

MOOR POND WOODS, PAPPLEWICK, NOTTINGHAMSHIRE

REPORT ON AN ARCHAEOLOGICAL AUDIT AND AN APPRAISAL OF FUTURE ARCHAEOLOGICAL INVESTIGATION



For: The Friends of Moor Pond Woods

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Summary

- The Friends of Moor Pond Wood have been working towards understanding the complex water control and cotton mill system at Papplewick devised by the Robinson family in the late 18th and early 19th Century, since receiving their first monetary grant in 2000. As the most recent phase of works draws to a close, the Friends commissioned Trent & Peak Archaeology (TPA) to collate all of the works completed since 2000 in the form of an audit and to make recommendations for future work.
- All works and findings written to date by TPA, Stephen Walker and the Friends were summarised in this document to support the recommendations.
- A walkover survey was also undertaken over three sections of the project area, with members of The Friends of Moor Pond Wood, to assess any areas of interest that had not yet been investigated. The three areas were – Upper Dam, Dam Banks, and Grange Cottages Wood.
- The walkover survey detected stonework immediately north of Linby Lane, that is possibly associated with moving water across the road from Upper Dam to the Dam Banks area. Stonework was also detected on the eastern bank of the Upper Dam former Mill pond and a drain was noted on the western bank.
- A bank was recorded parallel with a boundary fence within the subsidiary pond area of Dam Banks.
- The bank on the south side of Papplewick lane within Grange Cottage Wood was found to be steep and stony and will need investigating to try and establish how water was moved across the road. The bank and ridge to the south of the Grange Cottage sluice was recommended for investigation to determine any evidence of the existence of a spillway or launder that provided water to the mill wheels.
- It was recommended that more exploratory test pits are excavated throughout the project area along the bases of the leats in order to determine true profiles and absolute heights of the base and therefore the speed at which the water moved through the system. The stonework in Upper Dam and the ditch features in Dam banks must be explored to understand their purpose.
- It is hoped that this document can be used to produce a new set of research aims with which to approach the Heritage Lottery and other funders for grants to continue work in the Moor Pond Wood Project area.

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1 Introduction

- 1.1.1 Since 2000, the Friends of Moor Pond Woods have been striving to establish the extent and the complexity of a water system and its associated cotton mills built by the Robinson family at Papplewick from the 1770's through to the 1830's. With the help of a Local Heritage Initiative grant scheme, a number of areas have been investigated, recorded and conserved.
- 1.1.2 As this latest phase of works, funded by the Heritage Lottery Fund, draws to a close, Trent & Peak Archaeology were approached to collate all of the works completed since 2000 and to conduct an audit of the site. The Friends, in association with Trent & Peak, investigated three areas of the Moor Pond Wood site in the form of a walkover survey, in order to establish the presence of any more features that have not as yet been recorded. Subsequently this report has been produced to tie together all previous works alongside any new data collated by the Friends during the survey, to provide the Friends with recommendations for future work on the site.
- 1.1.3 The survey took place over three days from September to November 2016. The project was an opportunity to build capacity within the group by providing training in archaeological field techniques, mainly surveying and recording.
- 1.1.4 This report comprises a basic historical background to the site, a summary of all previous archaeological works that have taken place since 2000, the methodology and results of the walkover survey and recommendations for any works that could take place on the site in the future.

2 Site Topography and Geology

2.1 Topography

2.1.1 Moor Pond Woods, centred on NGR SK 54752 50794, is a large site to the west of Papplewick village (Figure 1). The linear project area, running northwest to southeast parallel with Moor Road, is 9.35 hectares in size, divided by Papplewick Lane and Linby Lane. The river Leen flows to the west of Moor Pond. The site is mostly woodland and there still remain significant earthworks associated with the industrial activity connected with cotton milling by George Robinson in the later 18th- early 19th century. The site is generally higher to the north of Linby Lane above 70m OD, whereas the far south of the site, Grange cottage woods, is approximately 60m OD.

