

Pwll-y-Llygod Bridge, Trimsaran, Carmarthenshire

Level 3 Historic Buildings Record & Watching Brief Report

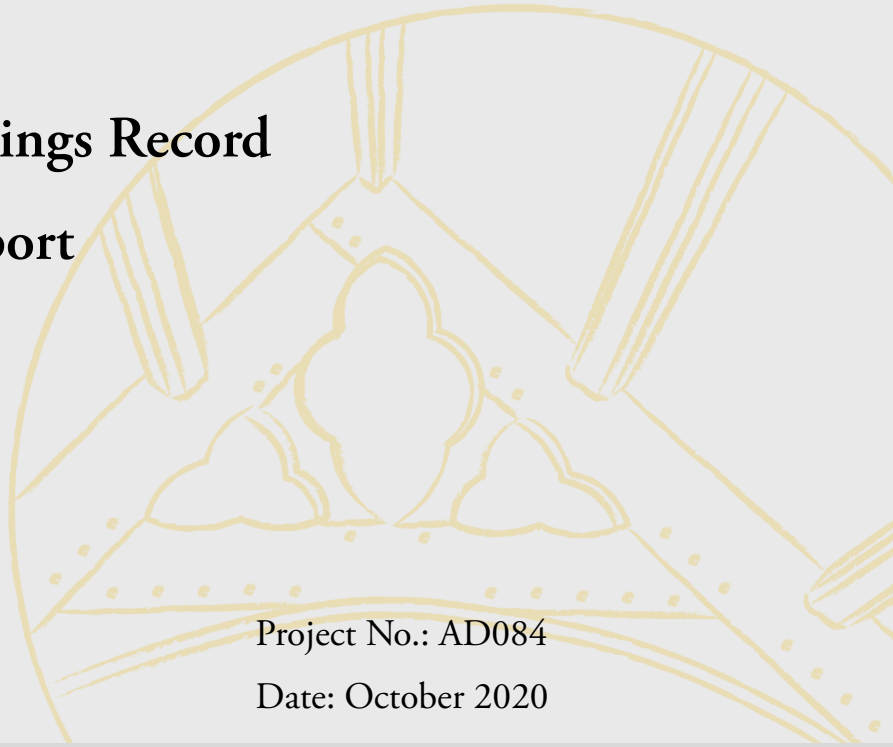
Ross Cook

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ArchaeoDomus
Archaeological & Heritage Services

3 Cysgod-y-Coed, Cwmann, Lampeter, Carms. SA48 8DN
01570 218048 / 07910 213557
ross.cook@archaeodomus.co.uk
www.archaeodomus.co.uk

Prepared for:

Bryan Samuel,

Ty Gwyn, Trimsaran Road, Llanelli, Carmarthenshire, SA15 4GR

Project No: N/A

By:

ArchaeoDomus Archaeological & Heritage Services

3 Cysgod-y-Coed, Cwmann, Lampeter, Carmarthenshire, SA48 8DN

Tel: +44 (0) 1570 218048 +44 (0) 7910 213557

Email: ross.cook@archaeodomus.co.uk

www.archaeodomus.co.uk

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Abbreviations used in this report

HER	- Historic Environment Record.
DAT-DM	- Dyfed Archaeological Trust Development Management
LPA	- Local Planning Authority.
NGR	- National Grid Reference.
NMR	- National Monuments Record.
OS	- Ordnance Survey.

All other abbreviations will be referred to in text.

Project Team

Ross Cook – A buildings archaeologist and dendrochronologist with a background in archaeology and buildings conservation. He has undertaken archaeological fieldwork throughout Wales and has also worked to produce detailed surveys of a wide range of Scheduled Ancient Monuments and Listed Buildings throughout Wales and England; this has included The Tower of London, Neath Abbey, Llansteffan Castle, Tretower Castle, Cilgerran Castle, Newport Castle Pembrokeshire, Picton Castle, and Brymbo Ironworks. Ross is the Cathedral Archaeologist at St Davids Cathedral, Pembrokeshire. He previously worked for the Royal Commission on the Ancient and Historical Monuments of Wales as a Historic Buildings Investigator (Archaeology), where he recorded buildings and Monuments, and provided advice on historic buildings at a national level. Currently he is involved with project work with Cadw, The Brymbo Heritage Group, and The Buildings of Medieval and Ottoman Palestine Research Project.

Ross also works as an Associate Dendrochronologist with the Oxford Dendrochronology Laboratory, through which he has undertaken work on sites such as Hampton Court Palace, Winchester Cathedral, Queens House Greenwich, The Tower of London, Christ Church and Magdalen College Oxford, Llwyn Celyn (Mons), and a large number of other smaller listed buildings and schedules sites throughout Wales and England.

ArchaeoDomus Archaeological & Heritage Services is the trading name of Ross Cook, who is an affiliate member of the CifA, and adheres to the CifA codes of conduct.

Cert. in Buildings Archaeology – University of Sussex, CCE.

PGCert. Social Anthropology – University of Wales, Lampeter

BA Joint Honours Archaeology & Anthropology – University of Wales, Lampeter

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Pwll-y-Llygod Tramroad Bridge, Trimsaran, Carmarthenshire

Level 3 Historic Buildings Record and Watching Brief Report

Summary

ArchaeoDomus Archaeological & Heritage Services was commissioned by Mike Garner, on behalf of Bryan Samuel, to prepare a Written Scheme of Investigation, and undertake a Level 3 Historic Buildings Record and Archaeological Watching Brief of Pwll-y-Llygod Tramroad Bridge, Trimsaran. The aim of this work has been to produce a record of the bridge prior to works and to allow for the development to be undertaken whilst monitoring for any potential archaeological resource.

The works proposed the conservation and stabilisation of the bridge, which had been damaged by successive flooding over the past 30 years. In particular, the north elevation, the up-river side, had suffered the collapse of a spandrel and wing-wall, and the lower portion of the east voussoirs and abutment. Consent was granted by Cadw on 27th September 2019, under consent number qA1382762;X.C32.AMO.

The Photogrammetric Survey and Historic Buildings Record was undertaken on 20th March 2020. As a result of the Covid-19 pandemic, the planned Watching Brief was amended to allow works to commence. This was done by providing guidance to the contractors to record daily progress on site, with detailed photos of any areas of rebuilding and consolidation. The post-work survey was undertaken on 24th July 2020. The result of this work is this Level 3 Historic Buildings Record, including interpreted drawings and a photographic archive.

A single test pit was excavated to the roadway to assess the potential for the survival of sleepers, rails or other materials or objects associated with railway infrastructure. No such materials survived, but the excavation did provide evidence to demonstrate the hardcore fill of the bridge, formed of coal dust, iron slag and stone.

The Historic Buildings Record and Watching Brief identified that Pwll-y-Llygod Tramroad Bridge, as it currently stands, is not the bridge constructed between 1768-70. Instead, it is a rebuild of circa 1850, retaining some elements of the earlier structure. The work demonstrated that the original bridge spanned the Gwendraeth-fach from the original abutment to the west, but rises on a more west-facing alignment from the east.

Whilst the original bridge at Pwll-y-Llygod was certainly built around 1768-70, it was rebuilt around or just after 1847 as a result of damage or introduction of locomotives. Despite this rebuild, the bridge still retains elements in the wing walls and abutments of the original bridge. Importantly, the bridge, both original and later, fulfilled a purpose by enabling coal to be moved efficiently from the mines of the Gwendraeth Valley to the quayside at Ythyn Frenig, via an integrated transport network of tramway, canal and seaways. The construction of this integrated network, one of the earliest in Wales, linked the valley to a trading network which took coal from the inland mines to Ireland, across Wales, to the West of England and even to the continent. The development typifies the pioneering nature of the Industrial Revolution in Wales from the end of the 18th century and well into the 19th, with resources being transported and commodified on a scale greater than ever seen before.

Pont Pwll-y-Llygod, Trimsaran, Sir Gaerfyrddin

Cofnod adeiladau hanesyddol a bugeilio archaeolegol

Crynodeb

Comisiynwyd Gwasanaethau Archeolegol & Threftadaeth ArchaeDomus gan Mike Garner, ar ran Bryan Samuel, i baratoi Cynllun Ymchwilio Ysgrifenedig, ac ymgymryd Cofnod Adeiladau Hanesyddol Lefel 3 a Briff Gwylio Archeolegol o bont dramffordd Pwll-y-Llygod, Trimsaran. Nod y gwaith hwn oedd i cynhyrchu cofnod o'r bont cyn y gwaith ac i ganiatáu i'r datblygiad gael ei gynnal wrth fonitro ar gyfer unrhyw adnodd archeolegol posib.

Cynnigiwyd y gwaith y cadwraeth a sefydlogaeth y bont, a chafodd ei ddifrodi gan lifogydd yn olynol dros y 30 mlynedd diwethaf. Yn benodol, y drychiad gogledd, yr ochr i fyny'r afon, wedi dioddef cwmp spandrel a wal-adain, a rhan isaf a voussoirau ac ategwaith dwyreiniol. Rhoddwyd caniatâd gan Cadw ar 27ain Medi 2019, o dan rhif cydsyniad qA1382762;X.C32.AMO.

Ymgymerwyd â'r Arolwg Ffotogrammetrig a'r Cofnod Adeiladau Hanesyddol ar 20fed Mawrth 2020. O ganlyniad y pandemig Covid-19, adolygwyd y Briff Gwylio a gynlluniwyd caniatáu i'r gwaith ddechrau. Gwnaethpwyd hyn trwy ddarparu arweiniad i'r contractwyr gofnodi cynnydd dyddiol i'r safle, gyda lluniau manwl o unrhyw feysydd ailadeiladu a chydgrynhoi. Cafodd yr arolwg ôl-waith ei gynnal ar 24ain Iau 2020. Canlyniad y gwaith hwn yw'r Cofnod Adeiladau Hanesyddol Lefel 3, gan gynnwys lluniad wedi'i ddehongli ac archif ffotograffig.

Cloddiwyd pwll prawfsengl i'r ffordd i asesu'r potensial i oroesi cysgwyr rheiliau neu ddeunyddiau neu wrthrychau eraill sy'n gysylltiedig â seilwaith rheilffyrdd. Goroesodd dim o'r fath deunyddiau, ond gwnaethant nodi goroesiad llenwad caled y bont, a ffurfiwyd o llwch glo, slag haearn a charreg.

Nododd y Cofnod Adeiladau Hanesyddol a'r Briff Gwylio nad yw'r pont dramffordd Pwll-y-Llygod, fel y mae ar hyn o bryd, y bont a adeiladwyd rhwng 1768-70. Yn lle mae'n ailadeilad circa 1850, a gadwodd rai elfennau o'r strwythur cynharach. Dangosodd hyn bod y bont, wrth rannu'r un lleoliad, yn rychwantu'r Gwendraeth-fach o'r ategwaith gwreiddiol i'r gorllewin, ond yn codi ar ochr fwy gorllewinol o'r dwyrain.

Er bod y bont wreiddiol yn Pwll-y-Llygod wedi'i hadeiladu yn sicr tua 1768-70, o ganlyniad o ddifrod neu gyflwyno locomotifau, cafodd ei ailadeiladu tua neu ar ôl 1847. Er gwaethaf yr ailadeilad, mae'r bont yn dal i gadw elfennau yn waliau adenydd ac ategweithiau'r bont gwreiddiol. Yn bwysig, cyflawnodd y bont, yn wreiddiol ac yn ddiweddarach, bwrpas trwy alluogi glo i cael ei symud yn effeithlon o fwyngloddiau Cwm Gwendraeth i ochr y cei yn Ythyn Frenig, trwy rwydwaith trafniadaeth integredig o dramffordd, camlas a morffyrdd. Yr adeiladu o'r rhwydwaith integredig hwn, un o'r cynharaf yng Nghymru, a gysylltodd y dyffryn â masnachu rhwydwaith a aeth â glo o'r pyllau glo mewndirol i Iwerddon, ledled Cymru, Gorllewin Lloegr a hyd yn oed i'r cyfandir. Mae'r datblygiad yn nodweddiadol o natur arloesol y Diwydiannol Chwyldro yng Nghymru o ddiwedd y 18fed ganrif ac ymbell i'r 19eg, gydag adnoddau cael eu cludo a'u nwyddau ar raddfa fwy nag a welwyd erioed o'r blaen.

1 INTRODUCTION

1.1 General

- 1.1.1 ArchaeoDomus was commissioned to undertake an archaeological programme of works, to include a Written Scheme of Investigation (ArchaeoDomus 2020), Historic Buildings Record and an Archaeological Watching Brief, during conservation and stabilisation works to the Pwll-y-Llygod Bridge, Trimsaran (SAM CM261; Fig. 9). This project has been commissioned by Mike Garner, of Garner Southall Partnership, on behalf of the land owner Bryan Samuel.



Fig. 1 – Post-work aerial photograph of Pwll-y-Llygod

- 1.1.2 The commissioning of this archaeological programme of investigation was to enable conservation and stabilisation work to commence, whilst making provision for an archaeological record. The outcome of the archaeological investigation is presented in this report as a record of works, with an analytical record of the monument grounded in the evidence observed during physical interventions and research from readily available sources. The final report will be deposited with the National Monuments Record and Regional Historic Environment Record. This is designed to enhance our understanding of the monument and to produce a lasting record of such intervention works.
- 1.1.3 Scheduled Monument Consent (qA1382762;X.C32.AMO) was granted on 27th September 2019. Cadw's consent is subject to archaeological conditions, in line with national policy set out in the *Ancient Monument and Archaeological Areas Act 1979*, as amended by the *Historic Environment (Wales) Act 2016*, and Section 3 of the *Well-being of Future Generations (Wales) Act 2015*, which places a duty on Welsh Ministers to improve the economic, social, cultural, and environmental well-being of Wales, in line with Section 4 of the same act. The Scheduled Monument Consent states:

5 (a) (i) written confirmation that a comprehensive digital photographic record of the Monument will be taken prior to the commencement of works, throughout the course of the works and upon completion of the works;...

5 (a) (v) That no works including site clearance shall commence until Cadw has been informed in writing of the name of an appropriately qualified individual who will be carrying out a watching brief and an appropriate scheme of historic buildings recording in accordance with a written scheme of investigation which has been submitted and approved in writing by Cadw. No work shall commence until Cadw has confirmed in writing that the proposed archaeologist is acceptable. A digital copy of the draft historic buildings survey report shall be submitted to Cadw for approval within 8 weeks of the project being completed.

- 1.1.4 The determining body for scheduled monument consent is Cadw, the Welsh Government's historic environment service, who generously grant aided this archaeological programme of works.
- 1.1.5 Requirement for programmes of archaeological works are laid out in *Planning Policy Wales, Section 6.1* (Edition 10, Dec 2018). Further guidance is provided by *TAN 24: The Historic Environment* (2017). This framework ensures that designated and undesignated heritage assets, archaeological remains and deposits are fully investigated, recorded and catalogued if they are to be affected as a result of activities associated with the development.
- 1.1.6 The fieldwork was commenced on 22nd January 2020 and concluded on 24th July 2020, and was undertaken in accordance with the guidance laid down by the Chartered Institute for Archaeologists; *CIfA Standards and Guidance for the Archaeological Investigation and Recording of Standing Buildings* (December 2014), *Historic England's Understanding Historic Buildings: A guide to good practice* (2016), and *CIfA Standards and Guidance for an Archaeological Watching Brief* (December 2014).
- 1.1.7 This report documents the results of the Historic Buildings Record and Watching Brief, and presents an assessment of the buildings development and use.

1.2 Glastir

- 1.2.1 The conservation and stabilisation works to Pwll-y-Llygod have been funded by the Glastir sustainable land management scheme.

1.3 Covid-19

- 1.3.1 As a result of the Covid-19 pandemic, starting in early 2020, the programme of works was altered to enable the documentation of works on-site by the contractor. This ensured strict social distancing and adherence to travel restrictions could be met.
- 1.3.2 Guidance was provided by ArchaeoDomus and the Inspector of Ancient Monuments, Louise Mees, to ensure a photographic record was made during the progress of work on site.
- 1.3.3 The photographic record, maintained by the contractor, has been included in this report and has allowed the project and findings relating to the monument's development to be documented and understood.

