Archaeological Survey of Cuckney Water Meadow System, Cuckney, Nottinghamshire
(SK 56449 71559).

Archaeological Survey Report

Andy Gaunt
Mercian Archaeological Services CIC
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Report MAS042

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Contents

Summary

A topographic survey of earthworks in the fields on the northern bank of the River Poulter, North of Cuckney Church (SK 56449 71559), was undertaken by community volunteers under supervision from Mercian Archaeological Services CIC in June 2018. This community archaeology project trained members of the public in surveying techniques, and was the first detailed measured survey of this section of water meadows to be undertaken. The survey was undertaken as part of the Battle of Hatfield Investigation Society, "*Warriors through the Landscape*" project sponsored by the Heritage Lottery Fund. The survey was also funded through match-funding from Mercian Archaeological Services CIC as part of the Sherwood Forest Archaeology Project.

The area surveyed formed part of a catchwork water meadows constructed between 1849 and 1850 for the Fourth Duke of Portland (Hillman & Cook 2016, p88). The system is very well preserved, consisting of a number of sections along the length of the system in the fields recorded. A large 'flood-dyke' carried water to the system from the pond at Cuckney Old Forge Dam to the West. The flood-dyke fed a system of 'carriers' (channels) and 'panes' (areas of grass to be flooded) before returning water to the canalised river Poulter to the south. The Cuckney water meadow system represents a relatively unusual example due to the steepness of the slopes involved (Hillman and Cook 2016 p88).

The system at Cuckney was one of a number of systems stretching along the Rivers of Sherwood Forest constructed by the Fourth Duke. "*As early as 1819- the idea of converting waste lands to useful purposes by the creation of water -meadows had first occurred to the Duke of Portland"…* (Courtesy of A.S. Turberville – A History of Welbeck Abbey & its Owners, Vol.2).

The project was designed to record and interpret the water meadows system at Cuckney. It utilised a number of surveying techniques using a combination of Differential survey-grade Geographic Positioning Systems

(GPS) and Electronic Distance measuring Total Stations. The project also analysed data from LiDAR survey flown by Bluesky as part of the "*Warriors through the Landscape*" project (Gaunt 2019).

The survey consisted of both objective and subjective survey. An objective survey of the entire field was undertaken with community volunteers walking transects at 1m intervals using a combination of GPS and robotic Total Station. This kind of survey method is known as 'objective' survey as it records points in a methodological way with no interpretative input from the user. The points are recorded on a grid to give even coverage of the site.

A 'subjective' survey of archaeological features was also undertaken. This included recording former water carriers and panes with Total Stations and GPS, along with surviving stone blocks which together formed a complex sluice gate system. In this method the survey is 'subjective' because the surveyor chooses what to record.

The sluice gate stones were recorded individually with Total Stations and were further recorded in three dimensions using photogrammetric survey. A photogrammetric survey consists of photographing an object or feature many times from many different angles. Computer software combines these photographs and an accurate three dimensional model is created.

The flood-dyke channel which fed the system via a series of inlet valves was also recorded, where accessible, and a number of large iron and wooden sluice gates were also recorded which survive along its length.

A LiDAR (light detection and ranging) survey was undertaken by Bluesky in April 2018, as part of this project. The survey covered an area from Whitwell Woods in the north to Church Warsop in south, and from Creswell in the west to Carburton in the east. The survey was undertaken at 0.25m resolution. Subsequent analysis of LiDAR data was undertaken by Mercian as part of the project, and the area of the catchwork water meadows has produced excellent results.

By combining the results of the LiDAR and topographic survey of the site a three dimensional model was created of the catchment water meadow,which has allowed a detailed understanding of its form and function to be interpreted. Detailed three dimensional photogrammetry has recorded the level of preservation of the stone sluices at the present day.

Ground-truthing and prospection of the wider water meadow system has helped to discover iron water management features and pipe work, and has also show that the water meadows were an addition to an already existing system of ponds and leets, parts of which are potentially medieval, powering a series of mills along the length of the Poulter between Langwith and Carburton.

1. Project location and geology

1.1. Project Location

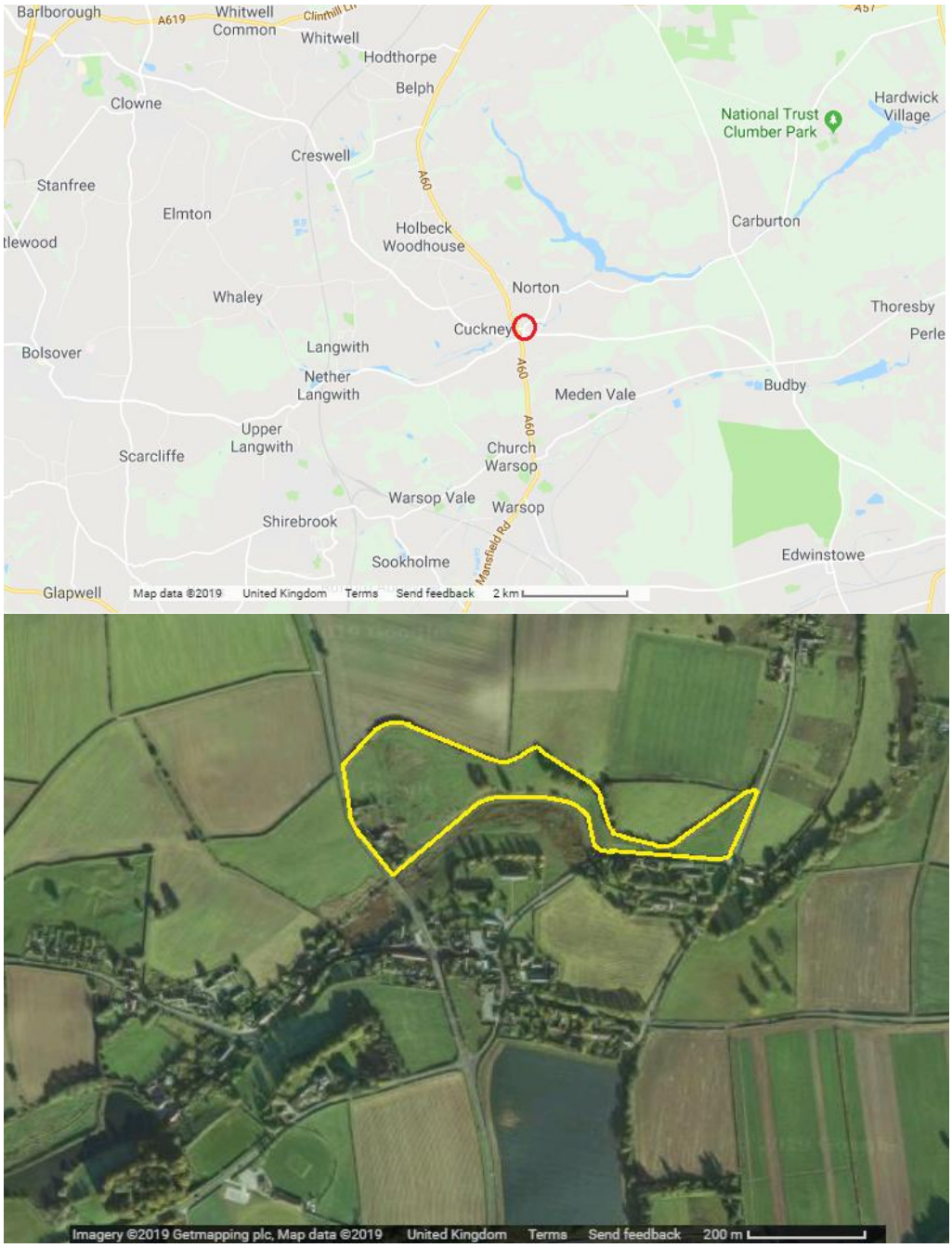

Figure 1: Site location outlined in red. Contains Mapdata © 2019, United Kingdom. Google. Imagery © 2019 Getmapping Plc, Map data ©2019.

1.2. Geology

The British Geological Survey 1:50,000 scale mapping indicates that the bedrock geology across the site is of the Lenton Sandstone Formation. This is a sedimentary Sandstone Bedrock "*formed approximately 247 to 272 million years ago in the Triassic and Permian Periods*". The local environment at the time of deposition was dominated by rivers. "*These sedimentary rocks are fluvial in origin. They are detrital, ranging from coarse- to fine-grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river or estuary (if in a coastal setting*)" (BGS.ac.uk - accessed 29/05/2019).

A very small section of the site in the south western corner between the property on the eastern side of the A60, and River Poutler is shown on the BGS 1:50 000 scale bedrock geology description as Mudstone And Sandstone of the Edlington Formation. This is a Sedimentary Bedrock formed approximately 252 to 272 million years ago in the Permian Period. The Local environment was previously dominated by lakes and lagoons. The depositional setting for these deposits were lakes and lagoons. "*These sedimentary rocks are lacustrine or shallow-marine in origin. They are detrital, generally fine-grained (but can include layers of coarser material) and form beds of carbonate-rich deposits sometimes including precipitated beds of evaporites*" (BGS.ac.uk - accessed 29/05/2019).

The southern edge of the site is bounded by the River Poulter. The flood plain of the river is mapped by the BGS 1:50 000 scale as superficial deposits consisting of Alluvium in the form of Gravel, Sand, Silt And Clay. These Superficial Deposits were formed up to 2 million years ago in the Quaternary Period. The local depositional environment was formerly dominated by rivers. "*These sedimentary deposits are fluvial in origin. They are detrital, ranging from coarse- to fine-grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river or estuary (if in a coastal setting)*" (BGS.ac.uk - accessed 29/05/2019).

2. Archaeological and Historical Background

2.1. Place-name

The English Place Names Society volume for Nottinghamshire published in 1940 gives the derivation of Cuckney as “The second element is eg. ‘island of marshy land.’ The first is probably... The personal name Cuca or Cwica, a pet form of such a name as [old english] Cwichelm (Gover et al 1940 p75). It lists the earliest appearances in the forms: Cuchenai 1086 Domesday Book, Cucheneia c 1150, Cuckeneya 1159-81, Cuckeneie c 1179, “and frequently in Inquisitions Post Mortem to 1295 with variant spellings Kuk- and -eye, eia, -aie, -aye, -ee.” Chugeneia 1185, Chugeneia 1187, Quikenea 1195, Kuyekeney c 1245, Cokeneye 1221, Cokkene 1393, Cokkenaye 1548, Coknay 1510, Cookney 1542, Cowkenay 1548, Cuckney 1684 (ibid).

2.2 The Domesday Book of 1086

“The Land of Roger de Bully.

Bassetlaw Wapentake

In CUCKNEY Alric and Wulfsige had 1 carucate of lands to geld. [There is] land for 2 ploughs. There Geoffrey, Roger’s man, has 1 plough, and 9 villains having 3 ploughs. [There is] woodland pasture 2 furlongs long and 2 broad. TRE* worth 20s; now 2s less.” (Williams & Martin Eds. 2003. Pp 764-766).

“The Land of Hugh fitzBaldric.

In Cuckney Swein had 2 carucates of land to the geld. [There is] land for 4 ploughs. Richard holds it of Hugh, and has there 2 ploughs in demense; and 3 sokeman on 2 bovates of land and 10 villains and 5 bordars having 2 ploughs. There is a priest and a church, and 2 mills [rendering] 8s [and] woodland

pasture 4 furlongs long and 4 furlongs broad. TRE, as now, worth 30s." (Williams & Martin Eds. 2003. P779).

*TRE - Tempore Regis Edwardi (Time of King Edward the Confessor). Refers to the value of the holdings at the time of the Norman Conquest, 1066. The second value relates to the value at the time of the Domesday survey 1086.

2.3 Prehistoric and Roman

The Historic Environment Record (HER) is the repository for archaeological knowledge and information for the county. A 2km wide search of the database, centered on Cuckney church brings up a list of 54 Monuments and Elements.

The records listed on the HER include a number of undated linear earthworks, an undated cropmark enclosures; one in both Norton and Cuckney, an undated banked enclosure, and undated irregular earthworks.

The earliest dateable object is a Roman coin dating from 268- 273AD.

This Roman coin is the only artefact registered on the HER for Cuckney with a confirmed date prior to the medieval period (see Appendix IV).

2.4. Medieval

2.4.1. Church.

The earliest reference to a church in Cuckney comes from the Domesday entry listed above, where a church and priest are recorded in 1086.

Nikolaus Pevsner describes the church in Cuckney in the following entry: "*St, Mary. An unusually long nave of c. 1200 with a N aisle, in the W with circular piers, then two of quatrefoil plan, finally the others octagonal... The arches are all semi-circular and double chamfered. In date the arcade seems to stand between the lower stages of the broad short W tower and the S door (two orders without columns, one zig-zag, the other a thick angular rope motif) on the one hand and the upper stage of the tower (ashlar with mid-C13 two-light windows) and the S porch on the other. The S porch in any case seems EE [Early English] throughout (see its door with stiff-leaf capitals and its corbel table). The Piscina has dog-tooth and nailhead ornament, - SCREEN now in the tower arch: only very small remains of Perp [Perpendicular] panel tracery*" (Pevsner. 1951. p58).

2.5. Post Medieval

An HER search from 2015 shows large amounts of building in the parish in the post medieval period, including a series of mills and workers cottages. The list also includes a number of sluices. These survive in the fields to the north of the River Poulter, and are the subject of this survey.

2.6. Water Meadows system.

The River Poulter was the subject of a water meadow improvement scheme by the Duke of Portland during the 18th and 19th century (Gaunt 2009: 2010). The area surveyed formed part of this catchwork water meadows constructed between 1849 and 1850 for the Fourth Duke of Portland (Hillman & Cook 2016, p88). The system is very well preserved, consisting of a number of sections along the length of the system in the fields recorded. A large 'flood-dyke' carried water to the system from the pond at Cuckney Old Forge

Dam to the West. The flood-dyke fed a system of ‘carriers’ and ‘panes’ (areas of grass to be flooded) before returning water to the canalised river Poulter to the south. The Cuckney water meadow system represents a relatively unusual example due to the steepness of the slopes involved (Hillman and Cook 2016 p88).

Figure 2: The Cuckney water meadow system as show on the 1884 Ordnance Survey 6 inches to 1 mile map.

The system at Cuckney was one of a number of systems stretching along the Rivers of Sherwood Forest constructed by the Fourth Duke. “*As early as 1819- the idea of converting waste lands to useful purposes by the creation of water -meadows had first occurred to the Duke of Portland”…* (Courtesy of A.S. Turberville – A History of Welbeck Abbey & its Owners, Vol.2).

The scale of the works required to construct such a water meadow system is described further on in Turbervilles account of the works by the Duke at Clipstone on the River Maun to the south east of Cuckney; “*The land which it was proposed to convert into meadows consisted of two widely divergent types – dry rough hill-sides and the swamps of the intervening valley. Each presented its own troublesome problems. The draining of the marsh was in itself a difficult and arduous undertaking, but the hill-sides were not more easily dealt with. Gorse and heather had to be destroyed; hillocks had to be flattened out, since an even slope must be secured. Special care had to be taken to*

preserve the good soil which was found on the high levels; and when, on the water being first introduced, it was found to run away into rabbit holes, these had to be dug out. Eventually the whole scheme proved a great success, beyond the Duke's highest expectation. Not only did the water-meadows provide excellent pasture for sheep and cattle, but they produced a great quantity of excellent manure for other lands, enriching five times as large an area as their own".

The Dukes water meadows were expensive to create, but gave a return of over 8% percent on the investment annually*. "The Duke's ambitious undertaking had, up to the year 1837, cost a little under £40,000; on the other hand, it was calculated that the annual value of the water-meadows was £3,660"*. It is therefore very easy to understand the Duke's motives for constructing water meadows systems and for bringing marginal land into profit.

Although the account in Turbervilles entry refers to the River Maun, it is clear the impact the works had on the landscape, and his description gives a vivid impression of how the Cuckney water meadows would have looked in their heyday and the stark contrast a lush swathe of green would have had against the surrounding forest landscape; *"The rough forest land remaining as it was all round the area which had been reclaimed, the vivid contrast between the tangle of heath, fern, and gorse on the slopes and the swamp with its rushes, snipe and wild duck, where nature yet remained untamed, on the one hand, and on the other the vivid green of the gently sloping water meadows, with the grazing animals upon them, was an eloquent testimony to the vision, the energy, and enterprise of the Duke of Portland.*" (Courtesy of A.S. Turberville – A History of Welbeck Abbey & its Owners, Vol.2).

3. Previous Archaeological Work

A description and interpretation of the Water Meadow system at Cuckney was included in the 2016 Transactions of the Thoroton Society publication by Jonathan Hillman and Hadrian Cook, "*By floating and watering such land as lieth capable thereof: recovering meadow irrigation in Nottinghamshire*".

A Level One survey of the Water Meadow System further to the east along the River Poulter was undertaken by Andy Gaunt, then of Nottinghamshire County Council Community Archaeology . The survey was undertaken in two seperate parts covering 3 large fields around the village of Carburton in 2009. The surveys were written up by Gaunt in two separate reports as:

- Gaunt, A. 2010a. *Carburton water meadows system. A level 1 archaeological survey for Scott Wilson and Natural England*. NCA-013. Archaeological report.
- Gaunt, A. 2010b. *A level 1 archaeological survey of Carburton water meadows system. Carburton, Nottinghamshire.* NCA-012. Archaeological report.

The area south, centring on Cuckney church has been subject to a number of archaeological investigations in recent years, under the supervision of Mercian Archaeological Services CIC, alongside the Battle of Hatfield Investigation Society.

These include:

- Mercian Archaeological Services CIC - Archaeological Investigation at Cuckney, Nottinghamshire. Bassetlaw, Nottinghamshire. End of Project Report. MAS049. Mercian Archaeological Services CIC (Budge 2019).
- Mercian Archaeological Services CIC - An Integrated Archaeological Survey of Cuckney Churchyard, Castle, and surroundings.Cuckney, Nottinghamshire, 2016. Including Geophysical Surveys and topographic survey. (Gaunt, A. & Crossley, S. 2016. An Integrated Archaeological

Survey of Cuckney Churchyard, Castle, and surroundings. Cuckney, Nottinghamshire. Mercian Archaeological Services CIC, MAS021. Archaeological Report).

