monuments; Registered Parks and Gardens; and Registered Battlefields.
Glamorgan Archives	Historic mapping, historic documentation, and relevant published and grey literature.
Powys Archives	Historic mapping, historic documentation, and relevant published and grey literature.
Royal Commission on the Ancient and Historical Monuments of Wales	Vertical and oblique aerial photography ranging in date from the 1940s to present.
Natural Resource Wales website	LiDAR imagery and point cloud data, available from the Environment Agency website.
Genealogist, Envirocheck, National Library of Scotland & other cartographic websites	Historic (Ordnance Survey and Tithe) mapping in digital format.
Grey literature	Cotswold Archaeology 2015a *Upper Neuadd Dam, Brecon Beacons National Park, Powys, Heritage Statement* Cotswold Archaeology 2015b *Upper Neuadd Dam, Brecon Beacons National Park, Powys, Historic Building Recording* ARUP 2019 *Lower Neuadd Reservoir, Heritage Impact Statement* Cotswold Archaeology 2019 *Lower Neuadd Reservoir, Brecon Beacons National Parks, Powys, Written Scheme of Investigation for a Programme of Archaeological Works*
Skanska Construction UK Ltd Archives	Maps, plans and section drawings of the Lower Neuadd Reservoir from the Taf Fechan Water Supply Board

Table 2.1 Key data sources

Level 3 Historic Building Recording

2.3. The following scope of work is based upon the application advice, as defined above (1.3), which requests a minimum Level 3 Historic Building recording as defined in the HE guidance '*Understanding Historic Buildings: A Guide to Good Recording Practice'* (2016a)

2.4. A Level 3 Historic Building Recording entails an analytical record, and comprises an introductory description followed by a systematic account of the building's origins, development and use.

2.5. The record includes an account of the evidence on which the analysis has been based, all drawn and photographic records required to illustrate the appearance and structure of the buildings and to support an historical analysis.

2.6. The information contained in the record was for the most part obtained through an examination of the buildings, both in person and utilising drone survey results. The documentary sources used were those which are most readily accessible, such as historic Ordnance Survey maps and other published sources viewed at the Glamorgan and Powys Archives.

2.7. The record contains some discussion on the broader stylistic or historical context and importance of the buildings. A Level 3 record is also considered appropriate when the fabric of a building is under threat, but time resources or structural safety are insufficient to allow for detailed documentary research, or where the scope for such research is limited.

2.8. A Level 3 record will typically comprise:

- drawing
- photography
- written account

2.9. For the purpose of this exercise, and due to the access limitations mentioned above, a combination of close range photographic record and aerial photogrammetry was employed.

2.10. The aerial photogrammetry was undertaken using a DJI Inspire 2 drone with an X4 camera (20mp) or an X7 (24mp) (where appropriate) and capture video in 4K. All

images were captured in RAW and from these TIF files were produced. The aerial photogrammetry comprises the following:

- Grid flight plans were flown to capture vertical images of the A minimum of 8 oblique views of the site and surrounding landscape context looking approximately north, north-east, east, south-east, south, south-west, west and northwest;
- Low-level aerial photography and video of structures and wall tops; and
- An overall vertical view of the site taken at maximum permitted height above ground level.

2.11. The additional photography to supplement the aerial photogrammetry was undertaken using a Full Frame Canon EOS 5D Mark IV (capable of producing 30.6 megapixel images). Images were captured in RAW format and later generated into TIFs.

2.12. All photography was undertaken in accordance with the Historic England's guidelines '*Photogrammetric Applications for Cultural Heritage*'.

2.13. To enable the production of metrically accurate 3d models, a technique called multi-image photogrammetry, or structure-from-motion, was employed. This involved the capturing of overlapping images of the site and buildings. Selected images of the site and buildings were processed using Agisoft Photoplan Pro software to produce fully rendered 3-dimensional models at 0.01-0.03m accuracy.

Limitations of the assessment

2.14. The historical background information which has informed this report was provided by a third party, ARUP (2019). It has been assumed that this data is accurate and no further research has been undertaken by CA. A small number of additional sources which were not covered by the Heritage Impact Assessment but were considered to be relevant were also consulted, as detailed in Section 3.

2.15. A selection of archival material pertaining to the Site was consulted in person at the Glamorgan and requested and received in digital format from the Powys Archives. There may be other relevant material held by the National Archives, other local repositories, and in private collections; which were not accessed.

2.16. A walkover survey was conducted within the Site on the 2nd of August of 2019 in dry and cloudy weather conditions, in order to inspect the buildings and structures to be recorded. Only external access was obtained due to the present disrepair of the structures and buildings which pose significant health & safety concerns.

3. UNDERSTANDING THE SITE

3.1. This section has been informed by the Heritage Impact Statement produced by ARUP (2019) for the present planning application. This section has also been informed by the review of selected sources from the Glamorgan and Powys Archives. Historic England produced '*Infrastructure: Utilities and Communication, Listing Selection Guide*' (2011), which covers water supplies and reservoirs, and this has also been reviewed as an additional source.

Landscape context

3.2. The reservoir is located in the Taf Fechan Valley, high in the Brecon Beacons, *c*.12km north of Merthyr Tydfil. The reservoir is the lower of a pair situated within the mountain enclosed valley which runs north-west to south-east. The newer associated dam, Upper Neuadd, is located *c*.600m north-west of Site. The hills either side of the valley reach *c*.700m before rising northwards to *c*.873m at the head of the valley at Pen y Fan and Corn Dû. The Site lies at an average of *c.*403m 400m AoD and is surrounded by dense woodland or rough pasture, as well as coniferous plantations.

Historic Background

3.3. The Industrial Revolution forced the expansion of cities to accommodate factories and the workers needed. Most cities and towns did not have infrastructure to a scale that would accommodate for this pressure. This situation combined with several cholera outbreaks forced an Act of Parliament in 1876 to supply clean water across the country (AIA 2013).

3.4. The construction of reservoirs and other similar structures became an effort to institutionalise the landscape. This effort had as its epicentre the construction of large scale infrastructures and ancillary buildings for the benefit of the public that should integrate the landscape where they were to be sited as well as demarking the strength and power of the institutions that were responsible for them being built. As with other public utilities that were built from the mid-19th century onwards, the architecture and setting were used to impress, taking advantage of topography to develop multi-layered landscapes where the structures and buildings were to be integrated whilst demonstrating engineering and architectural prowess and sense of fashion. The impact these structures and buildings had on the surrounding countryside, and their setting, received careful consideration at the design stage by

employing landscape architects to design not only the buildings but the siting of the structures within the landscape. These types of institutional landscapes have been approached by Historic England guidance, and although not classifying as Registered Parks and Gardens their group value as landscape and architectural elements has been recognised (2017c).

3.5. After the first wave of construction of reservoirs, the continuous increase in demand led to the construction of the Lower Neuadd Reservoir by the Merthyr Tydfil Board of Health and which was completed by 1884, having William Jones of Neath as the main contractor, as shown on the 1st Edition of 1887 (Fig. 3).

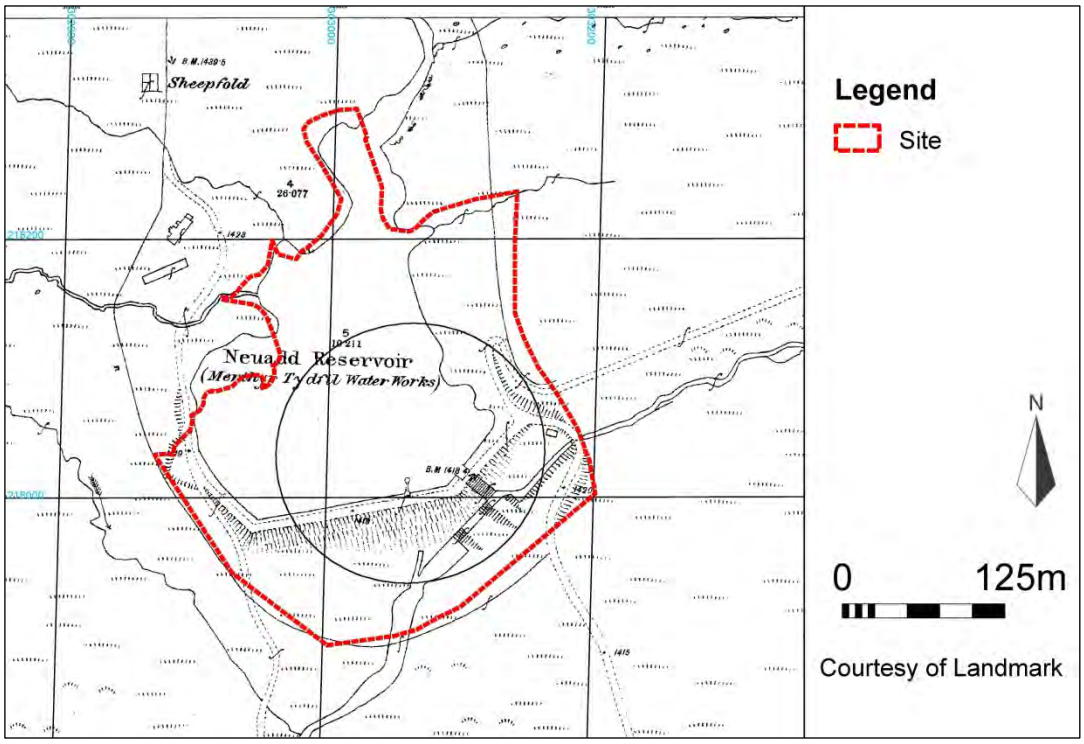

Fig. 3 Site location on 1887 1st Edition Ordnance Survey

3.6. Other structures and buildings built in association with the reservoir were (GRO WBTF, GRO DG/F/9/1):

- The dam, built c.1884, of earth or puddle clay;
- Weirs and sluices;
- Buildings (to the north-west of the reservoir);
- Boundary banks;
- Footbridge;
- Rain gauge; and

3.7. The demand kept steadily increasing and several studies were commissioned regarding the capacity of the existing reservoirs and the need for the construction of more (GRO DG/F8/16). This ultimately led to the construction of the Upper Neuadd Reservoir c.500m to the north of the Site by 1902. It was also at this time that the Old Filter House was built (Listing reference, GRO WBTF), although this was not reflected on the historic maps, since the 2nd Edition Ordnance Survey of 1905 (Fig. 4) does not depict the building. The only change from the previous map (Fig. 3) is the construction of the Filter House to the south-east corner of the Site.

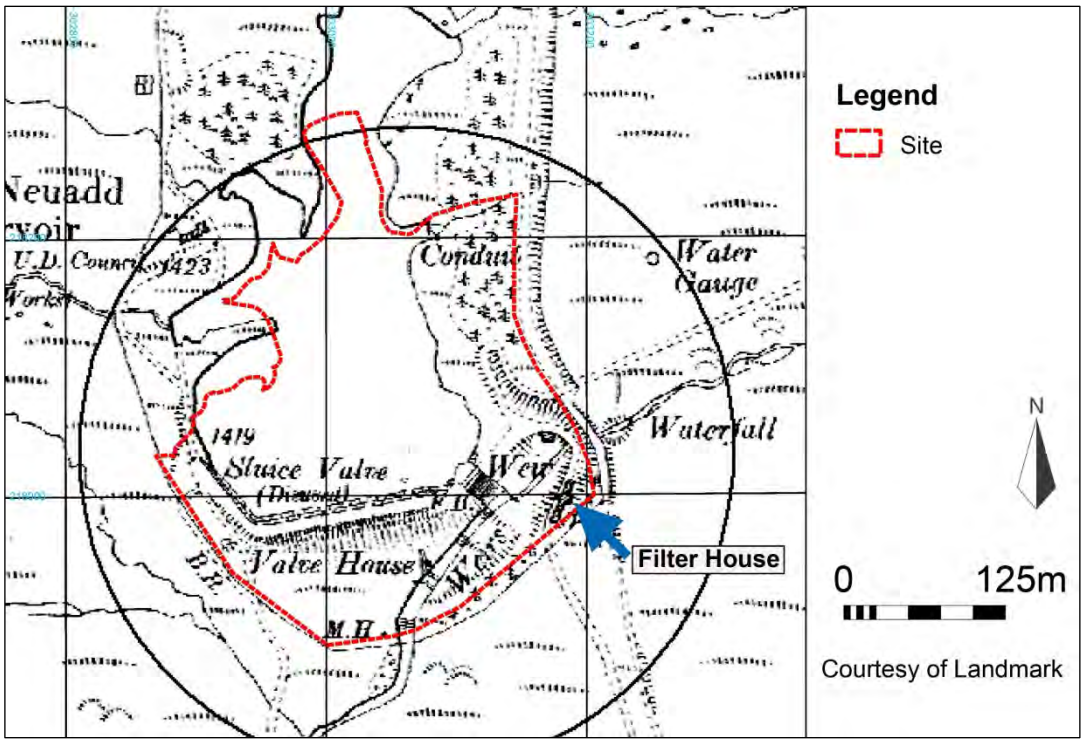

Fig. 4 Site location on 1905 Ordnance Survey Map

3.8. Once again the demand increased and more studies of sustainability were requisitioned (GRO DG/F/8/16). A series of commemorative booklets by the Taf Fechan Water Supply Board (GRO WBTF) documents the evolution of the reservoirs and the new ones being constructed, as well as the technical innovations (be it architecturally or in terms of machinery) introduced to each (GRO WBTF/17). The booklet that commemorates the inauguration of the Taf Fechan Reservoir and Works, of 1927, contained a map locating all of the reservoirs built until that point, and includes the Site (not reproduced since it doesn't give any details on the Site apart from its location).

3.9. In 1938 the Taf Fechan Water Supply Board undertook alterations and extensions to the Treatment House and published a memorandum which describes in detail the alterations to that building (GRO WBTF/18). This document informs that the Upper Neuadd Reservoir was filtered since its opening by a battery of seven mechanical pressure filters installed by the Candy Filter Company in a '*masonry building situated near the Lower Neuadd Reservoir'* (GRO WBTF/18). Due to constant updates on the water filtration techniques it was decided that said battery was obsolete and a replacement plan elaborated. This included:

- Reconditioning of the existing plant;
- Two new filter units;
- An air scour apparatus;
- New chemical plant;
- Electric generating plant; and
- The extension of the masonry building to house the additional plant and heating apparatus.

3.10. The document goes on to describe each of the works undertaken including both the new machinery installed but also describes in detail the extensions that the building underwent. It also includes a detailed plan of the building and the new machinery (Fig. 5).

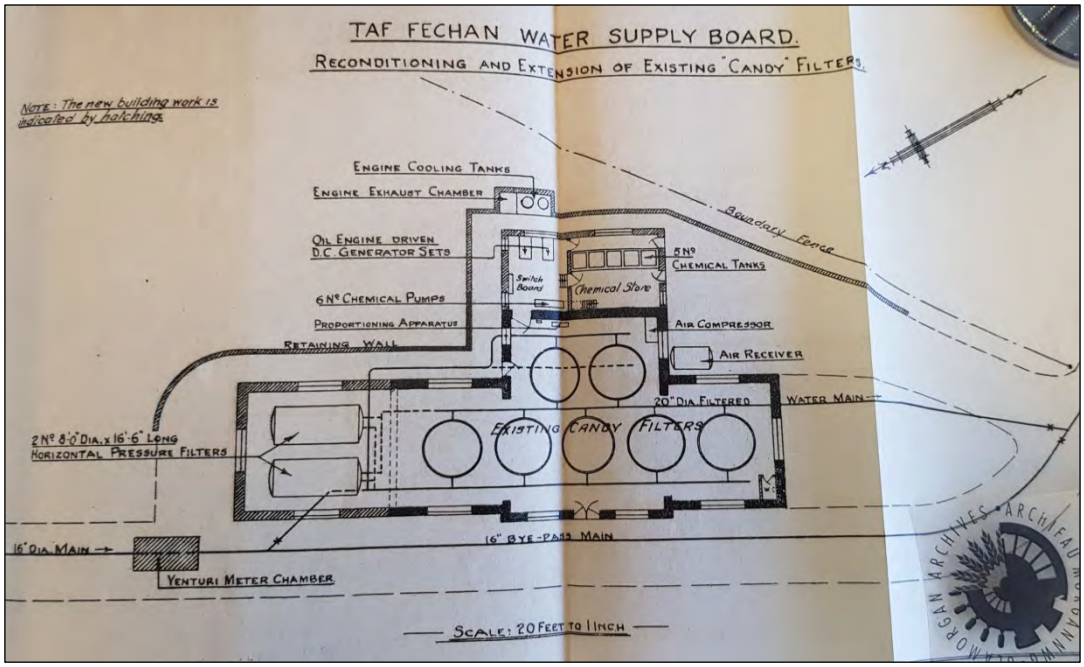

Fig. 5 Plan of the alterations and extensions to the Candy Filter House building (*courtesy of GRO*)

3.11. There are no Ordnance Maps detailing the Site area after the 1905 edition (Fig. 4) and before the 1953 Edition (Fig. 6), but small alterations to machinery and the related adaptations needed to buildings and other structures were still taking place as documented on the several documents and maps of the Taf Fechan Water Supply Board currently archived by Skanska Construction UK Ltd. In 1945 a proposal for extensions and alterations (Fig. 7) was drafted but only some of the proposals were carried out (TA/2/37). And in 1968 further remedial works were undertaken, albeit only focusing on the dam (see Appendix 3). Although a few more Ordnance Maps exist (Fig. 8 and 9) they do not record any visible changes to the buildings and structures.

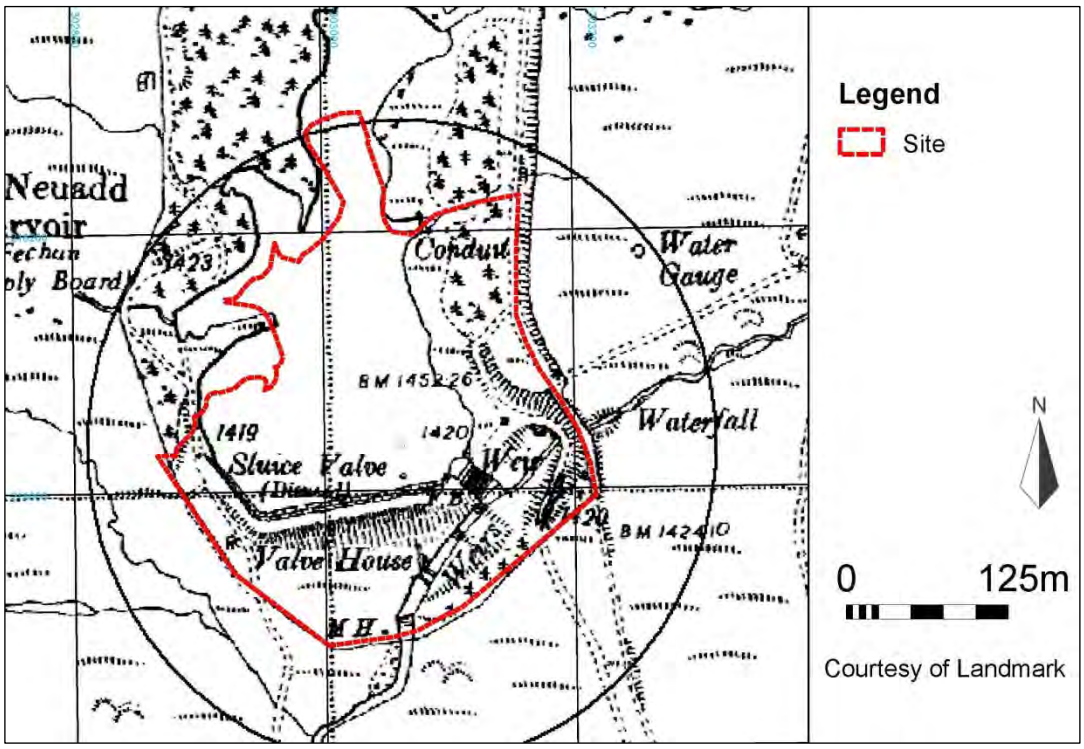

Fig. 6 Site location on 1953 Ordnance Survey Map

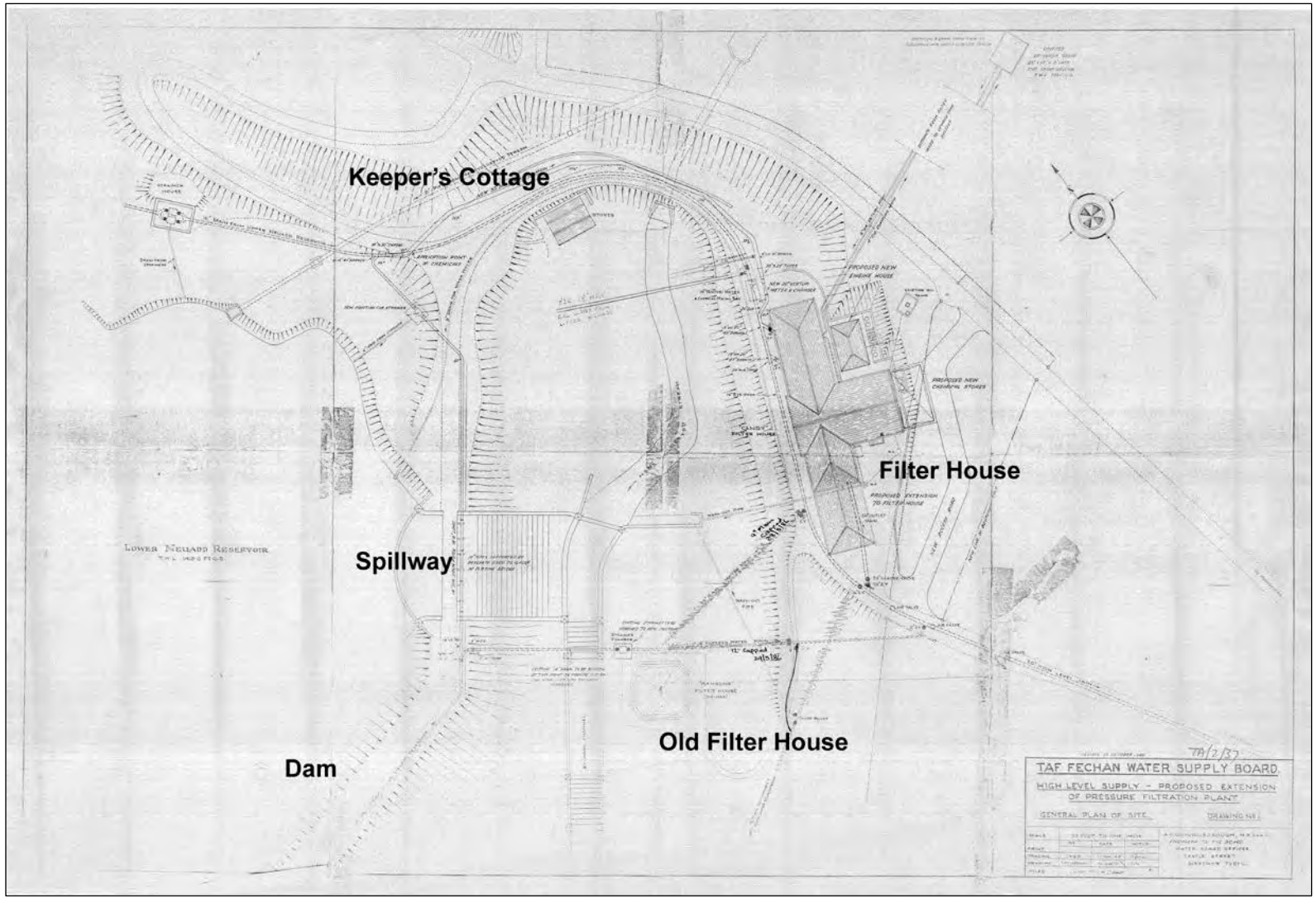

Fig. 7 Plan of proposed alterations and extensions of 1945 with annotated structures and buildings (courtesy of Skanska Construction UK Ltd)

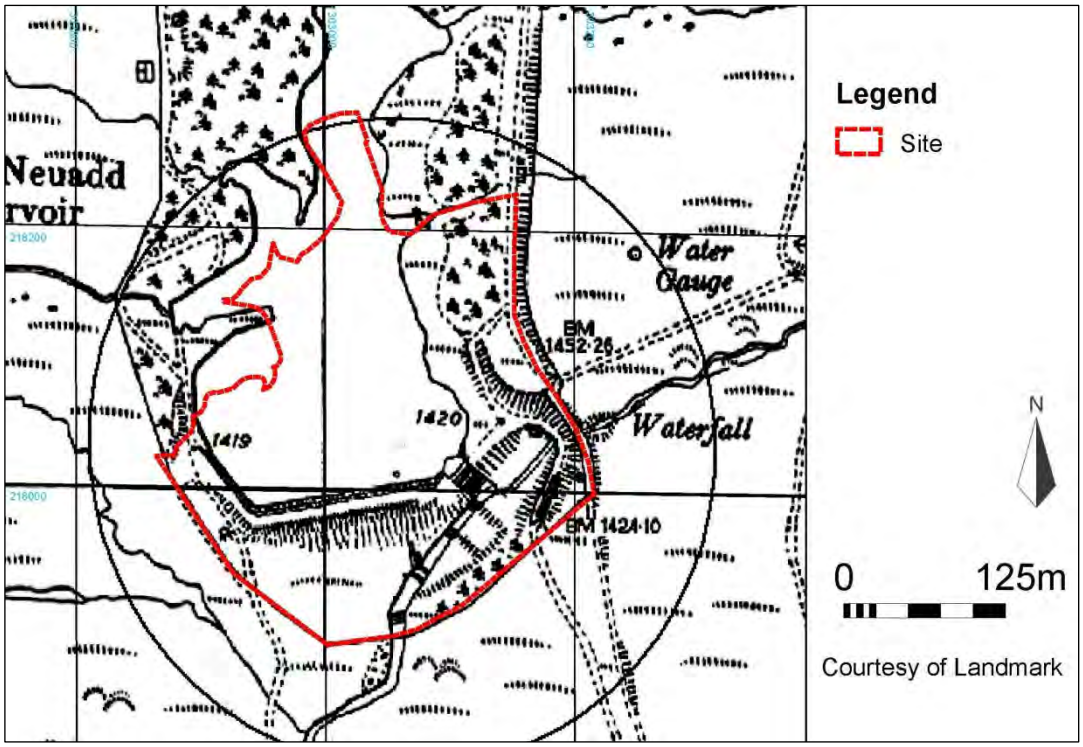

Fig. 8 Site location on 1964 Ordnance Survey Map

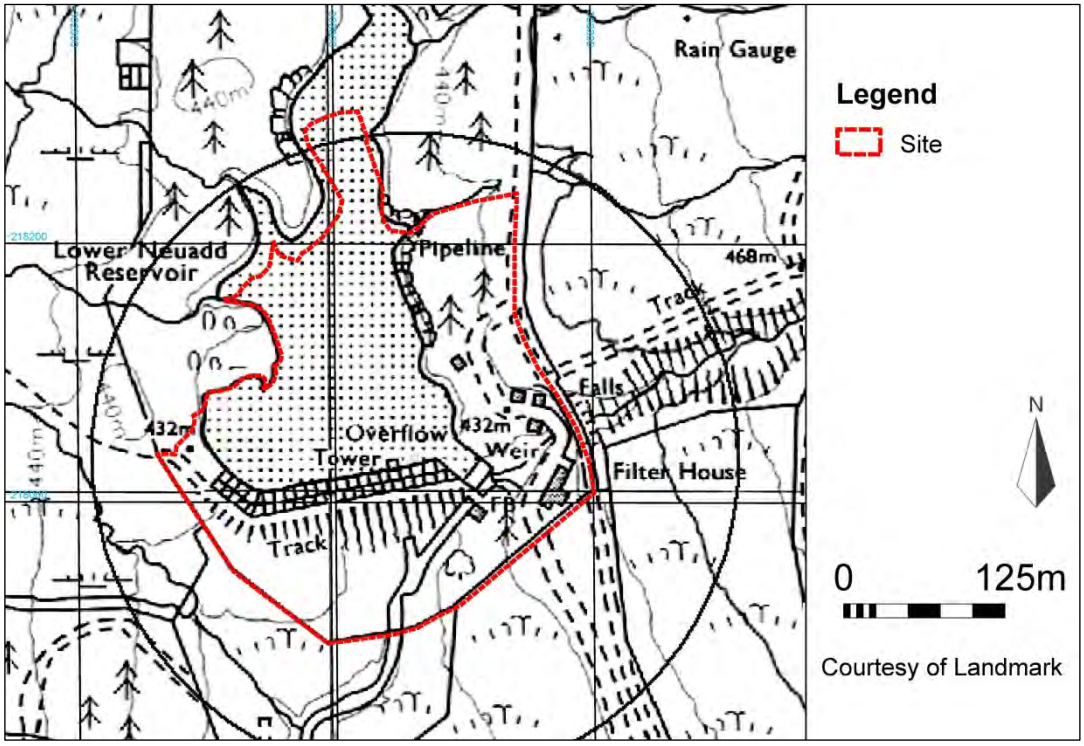

Fig. 9 Site location on 1978 Ordnance Survey Map

4. THE SITE – HISTORIC BUILDING RECORDING

Summary of the extant buildings

4.1. As mentioned, the state of disrepair of the buildings and structures caused considerable health & safety concerns and for that reason no internal access was afforded. As mentioned on Section 2 due to the access limitations a combination of close range photographic record and aerial photogrammetry was employed.