2 SITE AND LOCATION

2.1 General

2.1.1 Pwll-y-Llygod Tramroad Bridge is located to the north-west of the former mining village of Trimsaran, in the south-west of the county of Carmarthenshire. The former Carway Siding railway embankment runs westwards from the bridge for some 400m to meet the disused Cwm Mawr Branch Line. The bridge sits within a low-lying plain and spans a bend of the Gwendraeth Fawr river, which meets with the Gwendraeth Fach near Kidwelly, emptying into Carmarthen Bay to the west. The site is sited to the west and north of two small clusters of farm buildings, belonging to Maesgwendraeth Farm. Pwll-y-Llygod is bounded by agricultural land to all cardinal points. Access is provided by a small track from the north-east, which leads from a small, unclassified road. To the south-west is the Registered Historic Landscape of the Taf and Tywi Estuary (HLW (D) 9). The Glyn Abbey Golf Club is 400m to the north-east and the nearest church is Capel Sardis, 1km to the south in Trimsaran. The site sits at 9m above sea level and is centred around NGR SN 44613 06811 / 51°44'18.3"N 4°15'06.5"W.

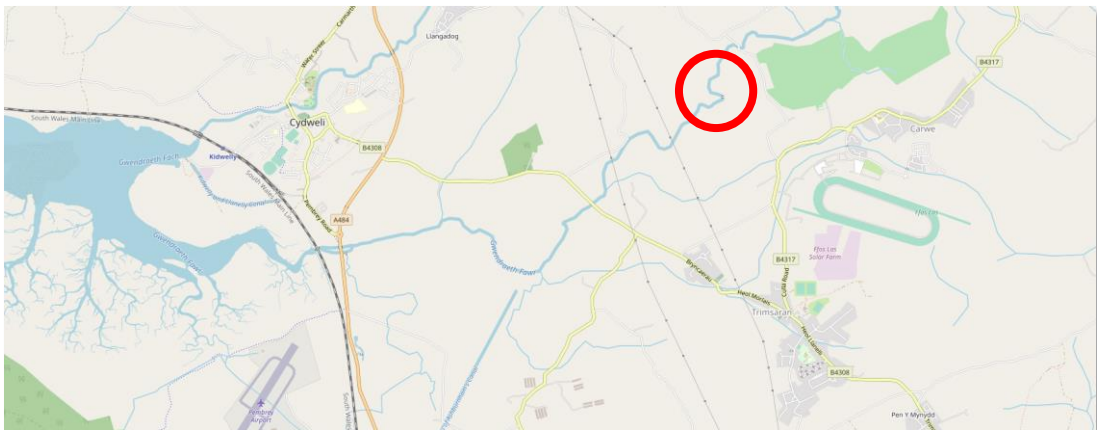


Fig. 2 – Location – Pwll-y-Llygod.
OpenStreetMap 2020. All rights reserved.



Fig. 3 – Location – Pwll-y-Llygod Tramroad Bridge and Carway Siding.
Contains Ordnance Survey OpenData © Crown copyright and database right 2020.

2.2 Geology

- 2.2.1 The underlying geology is formed of igneous bedrocks known as the South Wales Lower Coal Measure Formation of Mudstone, Sandstone and Siltstone (BGS) with superficial deposits of Alluvial Deposits of Clay, Silt, Sand and Gravel recorded (BGS). The local soil type is a loamy and clayey floodplain soil with naturally high groundwater (UKSO), classified as Gleysols (UKSO).

3 HISTORICAL BACKGROUND

3.1 Introduction

- 3.1.1 Pwll-y-Llygod Tramroad Bridge was constructed during a period of intensification of industry in the Gwendraeth Valley in the second half of the 18th century and formed part of a vital transportation link between the local collieries of the valley out to Carmarthen Bay.
- 3.1.2 The bridge is believed to have been built around 1768-70, which would make it the oldest tramroad bridge in Wales and one of the oldest in the World. However, some doubt is cast over this in the listing description.
- 3.1.3 The bridge comes under the same designation as the Kymer's Canal and Carway Siding, which were collectively Scheduled on 14th November 1996 under ID CM261 (pg. 99). The monuments were scheduled as a site of national importance for its potential to enhance our knowledge of 18th and 19th century transport systems.

'The monument consists of a section of canal, a water-filled earthwork, dating to the 18th century and includes c. 380m of the eastern end of the Kymer's Canal. Kymer's Canal was built in 1766-8 and was designed for sea-going barges it is broader than later canals in the area and survives as a partly water filled earthwork 4m wide and 1.5m deep. The northern side is embanked by a clay and earth mound c 2.5m wide and standing 1.5m above its surroundings. The southern side has a similar but wider embankment which originally carried a contemporary tramroad and a railway siding (rails still survive). At the terminus was a small dock or turning bay projecting NE and showing as a slight earthwork in the pasture field. The tramroad crossed the river by an elegant segmentally-arched stone bridge, 3m wide and without parapets, believed to date from the construction of the canal. The monument is of national importance for its potential to enhance our knowledge of 18th and 19th century transport systems. It retains significant archaeological potential, with a strong probability of the presence of associated archaeological features and deposits. A canal may be part of a larger cluster of industrial monuments and their importance can further enhanced by their group value. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive.'

- 3.1.4 Pwll-y-Llygod Tramroad Bridge also carries a Grade II Listing (12537) (pg. 100) and was designated as such on 23th July 2003.

'Part of a tramroad that took coal from collieries at Carway to Kymer's Canal, which was completed in 1769. The date of the tramroad, and bridge, is not certain. The tramroad is said to have been built c1770, which would make the bridge the oldest surviving railway bridge in Wales, and alternatively to have been built c1802. Masonry details suggest that the present bridge was built later, although still perhaps in the first half of the C19, and therefore replaced an earlier structure. The tramroad was still in use in 1863.'

- 3.1.5 In circa 2000, the arch spring to the north-east collapsed after heavy flooding. Shortly after, emergency repair works were undertaken through Grant Aid from Cadw and overseen by Rick Turner and Peter Wakelin, both Inspectors of Ancient Monuments. The work inserted an acrow prop to support the surviving arch, with the exposed masonry supported with bags of sand and cement.
- 3.1.6 The Royal Commission records the bridge under NMRW: **43100**.
- 3.1.7 The name of the bridge, Pwll-y-Llygod, translates as Pool of the Mouse.
- 3.1.8 In recent history the bridge appears to have also been named as Pwll-y-Llygoed. However, no historical account of this name has been identified and may be a transcribing error.

3.2 Historical Background

- 3.2.1 The second half of the 18th century saw the intensification of earlier and very minor coal workings in the Gwendraeth Valley, largely from Great Forest and Pwll-y-Llygod. By the 1760s, the demand for coal was growing significantly in the larger towns along the South Wales coast, West of England and Southern Ireland. This increase was sufficient enough to lead Thomas Kymer, owner of the above mentioned coalpits, to petition parliament for permission to build a canal, to be done at his own expense.
- 3.2.2 In January 1766, Kymer sent his surveyor, Richard Evans, to present a scheme for a ‘navigable cut or canal’ to the parliamentary committee in charge of the matter. His scheme was to run a 26-foot-wide canal from the south bank of the Gwendraeth Fach, down-river of Kidwelly at a place called Ythyn Frenig, to Pwll-y-Llygod, on the Gwendraeth Fawr. A total length of 3 miles, at the time the longest canal in Wales.
- 3.2.3 On 19th February 1766, The Act (6 Geo. III c. 55) was granted for permission to divert the course of the Gwendraeth Fawr, for the construction of the new navigation. Commissioners were appointed from the local gentry and landowners to ensure the proper execution of the Act. They met for the first time on 12th March 1766 at the Pelican Inn, Kidwelly.
- 3.2.4 By September 1766, construction of the canal was well advanced, with leases obtained from landowners for most of the canal’s route.
- 3.2.5 Within two years of commencement, the canal was in the final stages of completion. Richard Evans writes to Kymer on 9th February 1768 to notify him that the towpaths are ready for gravelling. Writing again on 26th May, Evans gives note of the canal being in full operation and the quayside is well underway.
- 3.2.6 On 16th July 1768, the canal is completed, with barges now able to navigate from Pwll-y-Llygod to the quay at Ythyn Frenig.

- 3.2.7 The canal was built large enough for a single barge to travel, with passing places at Muddlescombe and Morfa, and a turning bay at Pwll-y-Llygod. The barges were not limited to canal use, as Evans notes in several letters that they were taken to St. Clears for timber.
- 3.2.8 On completion a number of permanent bridges, of wood or stone, were constructed to allow canal crossing at key points, including the Morfa Farm bridge (NPRN 416959) to carry the Kidwelly-Llanelli turnpike road. Importantly, Pwll-y-Llygod was constructed as a single span stone bridge over the Gwendraeth Fawr, to enable a tramroad to bring coal from the mines to Carway Siding for transfer to canal barges.
- 3.2.9 The canal was instantly successful, with Evans writing to Kymer on 1st April 1770 to inform him of the increase in trade and orders. New custom was now coming from Ireland, North Wales, the eastern, southern and western counties of England, and from time to time, the continent. Evans notes that they are able to load as many as ‘60 hundred [hundredweight?] a day’. During the spring and summer months, as many as 25 ships would be waiting in the river to be loaded with coal bought to the coast by the canal via the tramroad over Pwll-y-Llygod bridge.
- 3.2.10 In 1784, Kymer dies, leaving the enterprise to be continued by his four sisters. However, by the end of the century, the industry gradually declines, caused by the silting up of the river.
- 3.2.11 The canal remains in use and is once again made profitable when an Act of 1812 allows the canal to be extended to Llanelli and to a common called The Great Mountain, in the parish of Llanarthney, which included several small feeder branches. The Act incorporated The Kidwelly and Llanelly Canal and Tramroad Company and absorbed Kymer’s Canal.
- 3.2.12 By 1865, the railway network had expanded greatly in Carmarthenshire and South Wales, with locomotives now powerful enough to carry greater loads. This led to the canal and previous company being superseded by the Burry Port and Gwendraeth Valley Railway, which was laid over much of the canal from 1865.
- 3.2.13 The railway continued to operate to the local pits until circa 1913, when the Carway line was terminated at Pwll-y-Llygod after demand for coal from the small Gwendraeth Valley mines was in decline.
- 3.2.14 After the closure of the railway beyond the Carway Siding, the bridge became used as a crossing for Pwll-y-Llygod farm and has remained so ever since.
- 3.2.15 In circa 2000, the arch spring to the north-east collapsed after heavy flooding. Emergency repair works were undertaken through Grant Aid from Cadw and overseen by Ric Turner and Peter Wakelin, Inspectors of Ancient Monuments. The work inserted an acrow prop to support the surviving arch, with the exposed masonry supported with bags of sand and cement.
- 3.2.16 In 2013, the north-west abutment collapsed after heavy rain, with some of the stone now sitting on the bank below or in the Gwendraeth Fawr.

3.3 Cartographic Sources

- 3.3.1 The surveyors' map of 1811 from the Ordnance Survey, draughted by Thomas Budgen, gives the first tantalising evidence for a bridge at Pwll-y-Llygod. The map shows a dashed road, likely a tramway, from several areas to the east, over the Gwendraeth Fawr to the canal. The map maker lists the name simply as Pwll.
- 3.3.2 Interestingly, both the First Series Ordnance Survey Map of 1831 and the Tithe Map of 1842 do not show a bridge at Pwll y Llygod. However, the First Series notes the farm's name as Pwll Llygad and the Tithe Map as Pwll Lygod.
- 3.3.3 The first clear depiction of the bridge comes with the First Edition 25-inch to One Mile Ordnance Survey Map of 1880 (Fig. 5; Fig. 1010), with the farm's name given as Pwll-y-Llygod. By this time the Burry Port & Gwendraeth Valley Railway is established, with the Carway Branch clearly crossing the Gwendraeth Fawr. The map is also the first visual evidence to show the truncation of the canal by the railway.

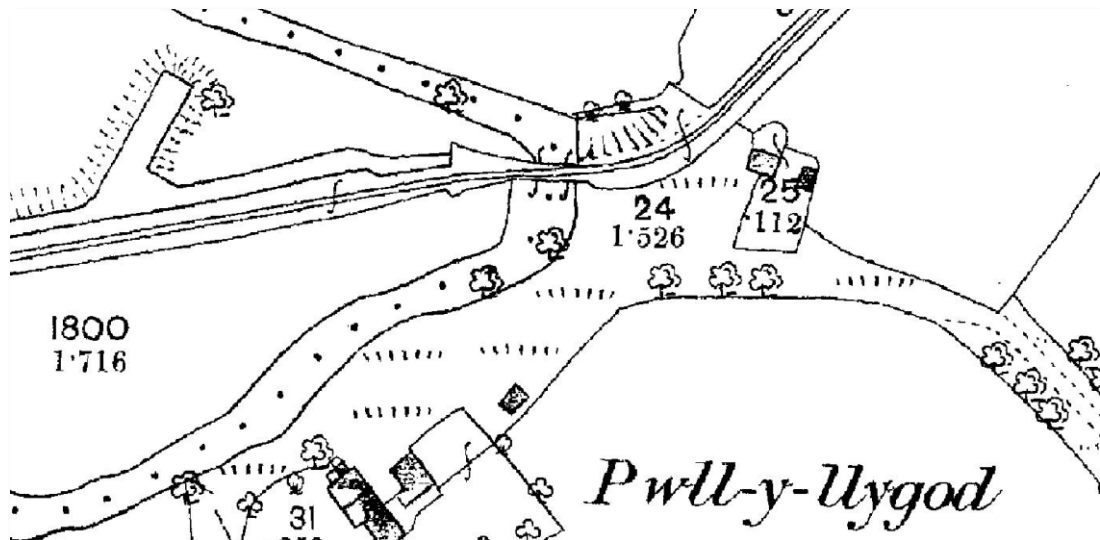


Fig. 5 – First Edition 25-Inch Ordnance Survey Map of 1880. © Landmark Information Group Ltd 2020.

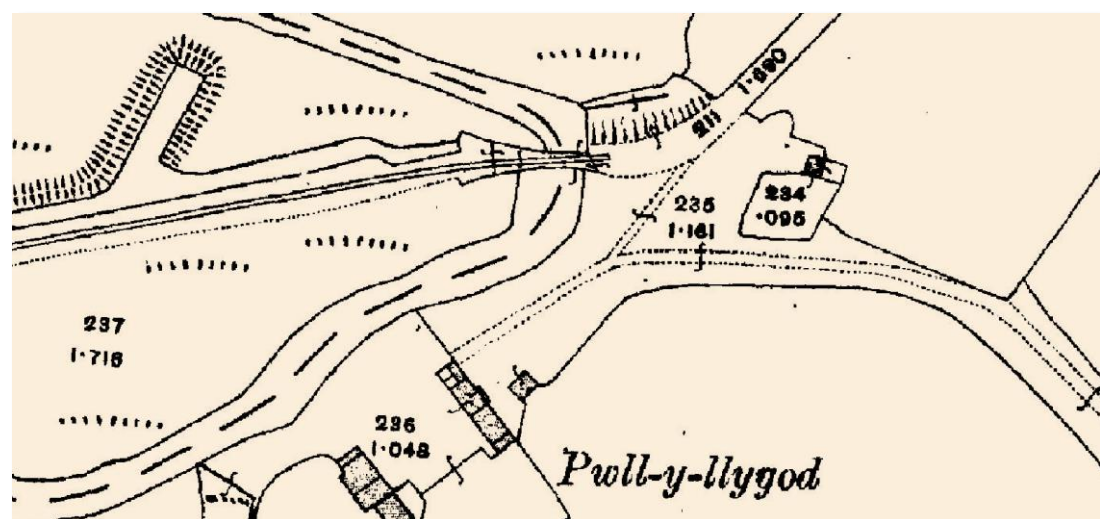


Fig. 4 – Third Edition 25-Inch Ordnance Survey Map of 1915. © Landmark Information Group Ltd 2020.