- The Church of St Mary, Cuckney, was subject to a photogrammetric survey by David Budge of Mercian Archaeological Services CIC, and it was shown that the church "*contains significant remains of medieval painted decoration on the south side of the north arcade that permits an insight into the original decorative scheme applied to the arcade. Fragments of paint elsewhere in the building provide hints of the nature of later decorative schemes. The paintings were revealed by the stripping of plaster and lime wash from the interior during restoration in 1907 but to date appear to have escaped study or academic attention. Examination of the painting by the writer in 2015 lead to a photographic survey of the most easily detected painted elements and a photogrammetric survey of the painting on the north arcade, in 2016. The digital model of the arcade produced by the photogrammetric survey was used to produce a scale drawing of the arcade and a record of the surviving painting.*

  The drawing was used as a base on which a reconstruction of the surviving elements of the decorative scheme of the arcade were reconstructed. Stylistic parallels and the stratigraphic position of the scheme indicate that the painting is contemporary with the construction of the arcade and was painted c.1200AD (Budge 2018, p1).

  The survey was written up by Budge in the report: Budge, D, 2018. *Medieval Wall Paintings at the Church of St Mary, Cuckney, Nottinghamshire. Norton Cuckney, Bassetlaw District, Nottinghamshire.* Mercian Archaeological Services CIC, MAS036. Archaeological Report.

- As part of the Integrated Archaeological Survey overseen by Mercian Archaeological Services CIC in 2015 mentioned previously, a Ground Penetrating Radar (GPR) survey of Cuckney church and churchyard was undertaken by RSK. The church detected anomalies underneath the church and in the churchyard that could represent burials and re-interments from a historic battle.

- In 1951 Maurice Barley wrote an article in the Transactions of the Thoroton Society regarding burials underneath the churchyard. He interpreted these remains as coming from the 12th century Anarchy of Stephen and Matilda (Barley 1951).

- In 1975 Stanley Revill investigated Cuckney and the wider landscape, noting elements relating to Hatfield and St Edwin in the area, and suggested that the skeletons discovered under the church may in fact have been related to the Battle of Hatfield in the 7th century.

- The theory that the Battle of Hatfield took place in the Sherwood Forest area was added extra credence by a recent survey of Edwinstowe church by Mercian Archaeological Services CIC (Gaunt 2017). The survey showed that the church faced the sunrise on the 12th October, as it was in the 12th century, when the church was rebuilt by Henry II. The 12th October is the Saint day of Edwin, King of Northumbria, who died at the Battle of Hatfield in the year 633. The report also suggested the presence of a cult of St Edwin in the village, with vigils and saints days to St Edwin being celebrated there in the 14th and 15th centuries. The report also suggested that the road-side chapel of St Edwin in nearby Clipstone was constructed by the Plantagenet kings as part of their emerging designed landscape around the royal hunting lodge of the King's Houses at Clipstone (for information about Gaunt's identification of Clipstone as a designed medieval landscape see Gaunt 2011, and Gaunt and Wright 2013).

4. Research Aims and Objectives

The Water meadows systems of Sherwood Forest are an important part of the development of the landscape and have been studied recently, resulting in the publication by Jonathan Hillman and Hadrian Cook (Hillman and Cook 2016).

The River Poulter Water Meadow system as well as being discussed in the above recent publication was also recorded further to the east at Carburton in 2009 by Andy Gaunt, then of Nottinghamshire County Council Community Archaeology, now of Mercian Archaeological Services CIC (Gaunt 201a; Gaunt 2010b).

This project was designed to record and interpret the water meadows system at Cuckney, in odder to enhance understanding of the Sherwood Forest Water Meadow systems, as the section recorded was referred to by Hillman and Cook as being well preserved.

The project forms part of Mercian Archaeological Services CIC's research questions into the landscape development of Sherwood Forest.

The project also ties into the East Midlands Historic Environment Research Framework by focusing on the following research agenda:

9. MODERN (1750 TO PRESENT): RESEARCH AGENDA

9.6 Agriculture

9.6.1. What was the impetus for the development of estate farming and rural agricultural industries, and what has been the landscape impact?

(Knight, Vyner and Allen, 2012.)

5. Methodology

5.1. Level 2 Survey methodology

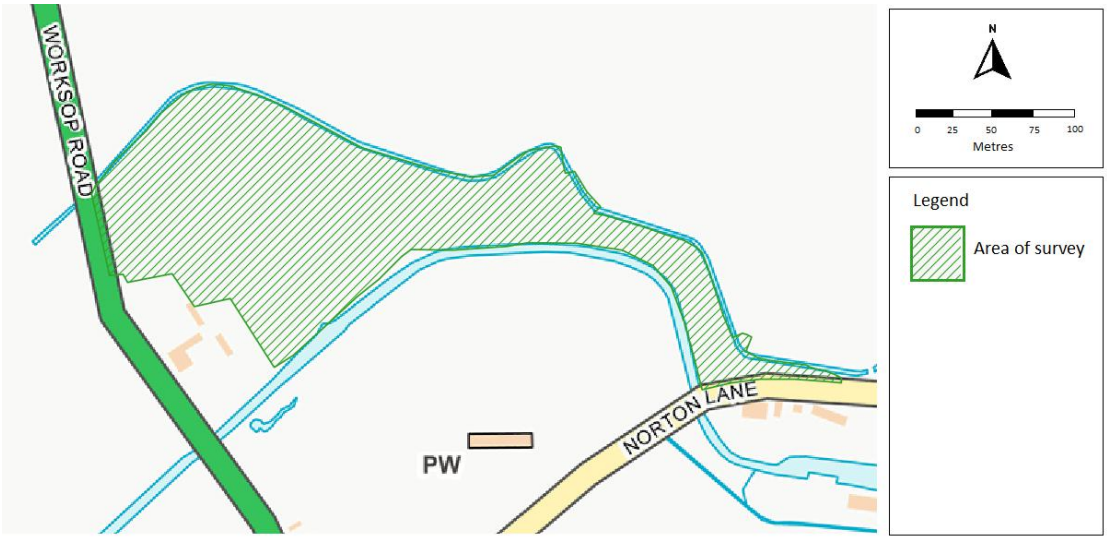

Figure 3: Area of Survey. Contains OS data © Crown copyright [and database right] 2019.

5.1.1. Equipment

The survey was undertaken using differential survey grade Global Positioning System (GPS), combined with Electronic Distance Measuring Total Station. The GPS system used was a *Leica GPS Viva* enabled to use Smartnet technology. This GPS system operates using Differential GPS (DGPS), where corrections are made to errors in the location data received from the satellites. The GPS rover was set to record static points, and the Total Station was used to allow recordings where satellite link was absent as recommended in Ainsworth, S. & Thomason, B. (2003). The DGPS device is mounted on a 2-metre-high carbon fibre pole. The height of the pole is entered into the DGPS. The DGPS is therefore held by the operator 2m above the ground to help improve communication with satellites and mobile phone signals. The DGPS records its location in 3D, receives corrections from a remote source to correct its location, and then removes the 2m staff height

before recording and storing its location in a data logger.

Alongside *Leica GPS Viva* the survey was undertaken using a *Leica TS16 Robotic Total Station* and *Leica TS06 plus.*

5.1.2. Control of survey

'*Control is the accurate framework of carefully measured points within which the rest of the survey is fitted*' (Ainsworth, et al. 2007). Section 2.1 Control of Survey in Metric Survey Specifications for English Heritage (Lutton 2003) states that metric survey '*must provide reliable and repeatable control capable of generating the required coordinates within the tolerances stated*' (Lutton 2003). As well as falling within the accepted tolerance levels, this technique also fulfils the requirement that the control must be repeatable.

5.1.3. Topographic survey method

The survey was undertaken using a combination of objective and subjective survey techniques. Static points were recorded by Differential GPS around the site to act as control points and station locations for subjective survey using Total Station.

5.1.3.1 Objective survey

The survey consisted of both objective and subjective survey. An objective survey of the entire field was undertaken with community volunteers walking transects at 1m intervals using a combination of GPS and robotic Total Station. This kind of survey method is known as 'objective' survey as it records points in a methodological way with no interpretative input from the user. The points are recorded on a grid to give even coverage of the site.

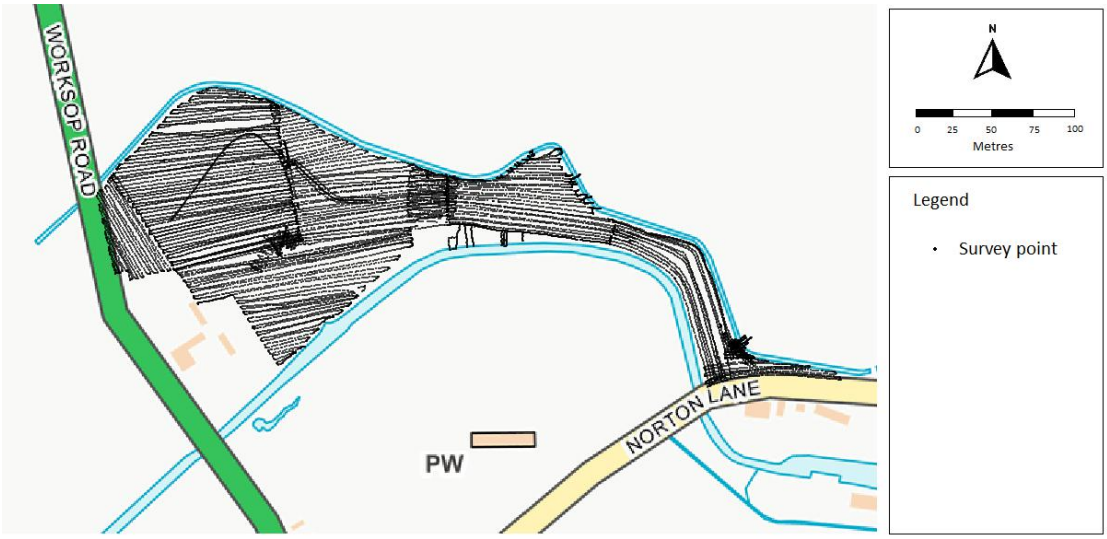

Figure 4: Objective Survey points. Contains OS data © Crown copyright [and database right] 2019.

Photograph 1: Volunteer Kevin Williamson undertaking objective survey using a Leica Robotic Total Station.

5.1.3.2. Subjective survey

A ‘subjective’ survey of archaeological features was also undertaken. This included recording former water carriers and panes with Total Stations and GPS, along with surviving stone blocks which together formed a complex sluice gate system. In this method the survey is ‘subjective’ because the surveyor chooses what to record.

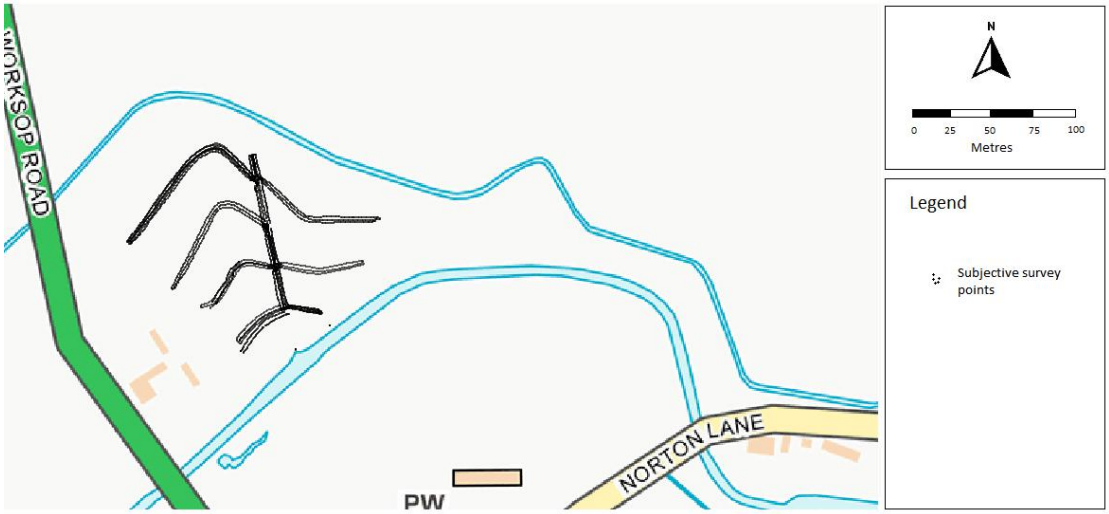

Figure 5: Subjective Survey Points. Contains OS data © Crown copyright [and database right] 2019.

5.1.3.3. Subjective survey of Stone Sluices

Individual stones of the 3 sluice-gate systems, which formed the sluice-gate cascade were recorded using EMD Total Stations.

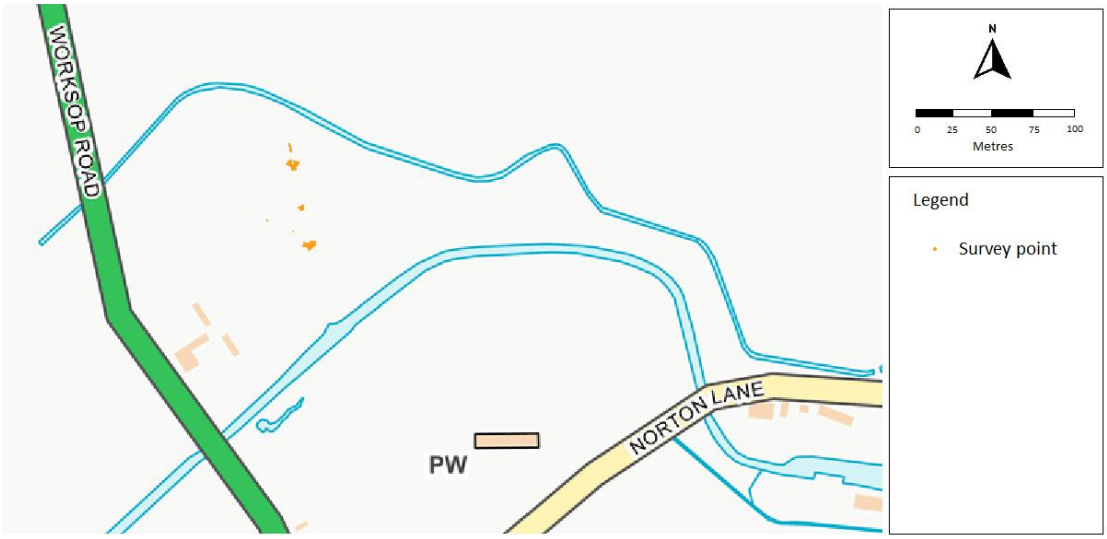

Figure 6: Sluice Gate Survey Points. Contains OS data © Crown copyright [and database right] 2019.

Photograph 2: Volunteers Bob and Sue Longden recording stone sluices using a Leica TS06 EDM Total Station.

Photograph 3: Volunteer Robin Orr recording stone sluices using a Leica GPS Viva.

Photograph 4: Volunteer Kevin Williamson recording stone sluices using a Leica TS06 EDM Total Station.

The stone sluices and and channels were cleared of vegetation by volunteers under the leadership of Bob Howlett. This clearance enabled the recording of the stones using the Total Stations mentioned in this section and also using

photogrammetric survey (see below).

5.1.4. Photogrammetric Survey Methodology

Photogrammetry is the method of recording measurements from photographs. The process enables the recording of high accuracy point locations on surfaces. In very basic terms a Photogrammetric survey consists of a large number of photographs being taken of an object of feature. These are then combined together using computer software to create models.

The project utilised photogrammetric survey, using Structure from Motion techniques, to create a detailed record of the standing remains of the stone sluice gate system to provide a record of the state of preservation of the remains, and to aid interpretation and analysis of the structures.

The methodology of the survey was undertaken in line with current best practice and standards and guidance, including but not limited to that in the bibliography.

The survey was undertaken using the Ordnance Survey British National Grid. The coordinate system and vertical datum was established using the control of survey mentioned above, and points recorded from a combination of Leica GPS Viva and TS06 Total Sation, and the OSGM02 transformation. The image control points for each survey were provided to a three dimensional accuracy of +/-3mm. No permanent survey marks were established on the site.

The photogrammetric survey used a Nikon D5100 16.2 megapixel DSLR with stock 18-55mm lens. Structure from Motion techniques was utilised.

Methodology of the photogrammetric survey followed Waldhäusl and Ogleby (1994), Grussenmeyer, Hanke K, Streilein A (2002), Historic England (2017), and other technical papers and standards and guidance, including those referenced therein, as appropriate.

The photogrammetric survey employed a camera base to subject distance ratio of no more than 1:4. Overlap between adjacent stereo images was of at least 80% and an overlap between adjacent strips of stereo image of at least 40%. The ground sample distance was a maximum of 3mm.

Community volunteers undertook part in the image capture process. All project volunteers received training and guidance from Mercian staff to ensure the images met the specifications and parameters for SfM photogrammetric survey. Image capture by project volunteers was supervised in the field by competent staff from Mercian Archaeological Services CIC to ensure compliance with the standard and guidance.

The photographs taken for the photogrammetric survey were used to produce a 3D point cloud model of the stones via structure from motion algorithms built in to 3DFlow's Zephr software. This software was used generate and output a textured point cloud that was manipulated and edited in Meshlab software (Cignoni et al 2008). The GIMP was used to trace the outlines of the existing stonework.

Photograph 5: David Budge undertaking Photogrammetric Survey of stone sluices.

5.1.5. LiDAR Analysis

A LiDAR (light detection and ranging) survey undertaken by Bluesky in April 2018. The survey covered an area from Whitwell Woods in the north to Church Warsop in south, and from Creswell in the west to Carburton in the east. The survey was undertaken at 0.25m resolution. Subsequent analysis of LiDAR data was undertaken by Mercian as part of the project, and the area of the catchwork water meadow produced excellent results.

The results are produced below and used in the interpretation of the water meadow system alongside the results from the fieldwork from this project.

5.2 Level One Survey methodology

A Level One survey of archaeological features was undertaken alongside the Level Two Survey. Features such as inlet valves, water inlets, stone sluices, wooden gates and ironwork features were recorded to understand the preservation of the site, and to help in interpretation of the system.