2.2 Geology

2.2.1 The underlying bedrock is comprised of Edlington formation mudstone and sandstone, and the superficial deposits consist of a terrace of Leen sand and gravel and alluvial clays and silts. (British Geological Survey 2015)

3 Historical Background

- 3.1.1 Papplewick is recorded as having two water mills and a mill dam in 1540 (Walker 1940, 231) and it is probable that the latter was located above Wark Mill, part of which still remains today to the north of Papplewick Lane (SK 547 505). The area of the former Walk Mill Pond still shows in the fields to the northwest of the Grange Cottage Woods.
- 3.1.2 George Robinson and sons probably took over the lease on the Walk Mill in the 1770s, which can be seen on Chapman's 1774 map of Nottinghamshire (Figure 2).
- 3.1.3 George Robertson came to Nottinghamshire from Scotland and settled in Bulwell in 1738, where he adopted the more English surname of Robinson. Here he was initially engaged in the business of bleaching cloth, which included the practice of 'crofting', the pegging down of linen cloth and keeping wet in so-called 'bleaching grounds' on meadowland adjacent to a river. In the 1770s the use of cotton was threatening to supercede that of linen, and the Robinsons decided to move into cotton spinning. In 1778, a new lease was made between the landowner Montagu and Robinson, allowing the latter to:

'to make a Cut or Canal from the said Dam or River Leen to and for the use of a large building then erecting ... intended to be used or employed as a Mill for spinning of Cotton, Silk, Flax or Wool.'

Greatrex (1986)

This new mill was situated close to the present-day Grange Farm, south west of Grange Cottage Woods, today only its footings remain buried under grassland and gardens. Robinson's second mill, Top Mill, was built in 1782, along with new ponds (Top Upper Dam and Upper Dam), straddling the parish boundary with Linby. This building was Robinson's smallest mill and, being castellated, was also known as Castle Mill (Walker and Sheppard 2011). The Middle Mill was also built at this time and had a small pond which was probably fed by water transferred via the leat system from Top Upper Dam. Forge Mill, which had a pond fed by the river Leen, dates from 1787. New Mill was built in 1790 at right angles to Old Mill, introducing a second water wheel to this part of the system. They became known as Grange Mill. A sunken tailrace from this building ran to the west of the Grange (where an angled brick buffer still shows in the garden) and joined another leat from the river lower down (Sheppard, 2001). The final mill to be developed, in 1794, was the Forest Mill at Bulwell (Walker, 2015).

- 3.1.4 The cotton-spinning business was carried on by sons James and John after George's death in 1798, with the former buying out his brother in 1806, thereafter carrying on in partnership with his own sons. A third generation George took over in 1817 and eventually sold the business as a going concern in 1821 Hopper, Glover & Co. for £3000 (although excluding Forge Mill, by then a corn mill) (Sheppard, 2001)
- 3.1.5 Between 1778 and 1794 a complex water supply system was developed. The whole system had numerous control points (sluice gates), extensive storage capacity (perhaps augmented by springs), drains and leats of varying size. There was allowance for both storing water for times of shortage and for dealing with excess. The latter may have been deemed important due to William, 5th Lord Byron at Newstead Abbey, who adversely affected Robinson's water supply by damming up ornamental lakes in his grounds and then reputedly released large amounts of water in an attempt to damage the mills downstream. A court case brought by Robinson in 1785 centred on proving the existence of and unrestricted use of ancient water rights, and the result went in his favour. Despite this ruling though the dispute over water continued for another 10 years and partly resulted in Robinson having two steam engines installed, one at Lower Mill, the other at New Mill, to guarantee power supplies. The problems with Lord Byron may also have had an influence on the design of the water system (Sheppard 2001).

- 3.1.6 What began as a simple water control and storage system in the 1770's appears to have quickly been altered and adjusted as additional demands were placed upon it. The system is estimated to have reached its maximum extent by 1830, which can be seen on Sanderson's map of 1835 (Figure 3). It continued to supply water to Top Mill and Forge Mill but it is not known when specific areas of the system fell out of use (Walker 2015).

4 Previous Archaeological Works

4.1 The Project

- 4.1.1 In 1999, the Papplewick Parish Council's Millennium Committee decided to develop the Moor Pond Wood area as a 'valuable permanent recreational resource' by focussing on three themes:

To improve access for all, especially elderly and disabled people;

To protect and improve the wildlife value of the woodland and water features;

To restore and interpret the archaeological features of the site.'

Friends of Moor Pond Woods (2014)

- 4.1.2 Over £100,000 has been raised and used to achieve these three themes in the past 15 years.
- 4.1.3 Trent & Peak Archaeology first became involved with the project in 2001. All works and reports completed by TPA, other professional units and the group themselves since 2001 are summarised here.
- 4.1.4 All of the works completed to date are shown on Figures 5 and 6.