- 3.3.4 The second edition of 1906 shows the area to be unchanged since the 1880 first edition.
- 3.3.5 The Third Edition of 1915 (**Fig. 4; Fig. 1111**) shows the Carway Railway to be no longer in existence, instead only the Siding remains with track existing to the eastern end of the bridge. All later Ordnance Survey mapping shows the bridge in the same form as 1915.

4 AIMS AND OBJECTIVES

4.1 Historic Buildings Record

- 4.1.1 The aim of the historic buildings record is to produce a lasting account of Pwll-y-Llygod prior to its restoration, renovation and alteration, defined by the CIfA (2014: 3) as:

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

- 4.1.2 Produce a descriptive and photographic record of the building prior to any alterations and adaptations made to the building through the planned programme of works.

- 4.1.3 Supplement the descriptive and photographic record with accurate drawn records, where and as these are required.

- 4.1.4 The results of the investigation and report will aim:

'to seek a better understanding, compile a lasting record, analyse the findings/record, and then disseminate the results.' (CIfA 2014: 3)

4.2 Watching Brief

- 4.2.1 The aims of the Watching Brief, as defined by the CIfA (2008; revision 2011), are:

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

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

- 4.2.2 The aims of the watching brief are to identify and record any potential archaeological remains or deposits during groundworks on site.
- 4.2.3 The watching brief will also seek to identify evidence, or lack therefore of, for the archaeological remains, deposits or finds associated with the medieval development of the town.

4.3 Results

- 4.3.1 The objective of the historic buildings record is to produce a permanent record of the site and to place this within a public domain through deposition with the Regional HER and the National Monuments Record of Wales.

5 METHODOLOGY

5.1 Introduction

5.1.1 All archaeological works have been conducted by a qualified archaeologist, or under the direction of the qualified archaeologist, in accordance with the methodology set out in the *Written Scheme of Investigation* (ArchaeoDomus 2020) and in line with the *Standards and Guidance* from the Chartered Institute for Archaeologists.

5.1.2 At the early phase of the project, the Covid-19 pandemic caused disruptions to the programme and method of work. Strict social distancing and restrictions on non-essential travel required the methodology to be adapted to reflect government policy. To enable work to progress to the monument, it was agreed by the Inspector of Ancient Monuments and project archaeologist (ArchaeoDomus) that works should continue if all aspects of the work was recorded photographically (**Appendix III**), so that a final report might be completed to document the interventions made during conservation.

5.2 Measured Survey and Drawn Record

5.2.1 A Level 3 Historic Buildings Record, in line with Historic England levels (2016), was undertaken to record the bridge and understand its phases of construction.

5.2.2 A photogrammetric survey of the bridge was made prior to commencement of conservation work. The on-site survey produced a set of photographs captured using a DJI Mavic 2 Pro (drone), to enable image capture from all angles. Ground control points were tied into the National Grid using RTK-GPS, which also provided dimensional control and ensured accuracy. The photogrammetric model was then processed in Agisoft Metashape and drawings produced in CAD.

5.2.3 The 3D model can be viewed online in a low-resolution format at: p3d.in/DF32t

5.2.4 As a result of the Covid-19 pandemic, the initial proposals for the project to allow for the survey to be updated from observations and measurements taken on site were not able to be undertaken. Therefore, the information presented after the initial record on 20th March to the completion record on 24th July, was collected photographically by the contractors, David A. Siggery Ltd. This information has been used to highlight areas of rebuilding, reinstatement and areas of original masonry. The post-works photographic record was suitable to produce a photogrammetric model

5.2.5 Drawings were produced at a scale of 1:1 in CAD and supplied at 1:50 at A2 in PDF and DXF formats.

5.2.6 The output from the measured and drawn record are the following items:

- ❖ AD084-1 - Elevations - Pwll-y-Llygod
- ❖ AD084-2 - Plan - Pwll-y-Llygod
- ❖ AD084-3 - Photogram Elevations and Arch - Pwll-y-Llygod
- ❖ AD084-4 - Photogram Plan - Pwll-y-Llygod
- ❖ AD084-5 - Record Photo Locations - Pwll-y-Llygod
- ❖ AD084-6 - Post-work Photogram Elevations - Pwll-y-Llygod
- ❖ AD084-7 - Post-work Photogram Elevations - Phased - Pwll-y-Llygod

5.3 Photographic Recording

5.3.1 A photographic record was made of the bridge, which included:

- ❖ General views of the bridge and its surroundings.
- ❖ All elevations.
- ❖ Record of interventions – maintained by the contractors.

5.3.2 All contractor photographs were taken in line with guidance provided by ArchaeoDomus (**Fig. 16; Appendix VI pg. 102**) and approved by the Inspector of Ancient Monuments, Louise Mees. This enabled work to continue, whilst providing a lasting account of interventions, changes and new findings regarding the monument and its development.

5.3.3 The photographic record has been compiled into an archive, which has been appended to this report (**Appendix III**).

5.3.4 Photographs were taken with a standard Canon 760D 24-megapixel camera with 18-50mm standard or 10-22mm wide angle lens, a DJI Mavic 2 Pro or by mobile phone, with sensors no less than 13 megapixels.

5.3.5 All photographs have been named using the project code, in this instance AD022, which are followed by a reference and number. The reference codes used are as follows:

- ❖ BW – Before works
- ❖ DW – During works
- ❖ PW – Post works
- ❖ TP – Test pit
- ❖ SF – Small Find

5.3.6 All photographs in this report are watermarked with the photograph's name, code and number.

5.4 Archaeological Test Pit

- 5.4.1 The archaeological recording techniques conformed to the best industry standard.
- 5.4.2 All excavations were undertaken by hand. The ground level was reduced to the archaeological horizon or the natural geological substrate, whichever was encountered first. The average depth of which was 13mm below the current ground surface. The generated spoil was visually inspected to maximise the recovery of archaeological artefacts.
- 5.4.3 All excavated sections were cleaned by hand and visually assessed. All deposits were recorded using a single continuous context numbering system pro forma (summarised in Appendix III).
- 5.4.4 Areas of potential archaeological features were manually cleaned to prove their presence or absence.
- 5.4.5 Small finds were collected and bagged in relation to their context. Finds will be recorded and stored with the site archive, unless otherwise specified.
- 5.4.6 A general photographic record was made using a Canon 760D 24-megapixel camera, with an 18-55mm EFS lens or 10-22mm wide angle lens, with ranging rods used where required.
- 5.4.7 The physical archive for the site is held by ArchaeoDomus.

5.5 Reinstatement

- 5.5.1 Once development has been completed, the remaining topsoil will be used to landscape the site, before planting to reduce the risk of erosion by the Gwendraeth Fawr.

5.6 Documentary Research

- 5.6.1 Documentary research was undertaken using readily available resources with additional research aided by map regression and Tithe Map searches. Historic trade directories were used to help establish a timeline of events for the building. Further research was undertaken using unpublished and published sources.

5.7 Reporting

- 5.7.1 This report has been written and compiled by Ross Cook, to the guidance provided by Historic England's *Understanding Historic Buildings; a guide to good practice* (2016) and the CIfA's *Standards*

and guidance for the archaeological investigation and recording of standing buildings or structures (2011).

5.7.2 This report has been written in Microsoft Word 2016 and uses Adobe Garamond Pro as its typeface.

5.8 Health and Safety

5.8.1 All work was carried out in accordance with the Health and Safety at Work Act 1974 and Health and Safety Advice in Archaeology (BAJR 2005).

6 PHOTOGRAMMETRY METHODOLOGY AND OUTPUT

6.1 Introduction

- 6.1.1 The survey of Pwll-y-Llygod Bridge was undertaken on 20th March 2020.
- 6.1.2 The aim of the survey was to capture the monument using controlled 3D capture (laser scanning or photogrammetry), to enable the production of accurate drawn plans for architectural, engineering and archaeological use.

6.2 Method

- 6.2.1 The monument was captured using a UAV (drone) equipped with a 35mm equivalent 20mp camera, with 1” sensor. Manual settings, including ISO, f/stop and exposure were altered during recording to enable the highest quality images for modelling.
- 6.2.2 Ground control points (GCPs) were set around the monument and their position tied into the Ordnance Survey National Grid using RTK-GNSS, consisting of base station and rover with datalogger.
- 6.2.3 All photographs include geographic coordinates collected by the drone’s onboard GPS sensor and stored with the images metadata.
- 6.2.4 All photographs were taken by drone over four consecutive flights. The use of drone enabled the capture of the monument from all angles, including the vaulting of the bridge’s arch.
- 6.2.5 Models were produced using proprietary photogrammetry software, into which 455 photographs of the monument were loaded for processing; Sparse point cloud → Dense point cloud → Mesh → Texture → Orthomosaic.
- 6.2.6 Dimensional control was then applied to the processed model using the coordinates collected from the ground control points. The model was then reprocessed using the new parameters and optimised cameras, which produced a model with overall dimensional error of 1.8mm.
- 6.2.7 High face count meshes were produced to retain the integrity of the original object, and then textured to 25,000 pixels (OBJ).
- 6.2.8 On completion of each model, models were exported to OBJ format for import to CAD for drawing and annotation.
- 6.2.9 The 3D model can be viewed online in a low-resolution format at: p3d.in/DF32t

6.3 Results

AD084 – Pwll-y-Llygod Photogrammetric Model		
Photographs	File Size	Dense Point Cloud
455	643.80 MB	40,280,045
Mesh Face Count	Texture Size (pixels)	Total Error
5,406,208	25,000 x 25,000	1.8mm

6.4 Post-works Photogrammetric Record

6.4.1 The post-works photogrammetric record was not a planned piece of work. However, there was a need to reconcile the pre-works survey with the findings, and alterations, of the conservation and stabilisation work. The post-work photographic record provided a good set of photographs from which a basic model was able to be produced. The model has not been subject to any dimensional control, such as ground control points. The purpose of the orthophotos is to provide a set of photorealistic elevations, to which overlays have been added to phase the masonry and demonstrate the level of rebuilding.

6.4.2 The model was built from 55 photographs, and used the same methodology as outlined in section 6.2.5 above.

7 RECORD OF INTERVENTIONS

7.1 Introduction

- 7.1.1 This section provides a breakdown of events and interventions made during conservation works to Pwll-y-Llygod Bridge, along with the main personnel and companies involved.
- 7.1.2 Physical interventions to the monument took place between 27th April and 24th July 2020.

7.2 Event Timeline

- ❖ *13th March 2019:* Initial site meeting.
- ❖ *22nd-24th January 2020:* Vegetation clearance.
- ❖ *20th March 2020:* Photogrammetric survey.
- ❖ *24th April 2020:* Project start-up meeting – via Microsoft Teams.
- ❖ *27th-28th April 2020:* Onsite operation commences with site setup.
- ❖ *29th April – 4th May 2020:* Roadway created to river.
- ❖ *5th-6th May 2020:* Temporary bridge installation.
- ❖ *7th May 2020:* Silt boom installation to river.
- ❖ *8th May 2020:* Installation of bund to east side of bridge and damming river.
- ❖ *11th-17th May 2020:* Cintec anchors installed.
- ❖ *12th May 2020:* Damming removed from river.
- ❖ *8th-18th June 2020:* New voussoirs installed with additional Cintec anchors.
- ❖ *19th June – 17th July 2020:* Repair and consolidation of masonry.
- ❖ *17th-24th July 2020:* Landscaping to area around bridge.
- ❖ *24th July 2020:* Completion meeting and test pit to roadway.

7.3 Pre-Works

- 7.3.1 Prior to all works commencing on site, a programme of vegetation clearance was undertaken on 22nd-24th January 2020 to enable a survey and initial record to be made of the bridge.
- 7.3.2 On 20th March 2020, an initial digital metric survey was undertaken to produce a full record of the bridge to provide an archaeological record and measured survey for the architect and engineer. This took the form of a photogrammetric model, from which drawings and orthographic images were taken (**Appendix II**).
- 7.3.3 A completion record was produced to document initial findings and report on the progress of the works (**Appendix VI**).

7.4 Conservation and Stabilisation Works

7.4.1 During the course of conservation and stabilisation works, the contractors maintained a photographic record in line with guidance provided by ArchaeoDomus (**Appendix II**) and agreed by the Inspector of Ancient Monuments, Louise Mees.

7.4.2 Operations commenced on 27th April to prepare the site for interventions to the monument. This laid a roadway from the farm track to the river, near the north-east wingwall, to allow the river to be dammed. This bought stone aggregate to site to form a compact roadway surface.

7.4.3 On 5th-6th May, a temporary bridge was installed, spanning the river to the south of the monument.

7.4.4 Between 7th-8th May, preparations were made to enable access to the lowest portions of the bridge's east abutment. A silt screen was placed down-river, and a dam was created to drain the river.

7.4.5 Between 11th-17th May and 8th-18th June, repairs began to the voussoirs and spandrel to the east abutment. This included the addition of new voussoirs to the east rise of the arch, which were dressed and installed using a simple former, supported by props. To support the arch and stabilise the bridge, 17 Cintec anchors were used to voussoirs as follows (from east to west);

- ❖ 12 type C anchors to 3, 5, 7, 9, 12, 14, 17, 20, 23, 27, 30, 33.

- ❖ 5 type B anchors to 36, 39, 42, 46, 49.

7.4.6 Between 8th June and 17th July, masonry repairs (reinstatement and repointing) were made to the bridge. This includes the following area:

- ❖ Base of east abutment (rebuilt and pointed)

- ❖ Base of west abutment (repointed)

- ❖ North-east spandrel (rebuilt and pointed)

- ❖ North-west spandrel and wing wall (rebuilt and pointed)

- ❖ South-west wing wall and spandrel (repair and repointed)

- ❖ South-east wing wall and spandrel (repair and repointed)

- ❖ South-west buttresses (repair and repointed)

7.4.7 The 17th to 24th July completed the works by landscaping the area surrounding the bridge and removing the temporary roadway.

7.4.8 A completion meeting was held on site on 24th July. After the meeting, a single test pit was excavated to the roadway to establish the existence, or lack therefore of, any sleepers or trackway.

7.5 Post-Works Record

- 7.5.1 On completion of the project the bridge was recorded photographically.
- 7.5.2 This report combines the information recorded through all elements of the project and seeks to collate the records maintained by the contractors.

7.6 Personnel

7.6.1 *Architect*

Mike Garner

Garner Southall Partnership, Ashby House, Middleton Street, Llandrindod Wells, LD1 5ET

7.6.2 *Surveyor*

Carl Morgan

Carl Morgan Building Surveyor – www.carlmorgan.co.uk

7.6.3 *Engineer*

Bob Williams

R V Williams Associates, Ashby House, Middleton Street, Llandrindod Wells, LD1 5ET

7.6.4 *Contractor*

David Siggery and Selwyn Jones

David A Siggery Ltd, Ty Gwyn, Llangynog, Carmarthen, Carmarthenshire, SA33 5AJ

8 HISTORIC BUILDINGS RECORD

8.1 Introduction

- 8.1.1 The historic buildings record was undertaken on 20th March 2020 and concluded on 5th July 2020, and comprised of a visual investigation, a measured survey and a photographic record.
- 8.1.2 The bridge spans a curve on the Gwendraeth-fach, connecting the coalmines of the Gwendraeth Valley to the newly constructed quayside at Ythyn Frenig.
- 8.1.3 The bridge has not carried locomotives since 1913, when the line was terminated at the eastern end of Carway siding. Since 1913, the bridge has carried farm traffic only.
- 8.1.4 The scope of the historic buildings record is to provide a written, drawn and photographic account of the buildings to a Level 3 Record as specified by Historic England (2016), prior to its conservation.
- 8.1.5 The drawn record is available in **Appendix II** and the photographic in **Appendix III**.