Each feature was given a unique identification code [CUCK18WM001], [CUCK18WM002]… where the site code element was ‘CUCK18’, and the ‘WM001’ element referred to the Water Meadows system and the individual reference number for the feature. The results can be seen in Appendix I. Each feature’s location was recorded using a Leica GPS Viva, or Leica TS06 Total Station, and was recorded via photographs.

The features are recorded in a table displaying the following headings:

Feature	Description	Easting	Northing	Photograph

Photograph 6: Volunteer Robin Orr recording features with a GPS Viva.

Photograph 7: Example of a photographic record of a water meadow feature.

5.3. Data preparation and analysis.

All survey data was processed in QGIS Geographic Information Systems (GIS) software.

5.4. Archiving and reporting

5.4.1. OASIS

An OASIS entry pertaining to the work has been created. The OASIS identifier for the project is OASIS ID - merciana2-357414.

5.3.2 Historic Environment Record

A copy of the report has been logged with the Nottinghamshire Historic Environment Record (HER).

5.3.3. Public Dissemination on-line

Mercian Archaeological Services CIC also publish free downloadable versions of this report via our website.

6. Results

6.1. Level One Survey Results

The Level one survey recorded 17 features listed in table 1, and the map in figure 7, below. Features include; wooden sluice gates, stone channels, stone inlets, and inlet valves. These features are discussed below in the conclusions section in relation to the interpretation of the function of the water meadow system. The Level One survey has enabled an analysis of the water meadow system, it is a record of the condition of the water meadow system at the time of recording, and forms the basis for management of the site. Table 1 is reproduced, along with a larger sized version of Figure 7, and photographs of each feature, in Appendix I.

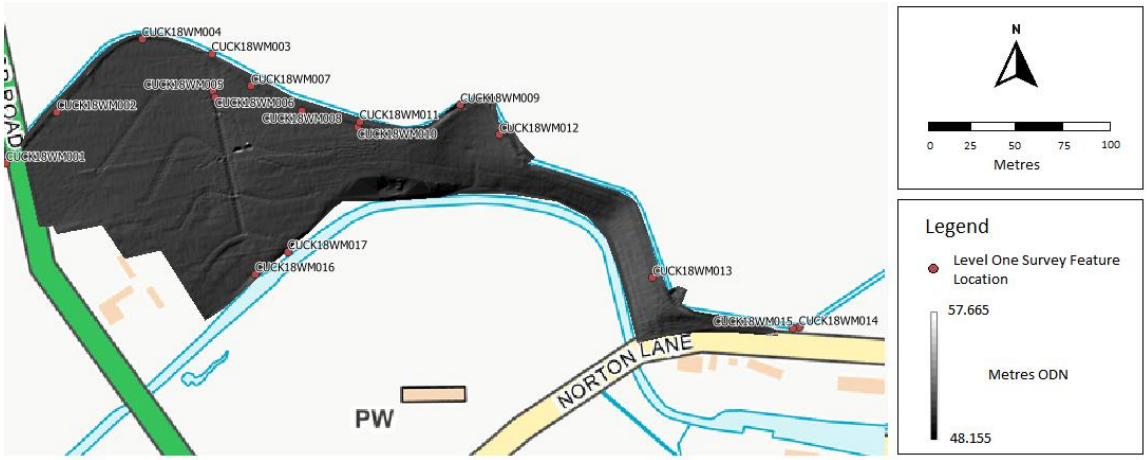

Figure 7: Level One Survey Results. Contains OS data © Crown copyright [and database right] 2019.

6.1.1.Table 1: Level One Survey Results

Feature	Description	Easting	Northing	Photograph
CUCK18WM001	Wood and Iron Sluice Gate	456323.127	371555.103	No Photograph - site inaccessible
CUCK18WM002	Water inlet from flood-dyke channel.	456359.722	371591.765	
CUCK18WM003	Water inlet valve for main sluice through here into a buried pipe before emerging to the south in the main stone channel [CUCK18WM006],.	456470.569	371633.745	
CUCK18WM004	Water inlet from flood-dyke channel.	456420.681	371644.130	
CUCK18WM005	Inlet for water into the stone sluice channel [CUCK18WM006], via an underground pipe from the flood-dyke channel to the north.	456471.901	371606.601	

CUCK18WM006	Main stone sluice channel	456473.004	371602.184	
CUCK18WM007	Stone water inlet from flood-dyke channel, with limestone baffle.	456499.060	371610.475	
CUCK18WM008	Stone water inlet from flood-dyke channel, with limestone baffle.	456535.442	371592.234	
CUCK18WM009	Wood and Iron Sluice Gate	456649.019	371596.982	

CUCK18WM010	Stone water inlet from flood-dyke channel, with limestone baffle.	456575.312	371581.093	
CUCK18WM011	Stone water inlet valve in flood-dyke channel, the iron paddle was opened to allow water to pass out of the flood-dyke channel to flood the water meadow panes to the south.	456576.696	371585.003	
CUCK18WM012	Stone water inlet from flood-dyke channel.	456677.073	371575.593	
CUCK18WM013	Limestone baffle- no associated stone water inlet from flood-dyke channel (blocked by presence of later path).	456787.055	371473.449	

CUCK18WM014	Wood and Iron Sluice Gate	456891.688	371437.834	
CUCK18WM015	Iron drain shield	456887.305	371437.288	
CUCK18WM016	Underground pipe outlet			No Photograph - site inaccessible
CUCK18WM017	Underground pipe outlet			No Photograph - site inaccessible

6.2. Level Two Survey Results

The Level Two survey recorded earthworks and features utilising both objective and subjective survey techniques as outlined above. The results are shown below in the form of shaded image models, hill-shade model and a 3D slope intensity model.

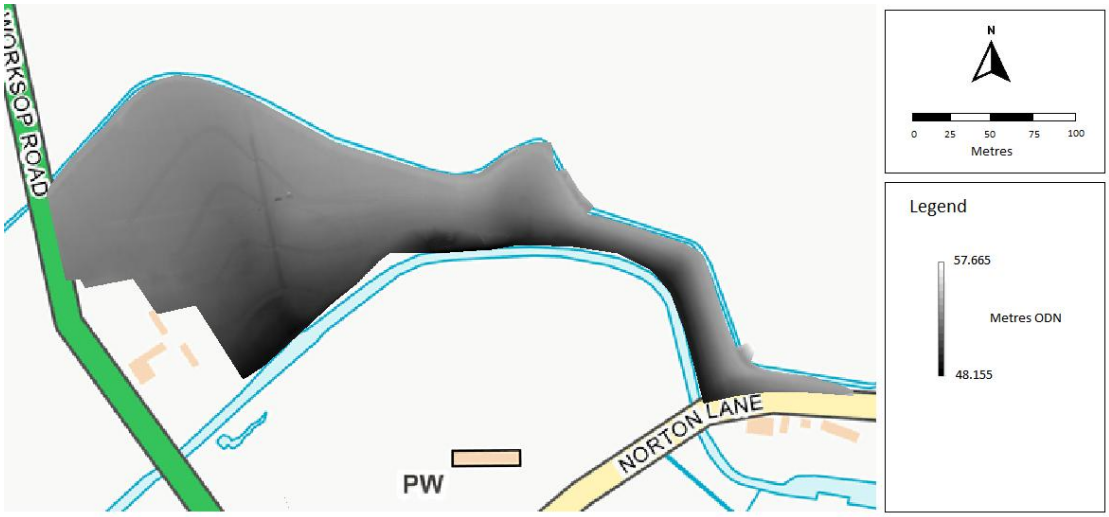

Figure 8: 3D Shaded Image model of Topographic Survey Points. Contains OS data © Crown copyright [and database right] 2019.

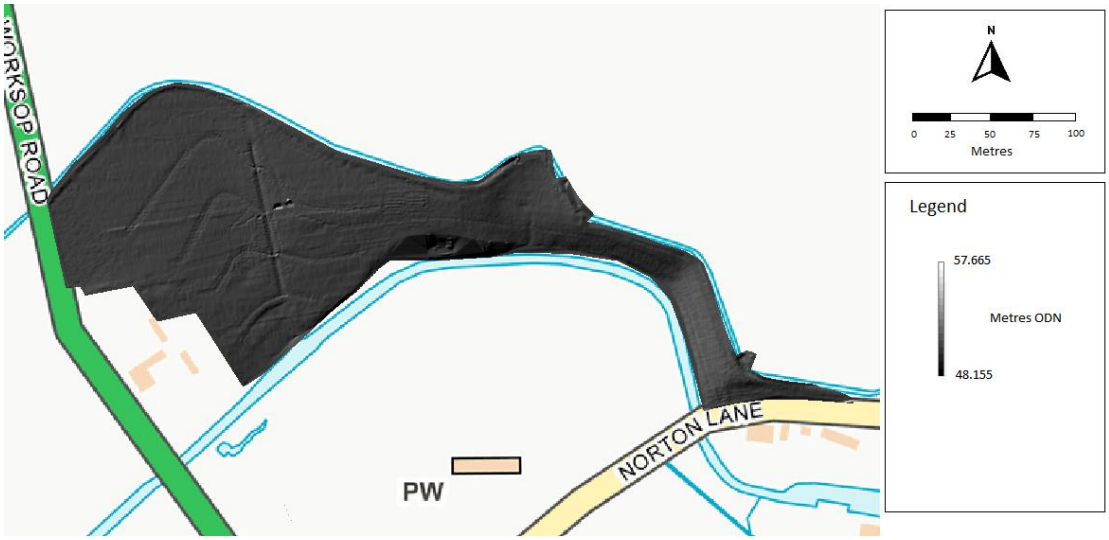

Figure 9: 3D Hill-shade Image model of Topographic Survey Points. Contains OS data © Crown copyright [and database right] 2019.

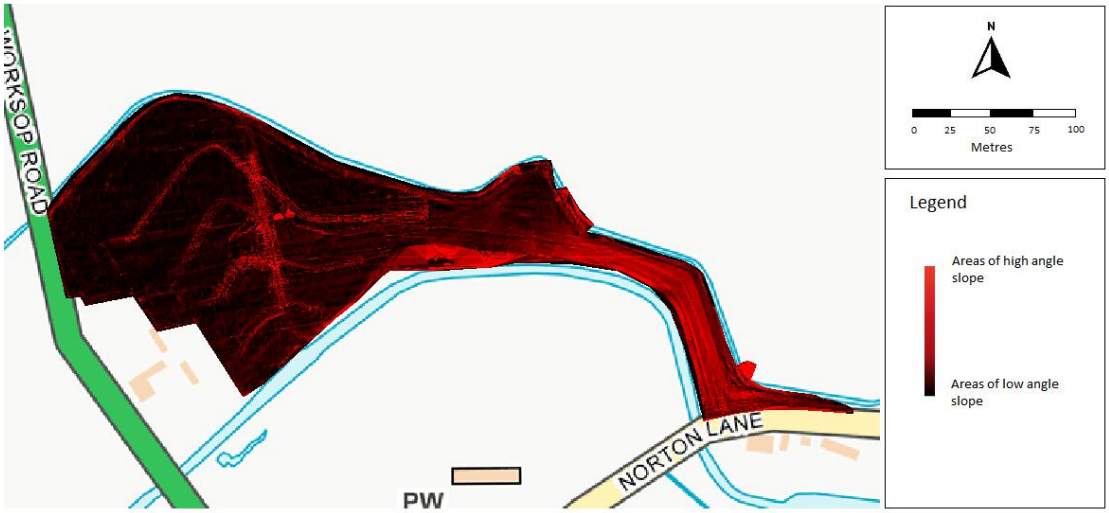

Figure 10: 3D Slope Intensity model of Topographic Survey Points. Contains OS data © Crown copyright [and database right] 2019.

6.3. Subjective Survey Results

The subjective survey focused on the channels and stone sluice complex, which consists of 6 panes and, 5 earthwork channels, a stone-lined channel, and 3 sluice-gate systems. The system is discussed in detail in the conclusions section below, in section 7. The results from the subjective survey can be seen in Figure 10.

Overall the combined subjective and objective surveys revealed 9 panes (see section 9 below).

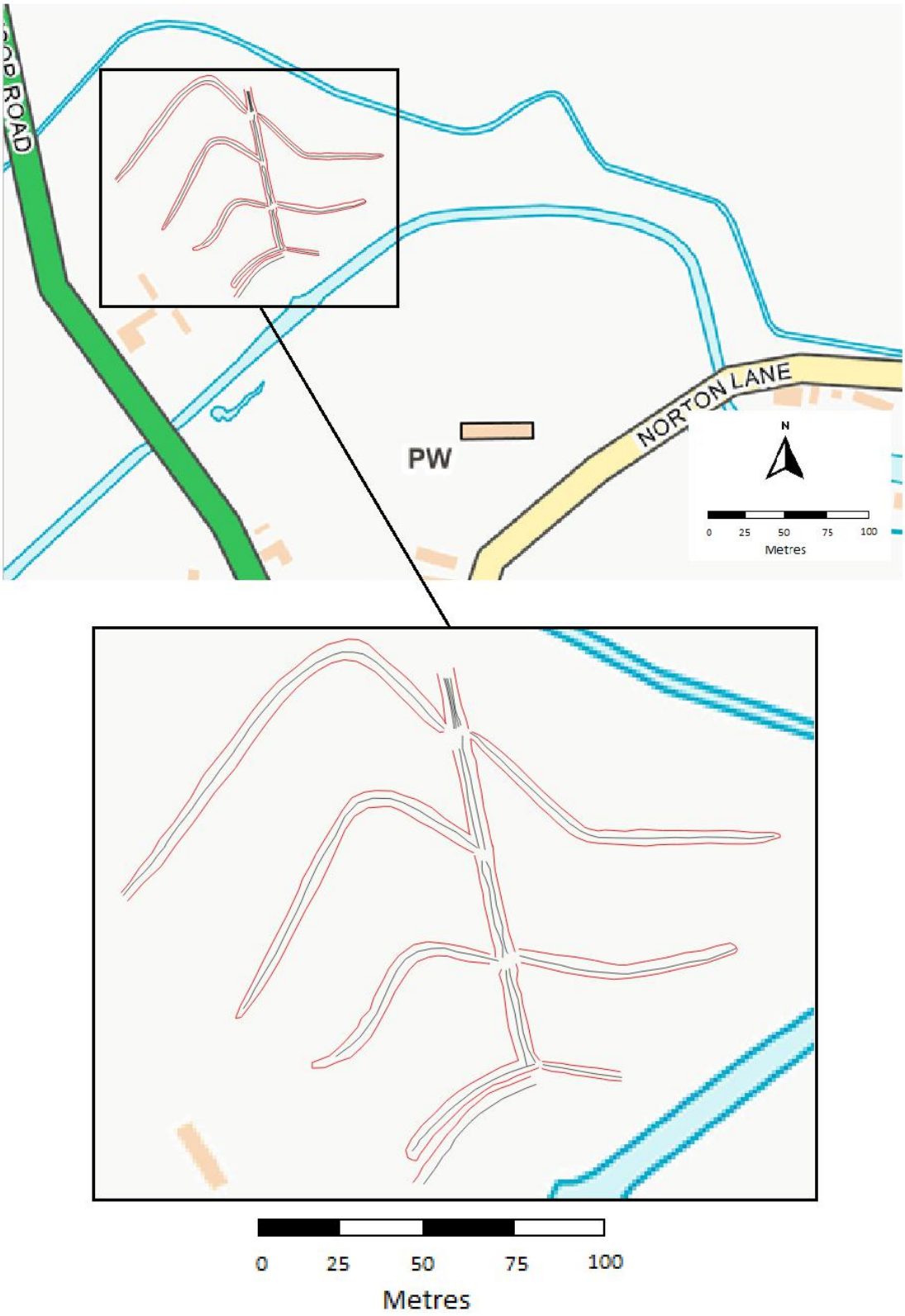

Figure 11: Topographic Subjective Survey Results, annotated for discussion. Tops of slopes marked with a red line, bottom of slopes marked with a blue line. Contains OS data © Crown copyright [and database right] 2019.

6.4. LiDAR Survey Results

The LiDAR survey results are displayed below in figures 12 and 13. The results are created from data collected by Bluesky at 0.25m resolution. They are excellent at a landscape scale, but the resolution is not sufficient for recording in detail individual features and stones. The data therefore forms an important part of analysing the site, when used in conjunction with the more accurate survey data produced in the field ads part of this project. The LiDAR data was also collected in April 2018, before the site was cleared of vegetation by Bob Howlett and other volunteers for the fieldwork, and therefore many features are concealed at the time.

Figure- 12: LiDAR survey data results showing the water meadows system to the north of the canalised River Poulter. Images produced by Mercian from original data provided by Bluesky.