4.2 Moor Pond Wood, Papplewick: An Archaeological Desk-top Study – PMP1 (Sheppard, 2001)

- 4.2.1 The desk based assessment, which was stage one of a two part study, was completed by Sheppard in 2001. It provides an historical background to Robinson's mills, drawing heavily on the extensive research and resulting articles written by Nan Greatrex in 1986-87. Using 18th and 19th Century maps and plans, Sheppard produced a plan of the complex water supply system, its relationship to the mills and the relationships between different parts of the system as far as they could be deciphered without excavation. 33 areas, as seen on Figure 4 were identified as important to the narrative of the site.

4.3 Moor Pond Wood, Papplewick: An Archaeological Site Survey and some Trial Excavations – PMP2 (Sheppard, 2003)

- 4.3.1 A complete site survey was conducted during 2002. 10 cross- profiles were set out at intervals to determine the varying heights and relationships of the separate lengths of leats, ponds and the River Leen. The line of the profiles can be found on figures 5 and 6. Detailed plans were made of the areas of the water system not previously recorded. This process identified and recorded remaining features and identified areas for further investigation.
- 4.3.2 Following on from the site survey, two of the areas were identified as targets for excavation work. Four trenches were opened in Area A near to Grange farm on the former site of New Mill, which had been subjected to a geophysical survey. Two trenches were opened in area B, a known sluice gate and adjoining stonework at the northwest corner of Moor Pond. The trenches from Area A can be seen on Figure 11.

4.3.3 Area A

- 4.3.3.1 Trench 01, measuring 3 x 0.6m was excavated across the leat, near the site of the former mill, to target a potential stone lined culvert. A modern ceramic field drain was uncovered at a depth of 0.7m, no evidence of a culvert was recorded.
- 4.3.3.2 Trench 02, measuring 3 x 0.6m was excavated within a noticeable depression. Below the subsoil, layers of ash, clay and bricks were uncovered. Beneath these was a layer of infill material, dark silt and rubbish, down to a depth of 1.8m. This depth suggests that a mill-wheel may have been situated in this area.
- 4.3.3.3 Trench 03, measuring 3 x 0.6m, was excavated to examine an east-west aligned linear detected in the geophysical survey a former floor level was uncovered at a depth of 0.25m, with a foundation trench for a wall running through the middle to a width of 0.9m and a depth of 0.7m
- 4.3.3.4 Trench 04, measuring 1.2 x 1.75m, was excavated around exposed stonework. The stonework was revealed to be a roughly made dry stone wall of possible agricultural purposes rather than an association with the former mill.

4.3.4 Area B

- 4.3.4.1 Trench 05 exposed the sluice gate and its associated walling above the north west corner of Moor Pond. The position of the sluice gate was marked by two columns of large stones which may have been coursed to accommodate a tall sluice gate, or to form a cascade feature (Scudder, pers. comm.). The walling upstream of to the sluice gate was curved and stepped to form a batter. A side channel was found coming into the north east wall from a high level.
- 4.3.4.2 Trench 06 exposed the side channel coming into the north east wall found in trench 05 3m to the east of the sluice walls. Two walls curved toward the sluice walls, to a point where two vertical iron rods were uncovered. The channel was thought to have been timber boarded, creating a trough spanning across the sluice walls. These two trenches are not visible on the figures provided with this report, as the sluice was conserved (Sheppard, 2007) and the plans show this conservation work instead.

4.4 An Appraisal of Future Archaeological Activity at the Moor Pond Wood Project, Papplewick, Nottinghamshire – PMP3 (Sheppard, 2004)

- 4.4.1 Written by Sheppard in 2004, this appraisal was used to identify eight specific areas where it was recommended that further work be carried out in the form of survey or excavation if necessary and any constraints that may hinder such works. The eight areas, consisting of the areas identified in the desktop study of 2001, are listed below and can be seen on Figure 4:
- 4.4.2 Area 3, where the leat would have crossed Linby lane. There are stonework remains to the north of the road.
- 4.4.3 Areas 7-9, a junction point for two large bodies of water with a large triangular enclosure and several inlets and outlets.
- 4.4.4 Area 19, an oval shaped brick lined feature near the south west corner of Moor Pond.
- 4.4.5 Area 21, where the leat would have crossed Papplewick, lane, establishing how the leat would have crossed the road

- 4.4.6 Area 35, the terminus of the leat 60m south of Papplewick Lane.
- 4.4.7 Area 24, the area immediately west of Grange cottages could be the site of a low level leat
- 4.4.8 Area 28, supposedly containing the remains of a stone lined drain
- 4.4.9 Area 29, the site of Old Mill and New Mill, some of which was identified as private property.