8.2 Description

- 8.2.1 Pwll-y-Llygod bridge (**Plates 7-27**) is simple in form, spanning the Gwendraeth Fawr in a single span, projecting from abutments to the east and west of the river.
- 8.2.2 Wing walls (**Plate 25**) run away to the east and west at gentle angles from the bridge, and in doing so retain the ground on the approach to the bridge from the east and from the railway embankment (Carway Siding) (**Plate 26**) to the west.
- 8.2.3 To the south-west, two small buttresses (**Plate 17**) support the wing wall, where the bridge begins to merge with the railway embankment.
- 8.2.4 The bridge is constructed of roughly shaped sandstone blocks, which are roughly coursed with risers spanning several courses.
- 8.2.5 The segmental vault is finished to the north and south elevation by large, hammer-dressed limestone voussoirs (**Plates 10-11, 20-21**), neatly formed with narrow mortar joints between. The lower portion of the north-east arch is supported by cement bags and an acrow prop (**Plate 10**).
- 8.2.6 Stonework is bonded in a lime mortar with small to medium aggregate of angular, subangular and round stone, with frequent elements of unslaked limestone.

8.2.7 The roadway (**Plates 5-6**) is covered in a layer of humus. This overlays the fill material of duff (coal dust), iron slag and mixed stone aggregate.

8.2.8 Trees, shrubs and vegetation grow from both elevations and the roadway of the bridge.

8.3 Damage

8.3.1 Since *circa* 2000, the north elevation has seen several areas become damaged and collapse as a result of flooding, erosion and vegetation growth. The cumulative effect of this caused the collapse of lower voussoirs and spandrel of the eastern side of the north arch (**Plates 10 & 56**). Shortly after the collapse, bags of sand and cement, along with an acrow prop, were used to support the arch and stop a total collapse of the bridge. This remained *in situ* until removal in 2020.

8.3.2 In 2012-2013, the culmination of vegetation clearance followed by severe flooding, saw the partial collapse of the north-west wing wall (**Plate 12**). This exposed the core material of the bridge and embankment.

8.3.3 General vegetation growth, including several large shrubs and trees, caused movement within the deck, which subsequently led to the movement of the upper parts of the walls leaning outwards.

8.3.4 Frequent winter and spring floods over the past decade have caused large amounts of scouring to the river bank, exposing the abutment and wing walls. This increase has also resulted in greater mortar wash.

9 BUILDING DATING AND ANALYSIS

9.1 Introduction

9.1.1 This section will primarily be concerned with the dating and development of Pwll-y-Llygod bridge, by drawing together the information gathered during the historic buildings record.

9.1.2 During the course of fieldwork, it was apparent that there are two different phases of development at Pwll-y-Llygod. These can be broken down into:

1768-70: Construction of the first bridge at Pwll-y-Llygod.

Mid-19th Century: Bridge rebuilt, using the earlier abutments as a base.

9.1.3 Fig. 6 below, shows the condition of the bridge, with full plans in **Appendix II**.

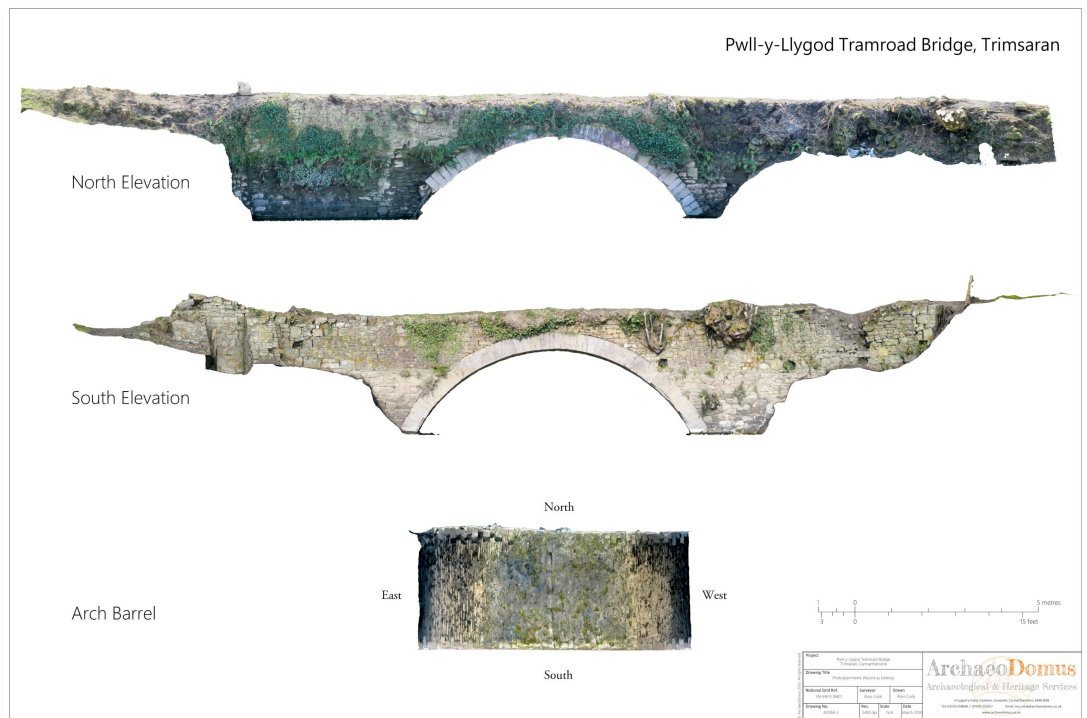


Fig. 6 – Photogrammetric orthoplanes of Pwll-y-Llygod.

9.2 Phase I - 1768-70

9.2.1 This first phase at Pwll-y-Llygod is intrinsically tied into the development of the Kymer's Canal, Ythyn Frenig Quay and the tram network from the Gwendraeth coalfields, and the need to transport coal out of the local area for profit. This was driven by the gathering pace of the Industrial Revolution at this time.

- 9.2.2 From historic sources we know that a bridge was constructed, or at least commissioned, at Pwll-y-Llygod within the immediate year after the completion of the canal, and have no reason to doubt that this is the site in question.
- 9.2.3 Evidence for an earlier bridge at Pwll-y-Llygod was confirmed once conservation work had begun, with the remaining vegetation removed and river culverted.
- 9.2.4 This earlier bridge was of a single span arch to abutments in about the same position as those seen today. The evidence, given below, shows that the original bridge sprung from the east abutment on a different alignment, rising moderately more towards the north-west.
- 9.2.5 Most significantly, the damming of the river exposed the lowest level of the abutments. To the east this clearly showed the earlier alignment of the abutment, demonstrating the rise of the vault on a slightly different alignment, and extending slightly further into the river from the east bank (**Plates 41-42**). To the west, the vault rises on the same alignment as the earlier. However, at the course below the level of the springer, the abutment splays out at a *circa* 45° angle into a possible earlier wing wall (**Plate 43**), or at least a foundation.
- 9.2.6 At the very lowest level of the east and west abutments, beneath the waterline, the masonry suggests that the northern side of the bridge may originally have been splayed wing walls to both east and west abutments (**Plates 43 & 51**).
- 9.2.7 Clearance of ivy to the south-east abutment and wing wall shows a distinct change in masonry, with a staggered joint in the masonry where this meets the spandrel (**Plates 80-83**). The lower masonry uses less regularly shaped stone than the later rebuild over the top of this. What this also makes clear is that the later rebuild retains portions of the masonry belonging to this phase, with the later works simply making good and repairing the existing structure.
- 9.2.8 Clearance of ivy to the north-east spandrel and wing wall demonstrated this side of the bridge retained a portion of wing wall to the very east end, made clear by the change in angle of the wall and a large and open masonry joint (**Plate 95**).
- 9.2.9 Clearance of ivy to the south-west uncovered a straight joint between the lower spandrel and wing wall (**Plate 108**). A single rectangular block was used to key the later spandrel (east) into the existing wing wall (west). This lower portion is clearly of reused masonry, appearing very different in colour and finish to that of phase II coursed over this.

9.3 Phase II - Mid-19th Century

- 9.3.1 The evidence for this second phase of development has been discussed in the section 8.2 above, which details the various areas that help to demonstrate the rebuilding of the bridge.

- 9.3.2 During this phase, the bridge is rebuilt, though for what reason it is not entirely clear. Damage from over 70 years of coal freight may have structurally weakened the original bridge, or it may not have been seen as suitable for the upgrade to steam power. Whatever the reason, a new bridge was undoubtedly commissioned and built.
- 9.3.3 Clearance of ivy and vegetation to the roadway and south elevation revealed regularly spaced openings in the top course of the masonry. The openings measure approximately 200mm/10inches wide by 150mm/6inches deep, which is also the average width and depth of a railway sleeper. Whilst the reason for these is not completely clear, they may have served to carry a cantilevered walkway off the side of the bridge, supported by the railway sleepers carrying the tracks.
- 9.3.4 When dismantling masonry, the fill material of the bridge was exposed. This demonstrated the fill consisted of a mix of duff (coal dust) along with stone and iron slag, and sits comfortably with a site redeveloped within an industrial transportation network.

10 FIELDWORK RESULTS

10.1 Introduction

- 10.1.1 As a result of the Covid-19 pandemic, starting in early 2020, the programme of works was altered to enable the documentation of works on-site by the contractor, rather than being monitored by the archaeologist. This ensured strict social distancing and adherence to travel restrictions could be met.
- 10.1.2 Guidance was provided by ArchaeoDomus and the Inspector of Ancient Monuments, Louise Mees, to ensure a photographic record is made during the progress of work on site and for the recovery and safe storage of any small finds.
- 10.1.3 The photographic record, maintained by the contractor, has been included in this report. As such, this method allowed the project to proceed, whilst being able to communicate development and new information to ArchaeoDomus and the Inspector of Ancient Monuments.
- 10.1.4 Due to changes in the project plan, the reduction and grading of the roadway was no longer deemed suitable. Instead, a gravel surface was to be laid to the roadway to protect the earlier surfacing beneath the layer of humus.
- 10.1.5 As a result, it was agreed that a single test pit (TP01) should be dug to determine the existence of sleepers and roadway surface.
- 10.1.6 In this section the results of the Watching Brief are presented. The extent of the interventions are shown in **Appendix II, Fig. 17** and **Appendix III**.
- 10.1.7 Excavation of the test pit was undertaken by a qualified archaeologist.

10.2 Stratigraphy

- 10.2.1 The stratigraphic sequence for the site is presented below.
- 10.2.2 The sequence represents the fill of the bridge with industrial waste (coal dust, slag and stone), with a surface of compact coal dust, on which the sleepers would have been bedded.

Test Pit 1 (TP01)				
Context	Type	Depth	Description	Period
101	Deposit	0.00-0.11m	Humus. Small to medium subangular stone inclusions. Coal dust and slag inclusions. Overlies 102.	Natural

102	Deposit	0.11-0.12m	Coal dust (duff) layer. Dark black. Overlies 103 .	19 th -20 th Century
103	Deposit	0.12-0.35m	Stoney hardcore layer. Small to large angular quarry stone. Slag and coal inclusions. Iron oxide staining. Contains 104 .	19 th Century
104	Deposit	0.30-0.35m	Sandy clay patch. Medium to large subangular stone inclusions. Oxide staining. Lime mortar inclusions. Slag and coal dust.	19 th Century

10.3 Test Pit 1 (TP01)

10.3.1 Test Pit 1 (TP01) was excavated on 24th July 2020, in agreement with the Inspector of Ancient Monuments.

10.3.2 The test pit was laid out to overlap three of the openings as described in 8.3.3, with a trench measuring 1.5m x 0.75m. However, this was reduced to 0.75m x 0.50m as a result of the highly compact material encountered, now spanning two of the openings.

10.3.3 The test pit revealed that there is no survival of sleepers or any materials associated with the railway track.

10.3.4 A simple stratigraphic sequence was revealed (**10.2**), which demonstrated a highly compacted surface and a fill of duff (coal dust), consolidated with larger waste materials, such as slag and stone waste.

10.3.5 *No further archaeological materials or deposits were identified.*

10.4 Small Finds

10.4.1 A small finds assemblage was recovered during the conservation works and from Test Pit 1 (TP01) excavated to the bridge's roadway. These finds have been rapidly assessed and recorded by ArchaeoDomus and presented in the table below:

Context	Material	No.	Wt (g.)	Comments
UNSTRAT	Iron	1	-	Iron rail cut spike recovered during conservation works. Unstratified. Post-1832. FN001 .
UNSTRAT	Iron	1	-	Iron rail dog spike recovered during conservation works. Unstratified. Post-1850. FN002 .
103	Slag	3	-	Crushed iron slag, recovered from 103 .

10.4.2 Given the nature of the finds, no further work has been undertaken.

10.4.3 *No further archaeological finds were recovered.*

10.5 Environmental

10.5.1 *No environmental deposits for sampling were identified.*

11 DISCUSSION

- 11.1.1 From the investigations on site, the evidence demonstrates Pwll-y-Llygod is a bridge of two significant phases of development. The first of which comes with the construction of the Kymer's Canal in the late 1760s, to bring coal from the Gwendraeth coal field to Carway Siding, for its transportation by canal to the quay at Ythyn Frenig. The second comes in the mid-19th century, likely replacing the bridge after some 70 years of heavy industrial use.
- 11.1.2 The construction of the bridge, and that of the canal and quayside, come at a time of intense industrial development in Wales in the second half of the 18th century, which sees it become the powerhouse of the Industrial Revolution and the world's first industrial nation.
- 11.1.3 The rebuilt bridge fits into a fairly standard form, with little to determine an exact date of construction from its architectural detail. However, the bridge is remarkably similar to that seen carrying the Old Castle Collier Road over the New Cut Canal in Llanelli (NPRN 411121) (Fig. 7), which was constructed in 1839-40. This bridge was built in a single phase of construction and, whilst having architectural differences to Pwll-y-Llygod as a result of its location, the voussoirs, form of the arch and stone coursing, strike a strong resemblance. One clear difference, is that the Old Castle Collier Road Bridge is finished with a string and parapet.



Fig. 7 – New Cut Canal Bridge, Llanelli.

- 11.1.4 Further evidence for the later rebuild was provided by the fill material of the bridge being a mix of duff (coal dust) along with stone and iron slag. The use of this material initially brought the date of construction into question, as a new bridge on a green site is unlikely to have ready access to the large amounts of such industrial waste material. The material is more in keeping with a site and industrial area that had already seen sustained production over a number of years, with likely deposits of coal dust being readily accessible after over 70 years of production and transportation.
- 11.1.5 The inclusion of slag is of particular interest as it helps to give some indication for the date, or at least a possible period of construction, if considered where this material originated. An earlier ironworks in the Gwendraeth Valley was in operation from the mid-17th century until 1763 (Riden, 1993: 29). However, given that it ceased operations before the original bridge was

constructed, it seems unlikely to be the source. More importantly to the second phase bridge is a new ironworks built at Trimsaran. This is first recorded with one furnace and no output in 1843 under the name Walneg, then again in 1847 with three built and two in blast as Walvey & Co (Riden *et al.*, 1995: 17). Though it is not possible to establish the origin with any absolute certainty, the ironworks at Trimsaran is likely to be the source of the slag used in the fill. Interestingly, the name of this ironworks is also recorded as ‘Coelbrook’, with the Afon Morlais running by the site, along which are located a number of collieries. If we take this as the likely source for the slag, we get a *terminus post quem* of 1847.