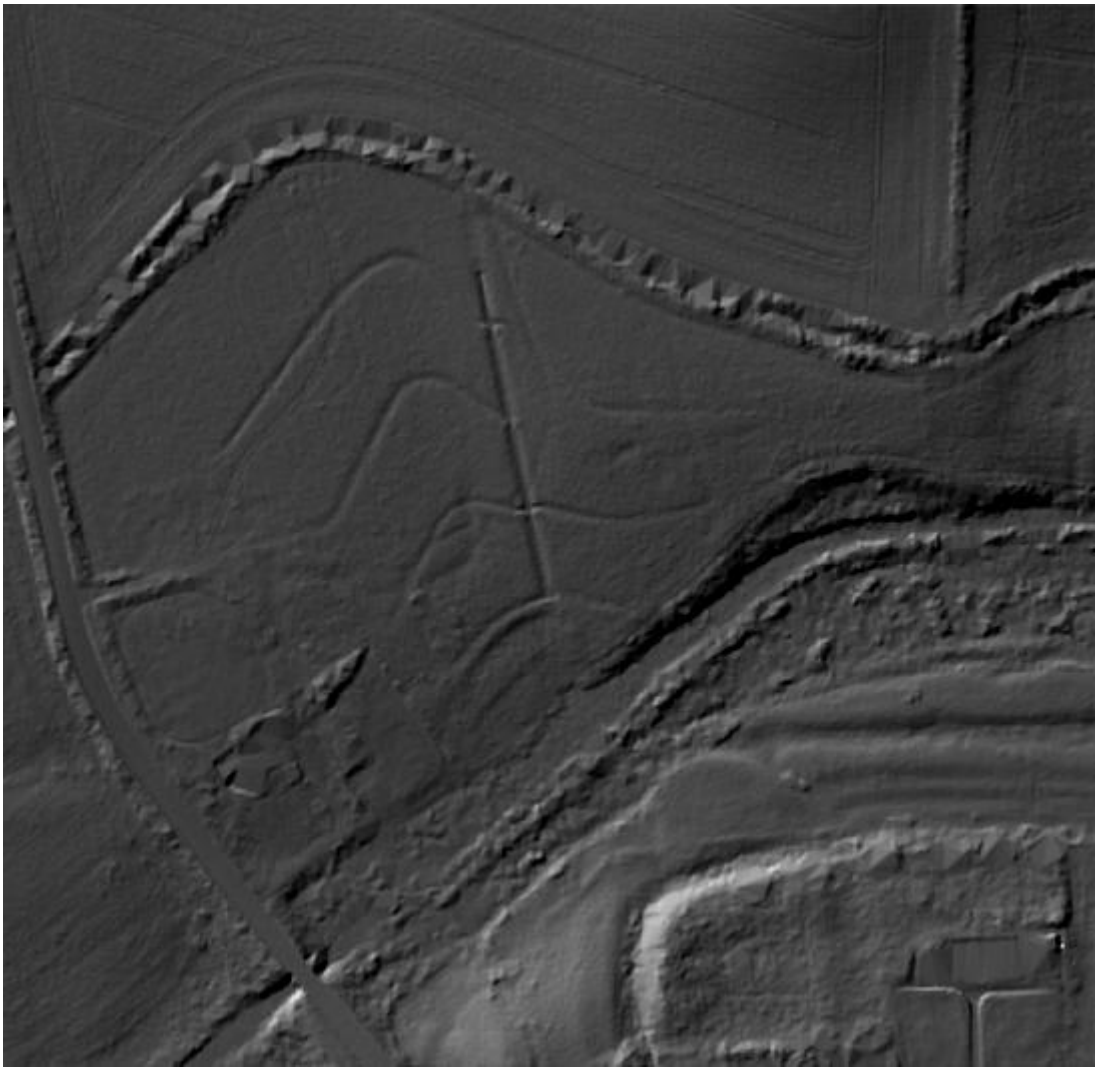

Figure13: LiDAR survey data results showing the water meadows system to the north of the canalised River Poulter. Images produced by Mercian from original data provided by Bluesky.

6.5. Photogrammetric & Sluice Gate Topographic Survey Results

Photograph 8: Stone sluice SG1, photograph facing south-east. Taken during photogrammetric survey. Scales are in 0.2m divisions.

Photograph 9: Stone sluice SG2, photograph facing north. Taken during photogrammetric survey. Scales are in 0.2m divisions.

Photograph 10: Stone sluice SG3, photograph facing south-east. Taken during photogrammetric survey. Scales are in 0.2m divisions.

The Photogrammetric survey results used ordnance survey points collected through topographic survey using GPS and Total station as stated above in the methodology. These points were used in the processing of the photogrammetric data to give the coordinate system and vertical datum in Ordnance Survey British National Grid. The results of the photogrammetric survey can be seen in figures 14 to 20 below, and are discussed in the conclusions below.

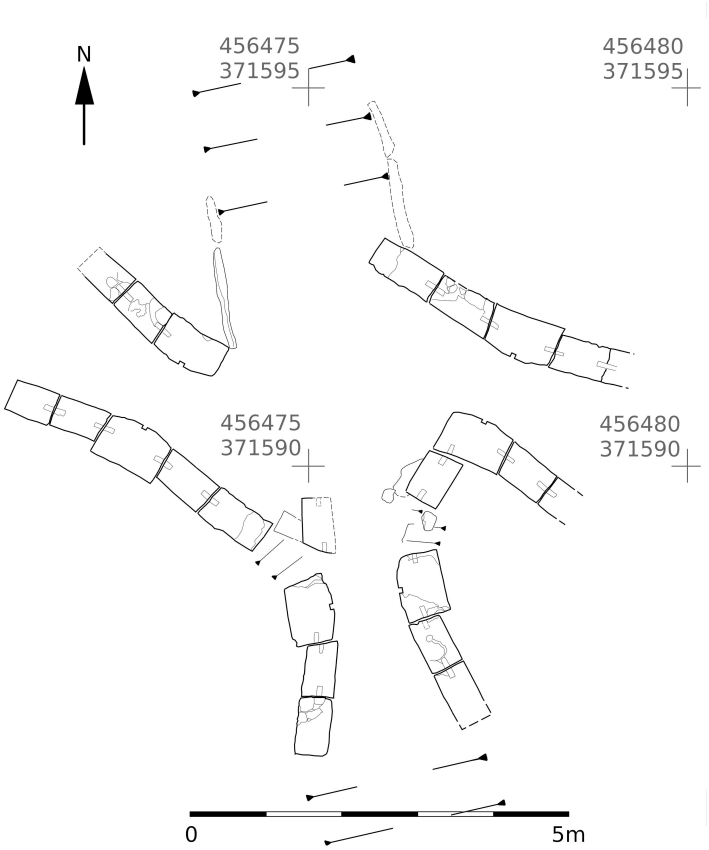

Figure 14: Plan of Sluice Gate 1 (SG1). Scale 1:100. Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps. Plan by D. Budge 2019.

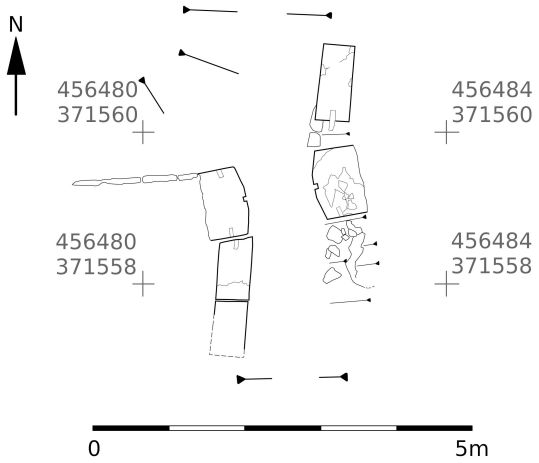

Figure 15: Plan of Sluice Gate 2 (SG2). Scale 1:100. Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps. Plan by D. Budge 2019.

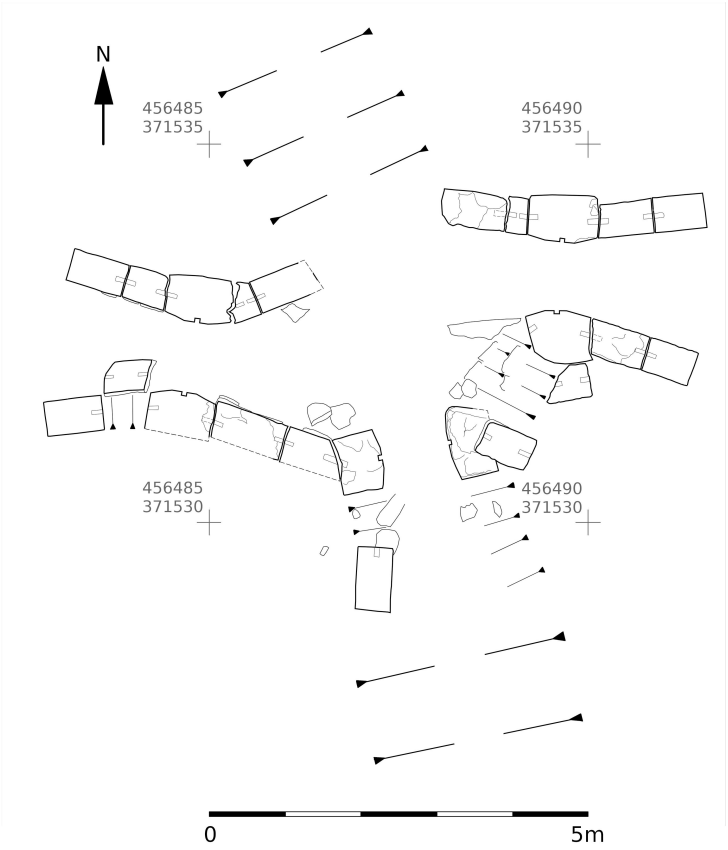

Figure 16: Plan of Sluice Gate 3 (SG3). Scale 1:100. Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps. Plan by D. Budge 2019.

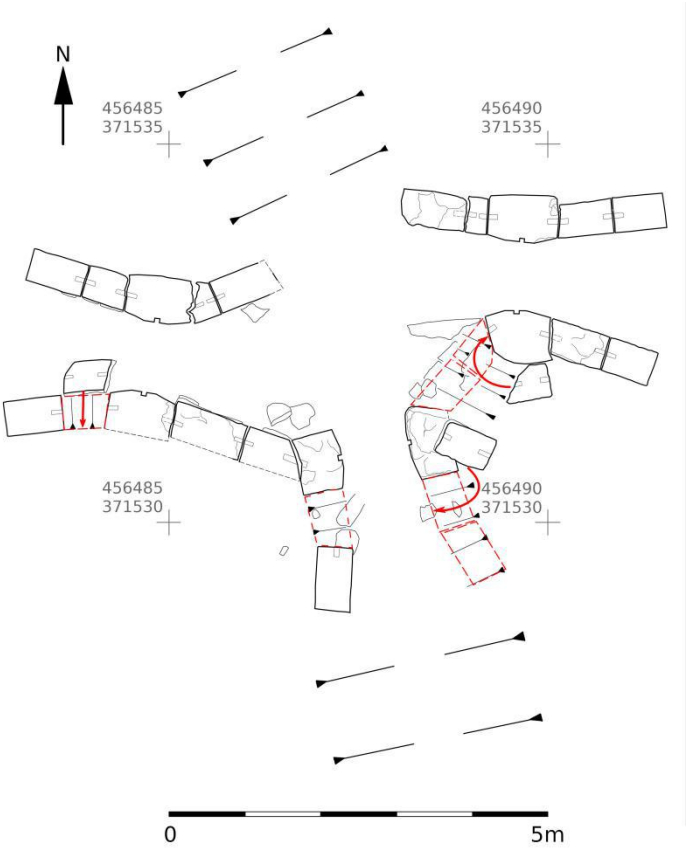

Figure 17: Plan of reconstruction of Sluice Gate 3 (SG3), showing where the stones now lie and their likely original locations in the sluice system. Scale 1:100. Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps. Red dashed lines show stones present in the coarse beneath those which have since moved. Plan by D. Budge 2019.

7. Conclusions & Discussion of the water meadow system

Recording, and subsequent analysis of the results of the LiDAR, photogrammetric, and topographic surveys of the site of the catchment water meadow system, has allowed a detailed interpretation of its form and function. Detailed three dimensional photogrammetry has recorded the level of preservation of the stone sluices at the present day.

Ground-truthing and prospection of the wider water meadow system has helped to discover iron water management features and pipe work, and has

also show that the water meadows were an addition to an already existing system of ponds and leets powering a series of mills along the length of the Poulter between Langwith and Carburton.

The following discussion relates to the results and interpretation depicted in figures 18-26 below. All features detected in the surveys have been allocated codes, to allow a detailed discussion, and for management of the site.

The system at Cuckney took water from the pond at Old Forge Dam upstream to the west (see figure 27 below). The pond and dam pre-existed the water meadows system which utilised the water from the pond, by carrying it into the flood-dyke channel via an aqueduct constructed over the River Poulter (which ran around the pond on the northern side).

The Old Forge Dam and pond, and pre-existing system may be in part medieval. Mill Hill on the southern side of the lake is mentioned in 1585 as *'Milne Hill*' (Gover, Mawer and Stenton 1940, p75). The pond was also used to drive a water mill.

The water was carried northwards from the Old Forge Dam pond in a flood-dyke channel which followed the contour level from the height of the water in Forge Dam, a height of around 54m. This flood-dyke has a sinuous form along its length, due to the necessity of following the contour line across the landscape. By following this contour, as the River Poulter continued its eastward journey to the south of the flood-dyke, it enabled a head of water to be transferred from the original water level in the Forge Dam pond to the water meadow system. The River Poulter had continued to gradually lose height as it moved eastwards. The River Poulter, itself canalised in this section had travelled 680 metres from the Old Forge Dam pond to the point where the sluice cascade drained into it at channel [CUCK18WM16], and fallen to a height of 48.5m when measured. The flood-dyke water had travelled 970m and maintained a height of approximately 54m (a slight fall must have existed within the flood-dyke, along its length, for water to flow in the correct direction, but it was not possible for absolutely accurate readings to be recorded along

the inside of the flood-dyke due vegetation and silting). These measurements are to give an indication of the variation in height produced by the system. The actual values would be dependant on the amount of water in the flood-dyke when in use, and the amount of water in the RIver Poulter which of course fluctuates. This transfer of water in the flood-dyke generated a difference of over 5 metres in height from the point where water fed into the system [CUCK18WM003], to the point where it drained into the River to the south of the main sluice gate channel [CUCK18WM16].

The water meadow system in the fields surveyed was divided into 9 panes. For the sake of modern interpretation and discussion the system has been divided into a number of sections (see figure 18). From west to east: Section 1 containing Panes 1 - 7, and Section 2 containing panes 8 and 9. Section 1 is sub-divided into part A containing Panes 1-4, part B containing Panes 5 and 6, and part C containing Pane 7. Section 1 and Section 2 therefore represent the the portions of the water meadow system either side of the iron and timber sluice gate [CUCK18WM009].

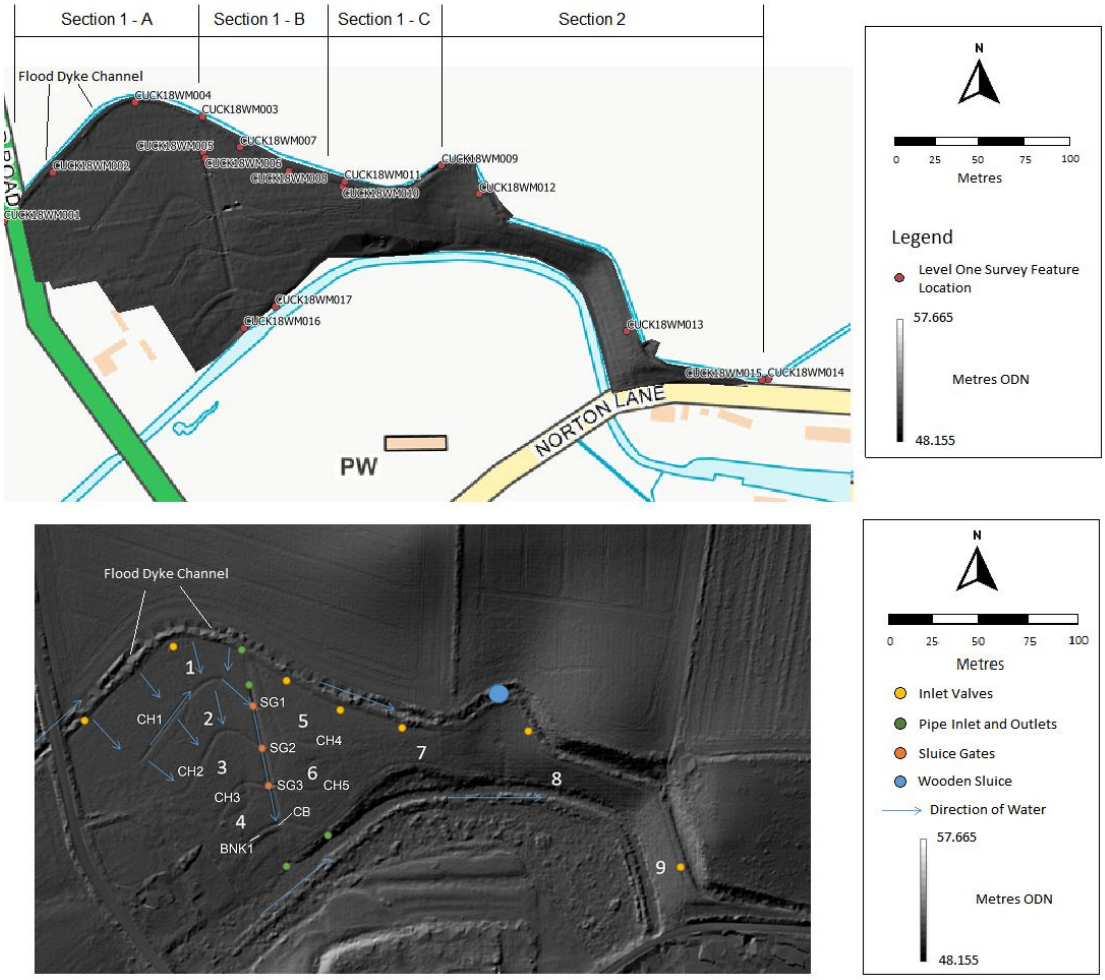

Figure 18: The Cuckney water meadows system showing the 9 panes that could be individually flooded and drained. The water inlets are marked in yellow, Example flooding of panes 1 and 2 show in blue arrows. Images produced by Mercian from original data provided by Bluesky.

Water was fed into the flood-dyke by opening the wooden sluice gate [CUCK18WM001], and the flow could also be cut off by closing the gate. The water could then be used to flood nine panes located eastwards of [CUCK18WM001] and all to the south of the flood-dyke channel. The system of panes was complex and designed to best utilise the landscape, and to allow panes to be individually, or collectively flooded depending on need.

In order to flood panes 1-7 the large iron and timber sluice gate (east) [CUCK18WM009] (marked with a blue circle on figure 18 and by code and point) had to be closed to allow water to build in the flood-dyke to the west.