4.2. The survey was undertaken solely from the exterior, from areas where there were no safety concerns. The buildings and structures to be recorded have been mapped on Figure 10 for ease of reference and comprise:

- Filter House (Fig. 10, **A**) and Extension (Fig. 10, **B**)
- Reservoir Keeper's Cottage (Fig. 10, **C**)
- Old Filter House (Fig. 10, **D**);
- Valve Tower (Fig. 10, **E**)
- Lower Neuadd Reservoir Dam (Fig. 10, **F**); and
- Spillway (Fig. 10, **G**).

4.3. Each building or structure will be individually discussed and this will include photographs and photogrammetric model figures illustrating the elevations and details mentioned throughout the text, but also a detailed location map of the building (or structure) and the photo locations.

303000

Lower Neuadd Reservoir (disused)

Pipeline

Tower

Filter House

218000

218000

303000

N

Legend

- Site
- Old Filter House
- Dam
- Spillway
- Reservoir Keeper's Cottage
- Filter House
- Valve Tower
- Extension

0 100m

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PROJECT TITLE

Lower neaudd Reservoir, Powys, Historic Building Recording

FIGURE TITLE

Site location plan showing extant Buildings and Structures

DRAWN BY	CJ	PROJECT NO.	CR0169	FIGURE NO.
CHECKED BY	JR	DATE	06/09/2019	10
APPROVED BY	AB	SCALE @ A4	1:2,000	

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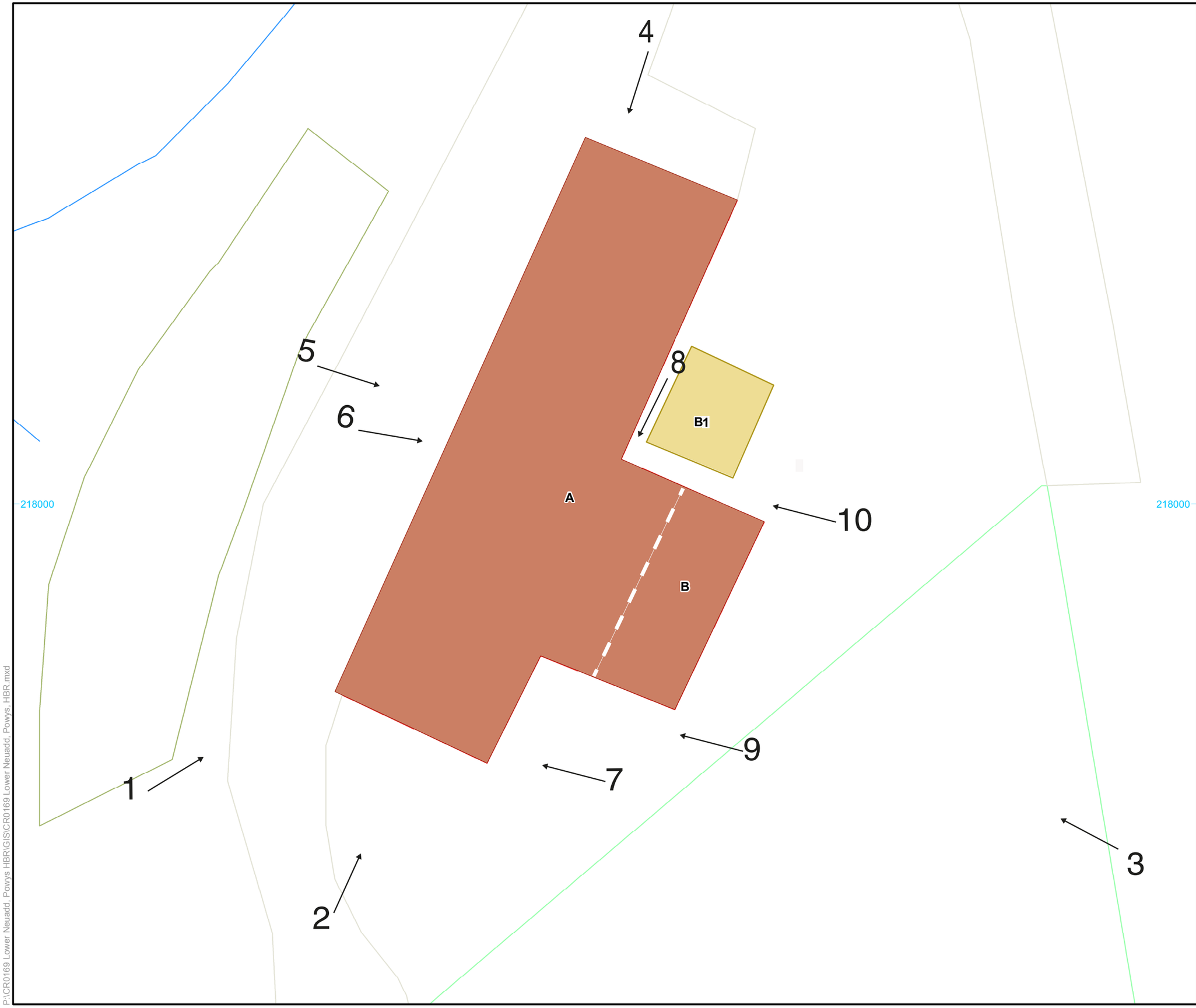

N

Legend

- Filter House (A)
- Extension (B1)
- 1 — Photo Location and Reference

0 — 10m

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PROJECT TITLE

Lower neaudd Reservoir, Powys, Historic Building Recording

FIGURE TITLE

Buildings A and B and photo locations

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The Filter House (Fig. 10 and 11, A) and Extensions (Fig. 10 and 11, B and B1)

The Filter House (A)

4.4. The Filter House (Fig. 10 and 11, A) is located on the south-east corner of the reservoir. It was built *c*.1900 and is represented on historic maps since at least the 1905 Ordnance Survey (Fig. 4), as discussed on Section 3. It was originally a T-shaped building, which was extended and adapted in 1938 and 1968 (see Section 3 and Figure 11). It is two storeys and built of randomly coursed pink stone blocks (Figure 12).

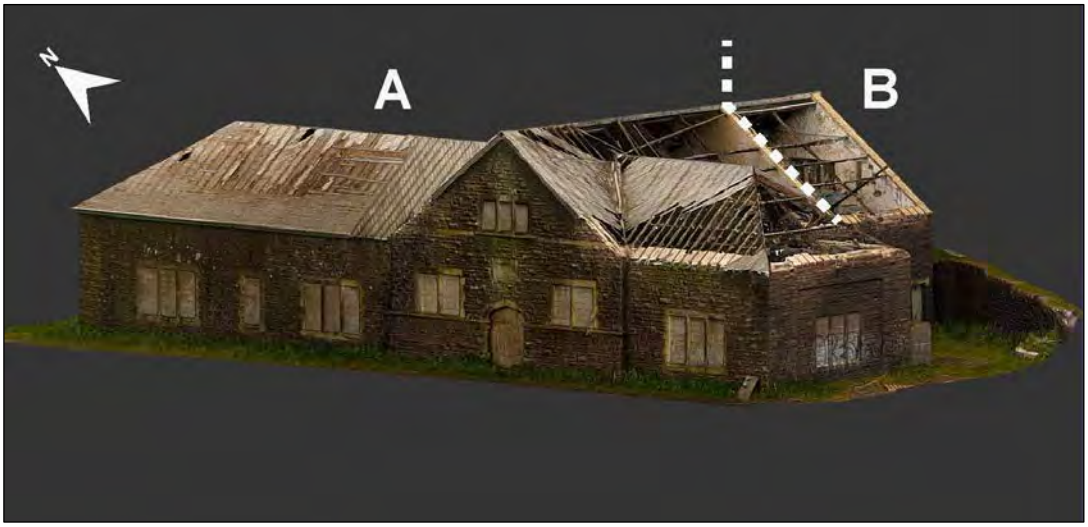


Fig. 12 Filter House (A) and Extension (B) photogrammetric model

4.5. The roof is in a quite severe state of disrepair with several portions of it lacking. What remains comprises corrugated metal panels but it is likely that the original was in Welsh slate. The windows and doors have been bricked or boarded up to prevent access.

4.6. The main elevation faces north-west towards the reservoir, and although a functional fit for purpose building there is some intention of beautifying the building through the window and door treatments (Photo 1). On the main elevation the front and main access door has a contrasting limestone neo-Tudor arch connected to a protruding limestone stringcourse (Photos 1 and 5). A second stringcourse is located further up, just under the only window of the 1st floor which is triple and has a simple limestone architrave (Photo 5). A limestone frame for a plaque is also visible above the main entrance but the plaque itself, likely a datestone, is no longer extant (Photo 6).

Photo 1 Filter House (A) main elevation

Photo 2 Filter House (A) south facing elevation

Photo 3 Filter House (A) south and south-east facing elevations

Photo 4 Filter House (A) north facing elevation

Photo 5 Detail of main elevation of building A

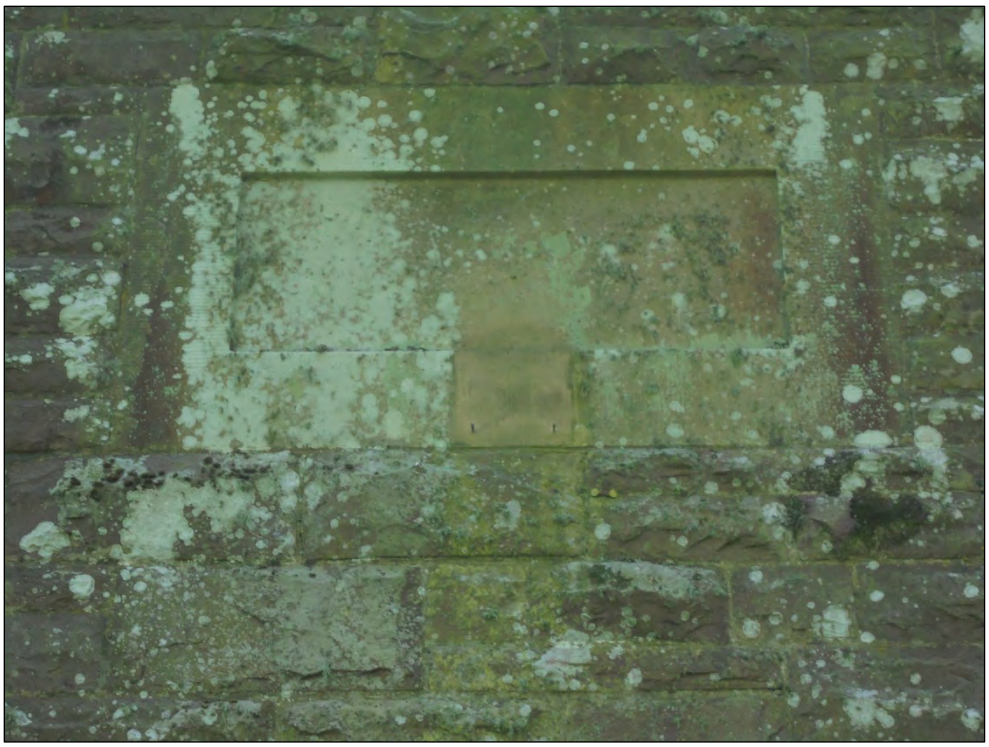


Photo 6 Detail of plaque above front door

Photo 7 Concrete lean-to

Photo 8 Detail of fixture on north-east facing elevation

Photo 9 Staircase to basement

Photo 10 Small extension (B1) to the north

4.7. The Filter House (A) also includes a design detail the purpose of which is unknown. On the south facing elevation (Photo 2) there is a 'sunken' square section of wall with a triple window. It is considered that this element may represent infilling of a large entrance needed for the machinery, although this is only hypothetical. This was done sympathetically, with the same materials and fabric and mirroring the north facing elevation. The plan of 1945 with the proposed extensions, proposed an extension be placed in this exact location but it is known that this did not happen, although it was not possible to ascertain the reason.

4.8. The building also includes several fixtures which are likely to be either original or very early. This includes cast iron fire escape ladders, external light fixtures (Photo 8), cast iron drain pipes and hoppers.

Extension B

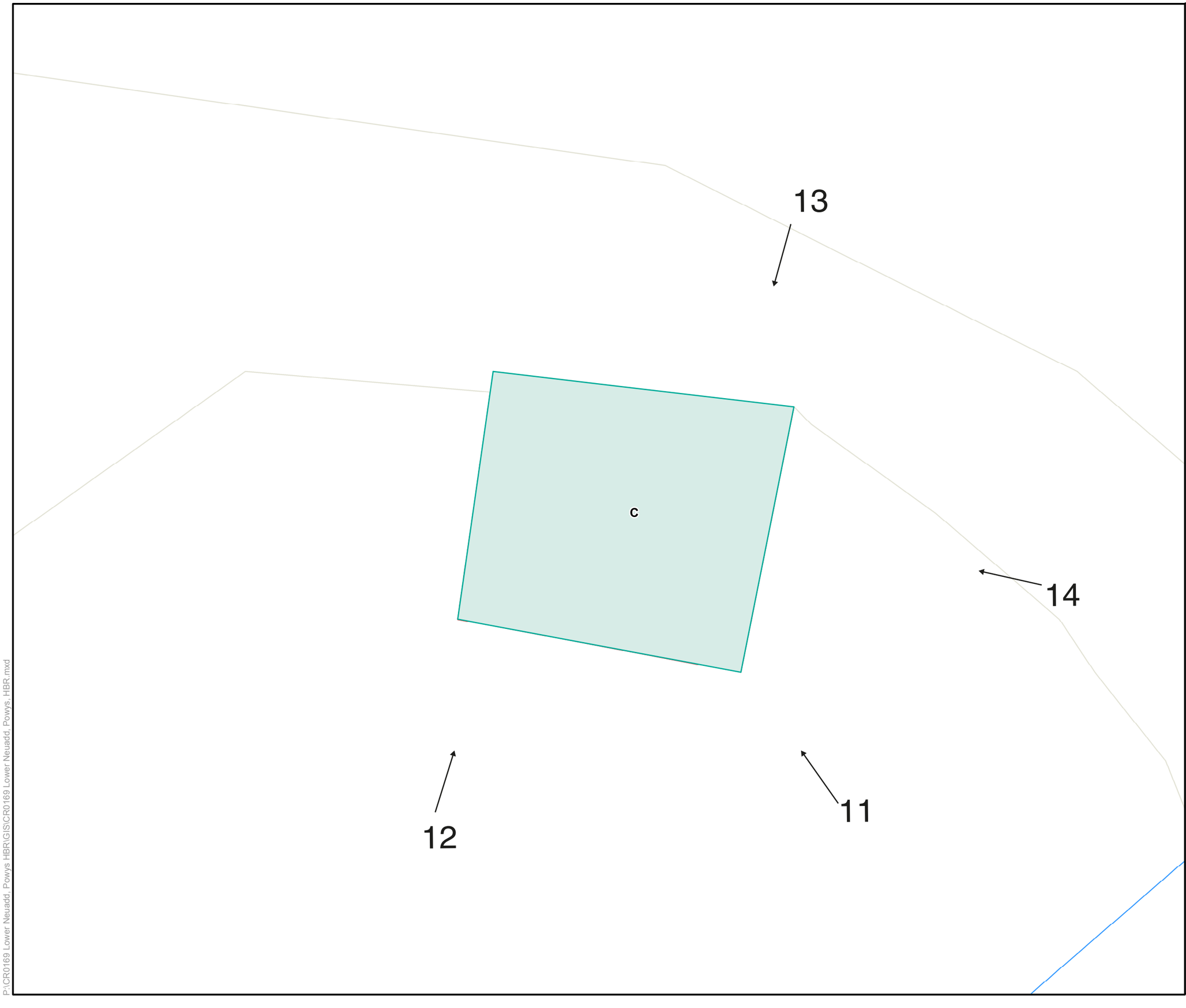
4.9. Extension B was built *c*.1938 when the Filter House (A) was adapted and extended to receive new machinery (see Section 3) and accommodate the chemical stores. This extension has been carefully incorporated within the building with the same fabric (Fig. 13, below), which means that the stylistic integrity of the building was largely maintained. However, this extension is still identifiable through the difference in the window treatments of the south facing elevation, which is simpler and the introduction of a basement level (Photo 9, above).

Fig. 13 Photogrammetric model of Building A and Extension B

4.10. The 1945 plan (see Fig. 6, above) proposed to extend this extension further to accommodate improved chemical stores but these were never installed and the new extension was never built.

Extension B1

4.11. Extension B1 (Fig. 11) is located to the rear of the Filter House (A) building (Photo 10, above). It was one of the proposed extensions, comprising a new engine house, which was documented on the 1945 plan and completed different fabric to the principle building. It measures *c*. 4m x 4m x 3m and is built of rendered engineer brick with a flat concrete roof. The windows and doors have been blocked up and the internal conditions and fixtures were not surveyed due to health and safety limitations.



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Legend

Keeper's Cottage (C)

1 Photo Location and Reference

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PROJECT TITLE

Lower neaudd Reservoir, Powys, Historic Building Recording

FIGURE TITLE

Building C and photo locations

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CHECKED BY	JR	DATE	06/09/2019	14
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The Reservoir Keeper's Cottage (Fig. 10, C; Fig. 14)

4.12. The Reservoir Keeper's Cottage (Fig. 10, C), or the Waterman's Cottage, is located *c*.30m to the north of the Filter House (A) and *c*.70m to the east of the Reservoir on a slightly raised area. The building is of a simple rectangular shape and is built of randomly coursed pink stone slabs of rectangular and squared shapes of different sizes.

Photo 11 Reservoir Keeper's Cottage (C)

4.13. It was built as the residence for the Reservoir keeper, but the 1945 plan (Fig. 6) annotates the building as 'Stores' meaning that its use as a dwelling had finished and the building was repurposed. Originally the building had a simple gable roof but at some point the building was extended and the roof obtained the current saltbox shape. The roof was likely to have been of Welsh slate, which seems to have been replaced with corrugated iron panels. The extension is clearly visible on Photo14.

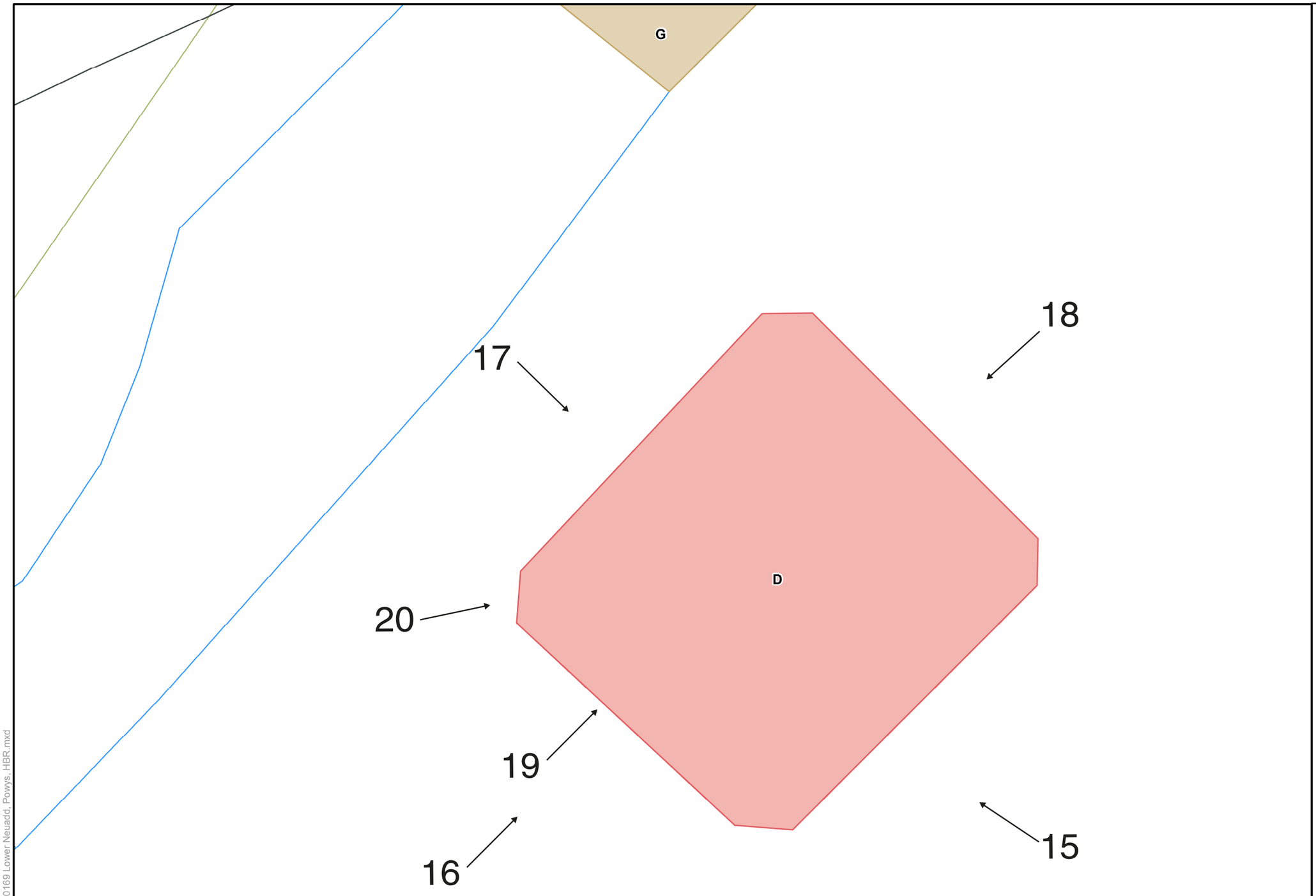
4.14. Although all of the windows and doors are currently bricked off, the original windows have a segmental brick lintel arch (Photos 11 and 14), which distinguishes them from the added windows on the north-west facing elevation (Photo 14). The area around the building is very overgrown and the vegetation prevented any closer inspection but the door is thought to be on the south facing elevation.

4.15. The chimney is simple, made of concreted rectangular ashlar blocks with a chimney pot with a crested cowl.

Photo 12 Reservoir Keeper's Cottage (C) detail of chimney

Photo 13 Reservoir Keeper's Cottage (C) north facing elevation

Photo 14 Reservoir Keeper's Cottage (C) west facing elevation



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Legend

Old Filter House (A)

1 Photo Location and Reference

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FIGURE TITLE

Building D and photo locations

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Grade II Listed Old Filter House (Fig. 10 and 15, D)

4.16. The Grade II Listed Old Filter House (Fig. 10, 15, and 16 below, D) is located *c*.40m to the west of the Filter House (A) and is in close proximity do the Spillway (G). As mentioned on the Listing (see Section 1) it is contemporary with the reservoir. Its purpose would be to remove/ filter unwanted constituents in the water making it safe to drink.

Fig. 16 Old Filter House (D) photogrammetric model

4.17. Designed as a '*faux*' folly in a neo-Tudor style within a landscaped reservoir this building includes elements intended to beautify an otherwise functional industrial building.