- 11.1.6 With the rebuild, evenly spaced openings the correct size to take a sleeper were built into the top of the south elevation and are omitted from the north. The reason for the inclusion of these openings is not entirely clear and may have been to simply allow the placement of railway sleepers to the roadway of the bridge, or may have allowed for a cantilevered walkway, supported by the sleepers and weight of the tracks.
- 11.1.7 The reason for the rebuild is not entirely clear and can only be speculative. It is possible that over 70 years of heavy industrial use, in combination with seasonal flooding, caused the bridge to weaken or even partially collapse as we have seen in the past 30 years. A second possibility was to better accommodate locomotives; the alignment of Phase I east abutment suggests that the span may have curved slightly over the river. Any repeated heavy loads being carried to Carway Siding would cause outward pressure and stress, ultimately leading to damage and failure.
- 11.1.8 The iron rail cut and dog spikes (Fig. 8), recovered during the works, do not serve to date the bridge directly and provide little supporting evidence for the date of the bridges rebuilding. However, we can at least be sure that the rail spikes demonstrate the railway track was that of the flanged tee rail type, secured to sleepers with rail spikes (or crampon), which was invented in the United States in 1832 by Robert Livingstone Stevens. The cut spike is the earlier of the two forms, though it has a long history, being used into the early-20th century. The dog spike emerges around 1850, the two lugs on the side of the head to make removal easier, which give the impression of a dog’s head and hence the name.



Fig. 8 – Railway spikes. Cut (top; FN001) and dog (bottom; FN002).

- 11.1.9 Importantly, we must now consider what this means to the significance of Pwll-y-Llygod, as its former identification as the oldest rail bridge in Wales, and second oldest in the world, has seeming been turned on its head.
- 11.1.10 The original bridge at Pwll-y-Llygod was certainly built around 1768-70, but as a result of damage or introduction of locomotives, it was rebuilt around or after 1847. Despite this rebuild, the bridge still retains elements in the wing walls and abutments of the original bridge. Importantly, the bridge, both original and later, fulfilled a purpose by enabling coal to be moved efficiently from the mines of the Gwendraeth Valley to the quayside at Ythyn Frenig, via an integrated transport network of tramway, canal and seaways. The construction of this integrated network, one of the earliest in Wales, linked the valley into a trading network which took coal from the inland mines to Ireland, across Wales, the West of England and even to the continent. The development typifies the pioneering nature of the Industrial Revolution in Wales from the end of the 18th century and well into the 19th, with resources being transported and commodified on a scale larger than ever seen before.

12 ARCHIVING

- 12.1 The results of the Historic Buildings Record and Watching Brief are this written report, interpreted survey, and photographic archive. This will be held by and will be deposited with the regional HER and the NMR. A PDF copy of the report will be made available from www.archaeodomus.co.uk.

13 SOURCES

13.1 Written Sources

- 13.1.1 **Historic England.** 2016, *Understanding historic Buildings; A guide to good practice.*
- 13.1.2 **CIFA,** 2014, *Standards and guidance for the archaeological investigation and recording of standing buildings or structures.*
- 13.1.3 **CIFA,** 2014, *Standards and guidance for an archaeological watching brief.*
- 13.1.4 **Welsh Government,** 2017, *Planning Policy Wales; Technical Advice Note 24: The Historic Environment.* Crown Copyright.
- 13.1.5 **Morris, W. H.** 1970. *The Canals of the Gwendraeth Valley (Part 1)* in Ed. The Carmarthen Antiquary, Vol. VI. Carmarthen, Carmarthenshire.
- 13.1.6 **Morris, W. H.** 1972. *The Canals of the Gwendraeth Valley (Part 2)* in Ed. The Carmarthen Antiquary, Vol. VIII. Carmarthen, Carmarthenshire.
- 13.1.7 **Cullen, P.** 2010. *Gwendraeth Valley Coal Mines.* Llanelli Regional Libraries, Carmarthenshire.
- 13.1.8 **Bowen R. E.** 2001, *Burry Port and Gwendraeth Valley Railway and its Antecedent Canals, Volume 1: The Canals,* Oakwood Press, Usk.
- 13.1.9 **Miller, R. W.** 2009. *Burry Port and Gwendraeth Valley Railway and its Antecedent Canals, Volume 2: The Railway and Dock,* Oakwood Press, Usk.
- 13.1.10 **Riden, P. & Owen, J. G.** 1995, *British Blast Furnace Statistics 1790-1980.* Merton Priory Press Ltd, Cardiff.

13.1.11 **Riden, P.** 1993, *A Gazetteer of Charcoal-fired Blas Furnaces in Great Britain in use since 1660.* Merton Priory Press Ltd, Cardiff.

13.2 **Online Sources**

13.2.1 **British Geological Survey**

Accessed: April 2018

www.bsg.ac.uk

13.2.2 **UK Soil Observatory**

Accessed: April 2018

www.ukso.org.uk

13.3 **Maps**

13.3.1 1880 OS 25 Inch to One Mile Map First Edition – Carmarthenshire

13.3.2 1915 OS 25 Inch to One Mile Map Second Edition – Carmarthenshire

APPENDIX I

Scheduled Monument Location

and

Historic Mapping



**Pwll-y-Llygod Tramroad Bridge,
Trimsaran, Carmarthenshire**

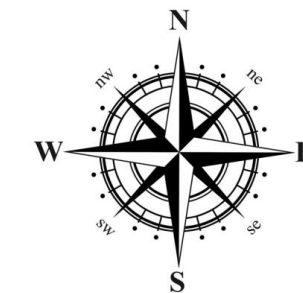
Scheduled Area - CM261

NGR: NGR SN 44613 06811


Drawn: Ross Cook

Date: August 2020

Project No.: AD084



Legend

 Scheduled Monument

Contains Bing Mapping Aerial Imaging. All rights reserved, 2020.

Fig. 9 – Location of Scheduled Monument.

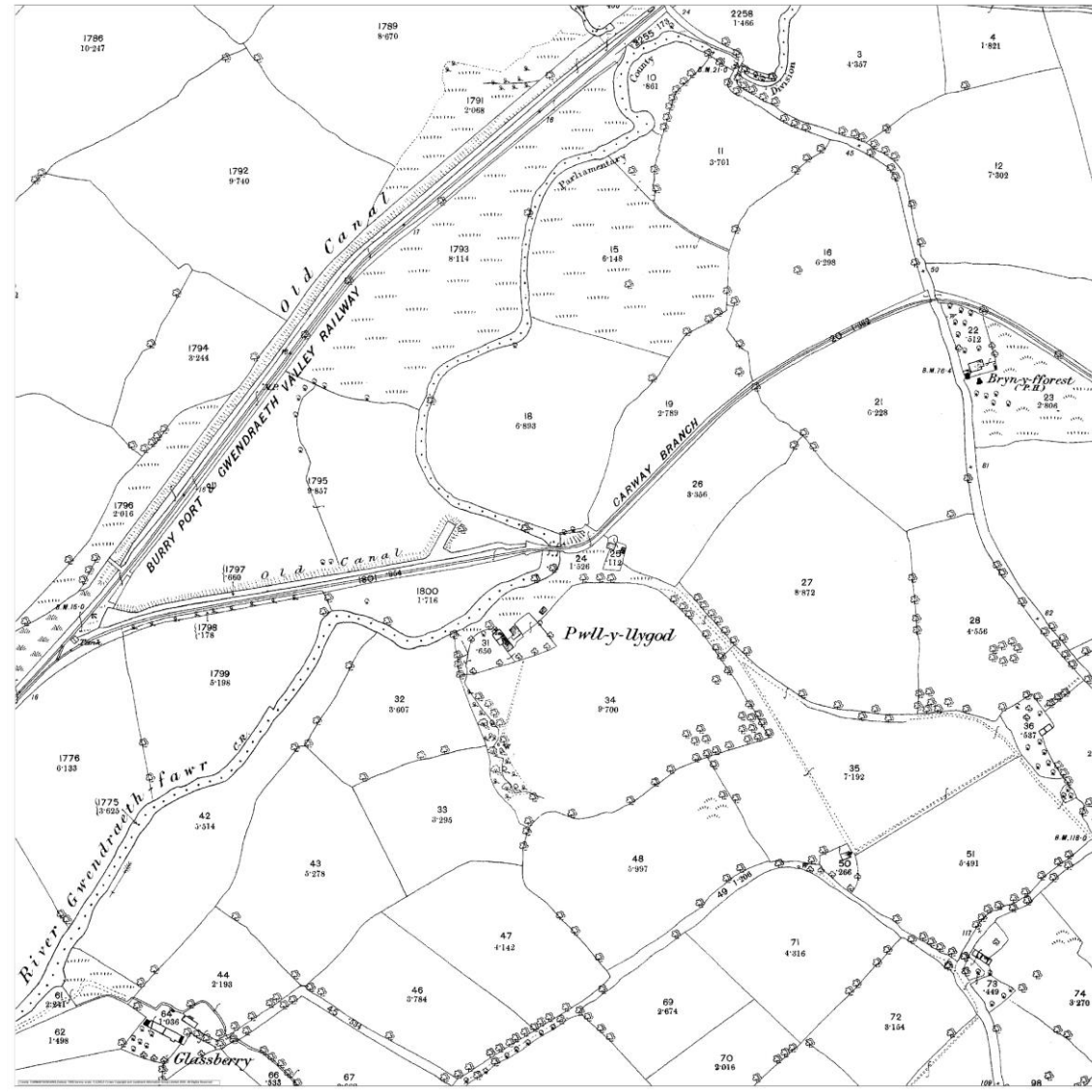


Fig. 10 – 1880 25-inch to One Mile, OS.
 © Landmark Information Group Limited 2020.

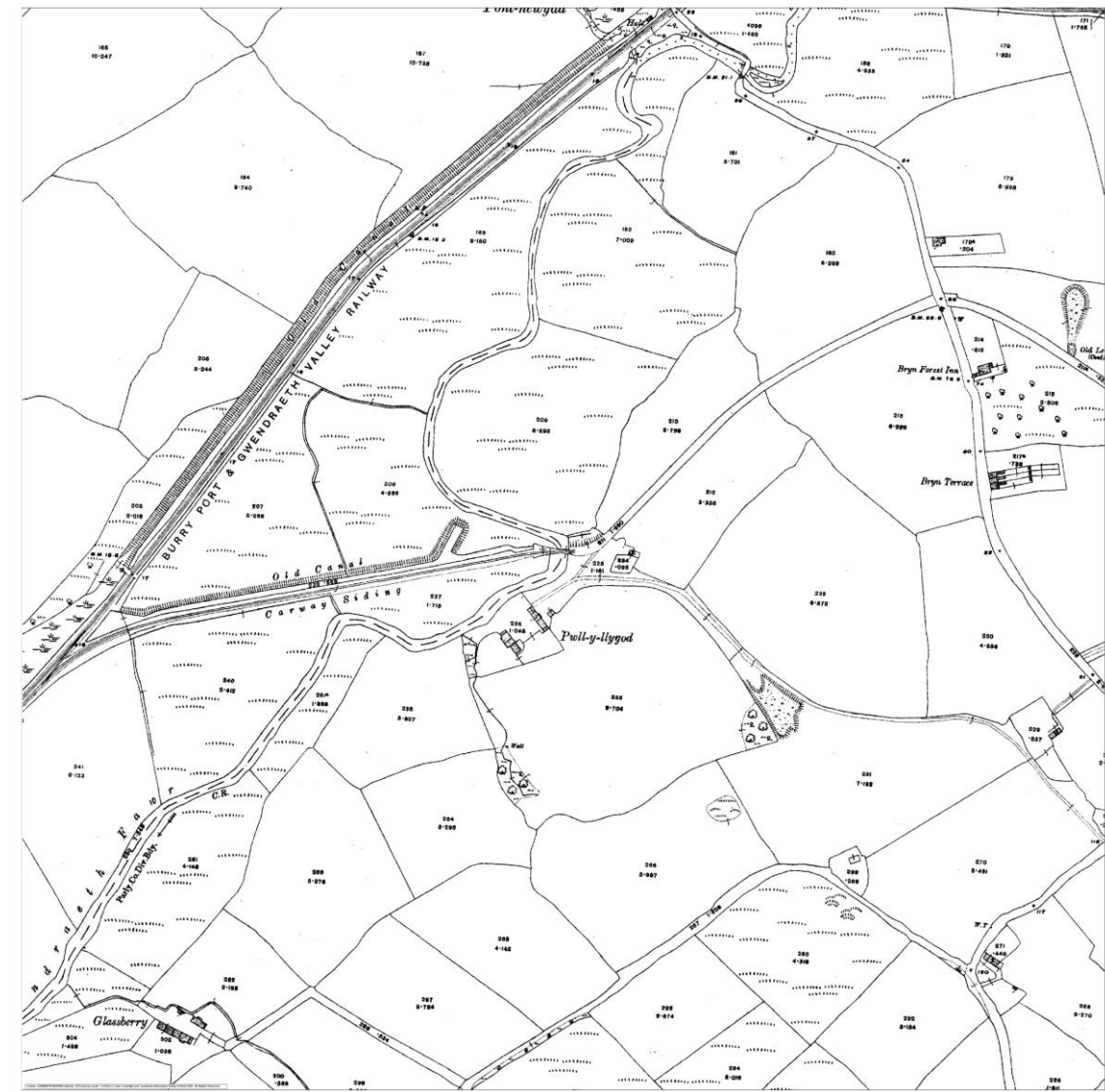


Fig. 11 – 1915 25-inch to One Mile, OS.
 © Landmark Information Group Limited 2020.

APPENDIX II

Drawn Record

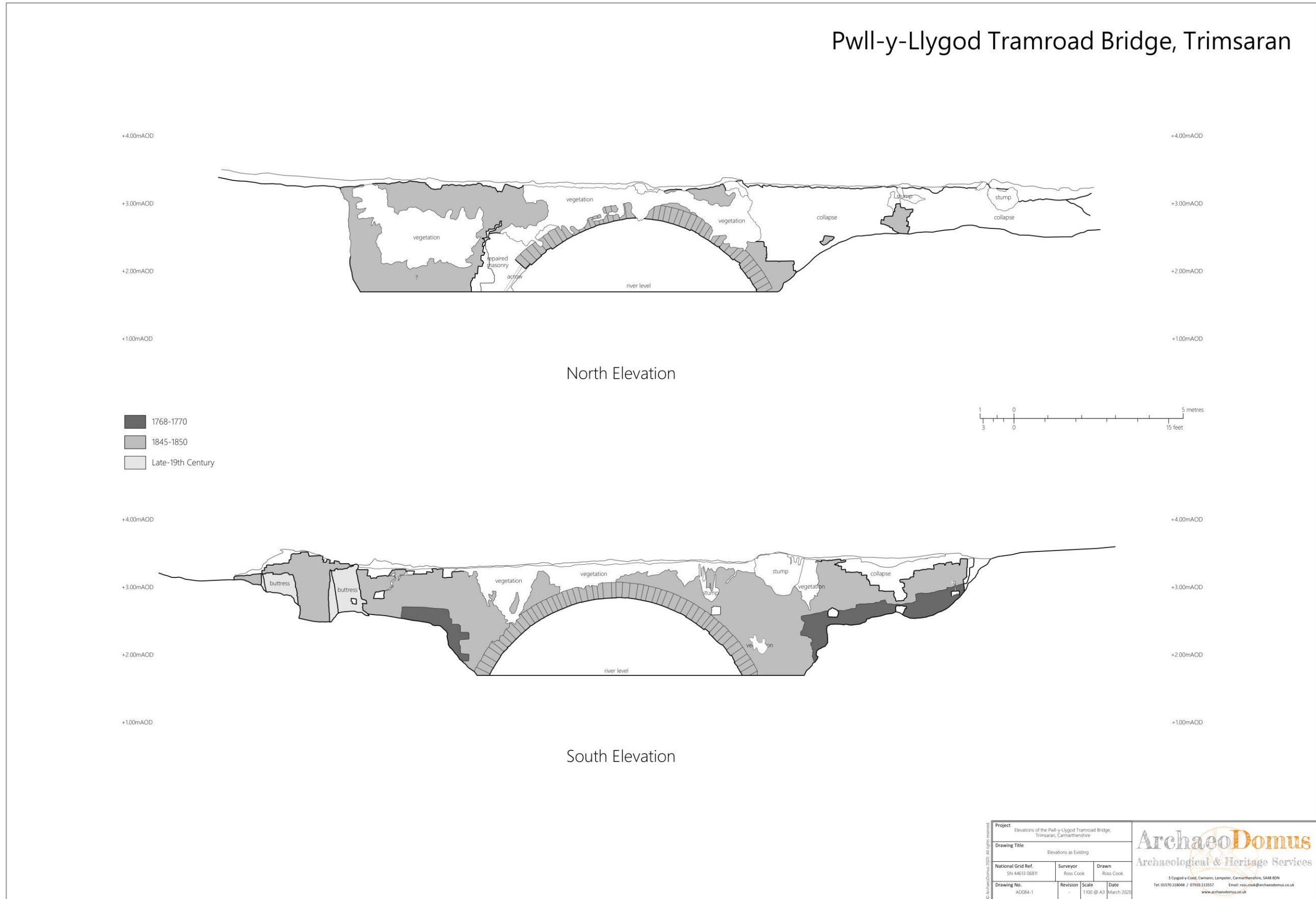


Fig. 12 – Elevations as Existing, Pwll-y-Llygod Tramroad Bridge.