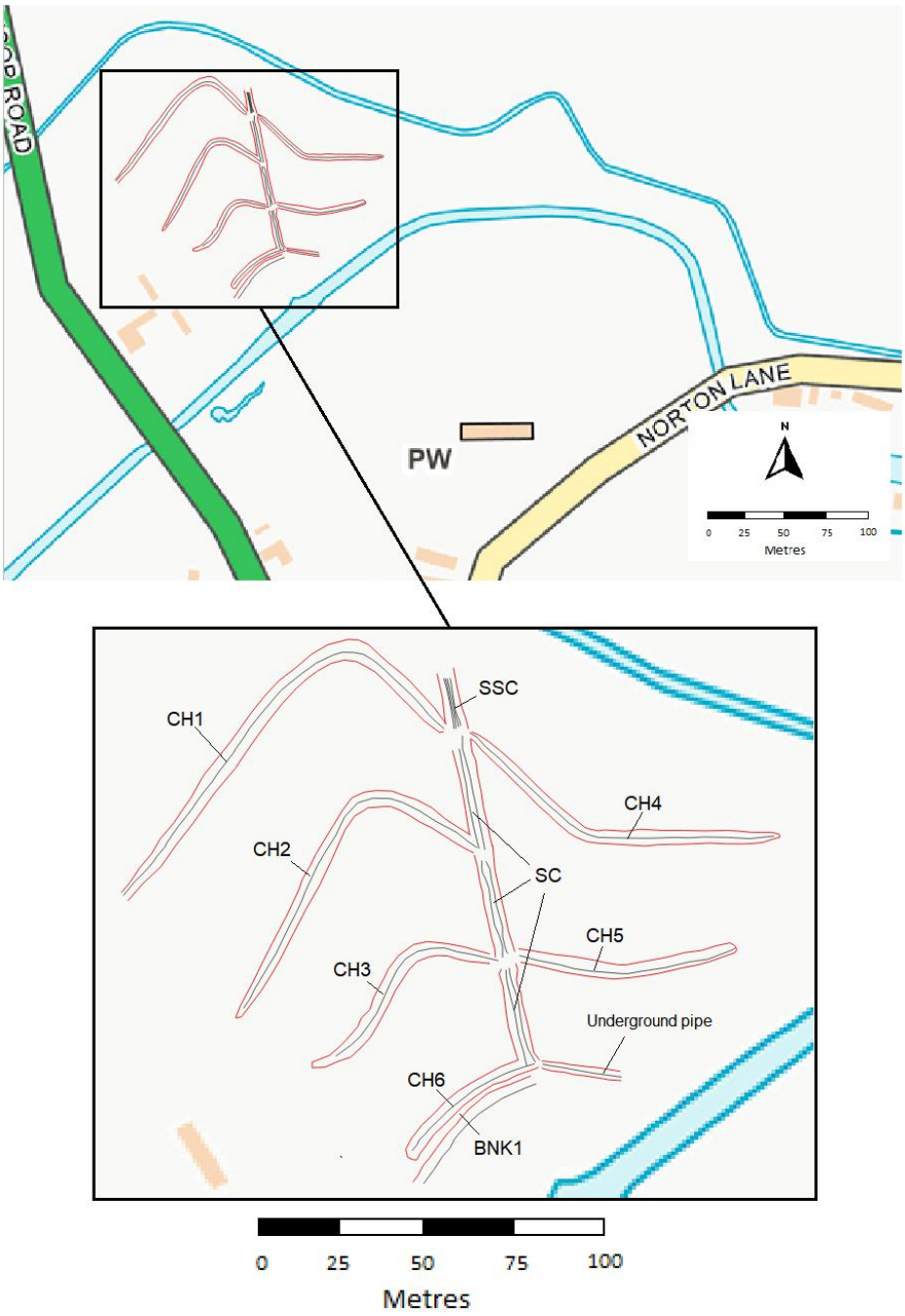

Figure 19: Topographic Subjective Survey Results, annotated for discussion. Tops of slopes marked with a red line, bottom of slopes marked with a blue line. Contains OS data © Crown copyright [and database right] 2019.

The first section of panes are shown as panes 1 - 6. These form a complex system both fed, and drained, by a cascade of stone sluices (SG1 - SG3). The stone sluice system is discussed in detail below.

The panes are separated by six drainage channels (CH1 - CH6 on figures 18 and 19). Pane 1 is located to the south of the main flood dyke. It was fed by two inlet valves [CUCK18WM002] and [CUCK18WM004]. If these were opened water entered and flooded Pane 1. Water moved down slope across Pane 1 and entered the channel CH1 to the south. If Sluice gate 1 SG1(i), was closed water would fill CH1 and would then cascade downwards onto Pane 2. If SG2 SG2(i) was closed CH2 would fill up and water would cascade down-slope onto Pane 3, and likewise if SG3 SG3(i) was closed water would fill up CH3 and water could flood Pane 4. Water could then enter the channel CH6 at the southern edge of Pane 4 adjacent to the earthen bank BNK1, which formed the southern end of the complex. Alternatively, if water was draining through SG3 SG3(i), to allow drainage from Pane 3 (via CH3), and SG3(iii) was opened, water would then exit southwards into the southern part of SC (sluice channel). It would then continue to the bottom of the system, where a stone baffle CB was built to retain the water and reduce erosional impact (see photograph 11 below).

Photograph 11: Stone baffle ‘CB’ photograph facing south-south-east.

Water could then be returned to the River Poulter though drains which disgorged at [CUCK18WM016] and [CUCK18WM017]. Alternatively, water could by-pass Pane 1 by being fed into the sluice gate cascade via [CUCK18WM003]. From here water was fed through a buried pipe and entered

a stone-lined sluice channel [CUCK18WM006] (labelled SSC on figure 19), via a stone outlet [CUCK18WM005]. Here the water could be used to flood Panes 2, 3, and 4 either individually, or collectively, by controlling the water supply at SG2 and SG3.

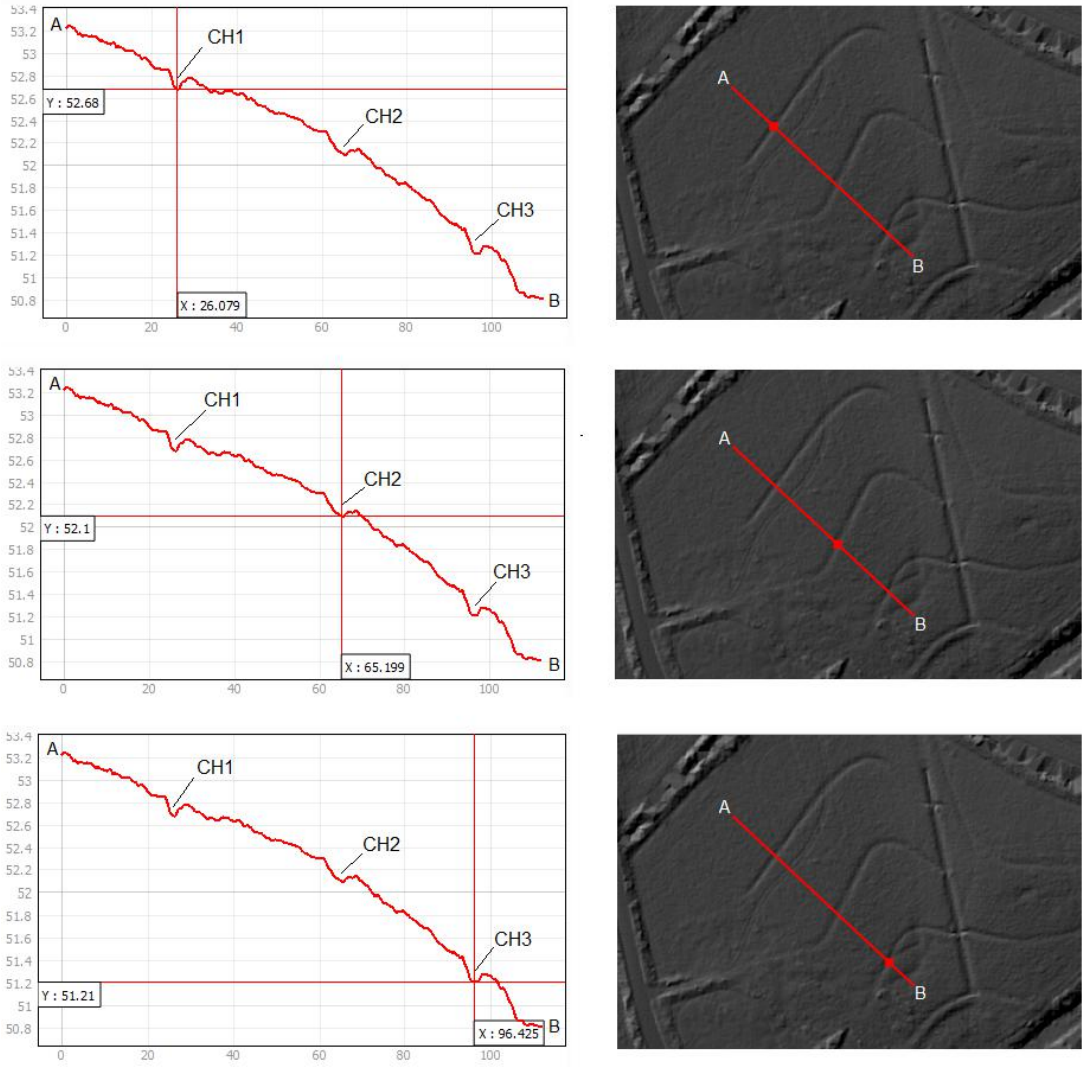

Figure 20: Cross-section 1. Cross section across panes 1-4 showing depths of the bottoms of channels CH1 - CH3. The graphs on the left hand side show the distance along the cross-section as the X Axis, with height above sea- level (ODN) on the Y Axis. The X and Y values displayed on each graph, are for the bottoms the channel CH1- CH3 respectively. The location of the readings on the graph are displayed on the ground on the associated image map to the right of each graph.

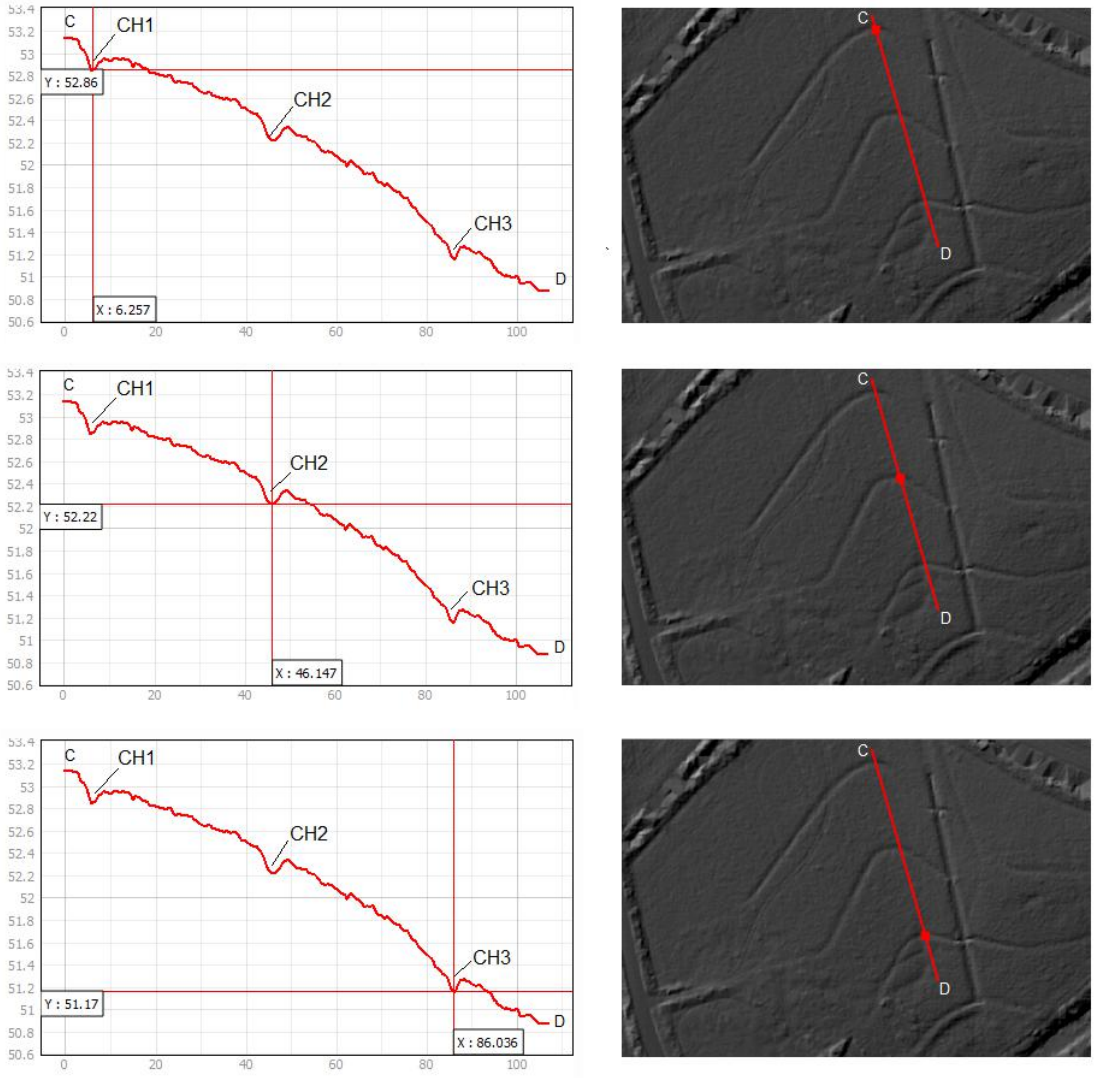

Figure 21: Cross-section 2. Cross section across panes 1-4 showing depths of the bottoms of channels CH1 - CH3. The graphs on the left hand side show the distance along the cross-section as the X Axis, with height above sea- level (ODN) on the Y Axis. The X and Y values displayed on each graph, are for the bottoms the channel CH1- CH3 respectively. The location of the readings on the graph are displayed on the ground on the associated image map to the right of each graph.

The cross-sections in figures 20 and 21 above show profiles across panes 1- 4, and channels CH1- CH3. The height readings demonstrate that (allowing for silting and some ground movement over time) the channels CH1- CH3 were approximately level across their length. This means that the channels could be drained, or filled, from the same sluice gates. This allowed each pane to be flooded, and drained, either independently, or combination with other panes, dependant on requirements. If the system was left empty, between

periods of use, excess water remaining in the channels would drain naturally into the sandy soils.

The eastern side of the sluice gate cascade were two panes. Pane 5 was up-slope of Pane 6, and was fed by stone inlets [CUCK18WM007] and [CUCK18WM008] from the flood-dyke channel to the north. Pane 5 was flooded and water passed down-slope across the pane to fill channel CH4 to the south. If SG1 was closed on this side (SG1(ii)), water could then be allowed to over-top CH4 to flood Pane 6 to the south.

SG2 did not have a channel or sluice gate on its eastern side and therefore Pane 6 stretched from CH4 to CH5 which fed into SG3 through SG3(ii). It is possible a further pane was situated to the south of Pane 6 and CH5, however no channel remains at the likely southern edge of this area. The line visible in the LiDAR data which could be interpreted as the bottom of a further pane is in fact the line of a covered underground stone-lined and stone-capped drain (marked as underground pipe on figure 19) which allows water from the sluice cascade to flow back into the River Poulter. This drain emerges as [CUCK18WM017]. Further investigation would be required to interpret whether this drain was altered from a pre-existing channel, if so then there may well have originally been a further pane south of Pane 6.

It is assumed here that there were only two Panes on the eastern side of the cascade (but further investigation could reveal there were formerly three panes) where there were four in the equivalent portion to the west. This is most likely due to a narrowing of the field due to the shape of the land caused by the topography and the location of the flood-dyke which maintained its height and followed the contours of the landscape.

Pane 6 could be independently fed from SG1 through (SG1(ii)) via CH4 without Pane 5 being flooded. Whether flooded along with Pane 5 or independently, water appears to have flowed from Pane 6 into the River Poulter to the south.

In this way the cascade of sluices and the associated channels could be used to flood and drain each pane 1- 6 individually, collectively as a whole, or in groupings.

The stone sluices have been recorded in detail through both topographic survey using Total Stations and through photogrammetric survey. The survey has shown the level of preservation, and has helped in interpretation.

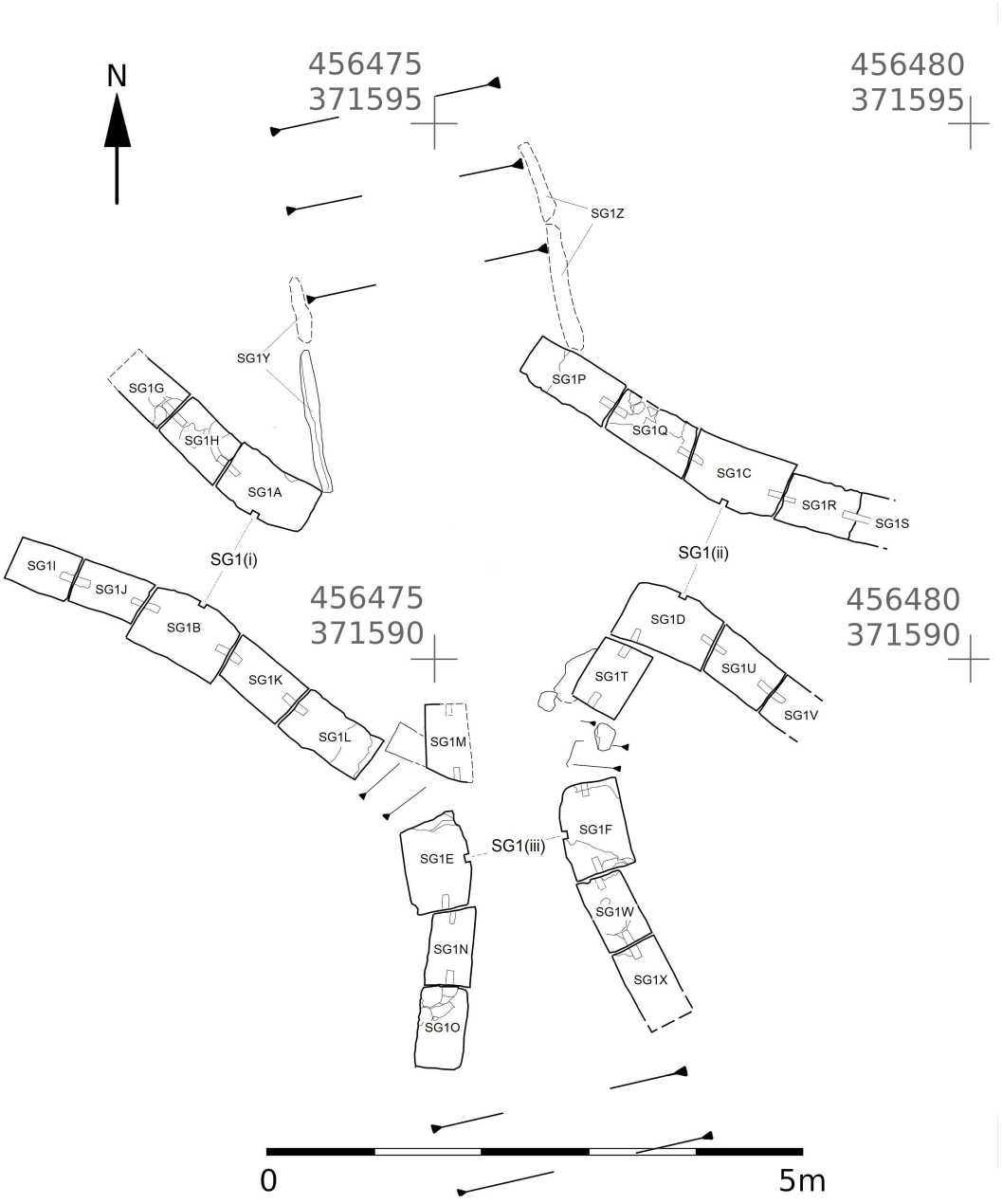

Figure 22: Labelled plan of Sluice Gate 1 (SG1). Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps.