4.18. It is a mock two storey octagonal building of rock-faced pink stone with some sandstone ashlar, squared with a pyramid hip cement roof with a central chimney. It has a square tower with chamfered corners, corbelled parapet and recessed roof with a simple pediment.

4.19. The main elevation (Photo 15) has a large arched doorway with pink stone voussoirs. The first floor has a 3-light ashlar mullioned window. The parapet has a small raised shouldered pediment over the window.

4.20. The remaining elevations have 3-light mullioned windows, on the ground floor and a bricked up '*oculus*' type window on the first floor (Photos 16-18).

4.21. On each of the corners of the building there is a cast iron drain pipe and hopper that might be original and date to the building's construction (Photo 20).

Photo 15 Grade II Listed Old Filter House (D) south-east facing elevation

Photo 16 Grade II Listed Old Filter House (D) south facing elevation

Photo 17 Grade II Listed Old Filter House (D) north-west facing elevation

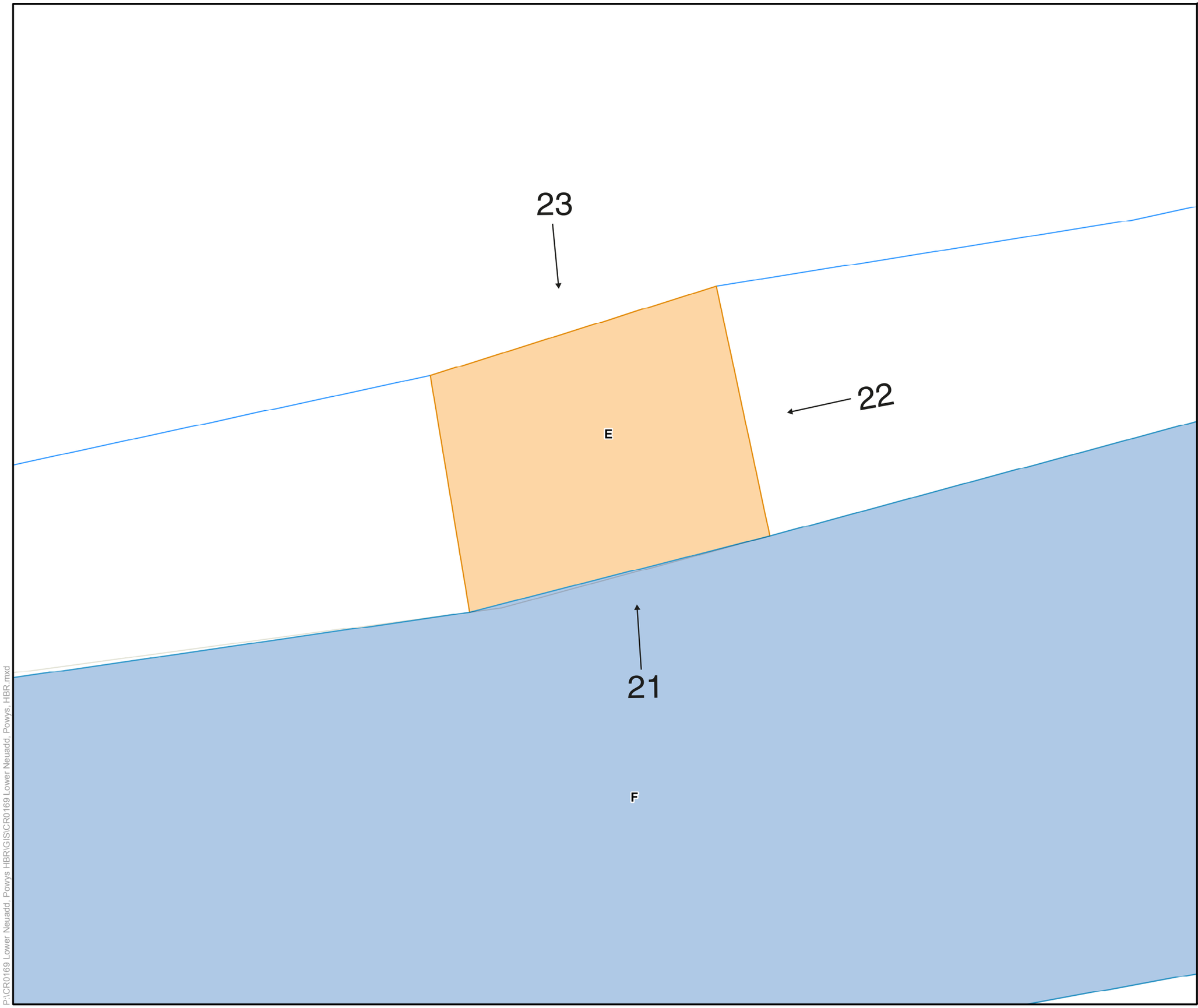
Photo 18 Grade II Listed Old Filter House (D) north-east facing elevation

4.22. As with all of the other buildings, the interior was not inspected, but some details were visible through the doors and windows. The brickwork seems to have been weathered and there are some visible cracks.

Photo 19 Detail of lower window of south facing elevation

Photo 20 Detail of cast iron drain pipe and hopper

4.23. The building also has a central decorated ventilation shaft (Photos 17 and 18), with an octagonal chimney pot which is considered to be original being of a typical Victorian design.



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Legend

- Valve Tower (E)
- Dam (F)
- 1 Photo Location and Reference

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PROJECT TITLE

Lower neaudd Reservoir, Powys, Historic Building Recording

FIGURE TITLE

Structure E and photo locations

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Valve Tower (Fig. 10, E; Fig. 17)

4.24. The Valve Tower (Fig. 10, E) is located on the dam embankment and is a simple cylindrical structure, built of stone with partial cement cover and a safety metal cap. The Valve Tower (E) sits above an outlet pipe or tunnel which would transport water out of the reservoir. It would include a system to control the opening and closing of valves, or gates, that control the flow of water through the outlet.

Fig. 18 Valve Tower (E) photogrammetric model

4.25. On the north facing side of the structure there is a weathered cast iron drain head/ pewter which is likely to be original (Photo 23).

4.26. Evidence for repairs can be seen on the top layers of the header brick bond of the structure (Photo 22). This is the ideal bond for this type of structure by allowing the rounding of the walls. Two metal beams are also visible (Photos 21 and 23), meant to give some structural stability these are most likely a recent addition.

Photo 21 Valve Tower (E) facing north

Photo 22 Valve Tower (E) facing west

Photo 23 Valve Tower (E) facing south

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E

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G

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Legend

- Valve Tower (E)
- Dam (F)
- Spillway (G)
- Old Filter House (D)
- 1 — Photo Location and Reference

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FIGURE TITLE

Structure F and photo locations

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The Dam (Fig. 10, F; Fig. 19)

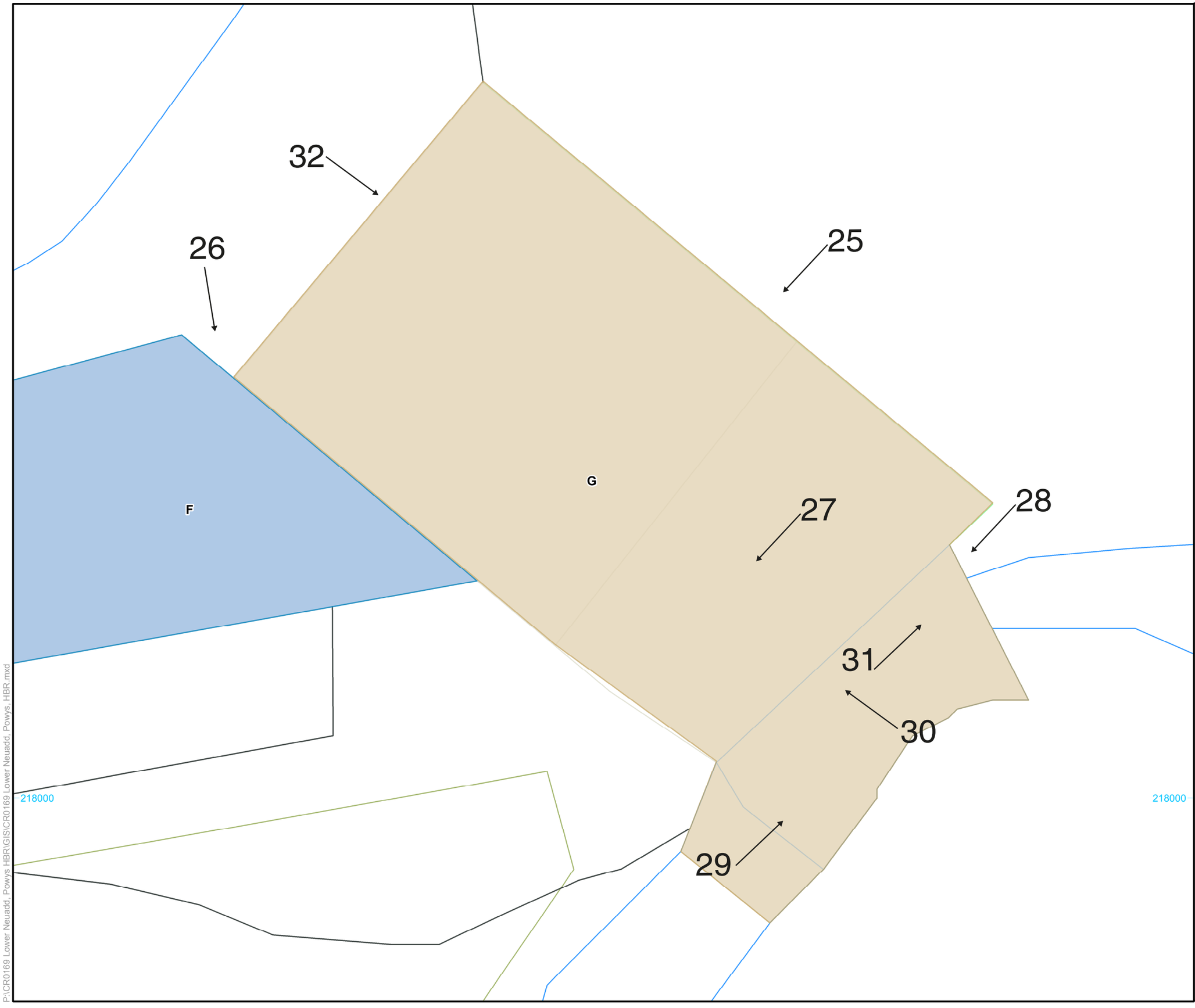
4.27. The Dam (Fig. 10, F) is located to the south of the reservoir and is adjacent to the Spillway (Fig.10, G). It is an earthen embankment dam made from natural and local materials, in this case earth and/or puddle clay (Bowtell and Gill 2006). If a cross-section was made across the dam it would show that is shaped like a bank or small hill with a core made of impermeable material to stop water passing through the dam.

Fig. 20 Dam (F) photogrammetric model facing south-west

Fig. 21 Dam (F) photogrammetric model facing north-east

4.28. The construction of clay-core earth dams has been recorded since at least the Romano-British period, but in the 18th and 19th century this type of structure not only became more common but became an important part of the design of reservoirs in the country as a part of a designed institutional landscape since it looks like a more natural and picturesque type of structure that contrasts with the more clearly manmade monumental structures such as the one at the Upper Neuadd Reservoir.

Photo 24 Dam (F) facing west



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Legend

- Spillway (G)
- Dam (F)
- 1 Photo Location and Reference

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FIGURE TITLE

Structure G and photo locations

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The Spillway (Fig. 10, G; Fig. 22)

4.29. The Spillway (Fig. 10, G) is adjacent to the eastern limit of the Dam (F), to the north of the Old Filter House (D) and to the north-west of the Filter House (A).

Fig. 23 Structure G (spillway) photogrammetric model

4.30. Spillways are generally structures that either form part of a dam, or are found just beside one. They are used when a reservoir is full to pass overflow of floodwater safely, and in a controlled way, over a dam, around it or through it. In this case the Spillway (G) is a side channel spillway, the type usually associated with embankment dams. It works by allowing the flow of water to travel over the spillway into a side channel from where it then flows down a chute and joins the river Blaen Taf Fechan downstream of the Dam (F).

4.31. The Spillway, referred to on the sections and plans as a byewash, is built of concrete slabs with pink stone masonry blocks, randomly coursed rubble wavewall and concrete kerbs with squared piers. It is built on top of the dam and it resembles a bridge connecting the water flow to the culverts and chutes through a masonry staircase with regular interval concrete steps on the higher level (Photo 27), and randomly sized blocks of rubble stone on the lower level (Photos 29 and 30). The concrete slabs of the higher level are considered to be quite recent, possibly installed during remediation works (Photo 25).

Photo 25 Spillway (G) facing south-west

Photo 26 Spillway (G) detail of wall and pavement facing south

Photo 27 Spillway (G) detail of byewash facing south-west

Photo 28 Spillway (G) detail of pier and wall

Photo 29 Spillway (G) facing north-east

Photo 30 Spillway (G) facing north-west

Photo 31 Spillway (G) facing north-east

5. ASSESSMENT OF SIGNIFICANCE

5.1. The buildings and structures within the Lower Neuadd reservoir are all part of the complex but do have different heritage and historic significance according to the their use and survival.

The Filter House (A and B) and Extension (B1)

5.2. The Filter House (A and B) has evidential and aesthetic values intrinsically connected with its fabric and built form. The building was built to serve a specific purpose and was repurposed several times to follow the technical innovations needed to the better functioning of the filters it lodged. It survived remarkably well considering that several portions of its roof are missing, but it preserved within it parts of the machinery as well as preserving the stylistic choices originally designed for it. The building is considered to be of heritage significance due to its history, preservation and architectural style, with added value when considered as part of the reservoir complex.

5.3. The Extension (B1) can be considered of no heritage significance since it does not accrue any heritage values. Architecturally the building had no innovations and its construction was completely purpose built. It demonstrates no intentions of beautifying and is the most modern of the buildings within the complex shedding no light on its development and use.

Reservoir Keeper's Cottage (C)

5.4. The Reservoir Keeper's Cottage adds human dimension to the complex, it was the house of the manager of the Reservoir until the mid-20th century when it became the stores for the reservoir. Hence it has communal and evidential values. Although considerably simpler in terms of architectural style and detail it retains heritage significance due to its connection to the complex.

Old Filter House (D)

5.5. The Old Filter House is the only building which is protected by statute, as a Grade II Listed. Similarly to the Filter House (A and B) its built fabric has survived remarkably well but it's architectural style and design is more complex, obviously so, almost as a *faux* Tudor folly. It accrues heritage significance from its physical form and fabric, from its history and purpose but sees its significance increase due the survival of the remainder of complex and of its historic setting. The building is as

intelligible within its landscape as it was when it was first built even if its use has been altered.

Valve Tower (E)

5.6. The Valve Tower has evidential values. Although not in use anymore, is another original remnant of the Reservoir complex. Its heritage significance derives from its state of preservation as a piece of water management/ engineering from the late Victorian period. Similarly to the other buildings and structures it sees its significance increase due to its connection to them and the surrounding landscape.

Lower Neuadd Reservoir Dam (F)

5.7. Although not as grand or intricate as other dams in the country, the Lower Neuadd Reservoir Dam is still a fine example of an earth dam/ embankment which has survived well through time having evidential and communal values. Its significance comes from its survival and connection to the buildings and structures on the complex but also to its careful siting within the surrounding landscape, giving it a slightly natural appearance that blends within the landscape whilst, at the same time, being the most imposing feature of said landscape.

Spillway (G)

5.8. The Spillway (G) and the related culverts have survived well and exhibit clear attempts to design the structure in an aesthetically pleasing manner having evidential, communal and aesthetic values. Although less prominent within the landscape it still reflects the stylistic choices for the design of the buildings. Its significance derives from its historic use, the design aesthetics, its degree of survival and the connections with the other buildings and structures within the complex

Summary

5.9. The buildings and structures within the complex are all considered to be of heritage significance with the exception of the modern Extension (B1). Even though only one of these has a statutory designation, they are all elements of the same designed institutional landscape which give coherence and legibility to each other and to the landscape by proxy.

6. CONCLUSIONS

6.1. The buildings and structures that form part of the complex of the Lower Neuadd Reservoir are all elements of what can be considered an institutional landscape.

6.2. This complex was built and designed with the purpose to endure, serve the communities in its environs and be imposing whilst integrating within its landscape.

6.3. Although the complex lacks the complexity and grandeur of similar Reservoir complexes of the same period (i.e. Upper Neuadd Reservoir) it was clearly intended to be imposing within its landscape with clear attempts to design buildings that, although mostly practical, built for purpose industrial buildings, still show signs of design efforts.

6.4. The buildings and structures are in advanced state of disrepair but their stylistic integrity has survived remarkably well with several of their oldest features and details surviving.

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1887 1st Edition Ordnance Survey (courtesy of Envirocheck)

1895 Merthyr Tydfil Waterworks, Neuadd Supply, Contract 1, Drawing No.1 (courtesy of the *Client Archives*)

1905 2nd Edition Ordnance Survey (courtesy of Envirocheck)

1927 Taf Fechan Water Supply Board, Map Shewing Reservoirs, New pipe Line and Areas of Supply (courtesy of GRO WBTF/17)

1953 Edition Ordnance Survey (courtesy of Envirocheck)

1964 Edition Ordnance Survey

1978 Edition Ordnance Survey

Subsequent Ordnance Survey maps viewed at:

www.promap.co.uk and http://www.envirocheck.co.uk/ and included in Appendix 2

Archive Sources

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Lower Neuadd pipework sketch

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DG/F9/1 – Papers relating to Neuadd Reservoir with suggestions for settlement

WBTF 1-25 – Taf fechan Water Supply Board commemorative booklets

D/GF/9/10 - Book of Maps

Powys Archives (PRO)

R/UD/LW/E/710/box 9/57 - Waterworks plans: Ddole Road pumping station, Llanfawr Reservoir and filter beds, Neuadd Reservoir, Gorse Spring

APPENDIX 1: WSI

Cotswold Archaeology

Lower Neuadd Reservoir
Brecon Beacons National Park
Powys

Written Scheme of Investigation for a Programme of Archaeological Works

for
Skanska Construction UK Ltd

on behalf of
DWR Cymru Welsh Water

CA Project: CR0110
Planning Refs: 19-17211-SO, 19-17166-LBC
July 2019

Lower Neuadd Reservoir
Brecon Beacons National Park
Powys

Written Scheme of Investigation for a Programme of Archaeological Works

CA Project: CR0110
Planning Refs: 19-17211-SO, 19-17166-LBC

Document Control Grid						
Revision	Date	Author	Checked by	Status	Reasons for revision	Approved by
A	17 July 2019	Sara-Jayne Boughton	Joanne Robinson	First Issue	Client comment	Ian Barnes
B	18 July 2019	Sara-Jayne Boughton	Joanne Robinson	Second Issue	Client comment	Ian Barnes

CONTENTS

1. INTRODUCTION

1.1 This document sets out details of a *Written Scheme of Investigation* (WSI) by Cotswold Archaeology (CA) for an archaeological watching brief at Lower Neuadd Reservoir, Breacon Beacons National Park, Powys (centred at NGR: 303052 218107) at the request of Skanska Construction UK Ltd.

1.2 Planning permission for the discontinuance and removal of the Lower Neuadd Dam was granted by Brecon Beacons National Park Authority (BBNPA; planning ref: 19/17211/SO), conditional on a programme of archaeological work. The scheme was submitted for EIA screening with the conclusion that significant effects on the historic environment might be reduced and managed by the implementation of appropriate programmes of archaeological field work and assessment. As per Schedule 3, 3, (h) EIA was less likely to be required for the proposal under section 38 of the Welsh Office Circular 11/ 99. A programme of archaeological works is therefore required to ensure that effects on the historic environment are reduced. A program of archaeological mitigation is also required by condition attached to associated planning application number 19-17166-LBC. In relation to intrusive impacts in relation to site establishment works and other infrastructure (as detailed herein), Alice Thorne, Heritage Officer, BBNPA has recommended that this programme of works comprise an archaeological watch brief and historic building recording. This WSI covers both the historic building recording and archaeological watching brief. In accordance with *Brief For An Archaeological Works At Lower Neuadd Reservoir, Torpantau, Merthyr Tydfil, Powys* (BBNP 2019), the building recording work will specifically relate to the Lower Neuadd Reservoir Dam (RCAHMW: 246468) and Valve Tower (RCAHMW: 246471), including elements of their curtilage.

1.3 This WSI has been guided in its composition by S*tandard and guidance: Archaeological watching brief* (CIfA 2014), the *Standard and guidance for the archaeological investigation and recording of standing buildings or structures* (CIfA 2014), *Planning Policy Wales, Edition 10*, *TAN24: Historic Environment* (EPRA PPW 2017; 2018), BBNPA *Local Development Plan* (2013) and any other relevant standards or guidance contained within Appendix B. This specification should be read in conjunction with *Understanding Historic Buildings; A guide to good recording practice* (English Heritage 2006).

The site

1.4 The reservoir is located in the Taf Fechan valley, high in the Brecon Beacons, approximately 12km north of Merthyr Tydfil. The reservoir is the lower of a pair situated within the mountain enclosed valley which runs north-west to south-east. The newer associated dam, Upper Neuadd, is located *c*. 600m north-west of site. The hills either side of the valley reach 700m before rising northwards to 873m at the head of the valley at Pen y Fan and Corn Dû. The site lies at an average of approximately 403m AOD and is surrounded by dense woodland or rough pasture, as well as coniferous forestry plantations.

1.5 The reservoir itself is an earth-filled embankment reservoir with a stone faced and concrete spillway at its south-eastern end. A single-track road runs to the buildings just south of the reservoir, with another track running to its east towards the upper reservoir. To the immediate south of the reservoir, close to the spillway, is an octagonal Filter House. Two other buildings, one close to where the track to the east crosses the watercourse, and another at the top of the slope to the south of Filter House, form a small grouping of reservoir-related structures (Ove Arup & Partners Ltd 2019).

1.6 The underlying bedrock geology of the area is mapped as Brownstones Formation - Sandstone and (subequal/subordinate) Agrillaceous Rocks, Interbedded of the Devonian Period. Superficial deposits of glacial Till, Devensian – Diamicton formed during the Quaternary period are noted (BGS 2019).

1.7 Those buildings which will be subject to the Level 3 historic building recording comprise:

- The curtilage listed dam; and
- The curtilage listed valve house.

1.8 Both of which will be directly impacted by the proposals.

1.9 Three further buildings are to be included within the report, though not subject to Level 3 historic building recording, comprising:

- the treatment house (likely curtilage listed);
- the listed filter house; and
- the spillway (possibly curtilage listed).

1.10 The above scope for the historic building recording was confirmed (which includes variants from the aforementioned Brief For An Archaeological Works At Lower Neuadd Reservoir, Torpantau, Merthyr Tydfil, Powys 2019) was agreed within Alice Thorne, Heritage Officer, during a site visit on 28 June 2019.

2. ARCHAEOLOGICAL BACKGROUND

2.1 A preceding archaeological and historical background within a Desk-Based Assessment (DBA) of the site has already been prepared by Ove Arup & Partners Ltd. It is not the intended to fully reprise the report but here is a summary of its conclusions.

Prehistoric

2.2 Evidence for human activity and settlement from the Mesolithic onwards has been recorded throughout the Brecon Beacons and the pollen record indicates activities of hunter-gatherers across Wales. Multiple find spots of flint tools dating to the Mesolithic, Neolithic and Bronze Age such as scrapers and arrowheads have been recorded in the DBA study area.

2.3 The closest evidence to site for prehistoric activity is the Lower Neuadd Standing stone, 180m south of site. A round barrow cemetery is also located in the centre of the Upper Neuadd reservoir; with the slightly raised ground it occupies standing as an island in the middle of the reservoir itself. A possible Bronze Age hut circle and attached enclosure has been recorded approximately 760m north-west of site, with further additions of standing stones, cairns and round barrows recorded. (Over Arup & Partners Ltd 2019).

Roman

2.4 The site is not located near any Roman military site or *vici*, around which much of the Roman development of mid and north Wales is centralised. However, the line of the Roman Road between Cardiff and Castell Collen Roman Fort, located c. 45km north of site at Llandrindod Wells is conjectured to run close to the western side of the Lower Neuadd Reservoir and up to the Upper Neuadd Reservoir (*ibid*.).

Early Medieval/Medieval

2.5 No evidence for early medieval activity is recorded within or near site but the site lay within the kingdom of Brycheiniog.

2.6 There is also no evidence for medieval activity recorded within or close to site. The uplands of the Brecon Beacons were subject to cultivation and pasture but the site itself was most likely used for grazing or was possibly even forested. One site of possible medieval date, although speculative, is that of the Twyn Y Neuadd huts. This site comprises a group of three definite and two possible rectangular huts, as well as one in ruinous form (*ibid*.).

Post-medieval

2.7 Throughout the post-medieval period, the uplands were used for sheep farming, breeding rabbits and the harvesting of natural resources such as fern, gorse and kindling. Post-medieval buildings within the study area of the DBA notes various features to this effect, such as boundary stones, sheepfolds, enclosures, walls and bridges.

2.8 A 1840 Tithe map shows the site located within common land owned by the parish as a meadow under seasonal occupancy (*ibid*.).

2.9 Lower Neuadd Reservoir forms the middle part of a post-medieval cascade, alongside Upper Neuadd Dam to the north and Pontsticill Reservoirs to the south-west, which provides potable water for the Merthyr Tydfil area and down to the city of Cardiff.

2.10 Successive outbreaks of cholera in Merthry Tydfil in 1832, 1849 and 1854 led to an Act of Parliament in 1876 to supply clean water and subsequently the construction of Pentwyn Reservoir between 1858 and 1862, approximately 3km south-east of site. Pentwyn Reservoir and its then untreated water fed eleven standpipes and the ironworks. Increasing demand led to the Lower Neuadd Reservoir being built between 1876 and 1884. It was designed to hold approximately 74 million gallons of water and a railway line was built from Torpantau station, approximately 2.5km south-east of site, to help with its construction (Coflein 2019).