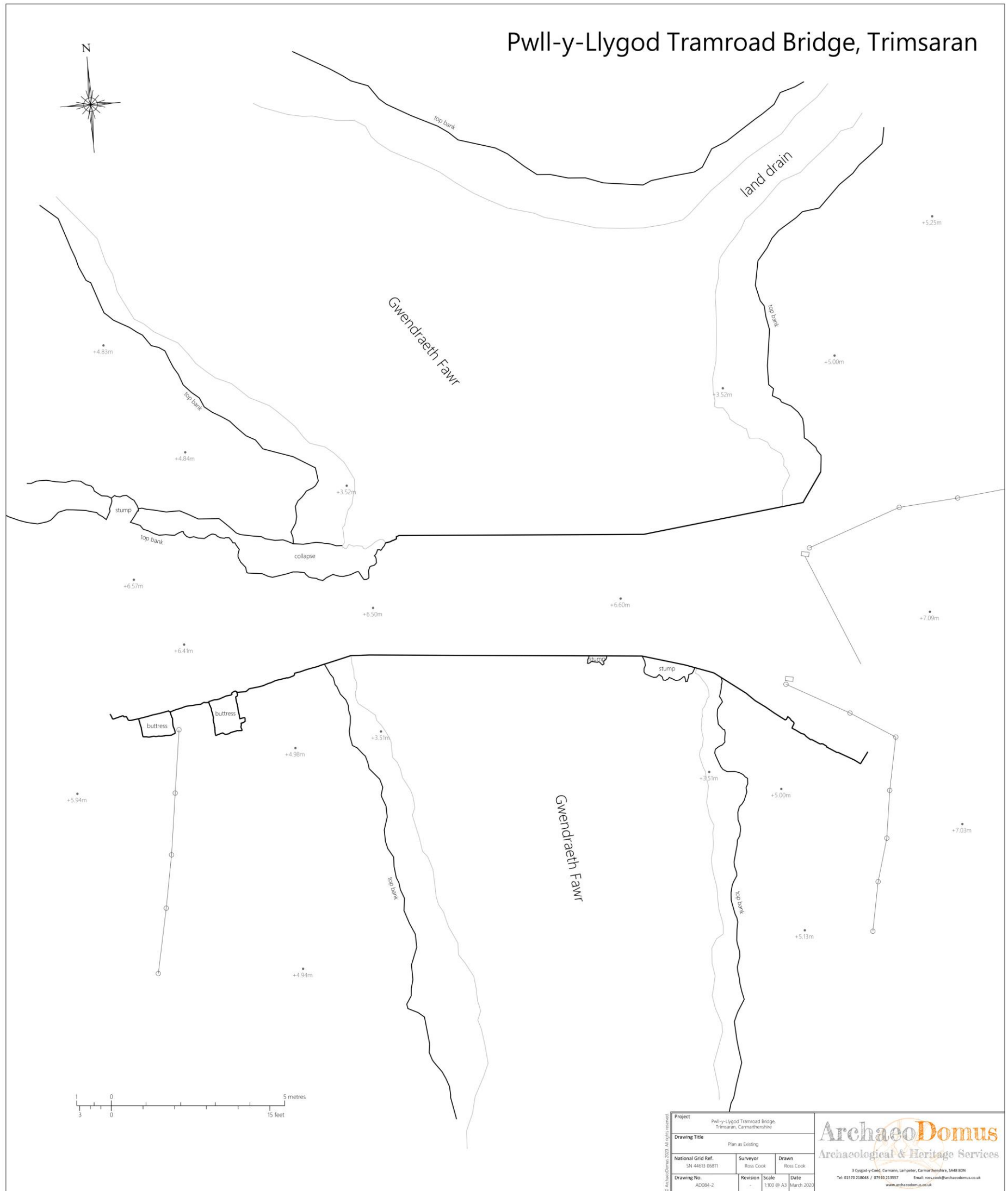


Fig. 13 – Plan, Pwll-y-Llygod Tramroad Bridge.

Pwll-y-Llygod Tramroad Bridge, Trimsaran

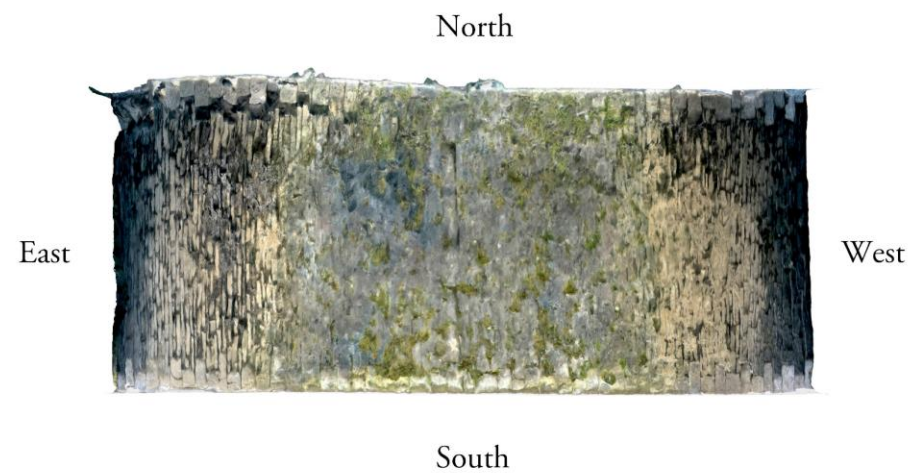
North Elevation



South Elevation



Arch Barrel



Project		Pwll-y-Llygod Tramroad Bridge, Trimsaran, Carmarthenshire	
Drawing Title			
Photogrammetric Record as Existing			
National Grid Ref.	Surveyor	Drawn	
SN 44613 06811	Ross Cook	Ross Cook	
Drawing No.	Res.	Scale	Date
AD084-3	2400 dpi	N/A	March 2020

ArchaeoDomus
Archaeological & Heritage Services

3 Crigol-y-Coed, Cerran, Lampeter, Carmarthenshire, SA48 8DN
Tel: 01570 218048 / 07950 213537 Email: ross.cook@archaeodomus.co.uk
www.archaeodomus.co.uk

Fig. 14 – Photogrammetric orthoplane as existing, Pwll-y-Llygod Tramroad Bridge.



Fig. 15 – Photogrammetric orthophoto as existing, Pwll-y-Llygod Tramroad Bridge.

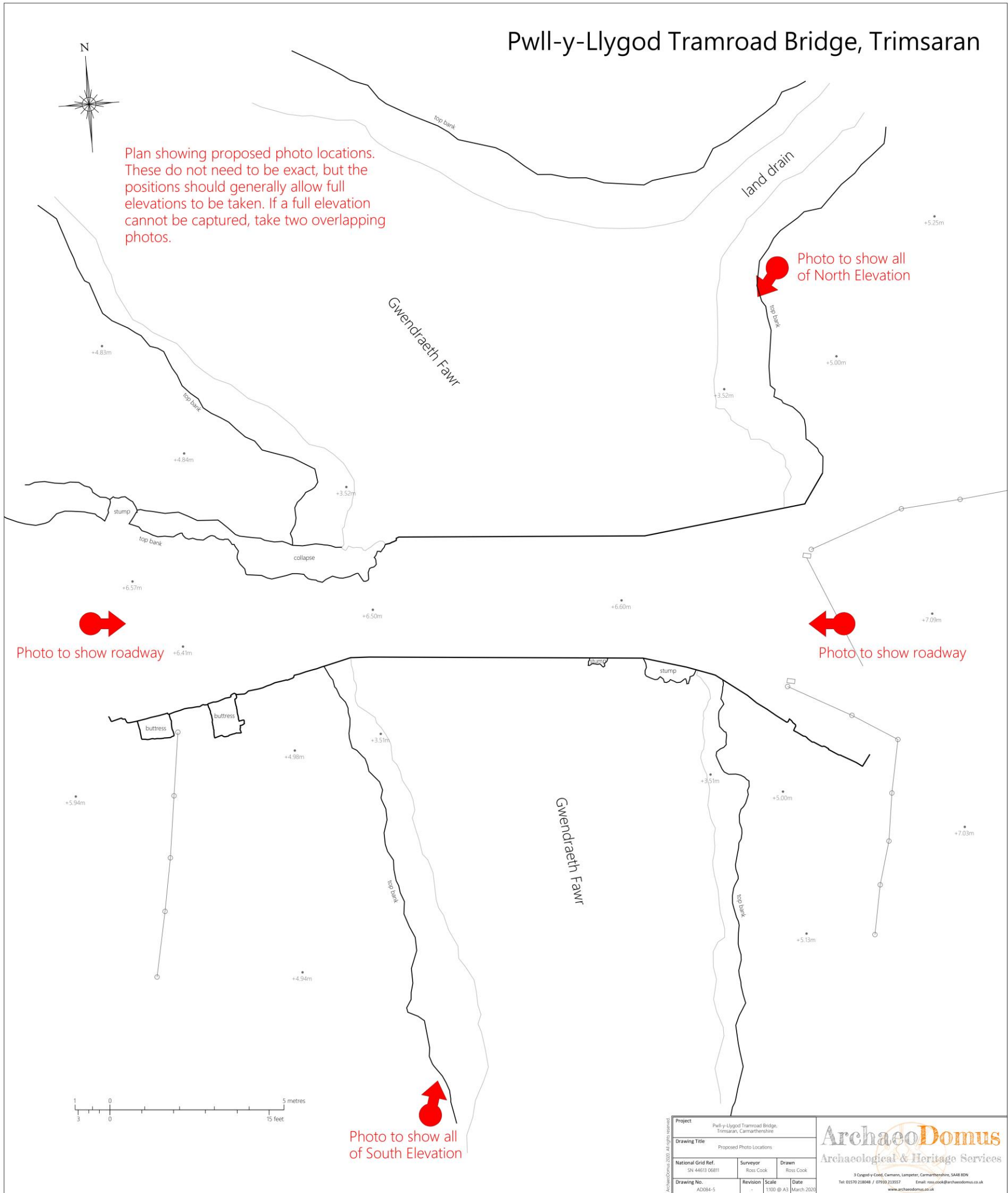


Fig. 16 – Proposed photo locations to contractors.

Pwll-y-Llygod Tramroad Bridge, Trimsaran



North Elevation



South Elevation


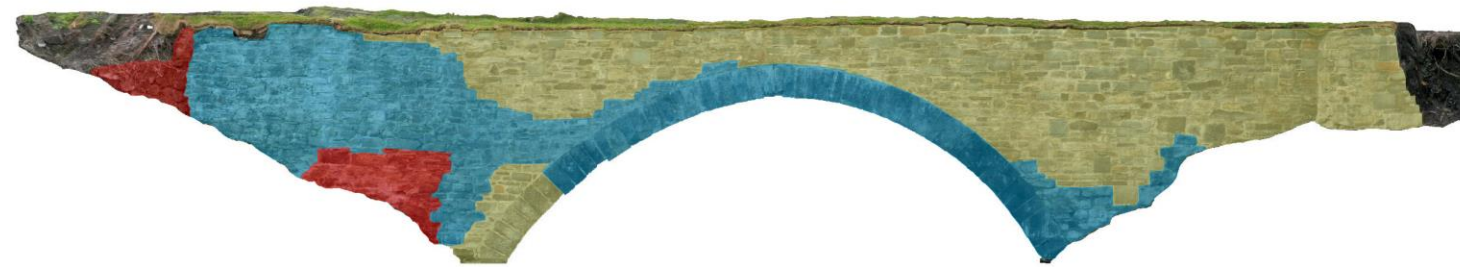
Project Conservation and Stabilisation of Pwll-y-Llygod Tramroad Bridge, Trimsaran, Carmarthenshire (CM26)				 Archaeological & Heritage Services	
National Grid Ref. SN 44613 06811	Surveyor Ross Cook	Drawn Ross Cook		3 Cysgod-y-Coed, Cwmann, Lampeter, Carmarthenshire, SA48 8DN Tel: 01570 218048 / 07910 213557 Email: ross.cook@archaeodomus.co.uk www.archaeodomus.co.uk	
Drawing No. AD084-7	Revision -	Scale 1:100 @ A3	Date Sept. 2019		

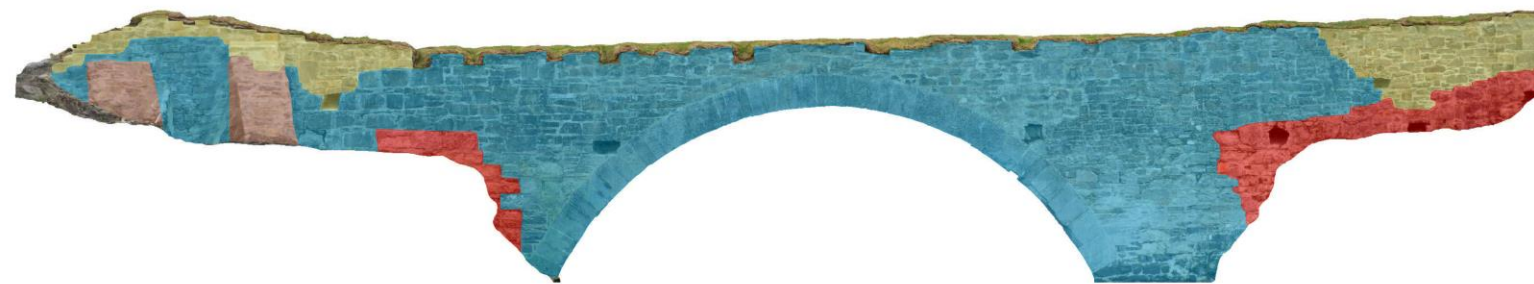
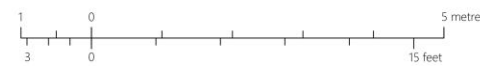
Fig. 17 – Post-work photogrammetric orthoplanes, Pwll-y-Llygod Tramroad Bridge.

Pwll-y-Llygod Tramroad Bridge, Trimsaran



North Elevation

- Phase I - 1769-70
- Phase II - 1845-50
- Phase III - Late 19th Century
- Rebuilt - 2020



South Elevation

Project Conservation and Stabilisation of Pwll-y-Llygod Tramroad Bridge, Trimsaran, Carmarthenshire (CM261)			
Drawing Title Post-work Elevations - Phasing Plan			
National Grid Ref. SN 44613 06811	Surveyor Ross Cook	Drawn Ross Cook	
Drawing No. AD084-7	Revision -	Scale 1:100 @ A3	Date Sept. 2019

ArchaeoDomus
Archaeological & Heritage Services

3 Cysgod-y-Coed, Cwmann, Lampeter, Carmarthenshire, SA48 8DN
Tel: 01570 218048 / 07910 213557 Email: ross.cook@archaeodomus.co.uk
www.archaeodomus.co.uk

Fig. 18 – Phased post-work photogrammetric orthoplanes, Pwll-y-Llygod Tramroad Bridge.