Sluice gate 1 (SG1) consists of three sluices; SG1(i), SG1(ii), and SG1(iii). The sluices are constructed of large Limestone blocks. The blocks forming gates SG1(i); SG1A and SG1B, contain a chiselled central groove where wooden boards could form the 'gate', blocking the flow of water between the two stones (see figure 22). Either side of the central groove, the stones have been chamfered, to form angled surfaces to allow the channels to funnel water into and out of the sluice gate. This is the case for SG1(ii) where the gate is formed between SG1C and SG1D, and also for SG1(iii) where stones SG1E and SG1F form the gate. All the sluice gates in the system are carved in this way (see figures 22-24).

SG1(i) drains Pane 1 where water enters SG1 from the west (via CH1). SG1(ii) drains Pane 5 (via CH4) where water enters SG1 from the east. Water is then either blocked from leaving SG1, or allowed to flow southwards via SG1(iii). The channel entering SG1 from the north is stone lined on both the channel sides and base. SG1Y and SG1Z are stones lining the side of the channel where it enters SG1.

Stone SG1M can be seen to have fallen north-eastwards into the channel, but otherwise most stones are in situ. Originally lead clasps were used to bind the large stones together. The lead has been removed, but the grooves carved into the stones are still present in most cases, except where erosion has removed them.

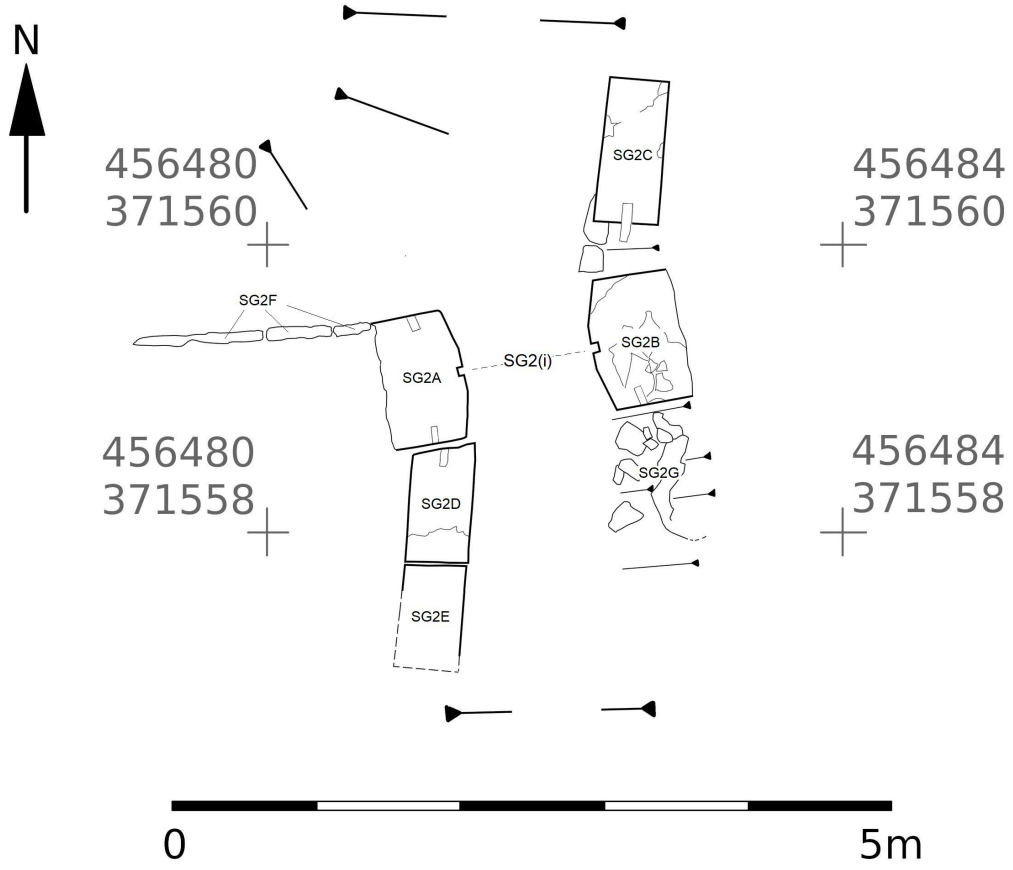

Figure 23: Labelled plan of reconstruction of Sluice Gate 2 (SG2). Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps.

Sluice Gate 2 SG2 consists of a single stone sluice SG2(i). SG2(i) is formed by stones SG2A and SG2B, which are similar to those in SG1, being chamfered, and containing a groove for the sluice boards. SG2(i) controls water flow through the sluice channel SC (figure 19). Stone SG2C has slumped northwards. This stone still has its lead clasp in place. The stone (absent but marked as SG2G) has disappeared. However, together with SG2B they represent the complete extent of stones on the eastern side of SG2, and this supports the suggestion above that there was no eastern gate at SG2.

There is also no western gate at SG2. Channel 2 CH2 flows into SG2 at this point and the stones marked SG2F provide protection from erosion at the point where CH2 enters SG2. Although there is no evidence present of any

previous former sluice gate on the western side, it could, of course, have been removed through alterations to the system. The presence of a groove cut into SG2A on its northern edge may suggest that there originally were further stones on this side. It could be that a previous gate on this side was removed, which originally controlled flow from CH2 into SG2. However CH2 would have needed to have been located slightly further north in such an instance, and there is no evidence of this. It is likely that, as the was no eastern gate in SG2, and no associated channel on that side, it was unnecessary to have a separate gate for CH2 on the western side of SG2. Water could be easily controlled through SG1(i) and therefore resources and money could be saved by operating SG2 as a single gate. In this case the presence of a groove on the northern edge of SG2 could suggest the grooves were added prior to construction by masons, not added on site once the stones had been put in place.

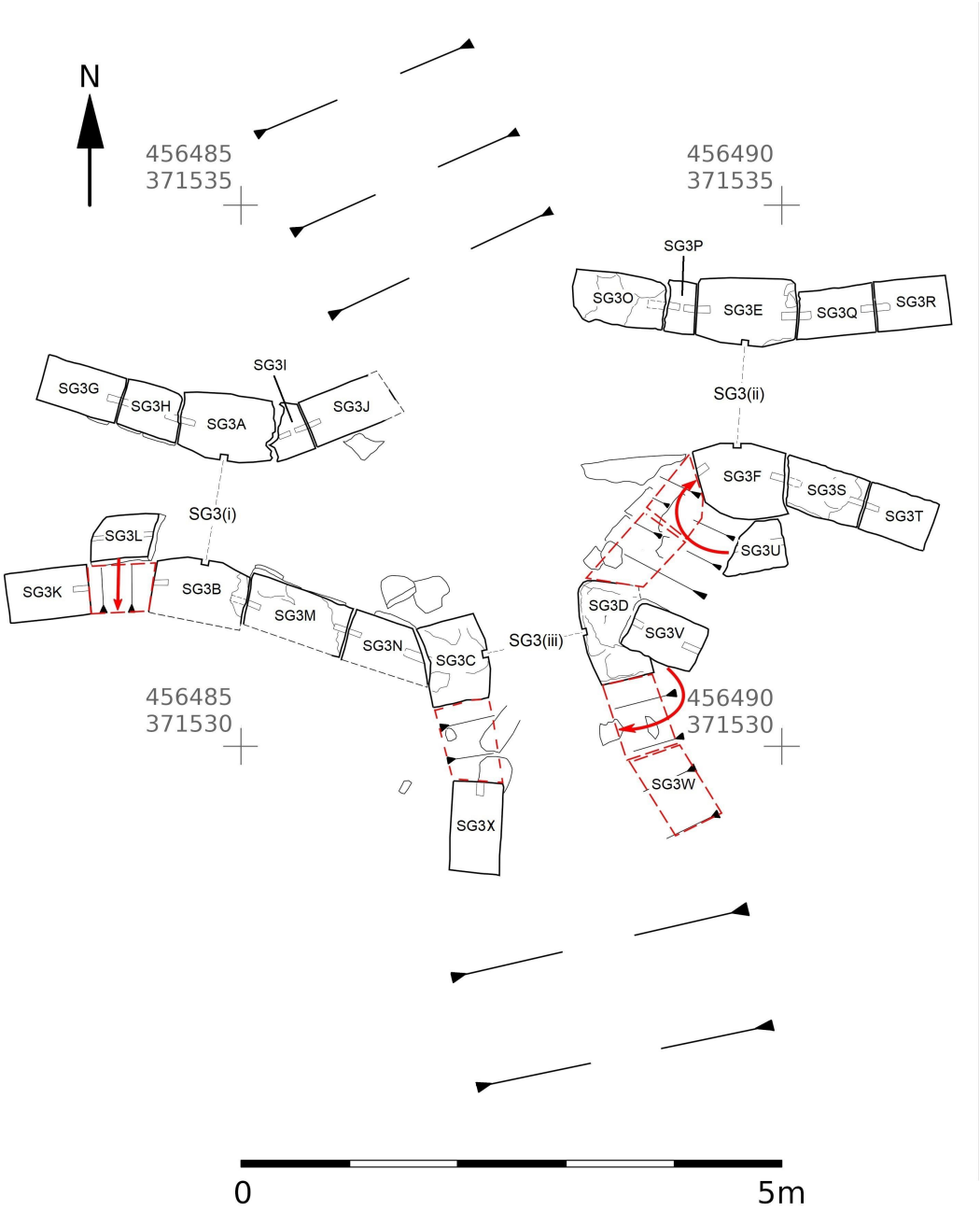

Figure 24: Labelled plan of reconstruction of Sluice Gate 3 (SG3), showing where the stones now lie and their likely original locations in the sluice system. Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps. Red dashed lines show stones present in the coarse beneath those which have since moved.

Sluice gate SG3 consists of three separate gates: SG3(i) formed from stone blocks SG3A and SG3B, controlling flow from channel CH3; SG3(ii) constructed from stones SGE and SG3F, controlling flow from channel CH5; and SG3(iii) created from stone blocks SG3C and SG3D, controlling the flow onwards into the southern part of SC.

The large stone blocks were shaped, and joined together with lead straps (now absent). The reconstruction above (figure 24 (and figure 17 in results section)) shows the likely locations of stones SG3L, SG3U, SG3V, and SG3X. The red dashed lines show stones from lower coarses still in situ where these stones were originally located.

The survey has shown that although damage has occurred to the stone sluice gates that form the cascade, the systems are still in good condition and this survey by detecting, recording and interpreting these important features, has helped to show that they are in very good state of preservation.

The channels CH1 - CH5 were cut to follow the contours of the hill-slope which they drained. CH1 to CH3 followed the contour of the field in this section with their western ends being further to the south, curving northwards in the middle and then returning southwards at the eastern end to enter the corresponding sluice gates. Conversely CH4 and CH5 curved southwards in the middle, with their eastern and western ends being further north, as a result of the changing shape of the contours in this part of the field.

To the east of Panes 1 - 6, was Pane 7. This could be flooded by opening a stone water inlet valve [CUCK18WM011] in the flood-dyke channel. Water passed through the bank of the flood-dyke to enter Pane 7 via the stone inlet [CUCK18WM010].

To the east of Pane 7, Panes 8 and 9 were flooded directly from the flood-dyke channel via stone inlets [CUCK18WM012] and [CUCK18WM13] (associated stone inlet missing - see below). This section of the flood-dyke was filled by opening wooded sluice [CUCK18WM009], and by closing wooden sluice [CUCK18WM014] at the eastern end of the system, to allow water to build up (see figure 18).

Stone inlets frequently were accompanied by stone baffles set to the south (down-slope) of the inlet to enable water entering the panes to be dispersed laterally to reduce the risk of erosion as the water entered the pane under pressure, and with considerable energy. These are preserved as

[CUCK18WM007], [CUCK18WM008] (feeding Pane 5), [CUCK18WM010] (feeding Pane 7), and [CUCK18WM013] (feeding Pane 9). The stone inlet associated with [CUCK18WM013] has been removed by the footpath crossing the pane at this location.

Panes 8 and 9 are single panes stretching from the flood-dyke to the river. This section of the system is very steep, according to Hillman and Cook, represents a "*relatively unusual example due to the steepness of the slopes involved*" (Hillman and Cook 2016 p88). It appears that water from these two panes along with Pane 7 flowed straight back into the River Poulter on the southern side. However there may have been associated drainage channels which are no longer present, that may have been removed from the river flood plane, in the intervening years following the water meadow system going out of use.

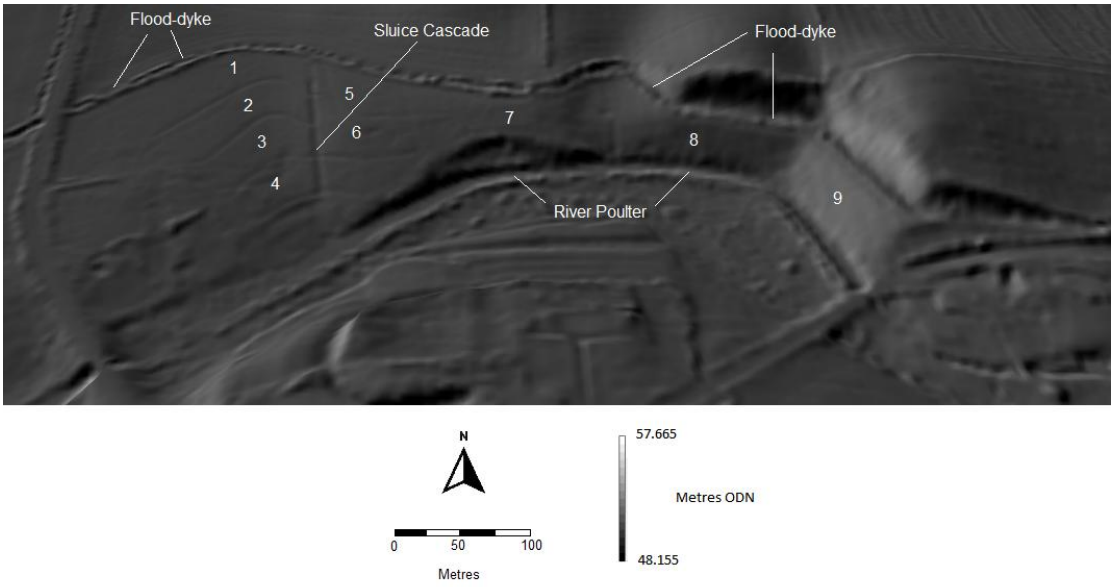

Figure 25: 3D LiDAR data model. Catchment Water meadow system looking North. The Panes are labelled by number. Panes 1 - 6 are aligned wither side of the sluice cascade. Panes 8 and 9 can be seen to occupy very steep ground. The Flood-dykes sinuous shape can be seen following the contour of the hillside. Images produced by Mercian from original data provided by Bluesky.

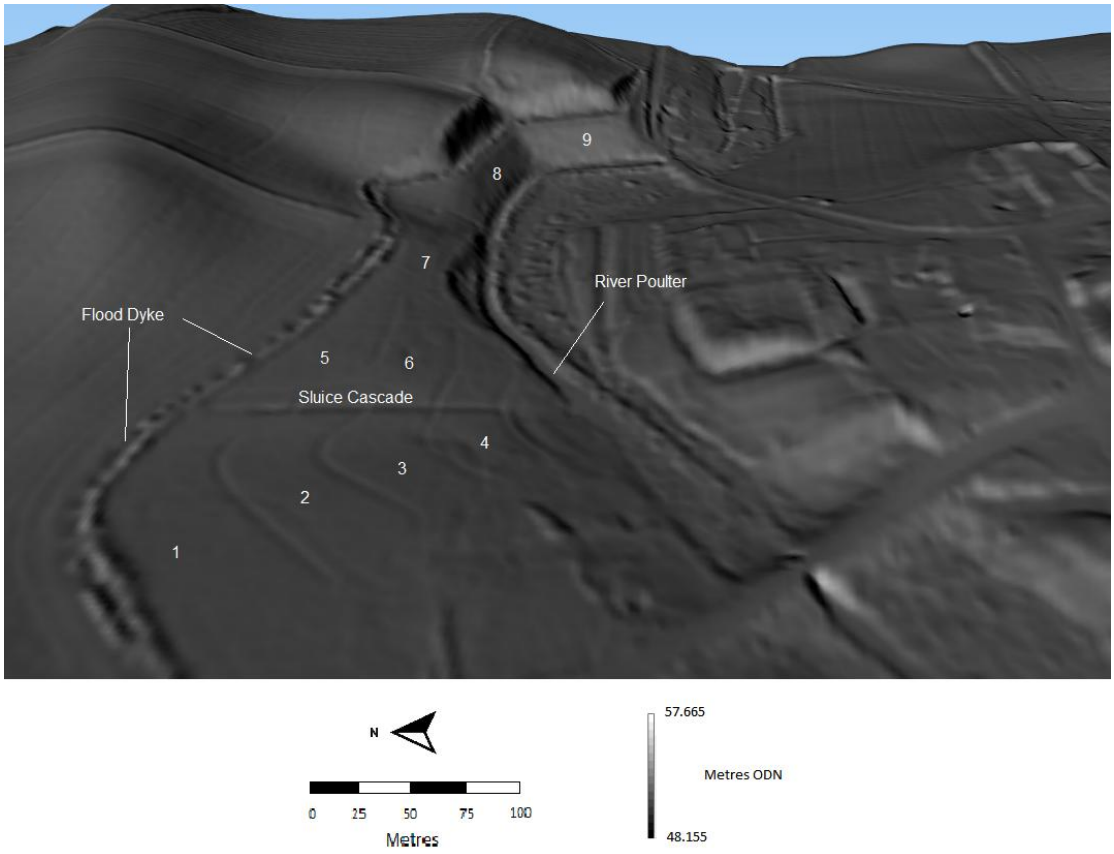

Figure 26: 3D LiDAR data model. Catchment Water meadow system from the Western end, looking East. The Panes are labelled by number. Panes 1 - 6 are aligned wither side of the sluice cascade. Panes 8 and 9 can be seen to occupy very steep ground. The Flood-dykes sinuous shape can be seen following the contour of the hillside. Images produced by Mercian from original data provided by Bluesky.