2.11 In 1902, the reservoir was replaced by the Upper Neuadd Reservoir, at 475m AOD, which allowed further areas of the country to be supplied with water without the need to pumping, such as Cwmbargoed, Bedlinog, Abercynon, Merthyr vale and High

Treharris. The expansion of Barry and the needs of Rhymney and Pontypridd added to those pre-existing needs and Pentwyn, later Pontisticill, Reservoir was planned in 1910, but was delayed by the first World War, and was opened in 1927 (*ibid*.).

2.12 Frequent assessments by DWR Cymru Welsh Water noting leakage and overspill eventually concluded that the upper, and then subsequently the lower, Neuadd reservoirs were no longer required for water supply. Thus, the reservoirs were put into permanent discontinuance (Water Projects Online 2016).

3. AIMS AND OBJECTIVES

3.1 The objectives of the archaeological watching brief, in accordance with and summarised from *Standard and guidance for an archaeological watching brief* (CA 2014), are:

- to monitor groundworks, and to identify, investigate and record all significant buried archaeological deposits revealed on the site during the course of the development groundworks in relation to the laydown areas, channel works and haul roads;

- to monitor the demolition of the dam and valve tower, to ensure a full record is made of structures impacted by works;

- at the conclusion of the project, to produce an integrated archive for the project work and a summary report setting out the results of the project and the archaeological conclusions that can be drawn from the recorded data. This will be integrated into an overarching archaeological and heritage report for the scheme.

3.2 If significant archaeological remains are identified, reference will be made to the appropriate research framework, so that the remains can, if possible, be placed within their local and regional context.

3.3 The objectives of the historic building survey are to complete a Level 3 Historic Buildings Survey of the Lower Neuadd Reservoir Dam (RCAHMW: 246468) and Valve Tower (RCAHMW: 246471). The full specification of such a survey is included within Appendix E, with elements outside the minimum requirements of a Level 3 survey as agreed within Alice Thorne, Heritage Officer, during a site visit on 28 June 2019.

4. METHODOLOGY

Excavation and recording

4.1 The watching brief comprises the observation by a competent archaeologist of all intrusive groundworks planned in relation to the completion of the laydown areas, channel works and haul roads (see Appendix C for the proposed areas of groundworks; the channel works are indicated specifically on drawing ref: 2172_W_204-ARP-12-XX-DR-SS-00011). The demolition of the dam and valve tower will be monitored and subject to recording (which may include traditional recording methodology, as below, or drone/UAV survey, Appendix F). Non-archaeologically significant deposits will be removed by the contractors under archaeological supervision. Where mechanical excavators are used, these will be equipped with a toothless bucket unless other standing consent requires an alternative methodology.

4.2 If archaeological deposits are encountered they will be planned and recorded in accordance with Technical Manual 1 *Fieldwork Recording Manual*. Each context will be recorded on a pro-forma context sheet by written and measured description; principal deposits will be recorded by drawn plans (scale 1:20 or 1:50, or electronically using Leica GPS as appropriate) and drawn sections (scale 1:10 or 1:20 as appropriate). Should detailed feature planning be undertaken using GPS this will be carried out in accordance with Technical Manual 4 *Survey Manual*. Photographs (digital colour) will be taken as appropriate. All finds and samples will be bagged separately and related to the context record. All artefacts will be recovered and retained for processing and analysis in accordance with Technical Manual 3 *Treatment of Finds Immediately after Excavation*.

4.3 In the event of archaeological deposits being found for which the resources allocated are not sufficient to support treatment to a satisfactory and proper standard or which are of sufficient significance to merit an alternative approach such as contingency excavation or physical preservation, the client and the BBNPA will be contacted immediately. Destructive work in that area will cease until agreement has been reached on an appropriate archaeological response.

Artefact retention and discard

4.4 Artefacts from topsoil and subsoil and un-stratified contexts will normally be noted but not retained unless they are of intrinsic interest (e.g. worked flint or flint debitage, featured pottery sherds, and other potential 'registered artefacts'). All artefacts will be collected from stratified excavated contexts except for large assemblages of post-medieval or modern material. Such material may be noted and not retained, or, if appropriate, a representative sample may be collected and retained.

Human remains

4.5 In the case of the discovery of human remains (skeletal or cremated), at all times they should be treated with due decency and respect. Where human remains are encountered, these will not be excavated unless their disturbance by the development is unavoidable. In cases where exhumation of human remains is deemed unavoidable/necessary, this will be conducted following the provisions of the Coroners Unit in the Ministry of Justice. All excavation and post-excavation processes will be in accordance with the standards set out in *CIfA Technical Paper No 7 Guidelines to the Standards for recording Human Remains* (CIfA 2004).

Environmental remains

4.6 Due care will be taken to identify deposits which may have environmental potential, and where appropriate, a programme of environmental sampling will be initiated. This will follow the Historic England environmental sampling guidelines outlined in *Environmental Archaeology, A guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation* (English Heritage 2011), and *CA Technical Manual 2: The Taking and Processing of Environmental and Other Samples from Archaeological Sites.* The sampling strategy will be adapted for the specific circumstances of the site, in close consultation with the CA Environmental Officer.

4.7 The processing of the samples will be done in conjunction with the relevant specialist following the Historic England general environmental processing guidelines (English Heritage 2011). Flotation or wet sieve samples will be processed to 0.25mm. Other more specialist samples such as those for pollen will be prepared by the relevant specialist. Further details of the general sampling policy and the methods of taking and processing specific sample types are contained within *CA Technical Manual 2: The Taking and Processing of Environmental and Other Samples from Archaeological Sites*.

Treasure

4.8 Upon discovery of Treasure CA will notify the client and the curator immediately. CA will comply fully with the provisions of the Treasure Act 1996 and the Code of Practice referred to therein. Findings will be reported to the coroner within 14 days.

Building Recording

4.9 In the absence of a Welsh equivalent, the historic building recording will comprise a Level 3 'analytical record', as defined by the Historic England Guidance 'Understanding Historic Buildings, A Guide to Good Recording Practice' (2016).

4.2 As per the above guidance (Historic England, 2016), the record will comprise an introductory description, followed by a systematic account of each building's origins, development and use. Any documentary sources used as part of this analysis will be referenced throughout.

4.3 The record will comprise of three elements; drawings, photography and a written account. Full methodology details are provided as Appendix E.

4.4 The drawn record will be provided by drone survey. The drone survey methodology is provided as Appendix F.

4.5 A site visit will also be undertaken. Those buildings outlined in Section 1.6 will be subject to external inspection only due to health and safety concerns. Regarding the contextual survey (Section 1.8), the spillway will not be subject to external inspection, and will be assessed utilising the results of the drone survey only due to health and safety and access concerns.

5. STAFF AND TIMETABLE

5.1 This project will be under the management of Ian Barnes MCIfA, Project Manager, CA.

5.2 The staffing structure will be organised thus: the Project Manager will direct the overall conduct of the watching brief as required during the period of fieldwork. Day to day responsibility however will rest with the Project Leader who will be on-site throughout the project.

5.3 The field team will consist of a Project Leader and/or Historic Buildings Offiers/Geomatics Officer, supplemented by additional Archaeologists as required).

5.4 The duration of the fieldwork will be dependent upon the contractor's programme. Once approval is received for the works to commence from all parties (including BBNP representatives), it is anticipated that the groundworks will be complete in *c.* 15 days.

5.5 Specialists who will be invited to advise and report on specific aspects of the project as necessary are:

Ceramics	Ed McSloy MCIfA (CA)
Metalwork	Ed McSloy MCIfA (CA)
Flint	Jacky Sommerville PCIfA (CA)
Animal Bone	Andy Clarke (CA)/
	Matty Holmes BSc MSc ACIfA (freelance)
Human Bone	Sharon Clough MCIfA (CA)
Environmental Remains	Sarah Wyles PCIfA (CA)
Conservation	Pieta Greeves BSc MSc ACR
	(Drakon Heritage and Conservation)
Geoarchaeology	Dr Keith Wilkinson (ARCA)
Building Recording	Peter Davenport MCIfA, FSA (CA)

5.6 Depending upon the nature of the deposits and artefacts encountered it may be necessary to consult other specialists not listed here. A full list of specialists currently used by Cotswold Archaeology is contained within Appendix A.

6. POST-EXCAVATION, ARCHIVING AND REPORTING

6.1 Following completion of fieldwork, all artefacts and environmental samples will be processed, assessed, conserved and packaged in accordance with CA Technical Manuals and the Brecknock Museum & Art Gallery or the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) guidelines. A recommendation will be made regarding material deemed suitable for disposal/dispersal in line with the relevant recipient Museums' collection policy.

6.2 An illustrated report will be compiled on the results of the fieldwork (observations on groundworks in connection with the laydown areas, channel works and haul roads) and assessment of the artefacts, palaeoenvironmental samples etc. The illustrated report will include:

(i) an abstract containing the essential elements of the results preceding the main body of the report, and a summary of the project's background provided in bilingual format in accordance with WAT 2018);
(ii) description and illustration of the site location;
(iii) a methodology of the works undertaken;
(iv) integration of, or cross-reference to, appropriate cartographic and documentary evidence and the results of other research undertaken, where relevant to the interpretation of the watching brief results;
(v) a description of the project's results;
(vi) an interpretation of the results in the appropriate context;
(vii) a summary of the contents of the project archive and its location (including summary catalogues of finds and samples);
(viii) a site location plan at an appropriate scale on an Ordnance Survey, or equivalent, base-map;
(ix) a plan showing the location of the areas observed and exposed archaeological features and deposits in relation to the site boundaries;
(x) plans of each area in which archaeological features are recognised. These will be at an appropriate scale to allow the nature of the features exposed to be shown and understood. Plans will show the orientation of features recorded in relation to north. Section drawing locations will be shown on these plans. Archaeologically sterile areas will not be illustrated unless this can provide information on the development of the site stratigraphy or show palaeoenvironmental deposits that have influenced the site stratigraphy;
(xi) section drawings of areas/trenches and features will be included where appropriate, with OD heights and at scales appropriate to the stratigraphic detail being represented. These will show the orientation of the drawing in relation to north/south/east/west. Archaeologically sterile trenches will not be illustrated unless they provide significant information on the development of the site stratigraphy or show palaeoenvironmental deposits that have influenced the site stratigraphy;
(xiii) photographs showing significant features and deposits that are referred to in the text. All photographs will contain appropriate scales, the size of which will be noted in the illustration's caption;

(xiv) a consideration of evidence within its wider local/regional context;
(xv) a summary table and descriptive text showing the features, classes and numbers of artefacts recovered and soil profiles with interpretation;
(xvi) specialist assessment or analysis reports where undertaken;

6.3 Specialist artefact and palaeoenvironmental assessment will take into account the wider local/regional context of the archaeology and will include:

(i) specialist aims and objectives
(ii) processing methodologies (where relevant)
(iii) any known biases in recovery, or problems of contamination/residuality
(iv) quantity of material; types of material present; distribution of material
(v) for environmental material, a statement on abundance, diversity and preservation
(vi) summary and discussion of the results to include significance in a local and regional context

6.4 Copies of the draft report will be distributed to Skanska Construction UK Ltd or their Representative and to the BBNPA thereafter for verification and approval. Thereafter, copies of the approved report will be issued to the Skanska Construction UK Ltd, BBNPA and the local Historic Environment Record (HER) in accordance with the Welsh Archaeological Trusts *HER Guidance for the Submission of Data to the Welsh Historic Environment Records*. Reports (including a Welsh language summary) will be issued in digital format (PDF/PDFA as appropriate) except where hard copies have been specifically requested, and will be supplied to the HER along with shapefiles containing location data for the areas investigated, archive details and digital photographs, as required by the Welsh HER guidelines (WAT 2018) and by the National Panel for Archaeological Archives in Wales guidelines (NPAAW 2017).

6.5 Should no further work be required, an ordered, indexed, and internally consistent site archive will be prepared and deposited in accordance with *Archaeological Archives: A Guide to Best Practice in Creation, Compilation, Transfer and Curation* (Archaeological Archives Forum 2007), *The National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales 2017* (National Panel For Archaeological Archives In Wales 2017), *Guidance for the Submission of Data to the Welsh Historic Environment Records* (WAT 2018) and the relevant museum guidelines (expected to be Brecknock Museum).

Academic dissemination

6.6 As the limited scope of this work is likely to restrict its publication value, it is anticipated that a short publication note only will be produced, suitable for inclusion within an appropriate local archaeological journal e.g. Archaeology Wales. Under normal circumstances, this will be submitted within a year of the completion of fieldwork (any anticipated increase in timescale will be communicated to BBNP). A short summary in agree format will be submitted to Archaeology Wales for inclusion in the 'Gazetteer of sites explored' concurrently. Should a full report of archaeological findings be necessary, text and supporting illustrations etc will be made available for publication will (in the absence of any factors in relation to analysis, processing or other element of reporting) occur in an appropriate regional or national archaeological journal within six months of the completion of fieldwork. Subject to any contractual constraints, a summary of information from the project will also be entered onto the online database for the National Monuments Record of Wales (NMRW) maintained by the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) in accordance with RCAHMW guidelines. This will include the upload of a digital (PDF) copy of the final report which will appear on the Archaeology Data Service (ADS) website once then NMRW record has been verified.

Public dissemination

6.7 In addition to the ADS website, a digital (PDF) copy of the final report will also be made available for public viewing via Cotswold Archaeology's *Archaeological Reports Online* web page, generally within 12 months of completion of the project (http://reports.cotswoldarchaeology.co.uk/).

Archive deposition

6.8 CA will offer the archive and, subject to agreement with the legal landowner(s), the artefact collection to Brecknock Museum & Art Gallery and will be consulted at this stage concerning their requirements and notified in advance of the expected time limits for deposition of the archive. Should Brecknock Museum & Art Gallery not wish to retain the material archive, it will be deposited with the RCAHMW.

7. HEALTH AND SAFETY

7.1 CA will conduct all works in accordance with the Health and Safety at Work Act 1974 and all subsequent Health and Safety legislation, CA Health and Safety and

Environmental policies and the CA Safety, Health and Environmental Management System (SHE), as well as any Principal Contractor's policies or procedures. A site-specific Construction Phase Plan (form SHE 017) will be formulated prior to commencement of fieldwork.

8. INSURANCES

8.1 CA holds Public Liability Insurance to a limit of £10,000,000 and Professional Indemnity Insurance to a limit of £10,000,000.

9. MONITORING

9.1 Notification of the start of site works will be made to the BBNPA so that there will be opportunities to visit the site and check on the quality and progress of the work.

9.2 A project programme is appended as Appendix D to facilitate any required monitoring.

10. QUALITY ASSURANCE

10.1 CA is a Registered Organisation (RO) with the Chartered Institute for Archaeologists (RO Ref. No. 8). As a RO, CA endorses the *Code of Conduct* (CIfA 2014) and the *Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology* (CIfA 2014). All CA Project Managers and Project Officers hold either full Member or Associate status within the CIfA.

10.2 CA operates an internal quality assurance system in the following manner. Projects are overseen by a Project Manager who is responsible for the quality of the project. The Project Manager reports to the Chief Executive who bears ultimate responsibility for the conduct of all CA operations. Matters of policy and corporate strategy are determined by the Board of Directors, and in cases of dispute recourse may be made to the Chairman of the Board.

11. PUBLIC ENGAGEMENT, PARTICIPATION AND BENEFIT

11.1 This project will not afford opportunities for public engagement or participation during the course of the fieldwork. However, the results will be made publicly available on

the ADS and Cotswold Archaeology websites, as set out in Section 6 above, in due course.

12. STAFF TRAINING AND CPD

12.1 CA has a fully documented mandatory Performance Management system for all staff which reviews personal performance, identifies areas for improvement, sets targets and ensures the provision of appropriate training within CA's adopted training policy. In addition, CA has developed an award-winning Career Development Programme for its staff, which ensures a consistent and high quality approach to the development of appropriate skills.

12.2 As part of the company's requirement for Continuing Professional Development, all members of staff are also required to maintain a Personal Development Plan and an associated log which is reviewed within the Performance Management system. All staff are subject to probationary periods on appointment, with monthly review; for site-based staff additional monthly Employee Performance Evaluations measure and record skills and identify training needs.

13. REFERENCES

BGS (British Geological Survey) 2019 *Geology of Britain Viewer* http://mapapps.bgs.ac.uk/geologyofbritain/home.html Accessed 20 May 2019

Brecon Beacons National Park Authority (BBNPA) 2013 *Local Development Plan* https://www.beacons-npa.gov.uk/planning/draft-strategy-and-policy/brecon-beacons-national-park-local-development-plan/ Accessed 20 May 2019

EPRA (Energy, Planning and Rural Affairs Wales) 2017 *Planning Policy Wales Technical Advice Note 24: The Historic Environment*

EPRA (Energy, Planning and Rural Affairs Wales) 2018 *Planning Policy Wales: Edition 10*

DCLG (Department of Communities and Local Government) 2012 *National Planning Policy Framework*

National Panel for Archaeological Archives in Wales (NPAAW) 2017 *The National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales*

Ove Arup & Partners Ltd 2019 *DWR Cymru Welsh Water Lower Neuadd Reservoir: Heritage Impact Statement* **Arup Report no. 241432-06**

WAT (Welsh Archaeological Trusts) 2018 *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)*

Water Projects Online 2016 *Upper Neuadd Dam Stability* http://www.waterprojectsonline.com/case_studies/2016/DCWW_Upper_Neuadd_Dam_2016.pdf Accessed 20 May 2019

APPENDIX A: COTSWOLD ARCHAEOLOGY SPECIALISTS

Ceramics

Neolithic/Bronze Age	Ed McSloy BA MCIFA (CA) Emily Edwards (freelance) Dr Elaine Morris BA PhD FSA MCIFA (University of Southampton)
Iron Age/Roman	Ed McSloy BA MCIFA (CA) Kayt Hawkins BA MSc MCIFA (freelance)
(Samian)	Gwladys Montell MA PhD (freelance)
(Amphorae stamps)	Dr David Williams PhD FSA (freelance)
Anglo-Saxon	Paul Blinkhorn BTech (freelance) Dr Jane Timby BA PhD FSA MCIFA (freelance)
Medieval/post-medieval	Ed McSloy BA MCIFA (CA) Kayt Hawkins BA MSc MCIFA (freelance) Stephanie Ratkai BA (freelance) Paul Blinkhorn BTech (freelance) John Allan BA MPhil FSA (freelance)
South West	Henrietta Quinnell BA FSA MCIFA (University of Exeter)
Clay tobacco pipe	Reg Jackson MLitt MCIFA (freelance) Marek Lewcun (freelance)
Ceramic Building Material	Ed McSloy MCIFA (CA) Dr Peter Warry PhD (freelance)

Other Finds

Small Finds	Ed McSloy BA MCIFA (CA)
Metal Artefacts	Katie Marsden BSc (CA) Dr Jörn Schuster MA DPhil FSA MCIFA (freelance) Dr Hilary Cool BA PhD FSA (freelance)
Lithics	Ed McSloy BA MCIFA (CA) Jacky Sommerville BSc MA PCIFA (CA)
(Palaeolithic)	Dr Francis Wenban-Smith BA MA PhD (University of Southampton)
Worked Stone	Dr Ruth Shaffrey BA PhD MCIFA (freelance) Dr Kevin Hayward FSA BSc MSc PhD PCIFA (freelance)
Inscriptions	Dr Roger Tomlin MA DPhil, FSA (Oxford)
Glass	Ed McSloy MCIFA (CA) Dr Hilary Cool BA PhD FSA (freelance) Dr David Dungworth BA PhD (freelance; English Heritage)
Coins	Ed McSloy BA MCIFA (CA) Dr Peter Guest BA PhD FSA (Cardiff University) Dr Richard Reece BSc PhD FSA (freelance)
Leather	Quita Mould MA FSA (freelance)
Textiles	Penelope Walton Rogers FSA Dip Acc. (freelance)
Iron slag/metal technology	Dr Tim Young MA PhD (Cardiff University) Dr David Starley BSc PhD
Worked wood	Michael Bamforth BSc MCIFA (freelance)

Biological Remains	
Animal bone	Dr Philip Armitage MSc PhD MCIFA (freelance) Dr Matilda Holmes BSc MSc ACIFA (freelance)
Human Bone	Sharon Clough BA MSc MCIFA (CA)
Environmental sampling	Sarah Wyles BA PCIFA (CA) Sarah Cobain BSc MSc ACIFA (CA) Dr Keith Wilkinson BSc PhD MCIFA (ARCA)
Pollen	Dr Michael Grant BSc MSc PhD (University of Southampton) Dr Rob Batchelor BSc MSc PhD MCIFA (QUEST, University of Reading)
Diatoms	Dr Tom Hill BSc PhD CPLHE (Natural History Museum) Dr Nigel Cameron BSc MSc PhD (University College London)
Charred Plant Remains	Sarah Wyles BA PCIFA (CA) Sarah Cobain BSc MSc ACIFA (CA)
Wood/Charcoal	Sarah Cobain BSc MSc ACIFA(CA) Dana Challinor MA (freelance)
Insects	Enid Allison BSc D.Phil (Canterbury Archaeological Trust) Dr David Smith MA PhD (University of Birmingham)
Mollusca	Sarah Wyles BA PCIFA (CA) Dr Keith Wilkinson BSc PhD MCIFA (ARCA)
Ostracods and Foraminifera	Dr John Whittaker BSc PhD (freelance)
Fish bones	Dr Philip Armitage MSc PhD MCIFA (freelance)
Geoarchaeology	Dr Keith Wilkinson BSc PhD MCIFA (ARCA)
Soil micromorphology	Dr Richard Macphail BSc MSc PhD (University College London)
Scientific Dating	
Dendrochronology	Robert Howard BA (NTRDL Nottingham)
Radiocarbon dating	SUERC (East Kilbride, Scotland) Beta Analytic (Florida, USA)
Archaeomagnetic dating	Dr Cathy Batt BSc PhD (University of Bradford)
TL/OSL Dating	Dr Phil Toms BSc PhD (University of Gloucestershire)
Conservation	Karen Barker BSc (freelance) Pieta Greaves BSc MSc ACR (Drakon Heritage and Conservation)

APPENDIX B: ARCHAEOLOGICAL STANDARDS AND GUIDELINES

AAF 2007 *Archaeological Archives. A guide to best practice in creation, compilation, transfer and curation*. Archaeological Archives Forum

AAI&S 1988 *The Illustration of Lithic Artifacts: A guide to drawing stone tools for specialist reports.* Association of Archaeological Illustrators and Surveyors Paper **9**

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Brickstock, R.J. 2004 *The Production, Analysis and Standardisation of Romano-British Coin Reports*. English Heritage (Swindon)

Brown, A. and Perrin, K. 2000 *A Model for the Description of Archaeological Archives*. English Heritage Centre for Archaeology/ Institute of Field Archaeologists (Reading)

Brown, D.H. 2007 *Archaeological Archives: A guide to best practice in creation, compilation, transfer and curation.* IFA Archaeological Archives Forum (Reading)

Buikstra, J.E. and Ubelaker D.H. (eds) 1994 *Standards for Data Collection from Human Skeletal Remains*. (Fayetteville, Arkansas)

CIfA, 2014, *Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology*. Chartered Institute for Archaeologists (Reading)

CIfA, 2014, *Standard and Guidance for Archaeological Desk-based Assessment*. Chartered Institute for Archaeologists (Reading)

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APPENDIX C: AREA OF ARCHAEOLOGICAL MITIGATION

SILT LAGOON

TIME LAPSE CAMERA

Pipeline

NO ACCESS TO CONSTRUCTION TRAFFIC

Track

PONTOON. 2 x PUMPS

2 x 150Ø PIPES FROM PONTOON PUMPS DISCHARGING TO EXISTING SPILLWAY CHANNEL

5 x 300Ø PUMPS AND PIPES FROM LOWEST POINT OF RESERVOIR DISCHARGING TO EXISTING SPILLWAY CHANNEL

Waterfalls

DAMAGED CULVERT / SINKHOLE

LOWER NEUADD RESERVOIR

AREA OF SILT REMOVAL

ROAD CLOSED

Weir

GROUND REPROFILING (FILL)

NOTCH CUT INTO EXISTING DAM WALL

TUNNEL

LOW FLOW CHANNEL

HAUL ROAD

EXISTING PRoW TO BE REINSTATED ON ORIGINAL ALIGNMENT

NEW BRIDGE OVER CHANNEL

TEMPORARY CONCRETE CANVAS PROTECTION BETWEEN LEVELS 420m - 411m AOD

TEMPORARY PRoW DIVERSION

TEMPORARY RIPRAP PROTECTION BETWEEN LEVELS 415m - 411m AOD

ALTERNATIVE HAUL ROAD ROUTE

SECURITY FENCE

TEMPORARY FOOT BRIDGE

SCHEDULED NATIONAL MONUMENT

20m EXCLUSION ZONE FENCING

TEMPORARY PRoW DIVERSION

LEGEND

A. LISTED BUILDING

1. SEPTIC TANK
2. GENERATOR
3. TOILET BLOCK
4. REFUELLING AREA
5. CANTEEN
6. DRYING ROOM
7. OFFICE
8. MEETING ROOM
9. STORES
10. CAR PARK
11. MUSTER POINT
12. GATE HOUSE
13. LAYDOWN AREA
14. SKIPS & RECYCLING
15. RAMS BOARD & EMERGENCY POINT
16. SITE GATE
17. SITE COMPOUND BOUNDARY SECURITY FENCE

N

APPROXIMATELY 110.00m OF DRAINAGE SWALE TO TO COLLECT AND CHANNEL OVERLAND FLOW AROUND THE PROPOSED LANDSCAPE RESTORATION
REFER TO DRAWING NO.
2172_W_204-ARP-12-XX-DR-CX-00013 FOR DETAILS.

PROPOSED REINSTATEMENT OF THE RIVER VALLEY - ASSUMED FOOTPRINT. REFER TO DRAWING NO.
2172_W_204-ARP-12-XX-DR-CX-00013 & 00014 & FOR DETAILS.

LOWER NEAUDD RESERVOIR

NEW FILTER BUILDING TO BE RETAINED. NO WORKS TO THIS BUILDING.

PROPOSED NOTCH TO BE CUT INTO EXISTING DAM. REFER TO DRAWING NO.
2172_W_204-ARP-12-XX-DR-CX-00017 FOR DETAILS.