4.5 Archaeological Project Report Moor Pond Woods, Dam Banks East Sluice DBES phase 1 (Walker, 2014)

- 4.5.1 The excavations that took place in 2005 were supervised by members of Nottinghamshire County Council Archaeological Service.
- 4.5.2 The east sluice was uncovered, revealing a near vertical wall on the north side of the excavation, made up of between 7 and 9 courses of square-cut stone. There were three large shaped blocks providing a slot to hold the sluice-boards in place. They were seen to extend to a depth of 1.10m from the top, but the base was not found. On the south side of the sluice a 1.5m length of a vertical retaining wall was exposed, seen to extend to a depth of 1.30m from the top (but the base was not found)
- 4.5.3 The curving wall on both sides of the central sluice blocks may suggest that water could be allowed to flow through the aperture in either direction, at different times. This is in sharp contrast to the arrangement at the South Sluice, where the curved walls on the north of the feature channel towards the south but the south wall is straight, at right angles to the direction of flow.
- 4.5.4 The north-east segment of the South Sluice was probably a late-stage modification, and therefore the East Sluice is likely to also be part of this later phase. The remnants of East Sluice can be found on Figure 9.

4.6 Recent Investigation and Conservation of some Historic Structures at Moor Pond Wood, Papplewick, Nottinghamshire – PMP4 (Sheppard, 2007)

- 4.6.1 Four sites that had been excavated and conserved since 2002 have been fully recorded here, referred to as Sites A to D. These sites can be seen on Figures 9 and 10:
- 4.6.2 **Site A:**
 - 4.6.2.1 The sluice in the northwest corner of Moor Pond, first uncovered in 2002, was consolidated and an interpretation panel put on a nearby footbridge. The stonework walls funnelling water to the sluice gate, would have stood at least 2m high, and were battered (angled backwards), well mortared and regularly coursed. The sluice gateway consisted of large ashlar blocks with a thick timber gate, which could have been raised by a rack and pinion device.

- 4.6.2.2 At a later stage, the top courses of stonework were removed to allow for an 11m long timber launder, or trough, to cross the sluice. Roughly constructed walling was added at either end of the launder to help funnel the water through. Both of these features have also been conserved.
- 4.6.2.3 Water for the sluice came from embanked holding area 6 (Figure 4) and ran into Moor Pond. Water for the launder came from the open area of water number 10 (Figure 4) and ran across into the leat.
- 4.6.3 **Site B:**
- 4.6.3.1 In 2005 a possible inlet was uncovered on the eastern edge of Moor Pond. Fragments of timberwork and ironwork suggest another trough feature that sloped down into the pond, delivering water towards the reservoir rather than draining it away.
- 4.6.4 **Site C:**
- 4.6.4.1 A length of structurally sound walling and a brick lined arched drain were uncovered and consolidated in 2003 at the south west corner of Moor Pond. The stonework walls survived to a height of 1.4m, and were battered and well mortared. The drain carried water away to the south west, toward the brick lined shaft (Site D)
- 4.6.5 **Site D:**
- 4.6.5.1 The brick lined open shaft, first uncovered in 2002, was emptied of infill to its base, measuring 4.5m deep. The shaft is sub rounded in shape, with a straight and flat south west face. At the base there is a brick inlet on the north east side and a stone lined outlet directly opposite. Some form of shuttering or gate was used above the outlet to control water. Water may have been forced upwards to go through a circular overflow drain, located approximately 2 m down on the south face, which had been blocked up with infill. It was unclear at this point how this shaft feature worked