APPENDIX III

Other Plans And Specifications

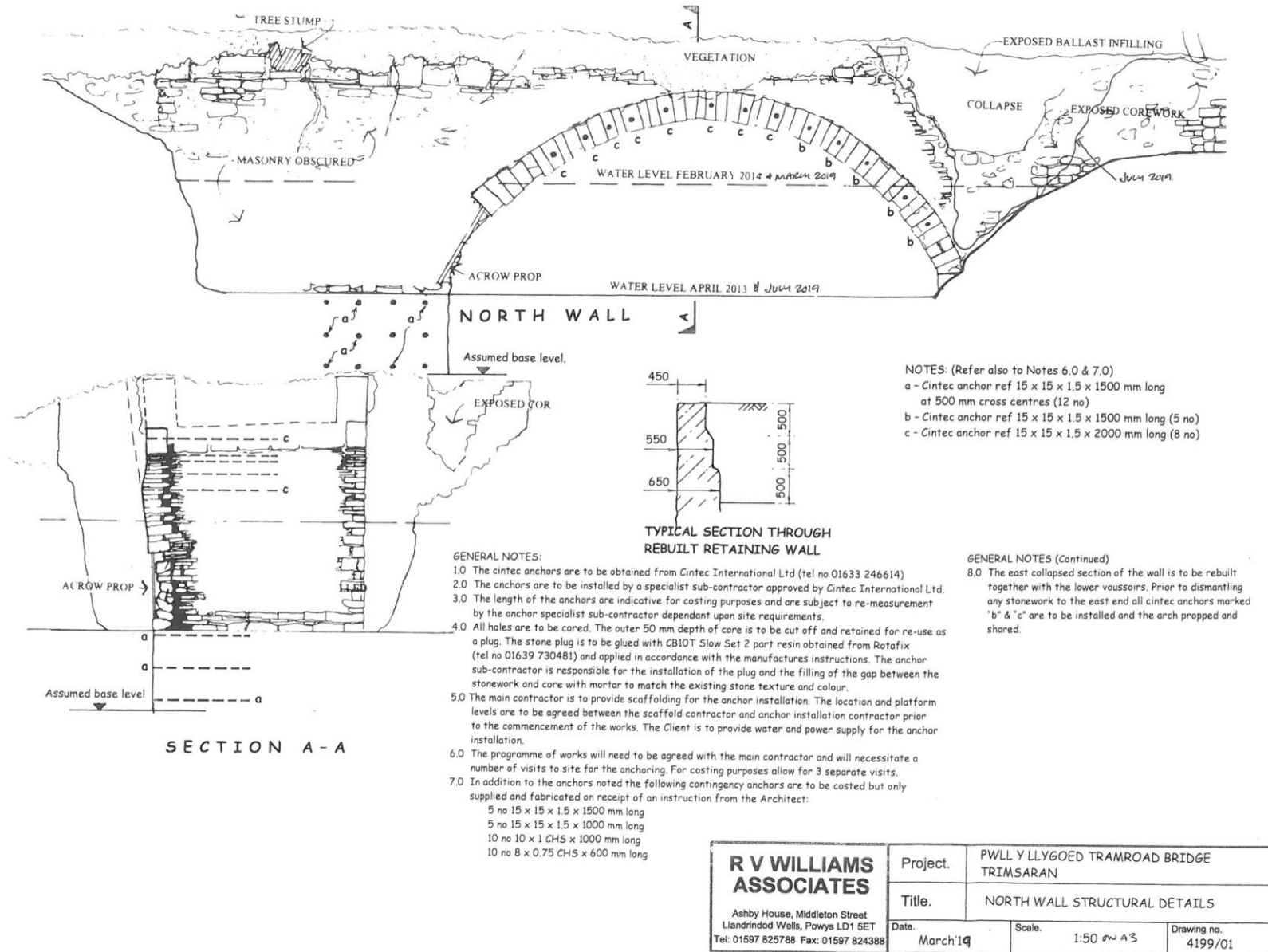
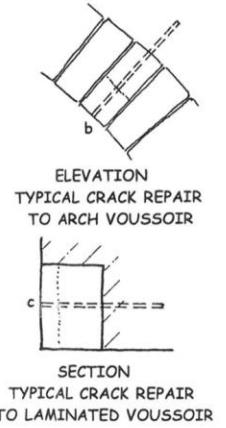
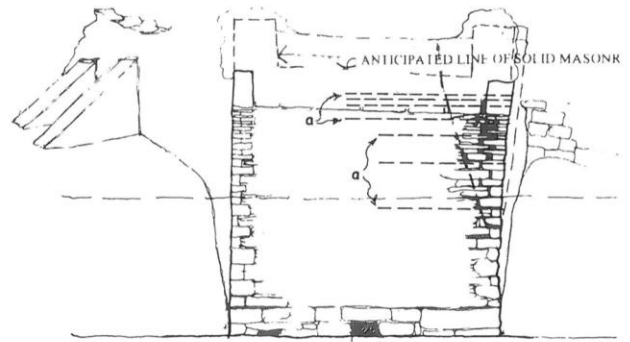
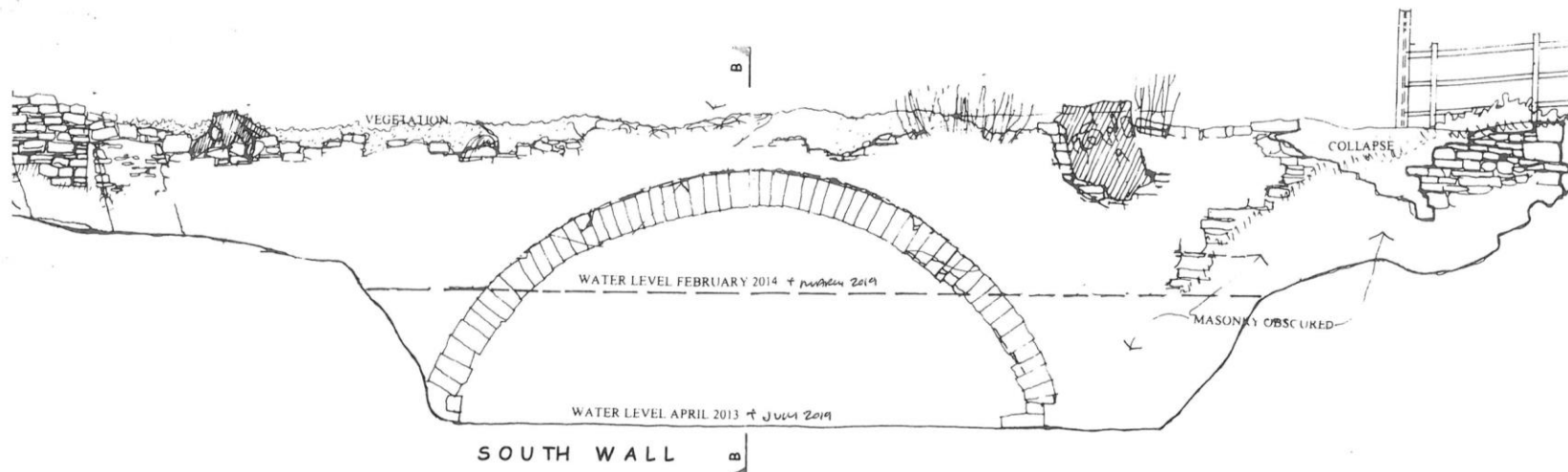


Fig. 19 – North Wall Structural Details – R V Williams Associates.



FOR GENERAL NOTES RELATING TO THE CINETEC ANCHORS REFER TO DRAWING 4199/01

- NOTES:
 a - Cintec anchor (refer to drawing 4199/01)
 b - Cintec anchor ref 10 x 1 CHS x 600 mm long (10 no)
 c - Cintec anchor ref 8 x 0.75 CHS x 600 mm long (10 no)

R V WILLIAMS ASSOCIATES Ashby House, Middleton Street Llandrindod Wells, Powys LD1 5ET Tel: 01597 825788 Fax: 01597 824388	Project.	PWLL Y LLYGOED TRAMROAD BRIDGE TRIMSARAN	
	Title.	SOUTH WALL STRUCTURAL DETAILS	
Date.	March 14	Scale.	1:50 & 1:20 A3
		Drawing no.	4199/02

Fig. 20 – South Wall Structural Details – R V Williams Associates.

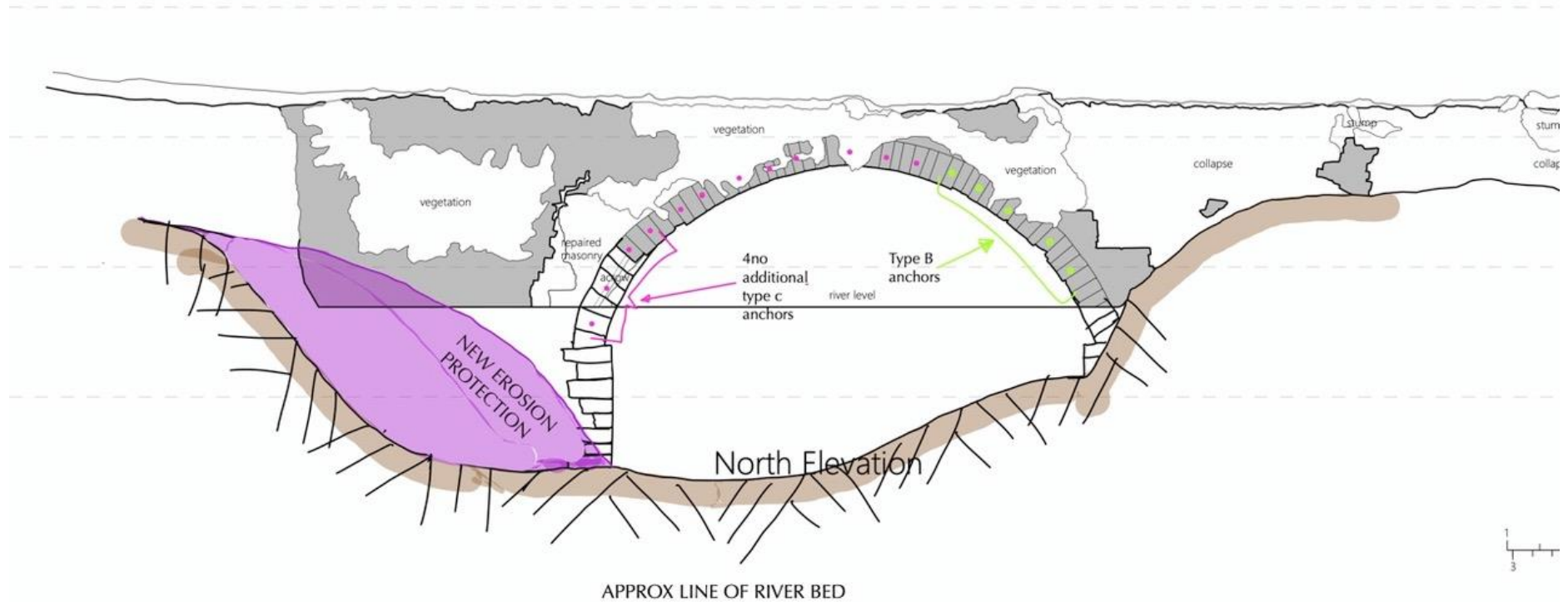


Fig. 21 – Cintec anchor locations, north elevation – Carl Morgan Building Surveyor.

APPENDIX IV

Photographic Archive



Plate 1 – Pre-works – Nadir view before clearance works.



Plate 2 – Pre-works – North elevation, before clearance works.



Plate 3 – Pre-works – South elevation, before clearance works.



Plate 4 – Pre-works – View to west, showing Carway Siding and Kymer's Canal.



Plate 5 – Pre-works – View east along roadway, after clearance works.



Plate 6 – Pre-works – View west along roadway, after clearance works.



Plate 7 – Pre-works – South elevation, after clearance works.



Plate 8 – Pre-works – North elevation, after clearance works.



Plate 9 – Pre-works – North elevation, showing east wing wall and abutment..



Plate 10 – Pre-works – North elevation, showing abutment and arch.



Plate 11 – Pre-works – North elevation, showing arch and west abutment.



Plate 12 – Pre-works – North elevation, showing collapsed spandrel and wing wall.



Plate 13 – Pre-works – Arch and barrel vault of east abutment, viewed from north, showing damage.



Plate 14 – Pre-works – Arch and barrel vault of west abutment, viewed from north, showing damage.



Plate 15 – Pre-works – North elevation, west spandrel and wing wall collapse.



Plate 16 – Pre-works – North elevation, west spandrel and wing wall collapse.



Plate 17 – Pre-works – South elevation, buttresses to west wing wall.



Plate 18 – Pre-works – South elevation, showing west wing wall and spandrel.



Plate 19 – Pre-works – South elevation, showing arch and west abutment.



Plate 20 – Pre-works – South elevation, showing arch.



Plate 21 – Pre-works – South elevation, showing arch and east abutment.



Plate 22 – Pre-works – South elevation, showing east wing wall.



Plate 23 – Pre-works – Arch and barrel vault of west abutment, viewed from south.



Plate 24 – Pre-works – Arch and barrel vault of west abutment, viewed from south, showing damage.



Plate 25 – Pre-works – Nadir view, after clearance works.



Plate 26 – Pre-works – View west, showing Carway Siding and Kymer's Canal, after clearance works.

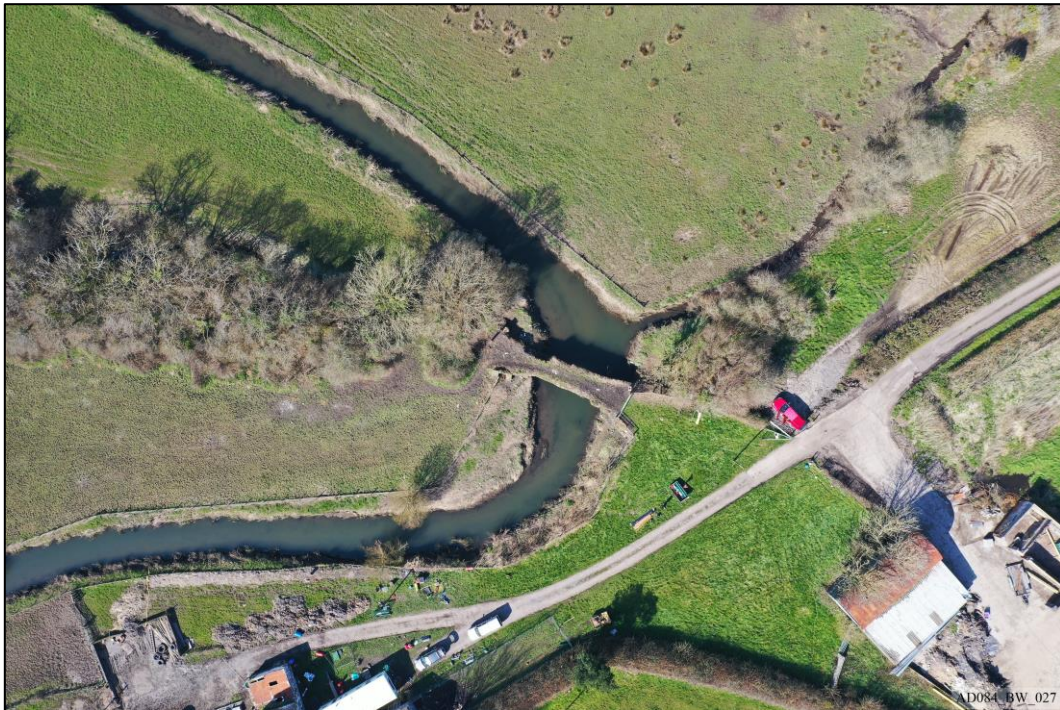


Plate 27 – Pre-works – High level nadir view.



Plate 28 – During works – Installation of temporary bridge to south.



Plate 29 – During works – Sediment filter.



Plate 30 – During works – North elevation, with scaffold and partial damming.



Plate 31 – During works – North elevation, showing scaffold and river damming.



Plate 32 – During works – North elevation, showing Cintec anchors to voussoirs.



Plate 33 – During works – View west, showing trackway to river.



Plate 34 – During works – View east, showing trackway to river.



Plate 35 – During works – View towards north, showing damming of river.