FOOTBRIDGE LOCATION. REFER TO DRAWING NO.
2172_W_204-ARP-12-XX-DR-CX-00015 FOR DETAILS.

EXISTING SPILLWAY AND OLD FILTER HOUSE TO BE RETAINED AS PART OF THE HERITAGE OF THE SITE. REFER TO DRAWING NO.
2172_W_204-ARP-12-XX-DR-SS-05000 FOR DETAILS OF REMEDIAL WORKS.

EXISTING FOOTPATH TO STAY ON ORIGINAL ALIGNMENT.
REFER TO DRAWING NO. 2172_W_204-ARP-12-XX-DR-CX-00015 FOR DETAILS.

LOW FLOW CHANNEL

A1

NOTES:

1. DO NOT SCALE FROM DRAWING.
2. ALL DIMENSIONS ARE IN METRES ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM.
3. CONTOURS IN THE RESERVOIR BASIN ARE BASED ON BATHYMETRIC SURVEY.

EXISTING UTILITIES KEY:

- EX HV — EXISTING HIGH VOLTAGE ELECTRICITY
- EX W — EXISTING WATER
- EXISTING WATER ABANDONED

CONSTRAINTS LEGEND:

- EXISTING WATER COURSE
- EXISTING FOOTPATH
- EXISTING FOOTPATH TO BE TEMPORARILY DIVERTED
- EXISTING SURFACE CONTOURS 5m
- EXISTING SURFACE CONTOURS 1m
- PROPOSED SURFACE CONTOURS 5m
- PROPOSED SURFACE CONTOURS 1m
- PROPOSED NEW FENCE
- PROPOSED NOTCH CUTTING
- PROPOSED LANDSCAPE RESTORATION
- DRAINAGE SWALE
- PROPOSED WATER SURFACE

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

CONSTRUCTION

1. WORKING NEAR WATER
2. SILT/DEEP MUD IN RESERVOIR BASIN
3. ASPESTOS FOUND IN BUILDINGS

MAINTENANCE / CLEANING / OPERATION

DECOMMISSIONING / DEMOLITION

REFER TO THE DESIGN RISK REGISTER FOR FURTHER DETAILS. IT IS ASSUMED THAT ALL THE WORKS ON THIS DRAWING WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WHO HAS CARRIED OUT A COMPREHENSIVE RISK ASSESSMENT.

0 5 10 15 20 25m
SCALE 1:500 @ A1; 1:1000 @ A3

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
C1	11.04.19	JH	ISSUED FOR CONSTRUCTION	VS	DN	11.04.19
P4	14.03.19	JH	ISSUED FOR INFORMATION	VS	DN	14.03.19
P3	28.02.19	JH	ISSUED FOR INFORMATION	VS	DN	28.02.19
P2	08.02.19	JH	ISSUED FOR INFORMATION	VS	DN	08.02.19
P1	05.02.19	JH	ISSUED FOR INFORMATION	VS	DN	05.02.19

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf
Ty Awen, Spooner Close, Coed Kernew, Newport, NP10 8FZ

Project Name.: LOWER NEUADD

Drawing Title.: PERMANENT WORKS GENERAL ARRANGEMENT PLAN

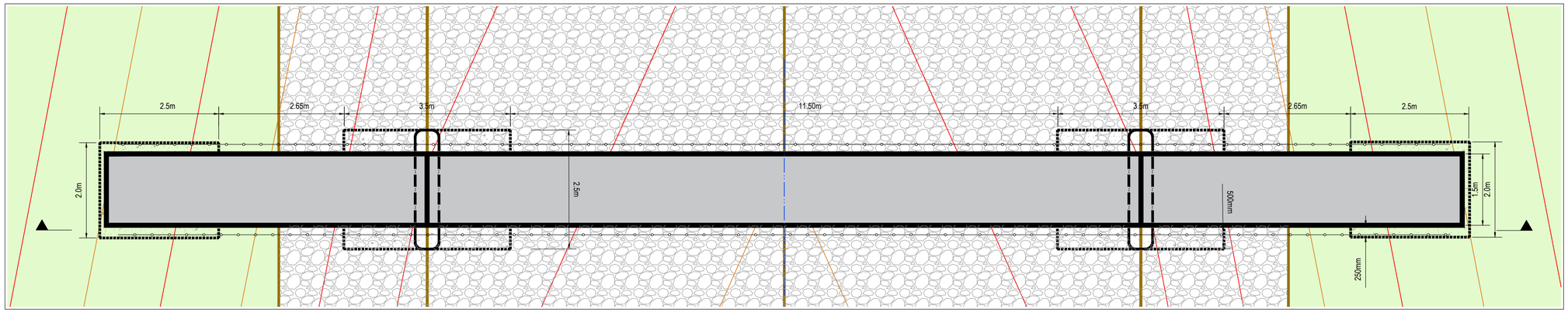
Suitability.: FOR CONSTRUCTION — Suitability Code.: A

Originator.	Designer.	Date.
JH	DN	MAR 19
Internal Project Number.	Scale.	Rev.
241432-00	1:500	C1

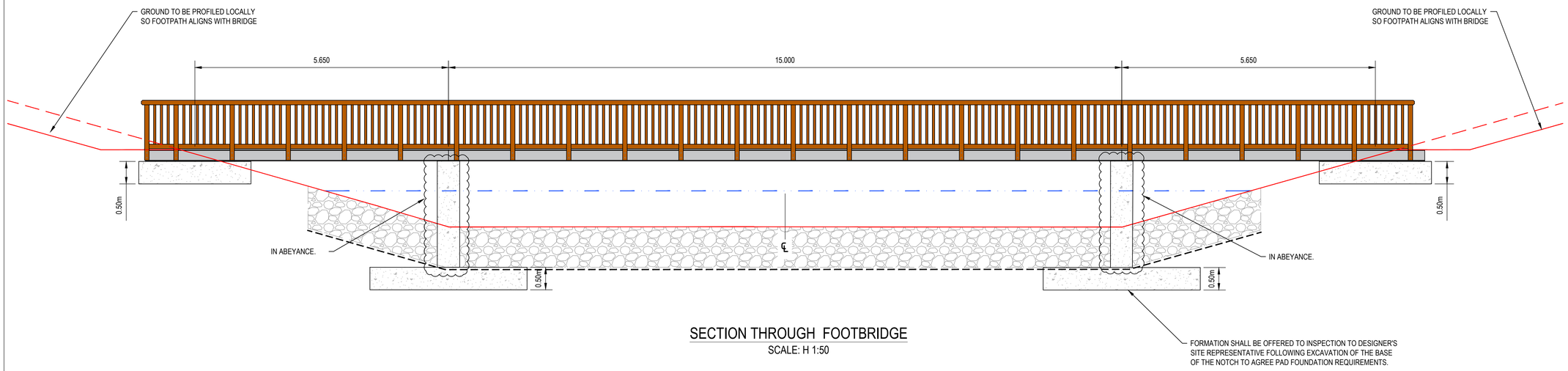
Drawing Number.: 2172_W_204-ARP-12-XX-DR-SS-00011

NOTES ABOUT STATUTORY UTILITY PROVIDERS RETURNS

1. THE POSITIONS OF THE EXISTING SERVICES ON THIS DRAWING HAVE BEEN INTERPRETED FROM INFORMATION RECEIVED FROM THE STATUTORY LOCAL AUTHORITIES.
2. THIS DRAWING IS DIAGRAMMATIC AND HAS BEEN PREPARED AS AN OVERVIEW . IT IS NOT DEFINITIVE AND THE SITE TEAM MUST REFER TO THE ORIGINAL RECORDS FOR FULL DETAILS AND TO CONFIRM THE LOCATIONS OF EXISTING SERVICES ON SITE PRIOR TO THE WORKS BEING UNDERTAKEN.
3. THE SITE TEAM SHOULD ANTICIPATE ADDITIONAL SERVICES CONNECTING TO THE PROPERTIES AND / OR STREET FURNITURE SUCH AS LAMPPOSTS THAT ARE NOT GENERALLY COVERED BY THE RETURNS FROM INDIVIDUAL STATUTORY AUTHORITIES
4. EXACT LOCATION OF UTILITIES SHOULD BE CONFIRMED ON SITE.



FOOTBRIDGE PLAN
SCALE: 1:50



SECTION THROUGH FOOTBRIDGE
SCALE: H 1:50

A1

NOTES:

1. DO NOT SCALE FROM DRAWING.
2. ALL DIMENSIONS ARE IN METRES ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM.
3. REFER TO GENERAL ARRANGEMENT DRAWING NO. 2172_W_204-ARP-12-XX-DR-SS-00011 FOR LOCATION OF CROSS SECTION.
4. CONCRETE FOR FOUNDATIONS AND SUPPORTS TO BE DESIGNATED CONCRETE RC40/50XF IN ACCORDANCE WITH BS8500, TBC PENDING RESULTS OF FURTHER GI.
5. FOOTBRIDGES TO BE DESIGNED BY THE SUPPLIER TO BE IN ACCORDANCE WITH THE FOOTBRIDGE SPECIFICATION 2172_W_204-ARP-12-XX-SP-SB-10010.

LEGEND:

EXISTING LIDAR/TOPO GROUND PROFILE LEVEL

PROPOSED NOTCH CUTTING GROUND PROFILE LEVEL

0 2.5 5 7.5 10 12.5 m
SCALE 1:250 @ A1; 1:500 @ A3

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
P1	30.05.19	JH	ISSUED FOR INFORMATION	GDP	DN	30.05.19

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf
Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name.: LOWER NEUADD

Drawing Title.: NEW FOOTBRIDGE
SUPPORTS AND FOUNDATION DETAILS
PLAN AND SECTION

Suitability.	Suitability Code.
FOR INFORMATION	A

Originator.	Designer.	Date.
JH	GDP	MAY 19

Internal Project Number.	Scale.	Rev.
241432-00	1:50	P1

Drawing Number.: 2172_W_204-ARP-12-XX-DR-SS-05001

APPENDIX D: PROJECT PROGRAMME

Activity ID	SKA - Responsibili	Activity Name	Start	Finish	Total Float	Od	Monthly Variance
LOWER NEUADD RES Discontinuance			14-Jun-19	24-Mar-20	190	192	-13
Stage 3 & 4 Combined Feasibility, Detailed Design, and Ealry construction start			14-Jun-19	10-Jul-19	363	19	-22
Early Construction Start			14-Jun-19	10-Jul-19	363	19	-22
WP0 - Enabling Works & Site Setup			14-Jun-19	10-Jul-19	363	19	-22
Diversion of existing footpaths			25-Jun-19	26-Jun-19	10	2	-32
A9980	Skanska	Temporary diversion of existing Footpath	25-Jun-19	26-Jun-19	10	2	-32
Compound Site up			17-Jun-19	04-Jul-19	4	14	-35
A11200	Skanska	Site strip with Archological attendance	17-Jun-19	17-Jun-19	0	1	
A10050	Skanska	Construction of temporary haul A - Access to compound	18-Jun-19	20-Jun-19	2	3	-25
A6330	Skanska	Reduce level excavation	21-Jun-19	25-Jun-19	2	3	-38
A11210	Skanska	Place, level, compaction and trim of stone to compound area	26-Jun-19	28-Jun-19	2	3	
A6340	Skanska	Delivery and setup of site offices and welfare	01-Jul-19	02-Jul-19	4	2	-40
A11230	Skanska	Temporay drainage and installation of septic tank	01-Jul-19	01-Jul-19	2	1	
A11220	Skanska	Construction of contractor car park	02-Jul-19	02-Jul-19	2	1	
A6360	Skanska	Compound fencing inc any hoarding's and signage	03-Jul-19	04-Jul-19	4	2	-42
A6350	Skanska	Temporary power and connections	03-Jul-19	04-Jul-19	4	2	-37
Lay Down Area			18-Jun-19	10-Jul-19	2	17	-44
A6380	Skanska	Site strip with Archological attendance	18-Jun-19	19-Jun-19	0	2	-29
A11240	Skanska	Place, level, compaction and trim of stone to laydown area	03-Jul-19	08-Jul-19	2	4	
A11250	Skanska	Compound fencing inc any hoarding's and signage	09-Jul-19	10-Jul-19	2	2	
Down stream works			14-Jun-19	21-Jun-19	376	6	-24
Haul rd & Laydown Area			20-Jun-19	20-Jun-19	0	1	-23
A10060	Skanska	Site strip with Archological attendance	20-Jun-19	20-Jun-19	0	1	-23
New channel works			14-Jun-19	21-Jun-19	376	6	
A11880	Skanska	Install downstream temporary slit management measures ** Link **	14-Jun-19	20-Jun-19	377	5	
A11260	Skanska	Site strip with Archological attendance	21-Jun-19	21-Jun-19	0	1	
Upstream Works			24-Jun-19	28-Jun-19	65	5	-31
Haul rd C and Laydown area (13)			24-Jun-19	28-Jun-19	65	5	-31
A11280	Skanska	Site strip with Archological attendance	24-Jun-19	25-Jun-19	0	2	
A10130	Skanska	2No. Temporary ducting crossing under haul rd C	26-Jun-19	26-Jun-19	31	1	-29
A11290	Skanska	Place, level, compaction and trim of stone to laydown area	26-Jun-19	27-Jun-19	0	2	
A11300	Skanska	Compound fencing inc any hoarding's and signage	28-Jun-19	28-Jun-19	65	1	
De -Silting of Existing Reservour			18-Jun-19	05-Jul-19	64	14	-19
A9990	Skanska	Construction of silt lagoons	18-Jun-19	25-Jun-19	2	6	-11
A11860	Skanska	Excavation, transportation and placement of slit within lagoons (cont. in Stage 5)	28-Jun-19	05-Jul-19	64	6	
A11870	Skanska	Construction of progressive Res access rd (cont. in Stage 5)	28-Jun-19	05-Jul-19	0	6	
Stage 5 - Delivery			08-Jul-19	24-Mar-20	0	176	-13
Construction			08-Jul-19	24-Mar-20	0	176	-13
WP0 - Enabling Works & Site Setup			08-Jul-19	13-Sep-19	62	49	-13
Down stream works			09-Jul-19	13-Aug-19	7	26	-23
Haul rd & Laydown Area			09-Jul-19	16-Jul-19	2	6	-32
A10010	Skanska	Place, level, compaction and trim of stone to Access Rd B	09-Jul-19	11-Jul-19	2	3	-33
A10020	Skanska	Temporary crossing to stream	12-Jul-19	12-Jul-19	2	1	-33
A10030	Skanska	Construction of laydown/turning area	15-Jul-19	16-Jul-19	2	2	-32
New channel works			17-Jul-19	30-Jul-19	2	10	-16
A10860	Skanska	Excavate and prep of channel formation from toe of Dam to existing	17-Jul-19	23-Jul-19	2	5	-11
A11270	Skanska	Place, level, compaction of 900mm stone layer	24-Jul-19	30-Jul-19	2	5	
Temporary Protection			31-Jul-19	13-Aug-19	7	10	-23
A10870	Skanska	Install erosion protection (Rip-Rap) to base and sides from toe of Dam to existing	31-Jul-19	13-Aug-19	7	10	-23
Upstream Works			17-Jul-19	22-Aug-19	0	29	-17
Water Management			17-Jul-19	23-Jul-19	15	5	-34
A10200	Skanska	5No. Temporary ducting crossing under Res accees rd	17-Jul-19	17-Jul-19	17	1	-42
A10110	Skanska	Over flow - Set up 2# Pontoon over pumping and discharge (Spillway)	22-Jul-19	22-Jul-19	15	1	-40
A10090	Skanska	Over flow - Set up 5# Pontoon over pumping and discharge (Spillway)	23-Jul-19	23-Jul-19	15	1	-34
Demolition of Existing			14-Aug-19	22-Aug-19	0	9	-17
A10150	Skanska	Remove existing tunnel pipework	14-Aug-19	19-Aug-19	0	5	-50
A10160	Skanska	Unplug (Coring) existing tunnel	20-Aug-19	22-Aug-19	0	5	-17
De -Silting of Existing Reservour			08-Jul-19	13-Sep-19	62	49	-13
A10070	Skanska	Excavation, transportation and placement of slit within lagoons (cont. from Stage 4)	08-Jul-19	13-Aug-19	64	27	-12
A11310	Skanska	Construction of progressive Res access rd (cont. from Stage 4)	08-Jul-19	19-Jul-19	0	10	
A10040	Skanska	Construction of progressive rock bund into Res.	22-Jul-19	13-Aug-19	0	17	-13
A10080	Skanska	Excavation, transportations and placement of slit within final lanscape area	16-Aug-19	13-Sep-19	62	20	-13
WP1 - Notch Works			31-Jul-19	01-Nov-19	0	67	-13
A10220	Skanska	Site strip area of deposition	31-Jul-19	06-Aug-19	2	5	-8
A10240	Skanska	Preparation (Benching) of area of deposition	07-Aug-19	15-Aug-19	2	7	-11
A10210	Skanska	Top soil strip and storage from area of Notch	16-Aug-19	19-Aug-19	2	2	-11
A10230	Skanska	Removal to store for reuse of existing stone pitching	20-Aug-19	20-Aug-19	2	1	-11
A10250	Skanska	Excavation and deposition of fill from reservior embankment	23-Aug-19	01-Nov-19	0	50	-13
WP2 - Channel erosion protection			23-Sep-19	10-Dec-19	7	57	-13
A10260	Skanska	Construction of FRC inlet weir	23-Sep-19	10-Oct-19	17	14	-24
A10270	Skanska	Excavate and prep of channel formation	04-Nov-19	07-Nov-19	1	4	-13
A10280	Skanska	Install erosion protection (Rip-Rap) to base and sides	08-Nov-19	03-Dec-19	7	18	-13
A10290	Skanska	Re-use of stone pitching as erosion protection (Optional)	14-Nov-19	10-Dec-19	7	18	-13
WP3 - Footbridge			15-Jul-19	09-Jan-20	0	118	-13
Peir Construction			04-Nov-19	06-Jan-20	0	36	-13
A10380	Skanska	Item *** Form stone access to works area inc. Crane/concrete pump pad	04-Nov-19	14-Nov-19	0	9	-13
A10300	Skanska	Item *** Excavate and install temporary works support to peir foundation	08-Nov-19	20-Nov-19	1	9	-13
A10310	Skanska	Item *** Construction pier foundations	15-Nov-19	27-Nov-19	0	9	-13
A10320	Skanska	Item *** Construct/form pier columns	28-Nov-19	10-Dec-19	0	9	-13
A10330	Skanska	Item *** Curring Lag	11-Dec-19	06-Jan-20	0	9	-13
Abutment Construction			21-Nov-19	20-Dec-19	1	22	-13
A10340	Skanska	Item 3.5.2 Excavate and prep formation level	21-Nov-19	26-Nov-19	1	4	-13

Start Date 08-Sep-17
Finish Date 05-Jan-21
Data Date 31-May-19
Run Date 03-Jun-19

Actual Work
Remaining Work
Critical Remaining Work
Milestone

PMOD9399

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Lower Neuadd Res - Construction

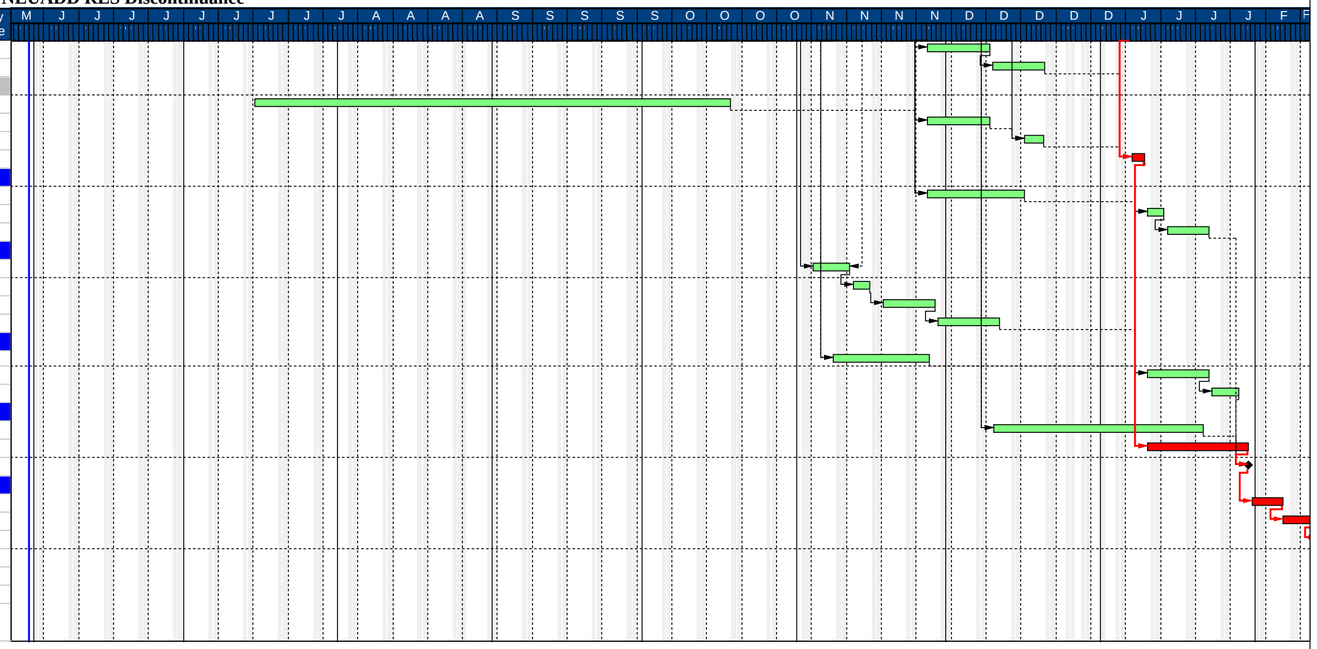
Date	Revision	Checked	Approved
02-Apr-19	Construction Summary	GDE	Jo.C

SKANSKA

LOWER NEUADD RES Discontinuance

Date: 03-Jun-19

Activity ID	SKA - Responsibili	Activity Name	Start	Finish	Total Float	Od	Monthly Variance
A10350	Skanska	Item 3.5.2 Construction of North and south abutments	27-Nov-19	09-Dec-19	1	9	-13
A10370	Skanska	Item 3.5.2 Curring Lag	10-Dec-19	20-Dec-19	1	9	-13
Install bridge structure			15-Jul-19	09-Jan-20	0	118	-13
A10390	Skanska	Item 3.5.1 Off site design and manufacture of bridge deck	15-Jul-19	18-Oct-19	33	69	0
A10400	Skanska	Item ***** Preparation of site access inc. laydown and turning area	27-Nov-19	09-Dec-19	6	9	-13
A10410	Skanska	Item 3.5.1 On site assemble of bridge compontets inc. temporary scaffold access	16-Dec-19	20-Dec-19	1	4	-13
A10420	Skanska	Item 3.5.1 Lifting into position and fixing of bridge structure	07-Jan-20	09-Jan-20	0	3	-13
WP4 - Fencing, Footpaths, and Access steps			27-Nov-19	22-Jan-20	6	31	-13
A10450	Skanska	Item 4.1.2 Acees steps to Notch profile	27-Nov-19	16-Dec-19	14	14	-13
A10470	Skanska	Item 4.3 Installation of new fence line to top of Notch profile	10-Jan-20	13-Jan-20	6	2	-13
A10460	Skanska	Item 4.1.1 Reinstatement of foot along Dam crest	14-Jan-20	22-Jan-20	6	7	-13
WP5 - Works to existing structures			04-Nov-19	11-Dec-19	11	28	-13
A10190	Skanska	Item 3.1.2 Infill/removal of existing tower tunnel (dependant on Notch profile)	04-Nov-19	11-Nov-19	11	6	-13
A10180	Skanska	Item 3.1.1 Demolition of existing tower to revised ground profile inc infill of remainder	12-Nov-19	15-Nov-19	11	4	-13
A10430	Skanska	Item 3.2 Repointing and sealant to existing spillway	18-Nov-19	28-Nov-19	11	9	-13
A10440	Skanska	Item 3.3 Repointing and install of masonary stone along existing watercourse	29-Nov-19	11-Dec-19	11	9	-13
WP6 - Landscaping			08-Nov-19	28-Jan-20	2	48	-13
A10480	Skanska	Item 4.2 Placement from storage of topsoil to area of deposition	08-Nov-19	27-Nov-19	23	14	-13
A10490	Skanska	Item 4.2 Placement from storage of topsoil to Notch profile	10-Jan-20	22-Jan-20	2	9	-13
A10500	Skanska	Item 4.2 Seeding to area of topsoil placement	23-Jan-20	28-Jan-20	2	4	-13
Demobilisation and Reinstatement			10-Dec-19	30-Jan-20	0	27	-13
A10510	Skanska	Item ***** Removal of overpumping and water management	10-Dec-19	21-Jan-20	7	20	-13
A7180	Skanska	Item ***** Demob and Reinstatementof works area including access roads and laydown area	10-Jan-20	30-Jan-20	0	15	-13
A7535	Skanska	Item ***** Demobilisation & Reinstatement - Complete		30-Jan-20	0	0	-13
Time Risk Allowance			31-Jan-20	24-Mar-20	0	38	-13
A10690	Skanska	Flood Event 1 - Pump failure/heavy rainfall cause flooding to works area between 02JUL - 09DEC	31-Jan-20	06-Feb-20	0	5	-13
A10700	Skanska	Flood Event 2 - Pump failure/heavy rainfall cause flooding to works area between 02JUL - 09DEC	06-Feb-20	13-Feb-20	0	5	-13
A10710	Skanska	Flood Event 3 - Pump failure/heavy rainfall cause flooding to works area between 02JUL - 09DEC	13-Feb-20	20-Feb-20	0	5	-13
A10730	Skanska	Ground Conditions - Contamination levels above that exspected causing change to working method	20-Feb-20	26-Feb-20	0	5	-13
A10740	Skanska	Quantities - Depth of slit above that of bathometric survey (10%)	26-Feb-20	03-Mar-20	0	4	-13
A10890	Skanska	Enviornment - Additional works required following receipt of consents	03-Mar-20	11-Mar-20	0	6	-13
A10720	Skanska	Weather - Excessive rainfall cause stoppage or reduced efficenticies durring exc. & placement of fill material (10%)	11-Mar-20	24-Mar-20	0	9	-13



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APPENDIX E: BUILDING RECORDING SPECIFICATION

Drawn record

Required:
Measured plans (to scale or fully dimensioned) as existing. These may extend to all floors, or they may be restricted to one or a selection. The latter option may be appropriate, for example, in a town-centre building where an upper floor has been little altered. Buildings with a repetitive structure may also be planned on one floor, but a note or a sketch plan should be made to indicate the arrangement of other floors. Plans should show the form and location of any structural features of historic significance, such as blocked doorways, windows and fireplaces, masonry joints, ceiling beams and other changes in floor and ceiling levels, and any evidence for fixtures of significance.