The water meadow system is displayed in three-dimensions in figures 25 and 25 above. The images have a 3x vertical exaggeration to allow the topography to be better understood. The image in Figure 25 shows the catchment water meadow system seen from the South looking North. Figure 26, from the Western end, looking East. The Panes are labelled by number. Panes 1 - 6 are aligned wither side of the sluice cascade. Panes 8 and 9 can be seen to occupy very steep ground. The Flood-dykes sinuous shape can be seen following the contour of the hillside

At the far eastern end, water in the flood-dyke could exit the system in two ways. An Iron Drain Shield [CUCK18WM015] (see figure 18) is positioned to prevent blockages to a subterranean drain which runs south-east to take water to join the River Poulter at the fish ponds to the south of the Vicarage.

The Ordnance Survey 6 inches to 1 mile (figure 27 below), published in 1884 shows the water meadow system as it passes through Cuckney. The map shows the sluice gate [CUCK18WM014]. If this gate was opened water passed along the flood-dyke, crossing under the Norton Road, where it passed into another set of sluices, presumably forming a further cascade. These were likely ultimately to have drained south-eastwards into a further channel. This channel was derived from the 'fish pond' which formed part of a series of two ponds (see map in figure 27), created by damming the River Poulter to the south-east of the Vicarage. A sluice controlled access to this further carrier. The carrier flowed in a north-easterly direction, following a contour level taking it north of the River Poulter which also re-emerged from these ponds and flowed on also north-eastwards towards Carburton. This further carrier eventually fed a sheepwash north-north-east of Norton. The River Poulter flowed north-east into the 'Great Lake' at Welbeck, having passed Milnthorpe Lodge. The derivation of the name Milnthorpe is likely to be "*outlying farmstead or hamlet with a mill*", as is given for the derivation of the name of Milthorpe in Cumbria (Mills 2003, p329). It is suggested here that Milnthorpe may represent the location of a deserted village, which is depicted on Chapman's Nottinghamshire map of 1774.

The River Poulter then passes through the lakes of Carburton Forge Dam and Carburton Dam respectively before entering the Carburton Water meadow system recorded by Gaunt (Gaunt 2010a; Gaunt 2010b).

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Figure 27: Nottinghamshire XVIII.NW (includes: Cuckney; Holbeck; Nether Langwith; Norton; Welbeck.) Surveyed: 1883 to 1884. Published: 1884. The water meadow system at Cuckney can be seen stretching from Cuckney Damn to the Great Lake at Welbeck and Carburton Forge Dam. The Section recorded in this survey is included along with the various sluices listed.

This work can now be tied in with previous works on the system as discussed by Jonathan Hillman and Hadrian Cook (2016), and alongside previous surveys of the Carburton water meadows system to the east (Gaunt 2010a; 2010b), and represents a major advancement in the recording and analysis of the water meadows of the River Poulter.

The water meadow system at Cuckney was in use for over 100 years with the system finally falling out of use in the 1960s. Although a considerable amount of effort and expense undoubtedly was spent on its creation, the system more than likely paid for itself many times over, and represents an important part of the Cuckney and wider Sherwood Forest landscape development over time.

8. Future Work

Further sections of water meadow system in Sherwood Forest would also benefit from more extensive recording similar to that undertaken as part of this project. This would enable a better understanding of the water meadows systems across the wider region, which is an important element in the historic development of the Sherwood Forest landscape.

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Appendix I - Level One Survey Results

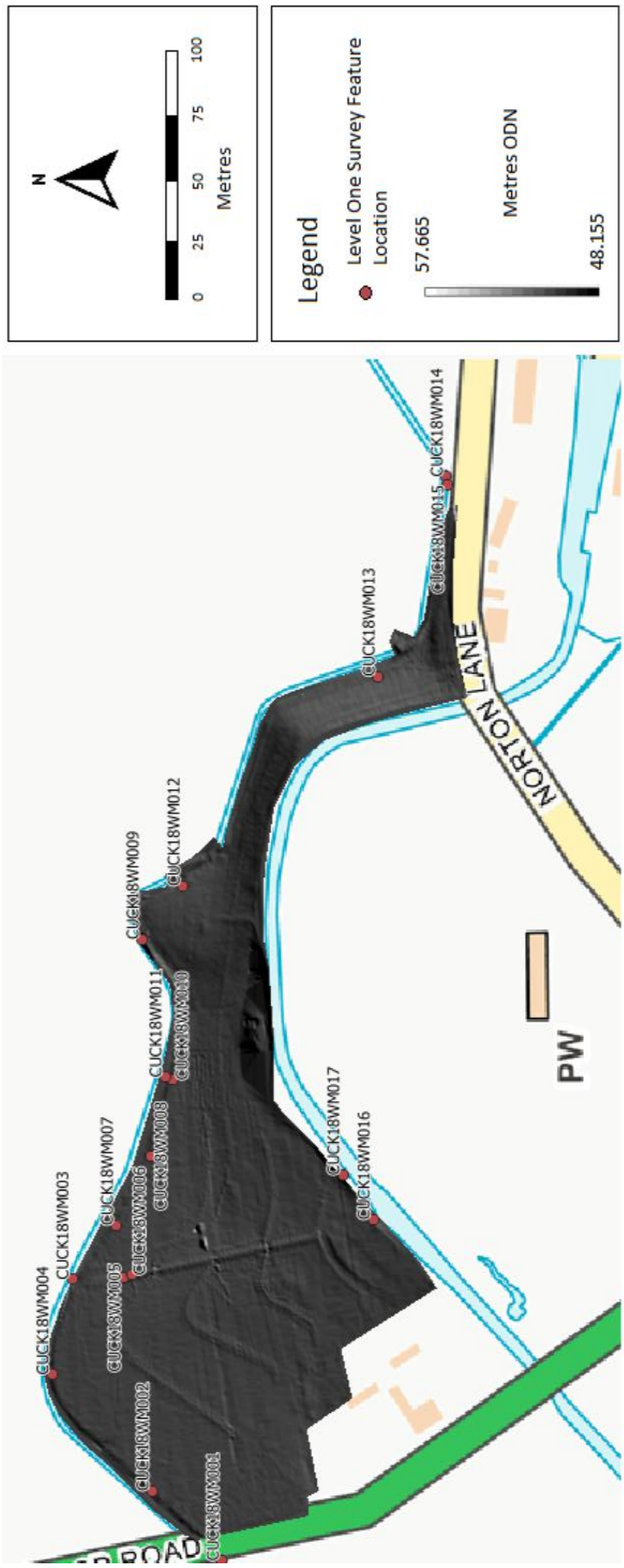


Figure___: Level One Survey Results. Contains OS data © Crown copyright [and database right] 2019.

Feature	Description	Easting	Northing	Photograph
CUCK18WM001	Wood and Iron Sluice Gate	456323.127	371555.103	No Photograph - site inaccessible
CUCK18WM002	Water inlet from flood-dyke channel.	456359.722	371591.765	
CUCK18WM003	Water inlet valve for main sluice through here into a buried pipe before emerging to the south in the main stone channel [CUCK18WM006].	456470.569	371633.745	
CUCK18WM004	Water inlet from flood-dyke channel.	456420.681	371644.130	
CUCK18WM005	Inlet for water into the stone sluice channel [CUCK18WM006], via an underground pipe from the flood-dyke channel to the north.	456471.901	371606.601	

CUCK18WM006	Main stone sluice channel	456473.004	371602.184	
CUCK18WM007	Stone water inlet from flood-dyke channel, with limestone baffle.	456499.060	371610.475	
CUCK18WM008	Stone water inlet from flood-dyke channel, with limestone baffle.	456535.442	371592.234	
CUCK18WM009	Wood and Iron Sluice Gate	456649.019	371596.982	

CUCK18WM010	Stone water inlet from flood-dyke channel, with limestone baffle.	456575.312	371581.093	
CUCK18WM011	Stone water inlet valve in flood-dyke channel, the iron paddle was opened to allow water to pass out of the flood-dyke channel to flood the water meadow panes to the south.	456576.696	371585.003	
CUCK18WM012	Stone water inlet from flood-dyke channel.	456677.073	371575.593	
CUCK18WM013	Limestone baffle- no associated stone water inlet from flood-dyke channel (blocked by presence of later path).	456787.055	371473.449	

CUCK18WM014	Wood and Iron Sluice Gate	456891.688	371437.834	
CUCK18WM015	Iron drain shield	456887.305	371437.288	
CUCK18WM016	Underground pipe outlet			No Photograph - site inaccessible
CUCK18WM017	Underground pipe outlet			No Photograph - site inaccessible

CUCK18WM002:

CUCK18WM003:

CUCK18WM004:

CUCK18WM005:

CUCK18WM006:

CUCK18WM007:

CUCK18WM008:

CUCK18WM009:

CUCK18WM010:

CUCK18WM011:

CUCK18WM012:

CUCK18WM013:

CUCK18WM014:

CUCK18WM015:

Appendix II - Photographs of wooden sluice CUCK18WM009

Photograph of wooden sluice gate CUCK18WM009, facing north-east.

Photograph of wooden sluice gate CUCK18WM009, facing north-east.

Photograph of wooden sluice gate CUCK18WM009, facing north-east.

Photograph of wooden sluice gate CUCK18WM009, facing east-north-east.

Photograph of wooden sluice gate CUCK18WM009, facing east.

Photograph of wooden sluice gate CUCK18WM009, facing east-south-east.

Photograph of wooden sluice gate CUCK18WM009, facing east.

Photograph: Stones forming channel side adjacent to wooden sluice gate CUCK18WM009, on southern side of channel, facing east.

Photograph: Stones forming channel side adjacent to wooden sluice gate CUCK18WM009, on southern side of channel, facing south.

Photograph: Iron winding screw for opening wooden sluice gate CUCK18WM009, facing west.

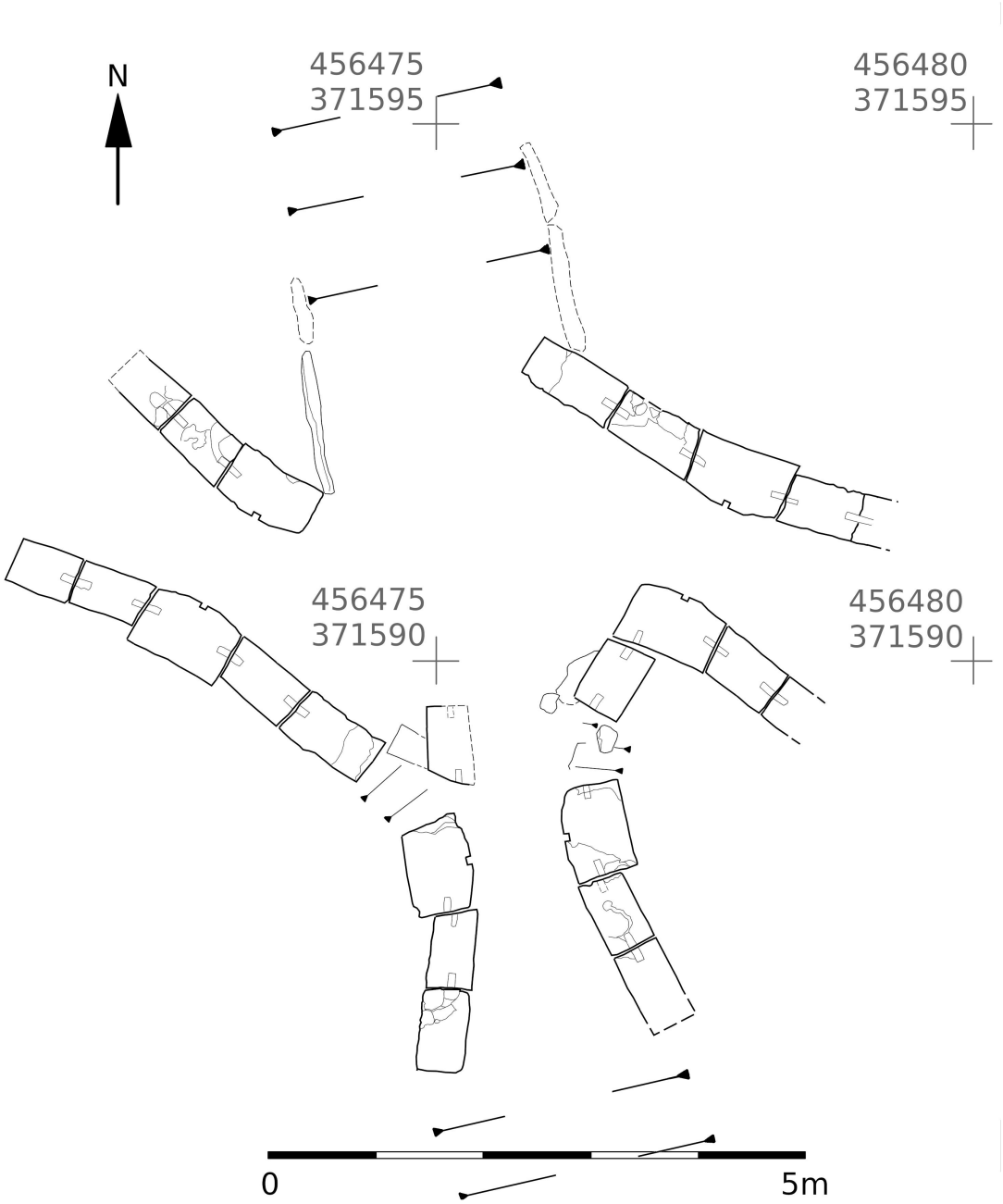
Photograph: Iron winding screw for opening wooden sluice gate CUCK18WM009, facing west.

Photograph of wooden sluice gate CUCK18WM009, facing west.

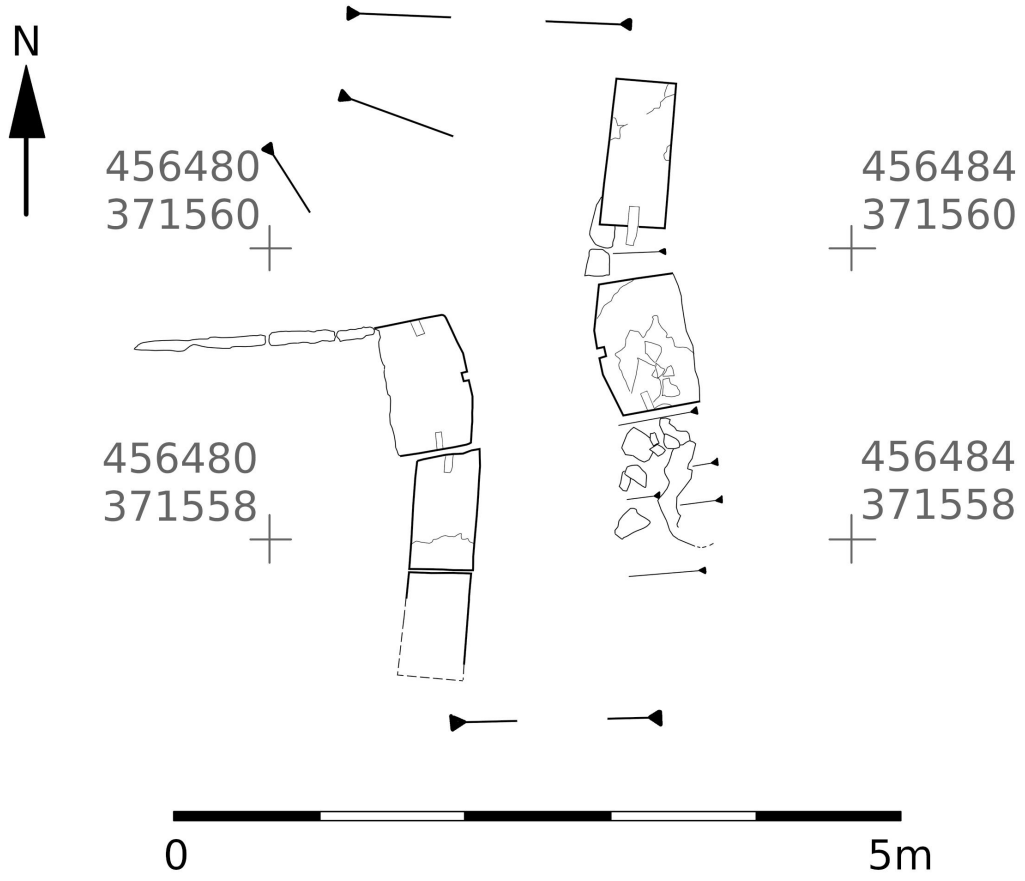
Photograph of wooden sluice gate CUCK18WM009, facing south-west.

Photograph: Stones forming channel side adjacent to wooden sluice gate CUCK18WM009, on northern side of channel, facing south.