Plate 36 – During works – View east, showing damming of river.



Plate 37 – During works – View west, showing damming of river.



Plate 38 – During works – View down north elevation from deck, showing damming of river.



Plate 39 – During works – View west, showing extended trackway and damming of river.



Plate 40 – During works – View east, showing damming of river.



Plate 41 – During works – View east, showing east abutment and ledge of earlier abutment.



Plate 42 – During works – View east, showing east abutment and ledge of earlier abutment.



Plate 43 – During works – North elevation, showing east wing wall and line of earlier wing wall.



Plate 44 – During works – South elevation, showing quoins to earlier east abutment.



Plate 45 – During works – North elevation, showing repair to east abutment.



Plate 46 – During works – View east, showing repair to east abutment.



Plate 47 – During works – View east, showing repairs to east abutment.



Plate 48 – During works – North elevation, showing repair to lower east abutment.



Plate 49 – During works – North elevation, showing repaired lower abutment.



Plate 50 – During works – View east, showing lower abutment.



Plate 51 – During works – View south, showing lower west abutment.



Plate 52 – During works – View west, showing south opening to lower west abutment.



Plate 53 – During works – View west, showing north opening to lower west abutment.



Plate 54 – During works – View west, showing repointing to north abutment.



Plate 55 – During works – View west, showing earlier abutment with remains of splayed wing wall.



Plate 56 – During works – North elevation, showing east spandrel repair and arch former.



Plate 57 – During works – North elevation, showing removal of east spandrel repair.



Plate 58 – During works – North elevation, showing removal of east spandrel repair and masonry rebuild.



Plate 59 – During works – North elevation, cleaning and dismantling of west spandrel and wing wall.



Plate 60 – During works – North elevation, cleaning of masonry to north wing wall.



Plate 61 – During works – North elevation, showing dismantled and lean of surviving masonry.



Plate 62 – During works – North elevation, showing dismantling of masonry to spandrel and wing wall.



Plate 63 – During works – North elevation, showing separation of masonry from corework.



Plate 64 – During works – North elevation, showing rebuilding of west spandrel and wing wall.



Plate 65 – During works – North elevation, rebuilding of west spandrel and wing wall.



Plate 66 – During works – North elevation, showing rebuilding of west spandrel and wing wall.



Plate 67 – During works – North elevation, showing rebuilding of masonry over arch.



Plate 68 – During works – North elevation, showing rebuilding of masonry to spandrel and wing wall.



Plate 69 – During works – North elevation, rebuilding of west wing and retaining wall.



Plate 70 – During works – North elevation, showing end and core of retaining wall.



Plate 71 – During works – North elevation, showing completed west spandrel and wing wall rebuild.



Plate 72 – During works – North elevation, showing completed west spandrel and wing wall rebuild.



Plate 73 – During works – South elevation, showing west wing wall masonry deterioration.



Plate 74 – During works – South elevation, showing dismantling of deteriorated masonry.



Plate 75 – During works – South elevation, showing core masonry to west wing wall.



Plate 76 – During works – South elevation, showing rebuilt wing wall masonry.



Plate 77 – During works – View east, showing top of masonry to wing and retaining wall.



Plate 78 – During works – View east, showing top of masonry to wing and retaining wall.



Plate 79 – During works – South elevation, view west showing rebuilt masonry of wing and retaining wall.



Plate 80 – During works – South elevation, showing damage to east wing wall.



Plate 81 – During works – South elevation, showing damage to east wing wall.



Plate 82 – During works – South elevation, showing partial dismantling of east wing wall.



Plate 83 – During works – South elevation, showing completed rebuild of east wing wall.



Plate 84 – During works – South elevation, showing completed rebuild of east wing wall.



Plate 85 – During works – South elevation, showing repair of buttresses to west wing and retaining wall.



Plate 86 – During works – North elevation, showing bulge in masonry to east spandrel.



Plate 87 – During works – North elevation, showing collapse of east spandrel.



Plate 88 – During works – North elevation, showing collapse of east spandrel.



Plate 89 – During works – View east, showing wall tops and roadway.



Plate 90 – During works – View west, showing wall tops and roadway.

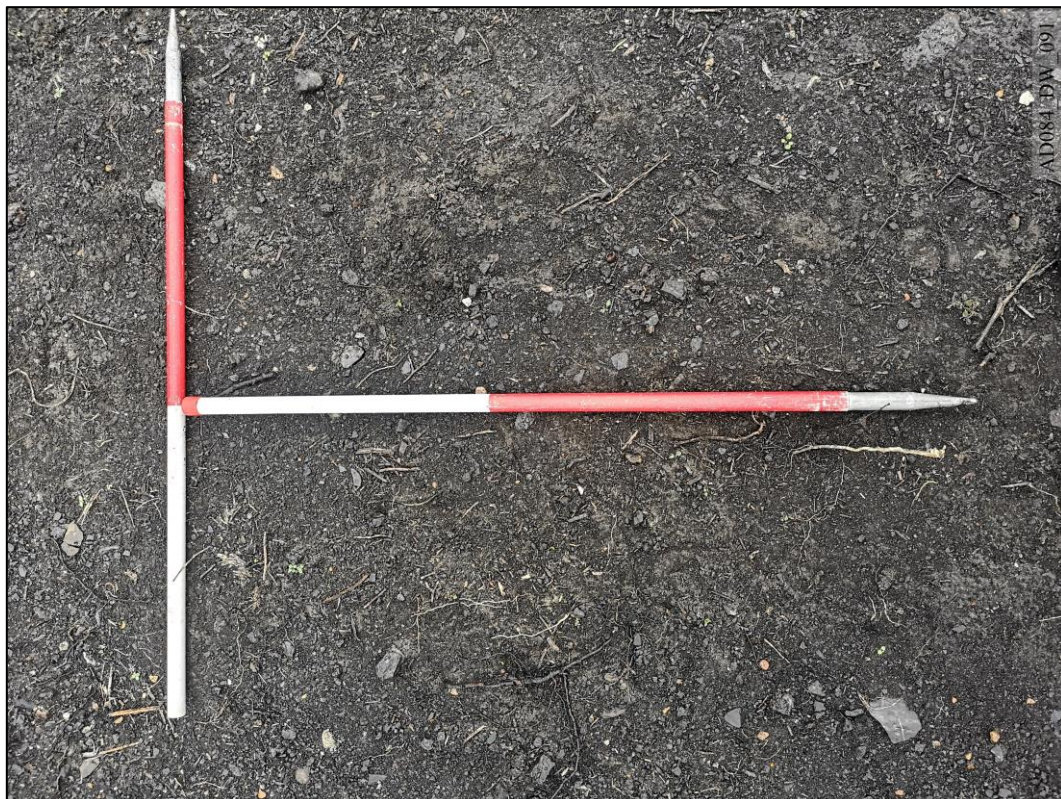


Plate 91 – During works – Surface roadway, showing dark humus to surface (natural).



Plate 92 – During works – Wall top to south elevation, showing opening in masonry.



Plate 93 – During works – Wall top to south elevation, showing opening in masonry.



Plate 94 – During works – North elevation, showing collapse of east spandrel.



Plate 95 – During works – North elevation, showing abutting of wing wall to earlier masonry structure.



Plate 96 – Post-works – Completed north elevation.



Plate 97 – Post-works – Completed north elevation.



Plate 98 – Post-works – Completed north elevation.



Plate 99 – Post-works – View east, showing completed roadway with turf wall capping.



Plate 100 – Post-works – Completed south elevation.



Plate 101 – Post-works – View north-east, showing cleared banks and bridge.



Plate 102 – Post-works – North elevation.



Plate 103 – Post-works – South elevation.



Plate 104 – Post-works – North elevation, showing east wing wall and spandrel.



Plate 105 – Post-works – North elevation, showing arch and spandrels.



Plate 106 – Post-works – North elevation, showing west spandrel and wing wall.



Plate 107 – Post-works – South elevation, west retaining and wing wall.



Plate 108 – Post-works – South elevation, west spandrel and arch.



Plate 109 – Post-works – South elevation, arch and west spandrel and wing wall.



Plate 110 – Post-works – Nadir view.



Plate 111 – Post-works – View toward north.



Plate 112 – Test Pit 1



Plate 113 – Test Pit 1, showing section.



Plate 114 – Test Pit 1, showing location.

APPENDIX V

Scheduled Monuments

&

Listed Buildings

Monument Description	Kymer's Canal and Pwll y Llygoed Tramroad Bridge	Cadw ID	CM261
Status	Designated	Locality	Trimsaran
Date Scheduled	14 th November 1996	County	Carmarthenshire
Easting / Northing	244403 / 206784	Period	Post Med. / Modern
Broad Class	Transport	Site Type	Canal
Summary Description and Reason for Designation			
<p>The following provides a general description of the Scheduled Ancient Monument. The monument consists of a section of canal, a water-filled earthwork, dating to the 18th century and includes c. 380m of the eastern end of the Kymer's Canal. Kymer's Canal was built in 1766-8 and was designed for sea-going barges it is broader than later canals in the area and survives as a partly water filled earthwork 4m wide and 1.5m deep. The northern side is embanked by a clay and earth mound c 2.5m wide and standing 1.5m above its surroundings. The southern side has a similar but wider embankment which originally carried a contemporary tramroad and a railway siding (rails still survive). At the terminus was a small dock or turning bay projecting NE and showing as a slight earthwork in the pasture field. The tramroad crossed the river by an elegant segmentally-arched stone bridge, 3m wide and without parapets, believed to date from the construction of the canal. The monument is of national importance for its potential to enhance our knowledge of 18th and 19th century transport systems. It retains significant archaeological potential, with a strong probability of the presence of associated archaeological features and deposits. A canal may be part of a larger cluster of industrial monuments and their importance can be further enhanced by their group value. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive.</p>			

Building Description	Pwll-y-Llygod Tramroad Bridge	Cadw ID	81328
Grade	II	Locality	Trimsaran
Date Listed	23 rd July 2003	County	Carmarthenshire
Easting / Northing	244612 / 206811	Postcode	
History			
<p>Part of a tramroad that took coal from collieries at Carway to Kymer's Canal, which was completed in 1769. The date of the tramroad, and bridge, is not certain. The tramroad is said to have been built c1770, which would make the bridge the oldest surviving railway bridge in Wales, and alternatively to have been built c1802. Masonry details suggest that the present bridge was built later, although still perhaps in the first half of the C19, and therefore replaced an earlier structure. The tramroad was still in use in 1863.</p>			
Exterior			
<p>A single-span bridge of coursed stone (overgrown at the time of inspection). Its segmental arch has hammer-dressed voussoirs.</p>			
Reason for Designation			
<p>Listed for its special industrial-archaeological interest as an early railway bridge, associated with the oldest canal in Wales. Scheduled Ancient Monument Cm 261 (CAM).</p>			

APPENDIX VI

Misc.

Email Correspondence

Date: 23rd April 2020

Afternoon,

Please find attached a plan showing the proposed locations for photos to be taken of Pwll-y-Llygod by the contractors.

The idea of this is to produce a set of photos to provide a record of the works as they progress. These should be taken at the end of each day to allow for the compilation of a photographic archive to accompany an interim/completion report. Although I anticipate that not all will be required as it will depend on the progress made each day. The record will also allow for the marking up of a set of photographs on completion to show where interventions have been made. As for the photos:

1. Photos can be taken with a compact camera or mobile phone, ideally above 10 megapixels.
2. The photos should be free from blurring.
3. If the elevations cannot be captured in a single photo, two overlapping photos from the same position will be ideal. The idea of the overlap will enable the images to be stitched together at a later date.

When masonry is to be removed/dismantled, photos should be taken as follows:

1. Prior to removal
2. After removal
3. After reinstatement

This will give further detail to the works and level of intervention.

The end result will be a report, which I will draw together using some of the information already produced in the WSI, with additional information on the bridge and details of the intervention, along with an appendix of plans and photos.

What would be useful is if one of you would be happy to receive the photos from the contractor and to put them into a simple Word format, with description. I've attached a copy of the Scheduled Monument Consent Completion Report template from Cadw, which shows the type of photo layout required (from page 3 on).

Any questions, fire away! Otherwise, I'll see you in tomorrow's meeting!

All the best,

Ross

Vegetation Clearance – Completion Report

Pwll-y-Llygod Bridge, Trimsaran

Ross Cook – 17.07.2020

Summary of Works

Vegetation clearance works were undertaken in late January 2020 by Derek Harris Tree Services, with a watching brief maintained by ArchaeoDomus. The aim of the watching brief was to monitor for any collapse of masonry caused by the clearance work, and to identify any further information on the bridge which may shed further light on its history. No collapse or damage was observed during the watching brief.

On completion of the clearance work, a photogrammetric survey was undertaken of the bridge for the production of a set of drawn and orthographic plans.

Scope

- ❖ Clear scrub vegetation from the deck, abutments and flanking riverbanks.
- ❖ Cut back trees and vegetation from the elevations of the bridge.
- ❖ Fell trees to the embankments north slope.
- ❖ Produce a set of drawn and orthographic elevations and plans.

Results

The clearance works removed a large amount of scrub vegetation and tree growth from the elevations, deck, abutments and flanking river banks (Plates 1-10). Alder and Ash were removed to the south elevation, leaving the trunk stumps and roots remaining. Several large Hazels were removed from the north slope of the embankment to allow access to the river bank, again leaving the stump and roots remaining. Ivy to the elevation of the bridge proved more difficult to remove, but was cut back where access was possible, leaving the rooted stem *in situ*.

Whilst the clearance provided a clearer view of some elements of bridge, the remaining ivy largely obscured further details. On removal during conservation works, a clearer picture of the bridge's development will be established.

Clearance revealed the internal fill material of the bridge to be a mix of duff (coal dust) along with stone and iron slag. The use of this material brings into some question the date of construction of the bridge as a new bridge on a green site is unlikely to have ready access to the large amounts of such material. The material is more in keeping with a site and industrial area that had already seen sustained production over a number of years. The inclusion of slag is of particular interest as it may help to establish a later date for construction.

There were two earlier furnaces in the valley at Ponthenri, this was simply known as Furnace (Riden, 1993: 29). However, these were charcoal furnaces in work until *circa* 1763 and therefore unlikely to have had any interaction with the construction of Pwll-y-Llygod. The first coked iron works in the Gwendraeth Valley was not founded until 1843 and first recorded in blast in 1847. The name of the works, located in Trimsaran, was first recorded with one furnace and no output in 1843 as Walneg, then again in 1847 with three built and two in blast as Walvey & Co (Riden *et al*, 1995: 17). This is presumably the source of the slag observed and used as larger aggregate to stabilise the looser duff. Interestingly, the name of the iron works is also recorded as 'Coelbrook', with the Afon Morlais running by the site, along which are located a number of collieries. If this information correlates with features observed during the course of repair works to the bridge, we may be able to establish a *terminus post quem* of 1847 for modification, repair or rebuilding.

On completion of works a survey of the bridge was made. This employed photogrammetry as the method for data capture, which used a drone with 20-megapixel camera to record the bridge from all angles. Dimensional control was provided by ground control points tied in to the OS National Grid using RTK-GPS. A total of 455 photographs produced a 3D model of 40,280,045 points, which was processed into a mesh 5,406,208 faces. The total error for the model was 1.8mm. The model was then used to produced drawn and orthographic elevations in CAD and exported to PDF.

Accompanying Documents

- ❖ AD084-1 - Elevations - Pwll-y-Llygod
- ❖ AD084-2 - Plan - Pwll-y-Llygod
- ❖ AD084-3 - Photogram Elevations and Arch - Pwll-y-Llygod
- ❖ AD084-4 - Photogram Plan - Pwll-y-Llygod

ArchaeoDomus Archaeological & Heritage Services

Tel/Ffôn: 01570 218048 / 07910 213557
Email/E-bost: ross.cook@archaeodomus.co.uk
Web/Gwefan: www.archaeodomus.co.uk
Social/Cymdeithasol: www.twitter.com/archaeodomus
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