Sometimes required:

- Measured drawings recording the form or location of other significant structural detail (for example timber or metal framing).
- Measured cross-sections or long-sections to illustrate the vertical relationships within a building (for example floor and ceiling heights, the form of roof trusses).
- Measured drawings to show the form of any architectural decoration (for example the moulding profiles of door surrounds, beams, mullions and cornices) or smallscale functional detail not easily captured by photography. A measured detail drawing is particularly valuable when the feature in question is an aid to dating.
- Measured elevations, where these are necessary to an understanding of the building's design, development or function.
- A site plan relating the building to other structures and to any related topographical and landscape features.
- A plan or plans identifying the location and direction of accompanying photographs.
- Copies of earlier drawings throwing light on the building's history.
- Three-dimensional projections when these are of value in understanding the building. If these are to be considered components of the record they must always be accompanied by measured plans, sections and elevational details.
- Reconstruction drawings and phased drawings, when these are of value. In phased drawings successive phases of a building's development may be shown by graded tone (dark to light, with the darker being the earlier) or by colour, by sequential diagrams or by annotation. Whenever phased drawings are included in a record, they must be accompanied by the unmarked drawings on which they are based.
- Diagrams interpreting the movement of materials (process flow) or people (circulation), or the segregation of people or activities (for example permeability diagrams), where these are warranted by the complexity of the subject. The evidence supporting the interpretations must be provided.

Photographic record

- A general view or views of the building (in its wider setting or landscape if below is also to be adopted).
- The building's external appearance. Typically a series of oblique views will show all external elevations of the building, and give an overall impression of its size and shape. Where individual elevations include complex historical information it may also be appropriate to take views at right-angles to the plane of the elevation.
- Further views may be desirable to reflect the original design intentions of the builder or architect, where these are known from documentary sources or can be inferred from the building or its setting.
- The overall appearance of the principal rooms and circulation areas.
- Any external or internal detail, structural or decorative, which is relevant to the building's design, development and use, with scale where appropriate.
- Any machinery or other plant, or evidence for its former existence.
- Any dates or other inscriptions; any signage, makers' plates or graffiti which contribute to an understanding of the building. A transcription should be made wherever characters are difficult to interpret.
- Any building contents which have a significant bearing on the building's history (for example, a cheese press, a malt shovel).
- Copies of maps, drawings, views and photographs, present in the building and illustrating its development or that of its site. The owner's written consent may be required where copies are to be deposited in an archive.

Written record

Required:

- The precise location of the building as an address and in the form of a National Grid reference.

- A note of any statutory designation (that is, listing, scheduling, Register of Historic Parks and Gardens, conservation area). Information on statutory designations can be found on the Historic England website. Non-statutory designations (local lists) may be added.
- The date when the record was made, the name(s) of the recorder(s) and the location of any archive material.
- A longer summary statement. This account should summarise the building's form, function, date and sequence of development. The names of architects, builders, patrons and owners should be given if known. Its purpose is to describe the building when no fuller record is necessary. Alternatively it may serve as an introduction to the more detailed body of a record that may follow, for users who may need a summary of the report's findings.
- An introduction briefly setting out the circumstances in which the record was made, its objectives, methods, scope and limitations, and any constraints. Where appropriate the brief for the work or the project design should be stated or appended.
- Acknowledgements to all those who have made a significant contribution to the making of the record, or who have given permission for copyright items to be reproduced.
- A discussion of the published sources relating to the building and its setting, an account of its history as given in published sources, an analysis of historic map evidence (map regression) and a critical evaluation of previous records of the building, where they exist.
- An account of the building's overall form (structure, materials, layout) and of its successive phases of development, together with the evidence supporting this analysis.
- An account of the building's past and present use, and of the uses of its parts, with the evidence for these interpretations. An analysis of a circulation pattern or of a decorative or liturgical scheme. An account of any fixtures, fittings, plant or machinery associated with the building, and their purpose. In an industrial building, a sequential account of the way in which materials or processes were handled.
- Any evidence for the former existence of demolished structures or removed plant associated with the building.
- Full bibliographic and other references, or a list of the sources consulted (in long reports it is preferable to include both). Websites which may prove to be ephemeral should be avoided as references wherever possible; where their use is unavoidable the full web address and the date on which the site was consulted should be noted.

Sometimes required:

- A contents list; a list of illustrations or figures.
- A summary of the findings of any specialist reports (for example dendrochronology or paint analysis).
- A discussion of the building's past and present relationship to its setting: its relationship to local settlement patterns or other man-made features in the landscape; its part in a larger architectural or functional group of buildings; its visual importance as a landmark, etc. For more guidance on investigating and recording landscapes see Understanding the Archaeology of Landscapes (English Heritage 2007; revised edition forthcoming).
- An assessment of the potential for further investigative or documentary work, and of the potential survival of below-ground evidence for the history of the building and its site.
- Copies of historic maps, drawings, views or photographs illustrating the development of the building or its site (the permission of owners or copyright holders may be required).
- Copies of other records of the building, including specialist reports (again with any necessary permissions), or a note of their existence and location.
- Any further information from documentary sources, published or unpublished, bearing on any of these matters, or bearing on the circumstances of its building, designer, craftsmen, ownership, use and occupancy, with a note on the sources of the information.
- An outline of the significance of the building. This can seek to identify both the significance of different features or phases of development in the building relative to each other, and also set important aspects of the building in a regional or national context.
- A glossary of architectural or other terms likely to be unfamiliar to readers. If few in number, terms may be explained more economically within the text or in footnotes.

APPENDIX F: DRONE SURVEY METHODOLOGY

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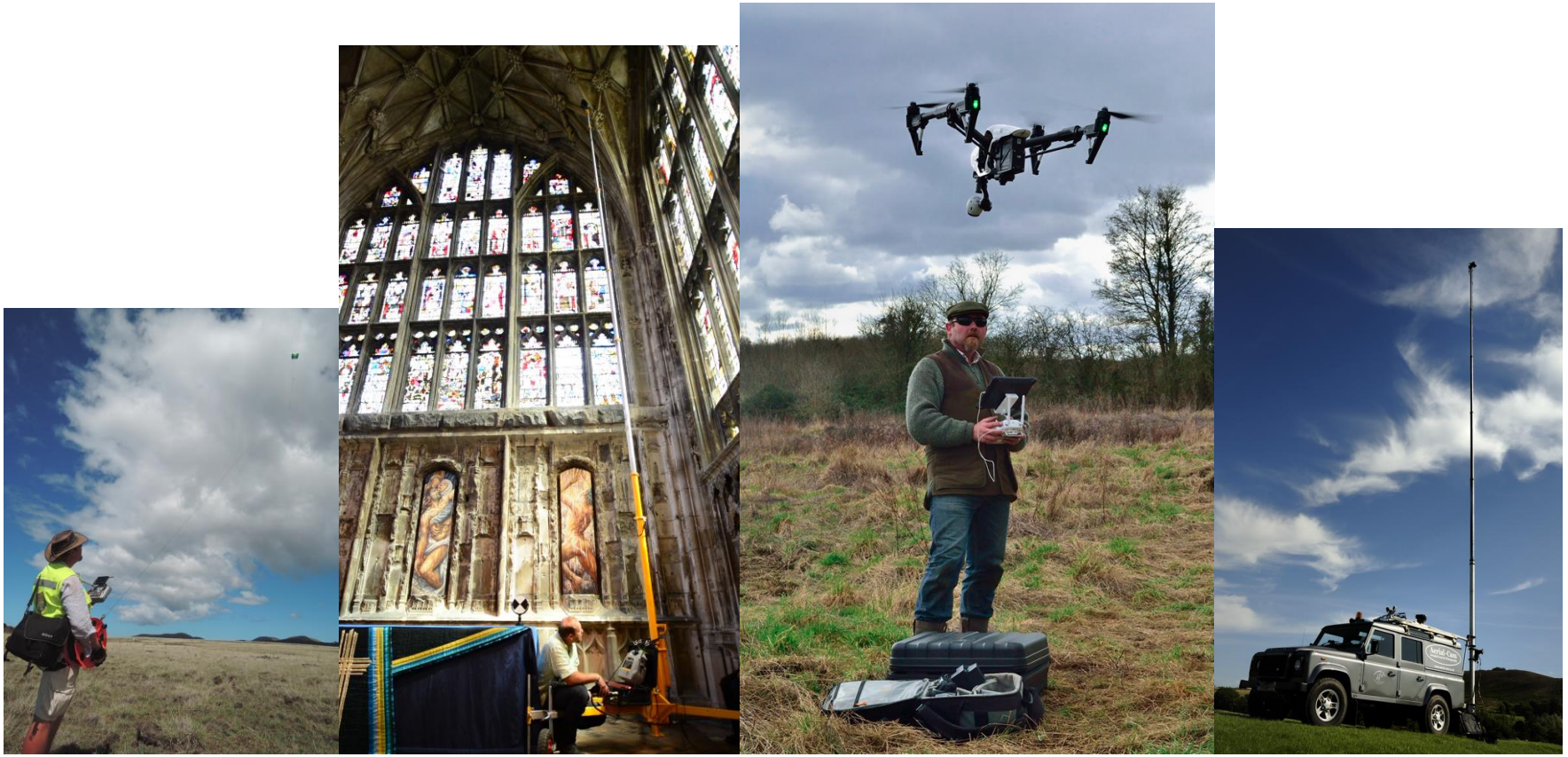
Aerial-Cam Method Statement and Risk Assessment:

Photographic Surveys – Low Level Aerial Methods

November 2017

www.aerial-cam.co.uk



Method Statement and Risk Assessment: Photographic Surveys

Photographic Surveys – Low Level Aerial and Photogrammetry

C O N T E N T S

Page

1. SUMMARY

This method statement was prepared by Adam Stanford of Aerial-Cam Ltd. The document sets out to describe the methods and equipment utilised for photographic survey during field work to record archaeological evidence, historic buildings and landscapes. Safety considerations are detailed in separate Risk Assessment documents, this method statement covers all equipment including Remotely Piloted Aircraft, for which additional regulatory and safety considerations are detailed in the Aerial-Cam Ltd Operations Manual.

2. INTRODUCTION

Aerial-Cam Ltd began providing photographic recording/survey solutions in 2006, the main tool for low level aerial work was the 20m telescopic mast mounted on a Land Rover with remotely operated D/SLR cameras. As requirements, have varied over the years additional equipment has been developed by Aerial-Cam's director and sole operator Adam Stanford. Including, hand held and dolly wheel mounted mast systems for building interiors or where vehicular access is not possible. In addition, research projects, overseas have led to the use of kites (KAP) and multi-rotor and fixed wing remotely piloted aircraft (RPAs) with radio control and fully stabilised GPS flight control systems. The outputs from the use of Aerial-Cam equipment are photographic survey (creating an archive of evidence photographs), photogrammetric surveying, (creating 3D models of evidence in the ground or building elevations, using the structure from motion (SfM) technique and software). As SfM relies on the movement of a camera from one position to the next over a subject so that accurate 3D representation can be created, the positioning and remote operation of cameras has become more important than ever..... This method statement details the equipment and methods that will be made available to Projects in 2016.

3. PHOTOGRAMMETRY - 3D MODELLING - STRUCTURE FROM MOTION

3.1.1 Software:

Agisoft Metashape (formerly Photoscan) software with a Professional edition licence. For advanced image-based 3D modelling solution aimed at creating professional quality 3D content from still images.

3.1.2 Process:

Digital photographs are captured of a subject (finds object, trench, building, landscape) with multiple photographs that have considerable overlap from one photograph to the next, or of the whole subject in each photograph, all from different positions. The photographic survey should be as complete as possible to ensure full coverage of each part of the subject in multiple images. All images are captured in RAW format (NEF or DNG) and batch processed into JPG (and TIF if required) and placed into a suitable folder on the PC workstation. The images are then selected in the photogrammetry software and aligned as it searches for common points in photographs and matches the feature points of the subject to create a point cloud. The camera positions are calculated automatically and a dense reconstruction or geometric model of the subject is built to create a Digital Surface Model. The resulting model can then be manipulated for viewing from any angle. The DSM can be overlaid or draped with the original photographs for true colour representation, but the removal of this texture and colour can allow for features to be viewed more clearly when using a variety of artificial light and shading techniques to highlight certain features (other software packages may be required depending on the type of analysis undertaken).

3.1.3 Photogrammetry Output:

a) 3D Models

Textured 3D models can be viewed and manipulated without the need for specialist software via online 3D viewing facilities. Individual models can be kept private and made available only to select audience or made publicly available as required. The viewer has the capacity to view, manipulate and change viewing options in a dynamic and easy to use interface. Additional information and links to more detailed models can be annotated directly on models. Should the internet not be available or for off-line storage purposes 3D models can be exported into stand-alone file formats such as 3DPDF.

b) Orthophotographs

Photogrammetry provides extremely accurate and proportionally correct representations of structures and scenes which can be positioned or ortho-rectified to be exported as rectified images in standard formats such as JPG and TIF. These Orthophotos can provide the basis for the production of traditional 2D drawings such as site plans and sections of archaeological excavations or elevations and stone by stone detail for historic buildings.

c) DEM/DTM

A digital elevation model (DEM) can be generated and represents a surface model as a regular grid of height values. DEM provide point, distance, area, volume measurements as well as generate cross-sections for a part of the scene selected by the user. Additionally, contour lines can be calculated for the model and depicted either over DEM or Orthomosaic in Ortho view within Photo Scan environment. A variety of file formats enable DEMs to be exported for additional processing in GIS.

3.1.4 Aerial Photogrammetry for site or earthwork survey

Aerial Photogrammetry for site or earthwork survey to produce 3D models of the landscape and Digital Elevation Models (DEM) for onward processing to provide a variety of visualisations so that an attempt at interpretation can be made.
Method: Aerial photographs are captured with a UAV/Drone, grid flight plans are flown over the survey area to capture vertical images from altitudes of between 50m and 120m, covering large areas in relatively short time-frames. The resulting data images are processed to produce point cloud, mesh and textured 3D models and DEMs as Geotif files. The DEMs are geo-referenced to the National Grid via GPS positioned ground control points or by aircraft derived GPS coordinates.

Results: The DEM Geotifs can be analysed using GIS to produce similar results to Lidar, with typical resolution of between 2 - 5cm/pix. Any specific file formats that may be required should be stated, as the point cloud and DEM data can be exported in diverse ways. 3D models will be uploaded to a private online viewing facility.

4. PHOTOGRAPHY

Depending on features or structures to be recorded via photographic survey the following equipment will be available:

4.1.1 Cameras:

Nikon D5300 – 24 mega pixels
DJI X4s (3 axis gimbal mounted aircraft system) – 20 mega pixels stills. 4K video

4.1.2 Camera Positioning/control:

Tripod
GPS
WiFi Remote viewing/shutter control unit
Telescopic Pole 5m
Telescopic Mast 8m
Telescopic Mast 15m
Multirotor Remotely Piloted Aircraft (UAV/Drone), GPS stabilised, radio controlled.

4.2 POLE PHOTOGRAPHY

Two sizes of hand held extendable telescopic mast for camera position above human height up to a maximum of 9m. This enables low level aerial photography to be achieved for oblique landscape/structure views and vertical or near vertical views of discrete features. The camera is controlled with a WiFi connection between the camera and a smart device for remote viewing and shutter release. This equipment has proven particularly effective during walk through landscape surveys and for SFM of structures both upstanding or at ground level.

4.3 DOLLY WHEEL MAST PHOTOGRAPHY

This device consists of an extendable 15m pneumatic hollow aluminium mast operated by hand pump or compressor. This equipment is mounted on a heavy-duty tri-frame with adjustable legs and dolly wheels. It is light enough to be manoeuvred by one person and is designed to ensure no damage occurs to structures and surfaces in the work area. On top of the mast a professional standard high resolution DSLR camera with separate viewfinder video feed, is positioned via pan/tilt and zoom mechanisms. This equipment is best utilised inside large buildings such as churches, where vehicular access is not possible, but photographing the interiors at height without the need for scaffolding and other equipment which may obscure the subject features. Once set up inside a building the Mast-Cam can be repositioned with relative ease for a variety of viewpoints. The equipment to control, position, capture and review is the same as used by the vehicle mounted system. Viewfinder screen display, joystick controlled camera position, mechanical zoom, tethered laptop manual control of all camera settings and large screen image review at ground level. All images are taken with a high resolution DSLR.

4.4 REMOTELY PILOTED ARICRAFT – (DJI Inspire 2 (X4s) and Mavic 2 Pro)

Multiple rotors (DJI Inspire 2 aircraft are Quadcopters with 4 rotors) power small aircraft to a maximum altitude of 120m (UK CAA limit above ground level)) within an approximate radius of 500m around a fixed GPS point (the area of takeoff and landing). In flight movement and control is stabilised by GPS and environmental/positional sensors. These lightweight unmanned aircraft are used to record archaeological evidence using cameras mounted on stabilising and

positional gimbals underneath the aircraft. These aircraft are increasingly being used by archaeologists around the world for aerial photography, video surveys and 3D modelling (SfM). This equipment can only be used when conditions are stable and wind speeds are low to medium (up to 20kmph depending on aircraft used).

Examples of 3D models I have done can be seen here:

https://sketchfab.com/aerial-cam

Aerial-Cam Ltd, surveys, some more information about what we do.

Landscape and feature mapping (includes earthworks, parchmarks/cropmarks etc), aerial photogrammetry to produce Orthophotographic and DEM/DSM files, resolution between 1 - 3cm, up to 100ha.

Methods etc:

Aerial Photogrammetry for landscape, feature (parch/cropmarks) and/or earthwork survey to produce 3D models of the landscape and Digital Elevation Models (DEM) for onward processing in order to provide a variety of visualisations so that micro-topographic interpretation can be made and as accurate high resolution mapping and Orthophotograhs.

Method: Aerial photographs are taken with a UAV/Drone, grid flight plans are flown over the survey area to capture vertical images from altitudes of between 50m and 120m, covering large areas in relatively short time-frames. The resulting data images are processed to produce point cloud, mesh and textured 3D models and DEMs as Geotif files. The DEMs are geo-referenced to the National Grid via GPS positioned ground control points.

Results: The DEM (DSM) Geotifs can be analysed using GIS to produce similar results to Lidar, with typical resolution of between 1 - 3cm/pix. Any specific file formats that may be required should be stated, as the point cloud and DEM data can be exported in different ways. 3D models will be uploaded to a private online viewing facility.

Geo-referencing is included via ground control points and survey grade GPS.

Travel and any other expenses are included, throughout the UK.

Deliverables:

1. Photographic archive (data and general photographs) and video if specified

2. Orthophotograph

3. DEM (DSM)

4. Geotifs and other file formats for pointcloud data as required.

5. 3D models, as required.

6. Photogrammetry processing report.

7. Option to commission full interpretive report.

Here is a brief outline of the services we currently offer:

Photographic Survey - Aerial Photography - Photogrammetry

1. Earthwork Survey - LiDAR equivalent output increasing resolution to between 1 - 3cm (LiDAR is typically 1m to 2m, or 25cm at best if available).

2. Stripped Area Survey - Record detail of features in photo textured mapping of large areas, rapidly, resolution 1 - 3cm .

3. Excavation 3D Recording - Recording excavated evidence within trenches, rapid sections and planning.

4. Historic Building Recording - Photogrammetric survey of historic structures, producing 3D models, elevation orthophotographs (rectified photography) and 2D stone by stone detailed line drawings.

5. Roof Inspection - Photographic, photogrammetric and/or video inspections of roofs and inaccessible areas of structures, eliminating the costs of scaffolding or risk to personnel working at height.

6. Landscape and feature mapping, aerial photogrammetry to produce Orthophotographic and DEM files, resolution between 1 - 3cm, depending of survey area, up to 100ha.

5. DISCUSSION

5.1.1 Advantages of Photogrammetry

Photogrammetry extends many benefits when recording heritage assets, which include the ability to use existing equipment such as digital cameras of all types and computers. The only essential addition is the photogrammetry software. This can be open source and available for free or at minimal cost, up to professional industry standard packages which cost in the thousands of pounds. Compared to the nearest similar method, laser scanning, the advantages are cost of equipment, the skills required to capture the data and process it are quickly learned and the end result provides a much more accessible and versatile output. As software improves photographic surveys can be reprocessed for better results or indeed where image sets are suitable can be retrospectively used for photogrammetry even when this was not the intention at the time of capture.

5.1.2 Accuracy

Comparison with other techniques such as terrestrial laser scanning and LiDAR have shown that photogrammetry can be sufficiently accurate, or in the case of LiDAR, better at capturing the detail required for Heritage recording. Although the multi-million point gathering systems will always win on numbers, the fact that traditional recording techniques within archaeology rely on drawing and measuring by hand, means that photogrammetry is relatively as accurate as any electronic method.

5.1.3 Versatility

The simplicity of equipment and technique lends itself to any form of evidence from small finds, sections, trench plans, building details to entire castles and landscapes, all with the same versatile data set. The outputs can be used for the production of traditional drawings, hybrid graphics, cross sections, accurate measurement, analysis and management of all kinds of heritage asset or evidence. The dynamic and easy to use 3D models are also extremely adaptable to different situations from recording and the discovery of petroglyphs and graffiti to earthworks and buried settlements.

5.1.4 Non-Contact Recording

Where the evidence is delicate or hard to reach the SfM process is beneficial in that it is a non-contact method, in many situations a remote sensing technique. There is no need for additional equipment such as scaffolding inside or outside buildings.

5.1.5 Accessible Data Set

The data set of images created for the photogrammetry provide a very detailed photographic record in their own right. These than can later be extracted from the archive for different kinds of analysis and re-processing with better and newer techniques as software is developed. The present day outputs from SfM work

are also in accessible formats such as PDF and standard image formats, as well as the increasing use of online viewing and manipulation facilities that only require a compatible browser and reasonable internet connection.

5.1.6 Scalable Technology

From the use of a mobile phone camera to fully professional DSLR the data can be gathered with a range of equipment. From hand held or tripod mounted to telescopic masts and remotely piloted aircraft, cameras generally can be positions with ease compared to other more expensive recording devices that require static stations and reference points positioned within the subject area.

5.1.7 Potential for community or team involvement

Given the ease at which a group of people can be shown how the technique works and that many images are needed for processing the photogrammetry of a subject, the potential for community or wider team involvement is great. Indeed larger structure projects would benefit considerably from having individuals team up to capture the data images, helping with positioning, stabilising and operating cameras, working their way around a planned route to capture all the detail. Then to help process the photogrammetry and see the results of their endeavours transform into 3D models.

5.1.8 Outreach

With the ability to upload results to online viewing facilities, with publicly available settings, the information about a find or structure etc. could be disseminated to a very wide audience, potentially within hours of the data images being taken. Coupled with multi-media/social-media involvement, publicity and the sharing of accurate, dynamic and interactive information has huge potential.

6. STAFFING

Operation of all equipment, photography and processing will be carried out by Adam Stanford (Aerial-Cam Ltd) Director, Archaeological Photographer).
Remote Pilot Qualification + CAA PfCO (formerly: PFAW)
Fellow of the Society of Antiquaries
Member - Chartered Institute for Archaeologists.
Life Member - Council for British Archaeology.
Hon. Research Fellow - School of Archaeology, Cardiff University.
Member - ARPAS-UK and Drone Safe Register.

7. RESULTING MATERIAL USE

All, photography, video and 3D model imagery will be made available to clients in unedited format at the end of the field work, subject to storage capacity being made available. Copyright of all materials remains solely with Aerial-Cam Ltd (unless agreed prior to award of contract). A non-commercial, non-exclusive unlimited use licence is granted on payment of invoice. Aerial-Cam (AS Ltd) will retain full copyright of all photographic images, any commissioned reports, tender documents or other project documents under the Copyright, Designs and Patents Act 1988 with all rights reserved; excepting that on receipt of full payment for commissioned work, it will provide a non exclusive licence to the Client and agents, to use and reproduce the information contained therein in all matters directly relating to the specific Project.

8. RISK ASSESSMENT (GENERIC)

Risk Management

Severity of Potential Injury / Likelihood of Fatality						
1 to 5 = Low Risk 6 to10 = Moderate Risk 12 to 15 High Risk 16 to 25 = Unacceptable		Insignificant 1	Minor injury 2	Injury 3	Major injury Life threatening 4	Fatality 5
Probability of Hazard	Almost Certain 5	*5*	*10*	*15*	*20*	*25*
	High Probability 4	*4*	*8*	*12*	*16*	*20*
	Medium Probability 3	*3*	*6*	*9*	*12*	*15*
	Low Probability 2	*2*	*4*	*6*	*8*	*10*
	Extremely Unlikely 1	*1*	*2*	*3*	*4*	*5*

- Acceptable risk factors for operations are GREEN and YELLOW – Flights can proceed.
- Unacceptable risk factors for operations are AMBER and RED – No Flights.

8.1 Communications

Key contacts telephone numbers for each flight operation will be recorded on the Pre-deployment survey Form, such as:

- Pilot
- Observer
- Client
- Local Police Station
- Local Hospital
- Local Air Traffic Control
- Any other local aircraft operators.
- Land owner

8.2 Pre-Notification

Where a task location lies within controlled airspace (other than Class G unless within an ATZ), then the Remote Pilot will, where appropriate, contact the relevant Air Traffic Control. This should be done at least twenty four hours before the flight to advise the controller of the planned flight operation and so that Aerial-Cam Ltd can be advised of any other information or restrictions.

Should any other authority or entity be identified during the Pre-deployment survey as possibly being affected by planned flight operations, then these too will be contacted if considered necessary.