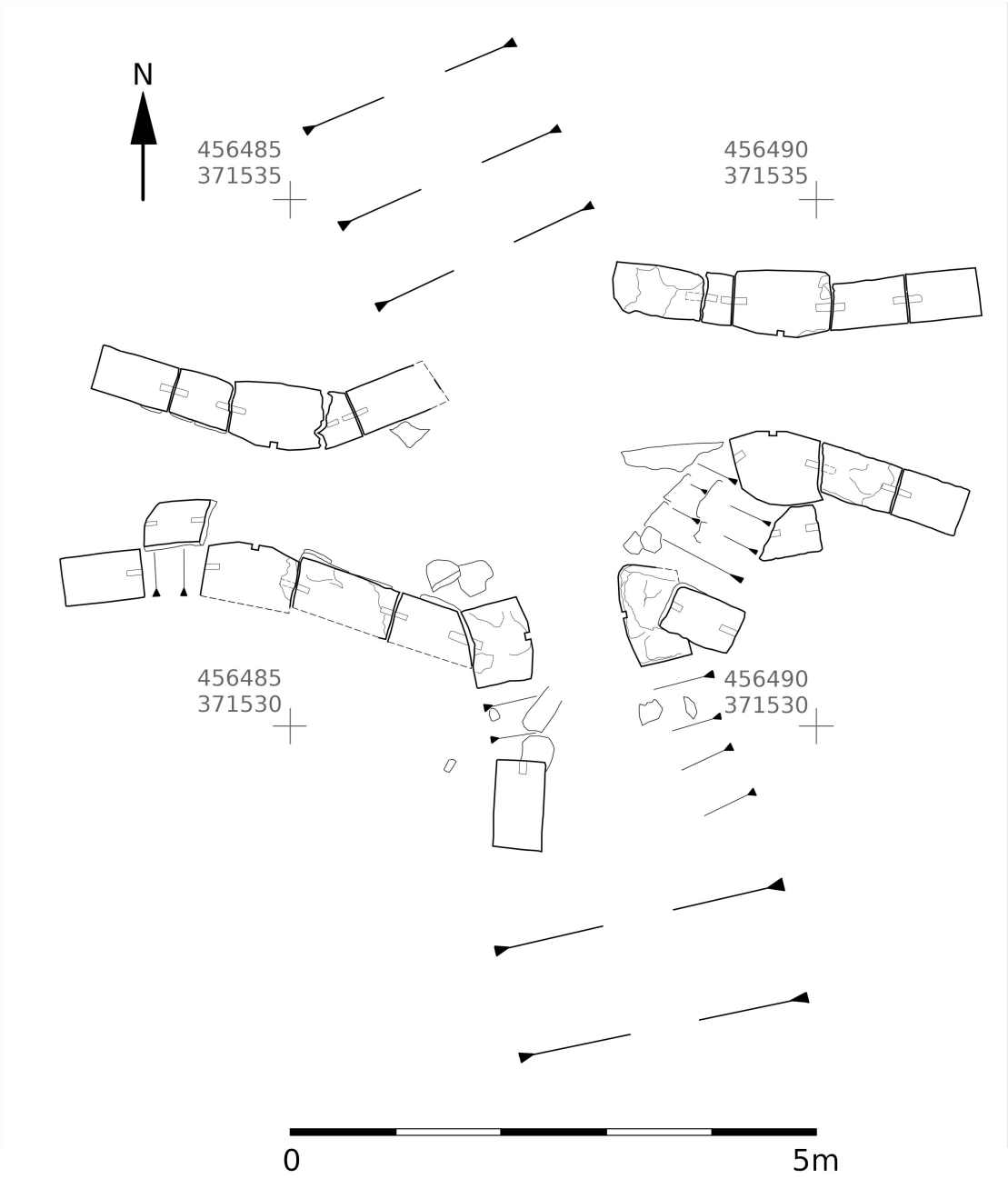
Appendix III - Photogrammetric Survey Plans



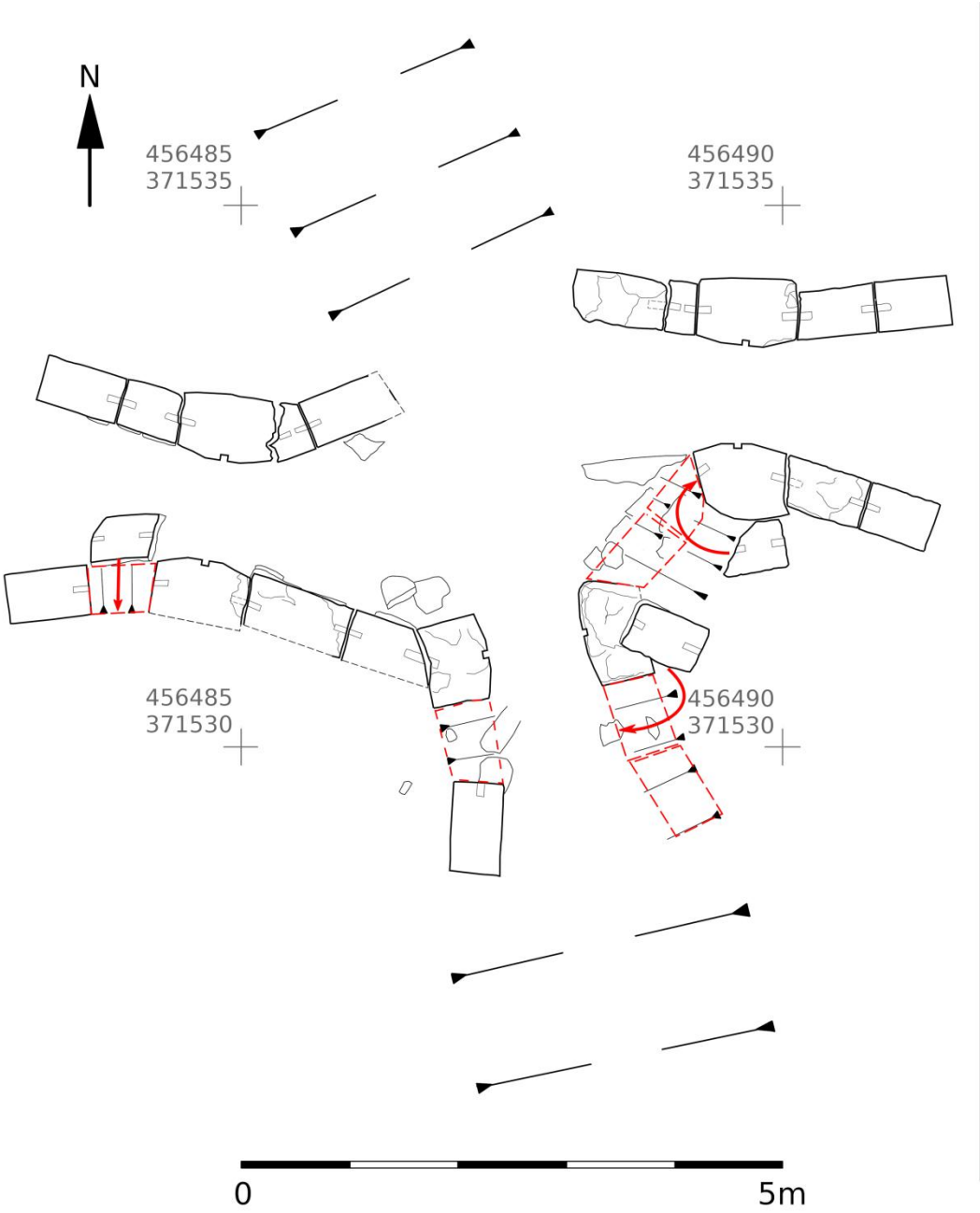
Plan of Sluice Gate 1 (SG1). Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps. Plan by D. Budge 2019.



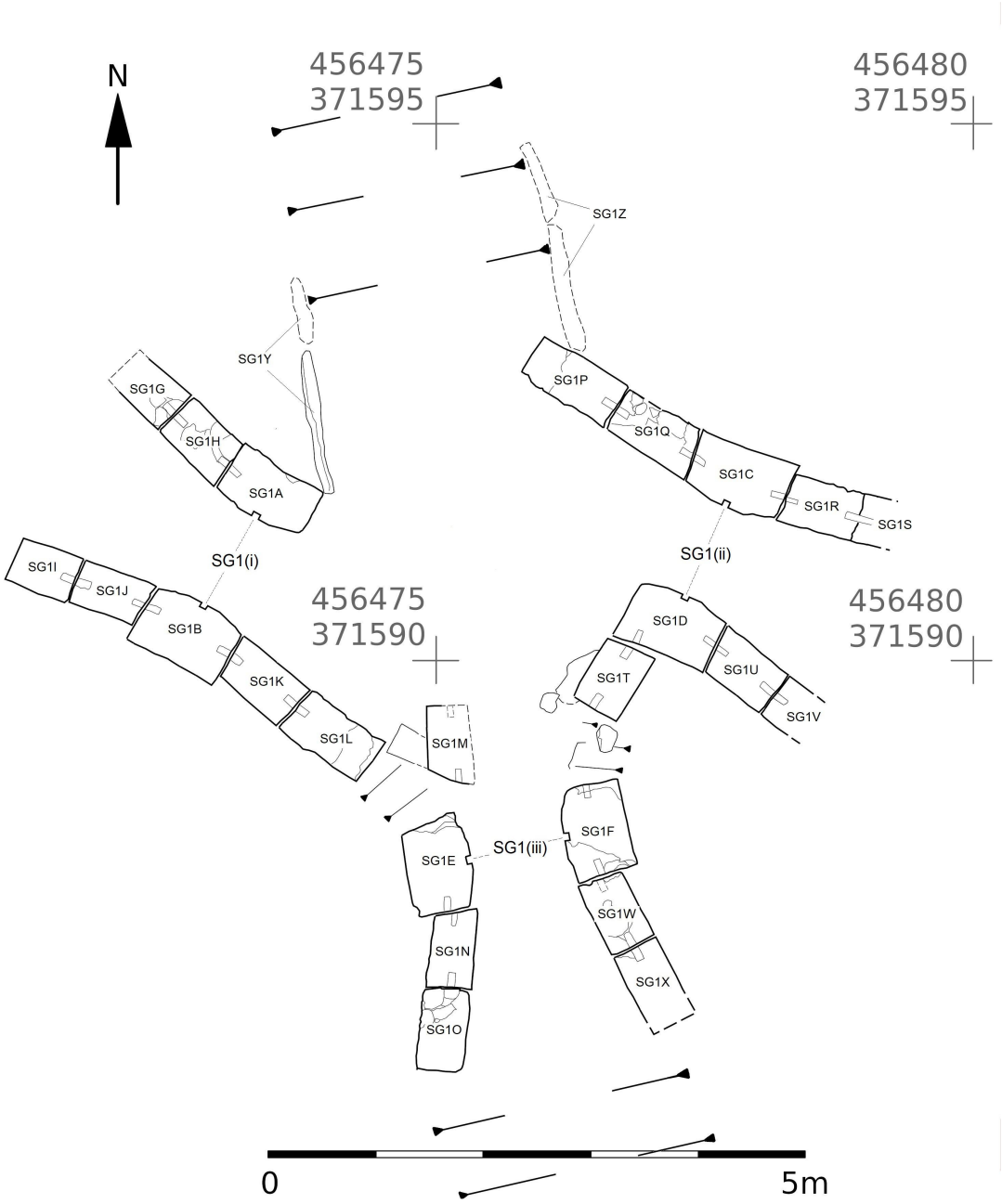
Plan of Sluice Gate 2 (SG2). Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps. Plan by D. Budge 2019.



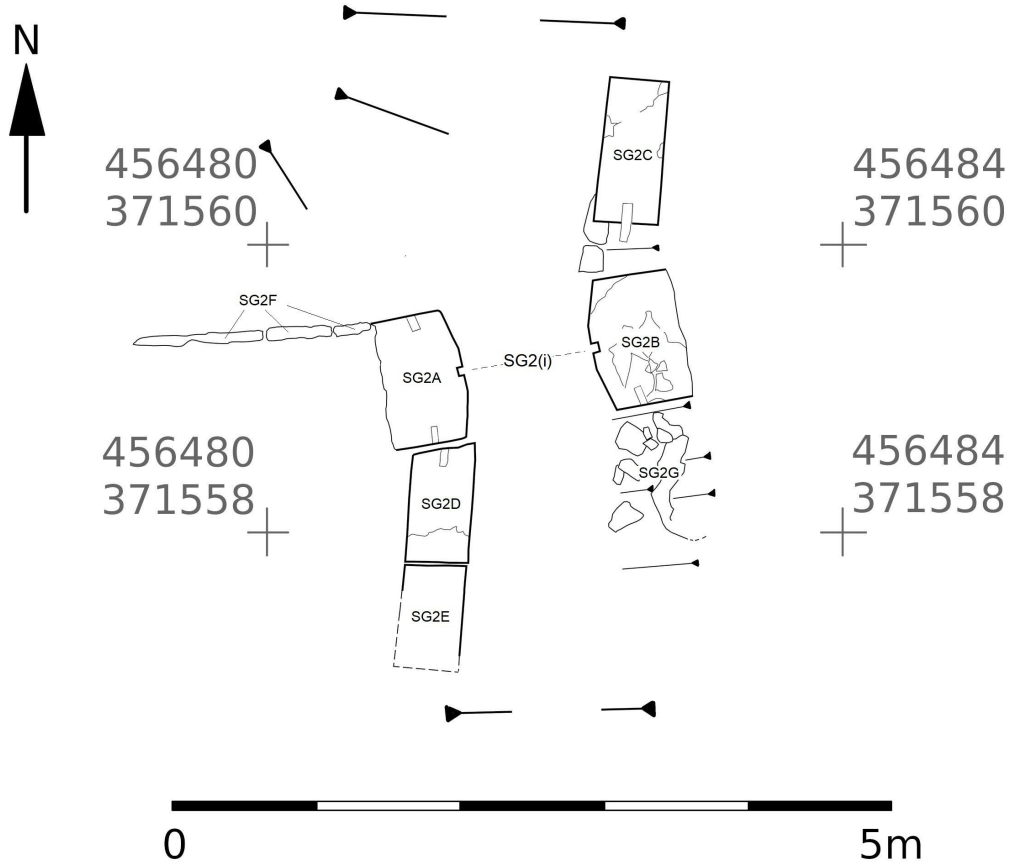
Plan of Sluice Gate 3 (SG3). Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps. Plan by D. Budge 2019.



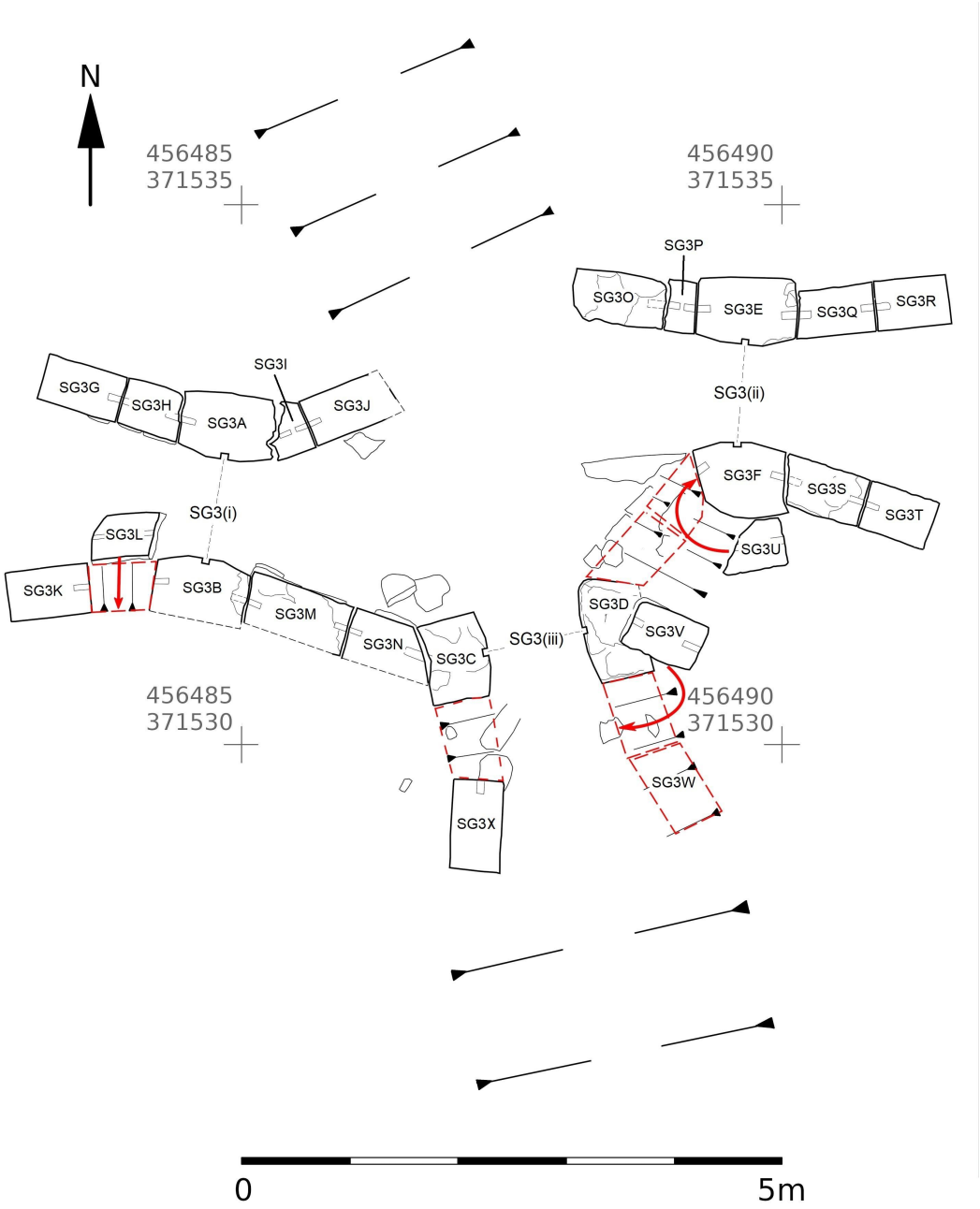
Plan of reconstruction of Sluice Gate 3 (SG3), showing where the stones now lie and their likely original locations in the sluice system. Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps. Plan by D. Budge 2019.



Labelled plan of reconstruction of Sluice Gate 1 (SG1). Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps.



Labelled plan of reconstruction of Sluice Gate 2 (SG2). Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps.



Labelled plan of reconstruction of Sluice Gate 3 (SG3), showing where the stones now lie and their likely original locations in the sluice system. Thick lines are the shaped blocks on the top level of masonry; thinner lines are un-faced stones and stones from lower courses protruding from below capstones and very thin lines are breaks, other features, and the holes for the cramps.

Disclaimer

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