8.3 Site Permissions

Land owner and any other permission needed for flight operations, should be obtained during the Pre-deployment survey, this may be carried out by the client. However evidence of permission from all relevant parties should be recorded prior to flight operations either electronically (via email) or hard copy signed documents.

8.4 Weather Forecasts

As weather forecasts evolve and change constantly, pre-deployment assessment of the weather conditions for planned flight operations will be a daily task a week or more leading up to scheduled flight dates. Clients will be informed of the outlook and likelihood of good weather or the need for rearrangement, restrictions or cancellation.

Comparative assessment of weather forecasts will be carried out with websites and other media broadcasts, such as the Met Office, BBC Weather etc.

TASK: Low Level Aerial Photography (Telescopic Mast)

A **HAZARD** is the potential to cause harm
A **RISK** is the likelihood of an event happening

HAZARD	A **SEVERITY OF HAZARD** 0 = No Hazard 5 = Could result in death	B **RISK LEVEL** 0 = Not likely 5 = Very likely	A x B **HAZARD RISK ANALYSIS**	• **PLANNED MITIGATING MEASURES**	C **REVISED SEVERITY OF HAZARD**	D **REVISED RISK LEVEL**	C x D **REVISED RISK HAZARD** • **ANALYSIS**
Accident while driving and manoeuvring the Aerial-Cam Land Rover on site	5	2	10	• It is the responsibility of the driver to ensure that regular checks are made for clearance of vehicle from stationary objects and people are carried out while driving. • Driver should be guided when manoeuvring within confined spaces and near pits, trenches etc. on site. • Driver to keep speed of vehicle below 5mph when on site.	5	1	5
Objects/debris falling onto personnel	2	2	4	• Safety checks should be made prior to erection of mast and other equipment, to ensure no part of the equipment can become loose while being operated. • Objects likely to fall are to be removed or secured prior to commencement.	2	1	1
Electrocution from over head power cables.	5	3	15	• Personnel to ensure positioning of vehicle and equipment at a minimum distance of 100m from over head power cables.	5	1	5
Electrocution from lightening strikes	5	3	15	• Personnel to ensure that mast equipment is not erected if a storm is imminent or if the forecast of lightening has been predicted.	5	1	5
				PTO			
Mast becomes unstable in windy conditions.	3	2	6	• In light winds upto 25mph guy ropes are to secure the mast in position.	4	1	4

				• In winds higher than 25mph personnel to ensure that mast equipment is not erected			
Visitor injured by equipment on the ground by the vehicle. E.g. Guy ropes, camera cables, mast equipment.	3	2	6	• Personnel to ensure working area is kept clear and all visitors told of any hazards around the vehicle. Cordoning off with traffic cones and/or hi-viz tape if required.	2	1	2
Falling from ladders	5	2	10	• All ladders to be erected carefully, on level ground and according to the instructions of the manufacturer. Only step ladder up to 3 steps to be used.	5	1	5
Exhaust gases entering and accumulating in confined space	5	1	5	• No engine to be left running in the vicinity of any confined spaces. • Site personnel to check for the presence of fumes in confined spaces and ensure that air quality is acceptable before entering that confined space.	5	1	5
Traffic accident when working adjacent to or on live traffic lanes.	5	3	15	• Personnel to wear reflective jackets and be aware of moving within close proximity to live traffic lanes. • Traffic cones, warning triangles and hi-viz tape to be used.	5	1	5
In addition Aerial-Cam personnel will abide by the specific health and safety provisions of the client and its contractors for each site.							

Pre-deployment survey - Basic Information	
Client Name/Company:	
Address:	
Contact Details:	
Task Location:	
Task Details:	
Task Date:	
Weather forecast:	
Remote Pilot:	
Site and Airspace Information	
Altitude above Mean Sea Level:	*In feet*
Vehicle access?	
Airspace Classification:	*General and MATZ, Danger, Restricted, Prohibited, etc.*
Any Client PPE specifications:	
Other potential airspace issues:	*Arms ranges, radio masts, bird sanctuaries, etc.*
Local ATC details:	*If present*

Other airspace users:	*Gliders, clubs, kites, model aircraft, heli-pads*
Permissions needed:	*Local authority, land owner etc.*
Public access	*Is planned area open to public and are people likely to be present?*
Terrain covered:	*Countryside or urban, trees, lakes, industrial, hospitals, housing, etc.*
Special risk:	*Congested, groups of people, over any roads, over any sensitive area, etc.*

Notifications			
Establishment	Date Notified	Contact name	Comments
Local ATC			
Other airspace users			
Military control			
NOTAM			
Other			

On-Site Survey - Flight Risk Assessment - Basic Information	
Weather Conditions	*Cloud cover, rain or other adverse conditions likely?*
Wind speed	*15 m/s generally, if open countryside, flight safety check between 15-20m/s.*
Temperature	*Min of +3C*
Proximity of buildings	*Owners / controllers aware of work as needed. Occupants made aware.*
Other people or animals present. Access points.	*Footpaths, building occupants, etc. If people not involved in the work may be present place signs, cones and sentry.*
Obstructions	*Any obstructions in planned flight area (masts, wires, trees, high buildings, etc.). Ensure continual line of sight.*
Take off and landing area	*Clear of FOD. Cordon off if any incursion is likely.*
Emergency landing	*Alternative landing site identified.*
Communications check	*(mobiles, radios) as required.*
Flight Assistant	*Is the job safe with one person (if no assistant present).*
Mission planning Flight Plan	*Cross check plan, identify the flight path required to complete the operation.*
Also complete the FLIGHT RISK ASSESSMENT (separate form)	

Aerial-Cam Detailed Aerial Photography	Aerial-Cam Ltd RPAS FLIGHT OPERATIONS - RISK ASSESSMENT	Job

TASK: Low Level Aerial Photography

A **HAZARD** is the potential to cause harm
A **RISK** is the likelihood of a particular event happening

	A	B	A x B		C	D	C x D
HAZARD	**SEVERITY OF HAZARD**	**RISK LEVEL**	**HAZARD RISK ANALYSIS**	**PLANNED MITIGATING MEASURES**	**REVISED SEVERITY OF HAZARD**	**REVISED RISK LEVEL**	**REVISED RISK HAZARD ANALYSIS**
In addition Aerial-Cam personnel will abide by the specific health and safety provisions of the client and its contractors for each site.							

Prepared by: Date **Read & acknowledged by:**

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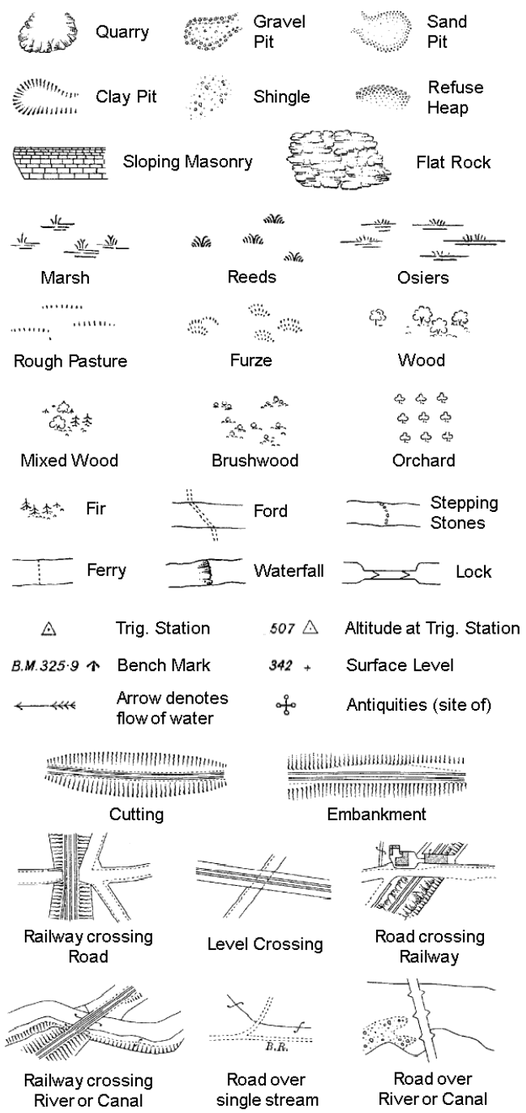
APPENDIX 2: HISTORIC ORDNANCE SURVEY MAPPING

Historical Mapping Legends

Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



County Boundary (Geographical)

County & Civil Parish Boundary

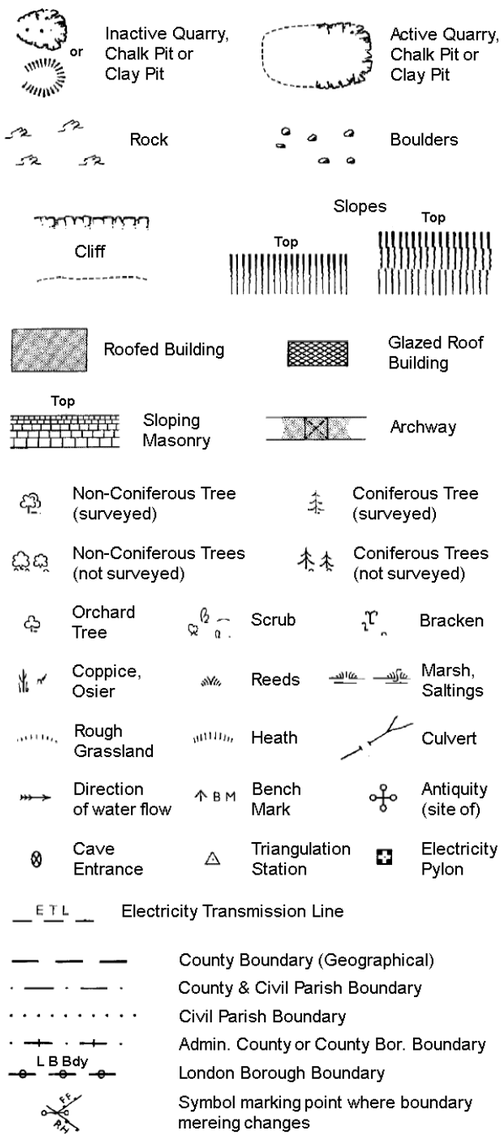
Administrative County & Civil Parish Boundary

Co. Boro. Bdy. County Borough Boundary (England)

Co. Burgh Bdy. County Burgh Boundary (Scotland)

B P B S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	St.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



County Boundary (Geographical)

County & Civil Parish Boundary

Civil Parish Boundary

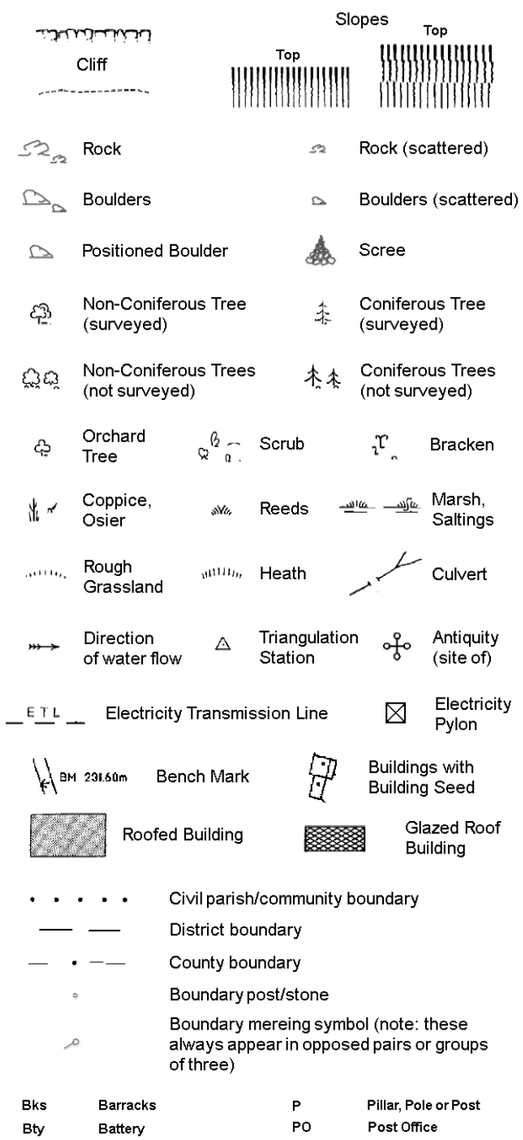
Admin. County or County Bor. Boundary

L B Bdy London Borough Boundary

Symbol marking point where boundary mereing changes

BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Track
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	Wr Pt, Wr T	Water Point, Water Tap
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump

Large-Scale National Grid Data 1:2,500 and 1:1,250



Civil parish/community boundary

District boundary

County boundary

Boundary post/stone

Boundary mereing symbol (note: these always appear in opposed pairs or groups of three)

Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
FB	Filter Bed	Spr	Spring
Fn / D Fn	Fountain / Drinking Ftn.	Tk	Tank or Track
Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
MH	Manhole	Wks	Works (building or area)
MP, MS	Mile Post or Mile Stone	W	Well

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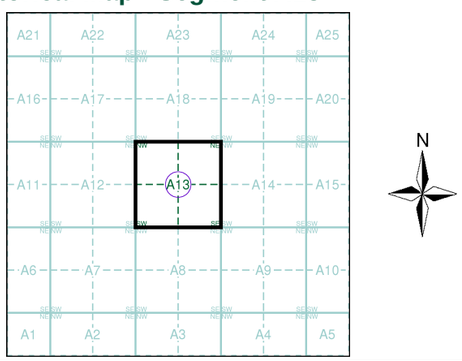
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Brecknockshire	1:2,500	1887	2

Historical Map - Segment A13



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Customer Ref:	CR0169
National Grid Reference:	303060, 218030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	100

Site Details

Site at 303050, 218110

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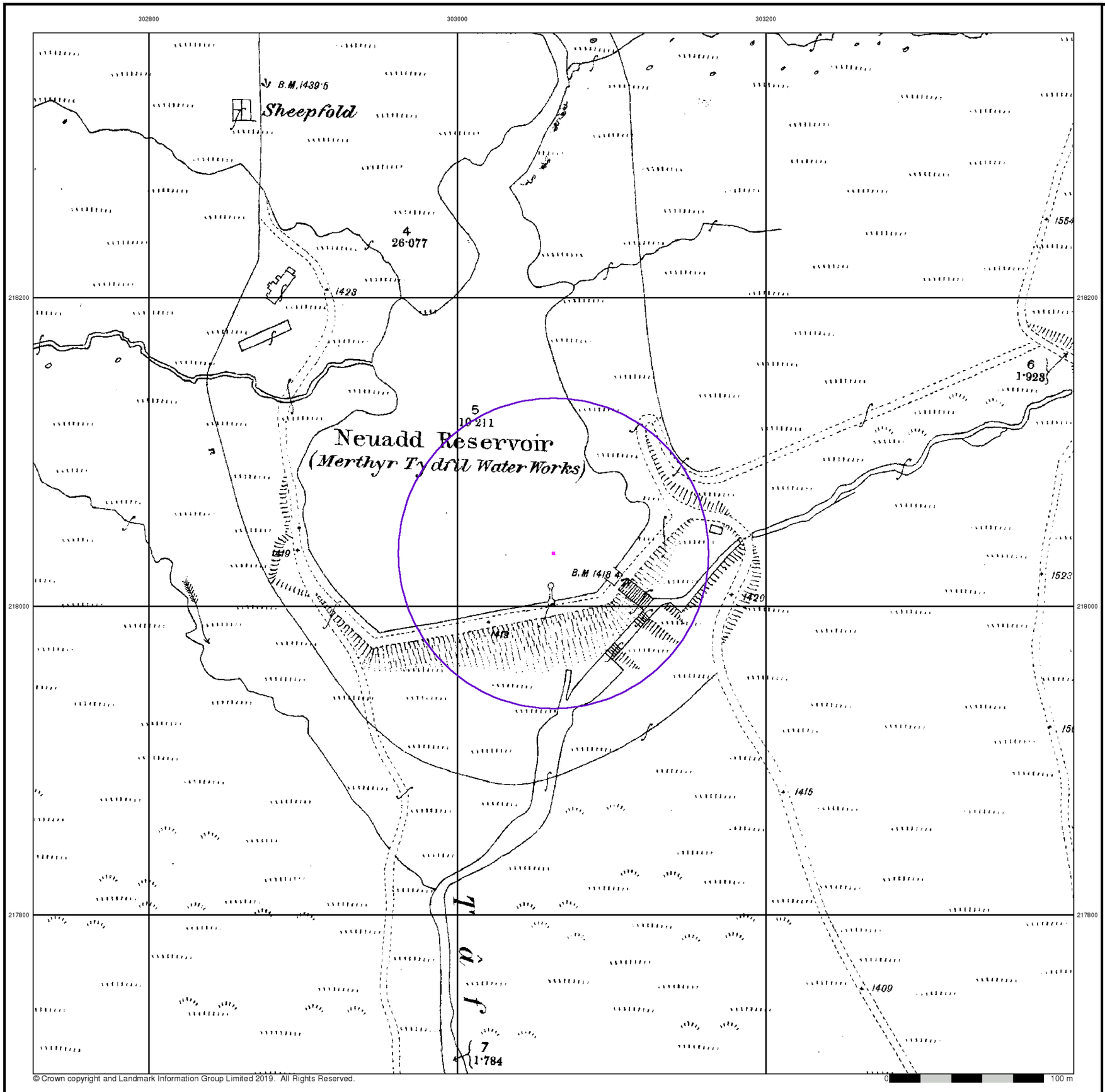

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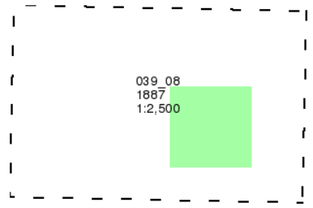
Brecknockshire

Published 1887

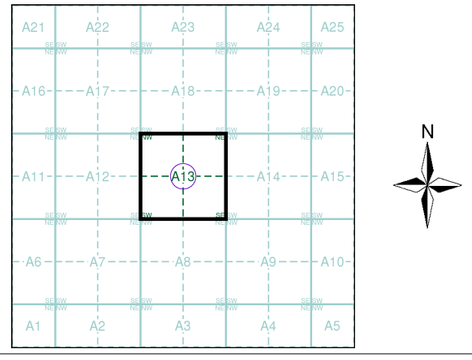
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



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Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	100

Site Details

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Historical Mapping Legends

Ordnance Survey County Series 1:10,560

Gravel Pit
Sand Pit
Other Pits
Quarry
Shingle
Orchard
Osiers
Reeds
Marsh
Mixed Wood
Deciduous
Brushwood
Fir
Furze
Rough Pasture
Arrow denotes flow of water
Trigonometrical Station
Site of Antiquities
Bench Mark
Pump, Guide Post, Signal Post
Well, Spring, Boundary Post
·285 Surface Level
Sketched Contour
Instrumental Contour
Main Roads
Fenced
Un-Fenced
Minor Roads
Fenced
Un-Fenced
Sunken Road
Raised Road
Road over Railway
Railway over River
Railway over Road
Level Crossing
Road over River or Canal
Road over Stream
Road over Stream
County Boundary (Geographical)
County & Civil Parish Boundary
Administrative County & Civil Parish Boundary
Co. Boro. Bdy. County Borough Boundary (England)
Co. Burgh Bdy. County Burgh Boundary (Scotland)
R.D. Bdy. Rural District Boundary
Civil Parish Boundary

Ordnance Survey Plan 1:10,000

Chalk Pit, Clay Pit or Quarry
Gravel Pit
Sand Pit
Disused Pit or Quarry
Refuse or Slag Heap
Lake, Loch or Pond
Dunes
Boulders
Coniferous Trees
Non-Coniferous Trees
Orchard
Scrub
Coppice
Bracken
Heath
Rough Grassland
Marsh
Reeds
Saltings
Building
Direction of Flow of Water
Shingle
Sand
Glasshouse
Pylon
Electricity Transmission Line
Pylon
Sloping Masonry
Pole
Cutting
Embankment
Standard Gauge Multiple Track
Road Under
Road Over
Level Crossing
Foot Bridge
Standard Gauge Single Track
Siding, Tramway or Mineral Line
Narrow Gauge
Geographical County
Administrative County, County Borough or County of City
Municipal Borough, Urban or Rural District, Burgh or District Council
Borough, Burgh or County Constituency
Shown only when not coincident with other boundaries
Civil Parish
Shown alternately when coincidence of boundaries occurs

BP, BS	Boundary Post or Stone	Pol Sta	Police Station
Ch	Church	PO	Post Office
CH	Club House	PC	Public Convenience
F E Sta	Fire Engine Station	PH	Public House
FB	Foot Bridge	SB	Signal Box
Fn	Fountain	Spr	Spring
GP	Guide Post	TCB	Telephone Call Box
MP	Mile Post	TCP	Telephone Call Post
MS	Mile Stone	W	Well

1:10,000 Raster Mapping

Gravel Pit
Refuse tip or slag heap
Rock
Rock (scattered)
Boulders
Boulders (scattered)
Shingle
Mud
Sand
Sand Pit
Slopes
Top of cliff
General detail
Underground detail
Overhead detail
Narrow gauge railway
Multi-track railway
Single track railway
County boundary (England only)
Civil, parish or community boundary
District, Unitary, Metropolitan, London Borough boundary
Constituency boundary
Area of wooded vegetation
Non-coniferous trees
Non-coniferous trees (scattered)
Coniferous trees
Coniferous trees (scattered)
Positioned tree
Orchard
Coppice or Osiers
Rough Grassland
Heath
Scrub
Marsh, Salt Marsh or Reeds
Water feature
Flow arrows
MHW(S) Mean high water (springs)
MLW(S) Mean low water (springs)
Telephone line (where shown)
Electricity transmission line (with poles)
BM 123.45 m Bench mark (where shown)
Triangulation station
Point feature (e.g. Guide Post or Mile Stone)
Pylon, flare stack or lighting tower
Site of (antiquity)
Glasshouse
General Building
Important Building

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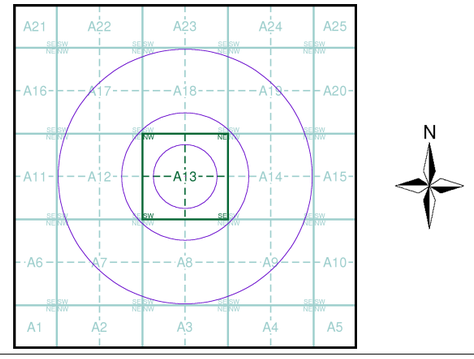
Historical Mapping & Photography included:

Historical Map - Slice A



Order Details

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National Grid Reference:	303060, 218030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 303050, 218110

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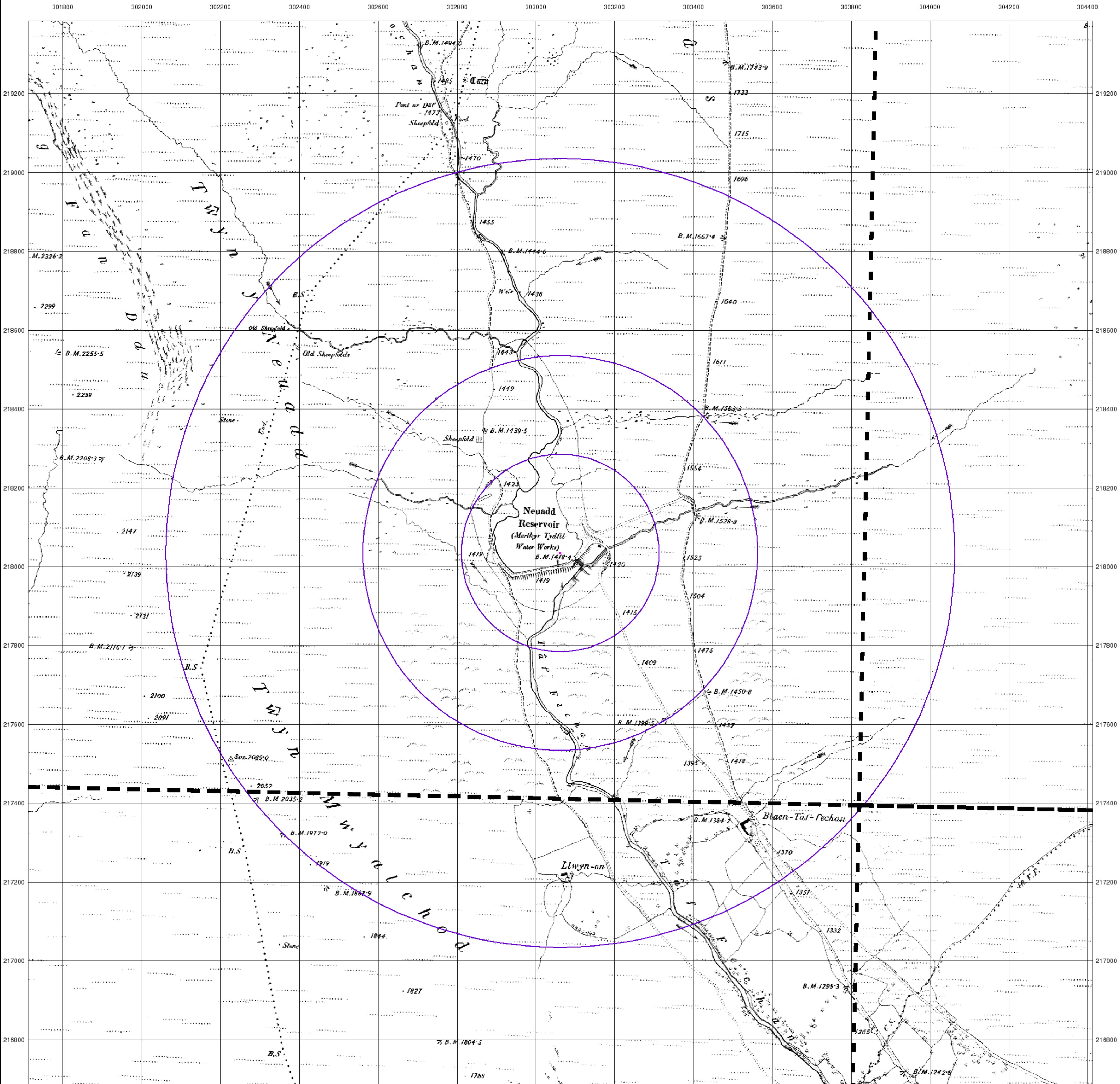

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Brecknockshire

Published 1886 - 1887

Source map scale - 1:10,560

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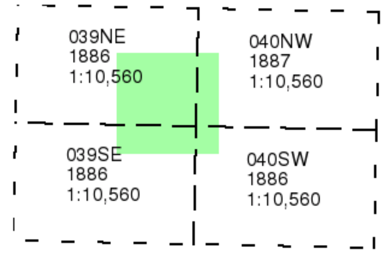
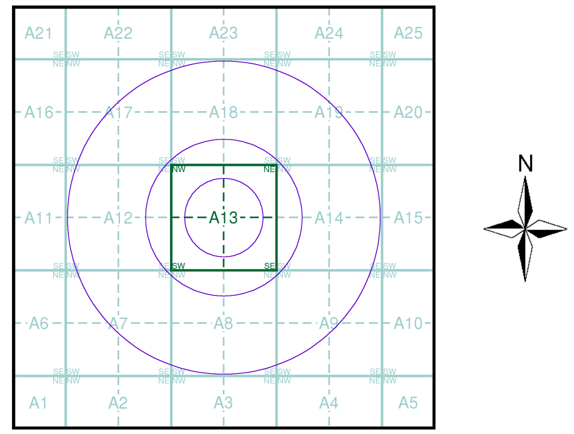
Map Name(s) and Date(s)



Historical Map - Slice A



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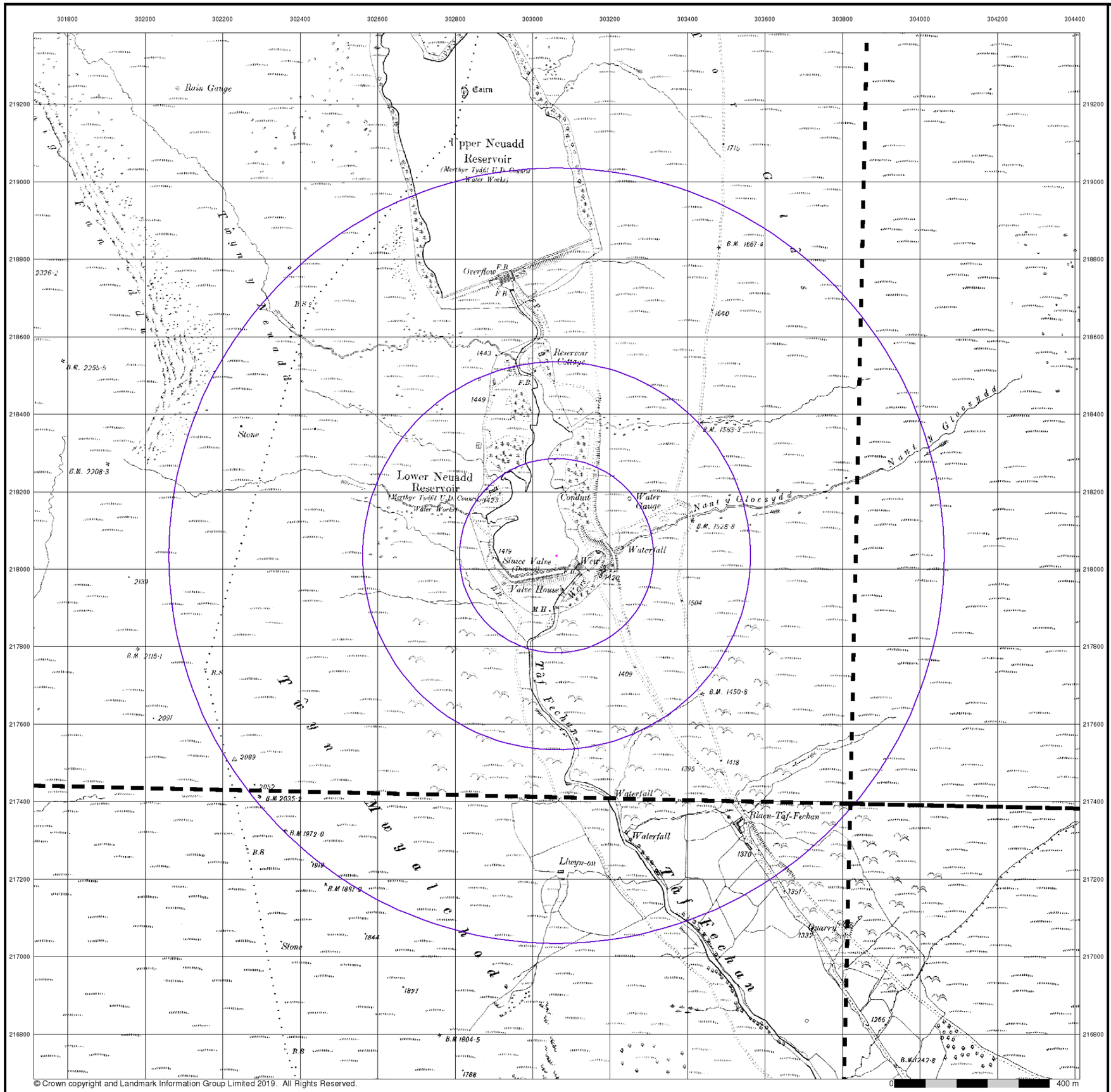

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Brecknockshire

Published 1905

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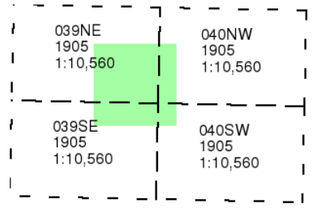

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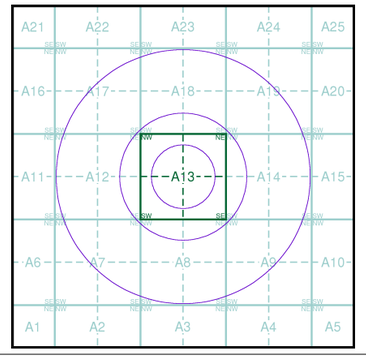

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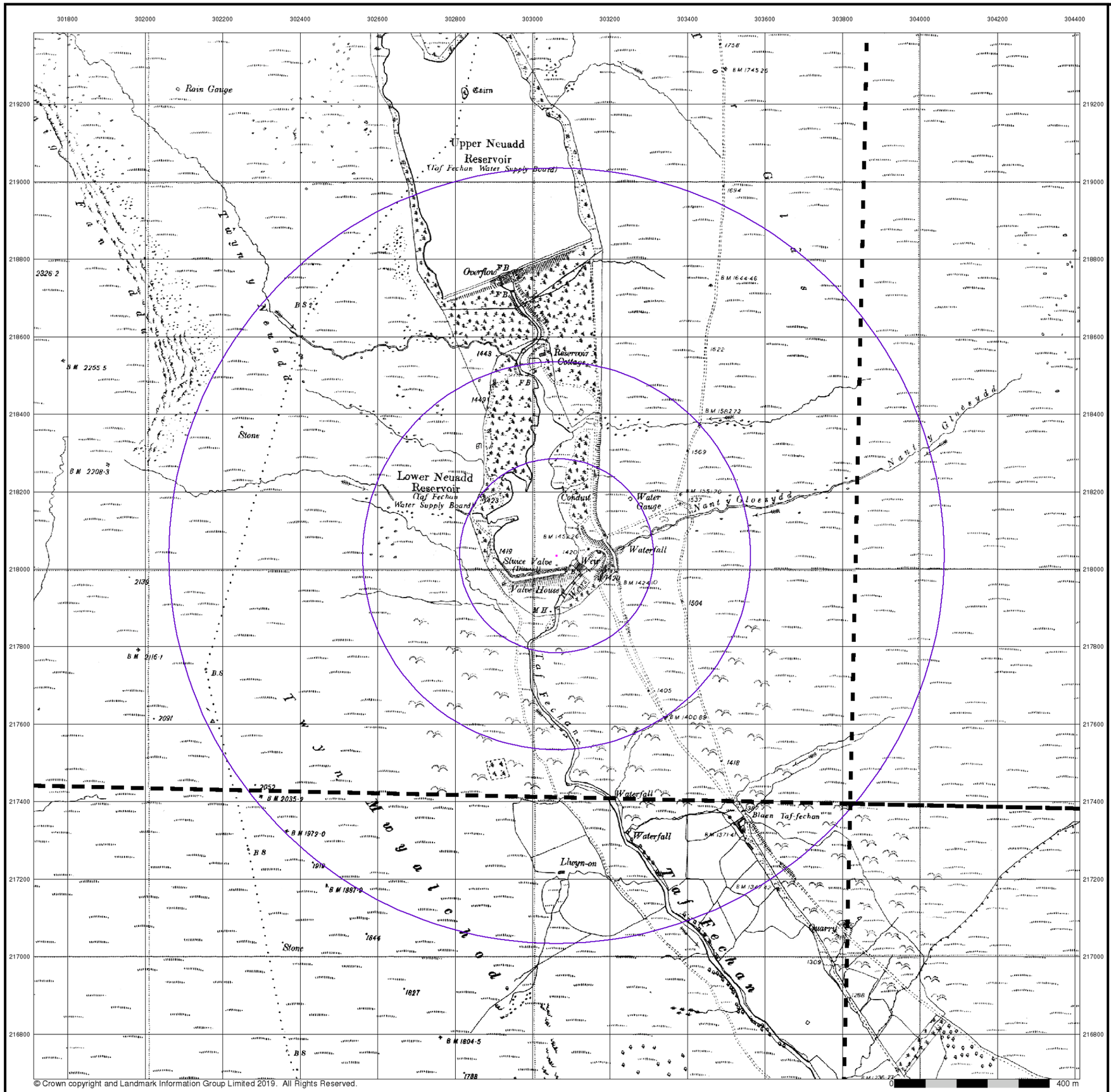

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Brecknockshire

Published 1953

Source map scale - 1:10,560

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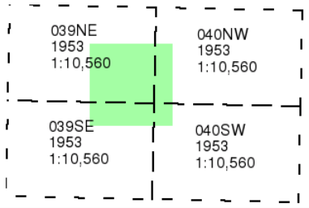
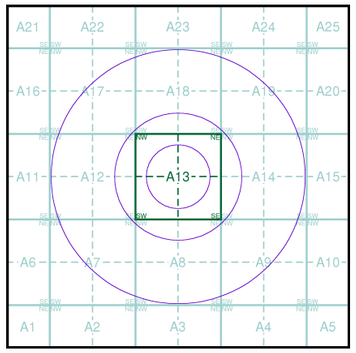


Historical Map - Slice A



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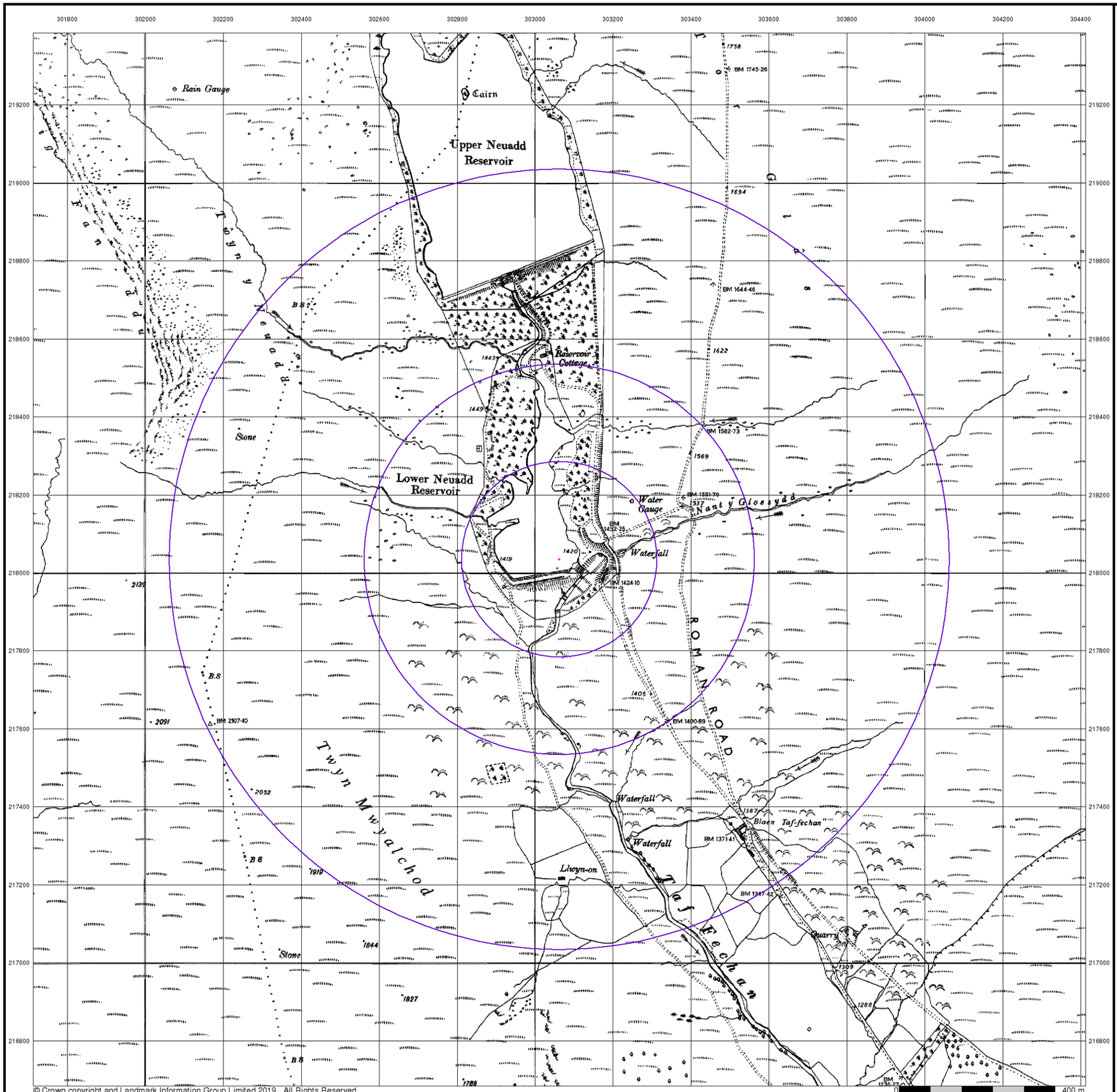

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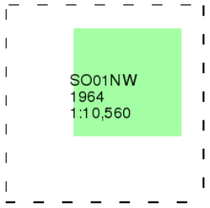
Ordnance Survey Plan

Published 1964

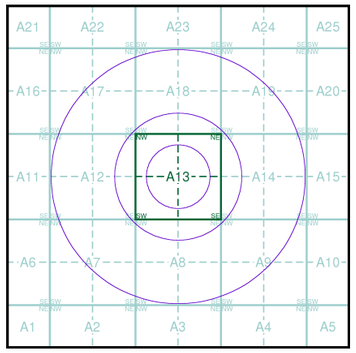
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

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Customer Ref:	CR0169
National Grid Reference:	303060, 218030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 303050, 218110

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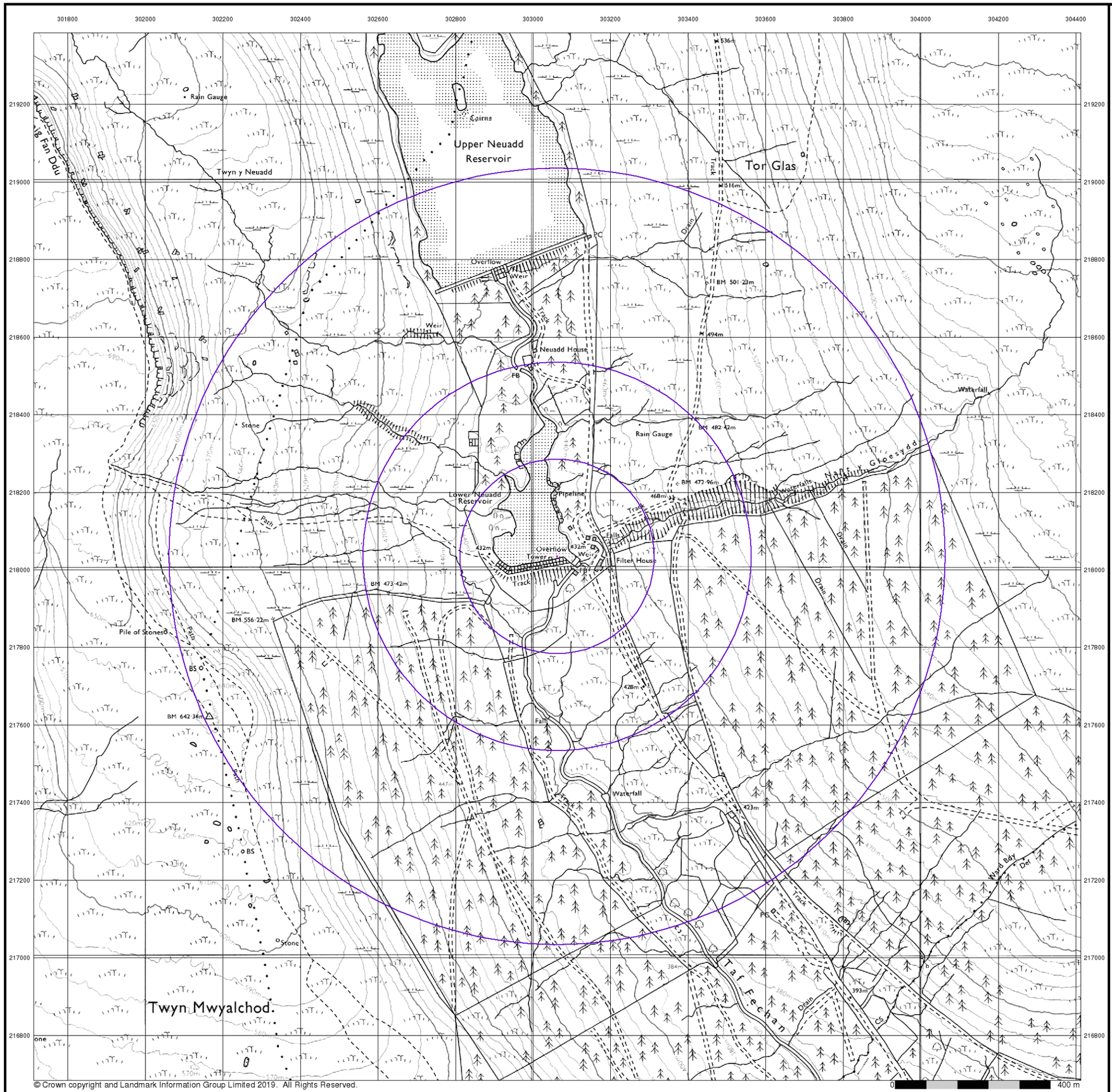

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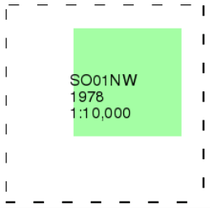
Ordnance Survey Plan

Published 1978

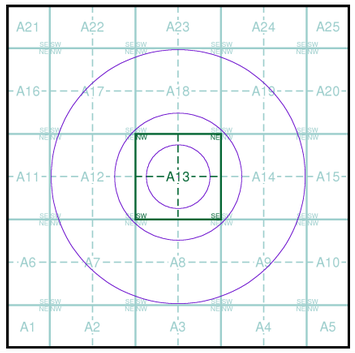
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	215319378_1_1
Customer Ref:	CR0169
National Grid Reference:	303060, 218030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

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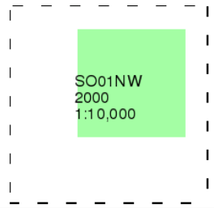
10k Raster Mapping

Published 2000

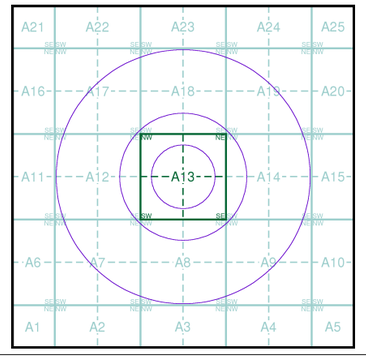
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	215319378_1_1
Customer Ref:	CR0169
National Grid Reference:	303060, 218030
Slice:	A
Site Area (Ha):	0.01
Search Buffer (m):	1000

Site Details

Site at 303050, 218110

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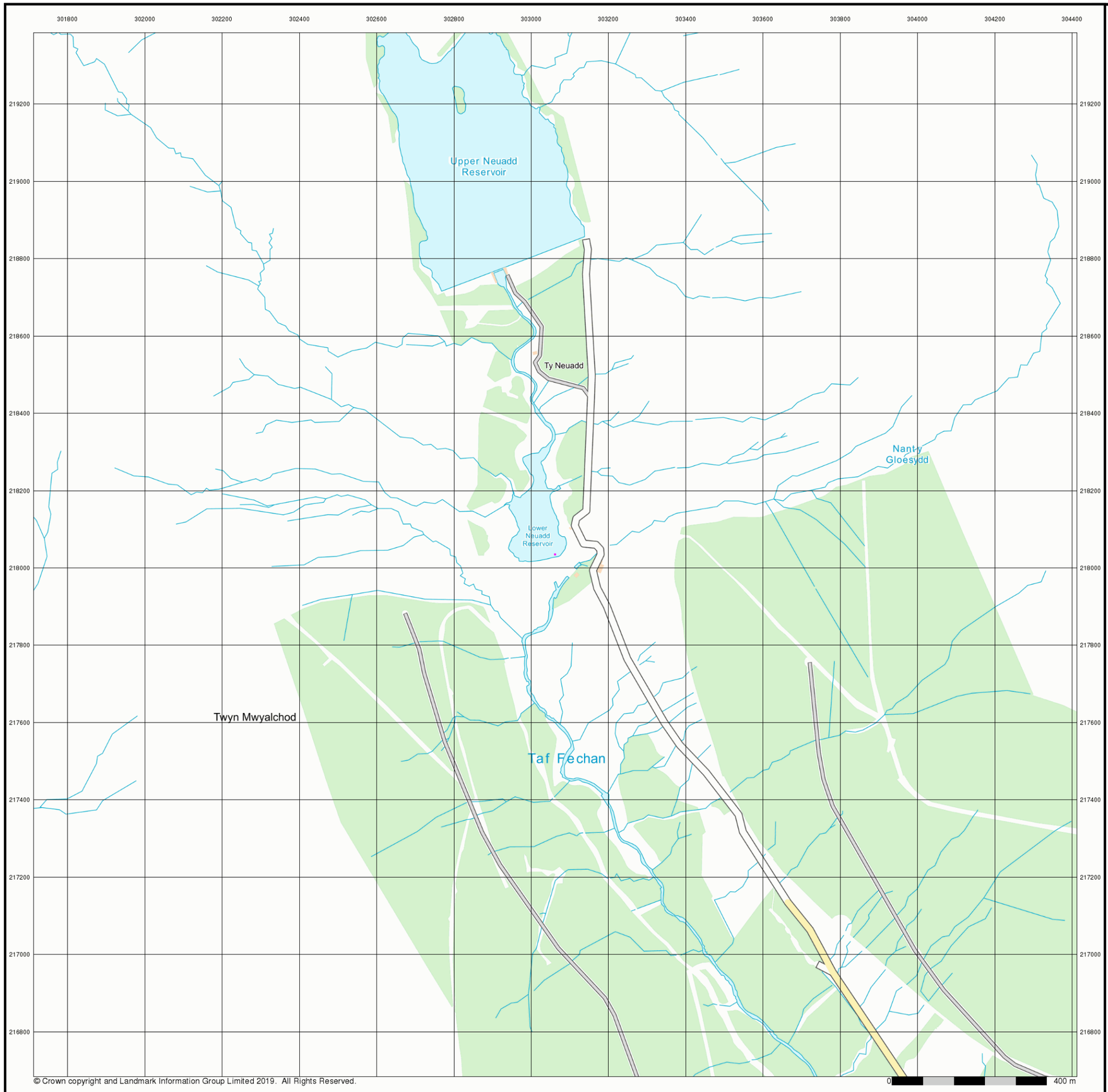

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Street View

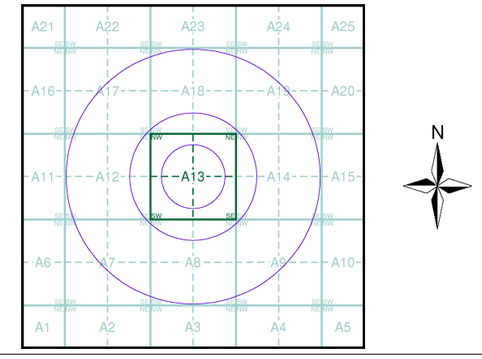
Published 2019

Source map scale - 1:10,000

Street View is a street-level map for the whole of Great Britain produced by the Ordnance Survey. These maps are provided at a nominal scale of 1:10,000

Map Name(s) and Date(s)

Street View Map - Slice A



Order Details

Order Number:	215319378_1_1
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National Grid Reference:	303060, 218030
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Site Area (Ha):	0.01
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APPENDIX 3 – HISTORICAL SECTIONS AND PLAN DRAWINGS

MERTHYR TYDFIL WATERWORKS

LOWER NEUADD RESERVOIR.

Alterations and repair of Bye-wash.

Drawing No. 1.

Scale of Feet

11 10 9 8 7 6 5 4 3 2 1

Pitching in Portland cement mortar

ELEVATION OF SOUTH WALL AND SECTION ON E. F.

Datum for South Wall 1340 O.D. For North Wall 1370 O.D.

ELEVATION OF NORTH WALL

PLAN

E

F

A

B

C

D

II

Where it is known that existing work must be removed, such work is drawn in red lines.
All new work, whether substituted for, or added to, old work, is coloured.
Existing work, not to be altered without special orders, is drawn in black and remains uncoloured.

Datum for section II 1370 O.D.

C

D

ENLARGED SECTION ON C D

Scale of Feet

Inches 0 1 2 3 4 5 6 7 8 9 10 15 20 Feet

101/441

25th January 1899

TA/2/23A

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