4.7 Archaeological Project Report Moor Pond Woods, The Dam Banks Ponds DBES phase 2 (Walker, 2014)

- 4.7.1 Two test pits of one square metre excavated in 2008 were supervised by members of Nottinghamshire County Council Archaeological Service. The first was on the terrace feature a few metres north-west of Dam Banks East Sluice (T1400). The other was in the low-lying area between the assumed site of the subsidiary pond and the channels leading to the South Sluice and Moor Pond (T1500). They were excavated to investigate evidence for the origin of the terrace feature running through the pond/leat site and to establish the presence of any evidence for the pond feature shown on the 1835 and 1847 maps.
- 4.7.2 The layers in the test pit on the terrace feature (T1400) are consistent with an interpretation that the terrace was periodically flooded, rather than containing flowing water that would have been more likely to deposit coarse-grained material. A layer of indurated gravel layer with yellow sandy matrix represented the former land surface.
- 4.7.3 Just below the surface there were numerous pieces of flaggy yellow-grey Magnesian limestone set into the grey sandy subsoil in test pit T1500. They are possible indications that this was the site of a channel linking a possible north subsidiary pond to the launder at the South Sluice. The stones may be remnants of a channel lining. Alternatively they may be remnants of a demolition phase, perhaps marking the site of a stone dump where useful material was stored and/ or sorted.

4.8 A Topographical Survey of Dam Banks, Moor Pond Woods, Papplewick, Nottinghamshire – PMP5 (Walker and Sheppard, 2011)

- 4.8.1 The Dams Banks area of Moor Pond wood was topographically surveyed in 2009 to establish what the site may have been used for. Over 2000 survey points were taken to create a surface plan of the leat, the series of irregular shaped banks or platforms, clear breaks of slope, hollows and curving gullies that make up this part of the project area.
- 4.8.2 It was thought that the site could have been used for bleaching linen. Alternative possibilities include 'hemp pits', the growing of willows for the revetting of banks, or simply a holding area for water. The results have been combined to fit onto Figure 5 overall plan

4.9 Archaeological Recording of a Wall Structure at Papplewick, Nottinghamshire, 2009-2011 – PMP6 (Sheppard, 2015)

- 4.9.1 In 2009 a length of wall measuring over 13m was uncovered and recorded 2-3m north of Papplewick Lane. The wall was consolidated and partly rebuilt in 2011. The wall was in front of a brick lined open shaft, first uncovered in 2002. The wall was curved in plan and there was a greater height of remaining rubble core work behind the sloping face.
- 4.9.2 A narrow opening within the wall was uncovered. It continued at least 1.5m northwards into the rubble core. Excavations around the opening revealed two lines of iron nails and several long rods, possibly related to a trough or launder. Below this, the remains of a brick arch were also uncovered, that had not extended beyond the front of the opening, and therefore may have been built to protect an earlier lower launder where it passed through the wall.
- 4.9.3 It is thought by Sheppard that the drain from the south west corner of Moor Pond (site C, Sheppard 2007) would have run through the shaft and crossed the path of both launders at a lower level, suggesting it pre existed the walling, launders and the leat to the north of Papplewick lane. A higher launder had to be built due to pressure on the drain relating to the building of the expansion of Grange Mill.

4.10 Grange Cottage Sluice, Moor Pond Woods, Papplewick, Nottinghamshire: Report on an Archaeological Investigation – PMP7 (Binns, 2015)

- 4.10.1 Excavations at the terminus of the leat south of Papplewick lane from 2011 to 2014 revealed two stone sluice walls, aligned north-south, approximately four metres wide and slightly curved to form a funnel. A cross wall and arch were revealed to connect the two sides of the sluice together, however only the brick 'springer' courses of the arch remained intact.
- 4.10.2 A brick culvert was revealed below the cross wall rubble, extending 3.05m further to the north. Both ends of the culvert had been badly damaged, possibly to denude the structure so that it could be covered up during landscaping, leaving none of it exposed.
- 4.10.3 It is possible that the culvert was built whilst the cross wall and arch were still standing and clay was packed in around the culvert and underneath the arch to make the entire structure narrower and watertight, potentially speeding up a dwindling flow of water.

- 4.10.4 There is no clear evidence for a control mechanism for either the stone sluice or the brick culvert, however the large slab [0011] at the north of the main structure covering a potentially timber lined slot could have formed the sill of a control gate. The dry stone walls overlying the slab, although crude, could have supported such a mechanism, which would have guided water into the brick culvert. A control mechanism at the northern end of the sluice would have helped to control the pressure coming down the leat (Walker pers comm. 2015).
- 4.10.5 The sluice and culvert have been consolidated and conserved, with new paths and viewing platforms put in place to make it easier for the public to access the site. The sluice can also be seen on Figure 9.

4.11 Dam Banks South Sluice Pond, Moor Pond Woods, Papplewick, Nottinghamshire: Report on an Archaeological Investigation – PMP8 (Binns, 2015)

- 4.11.1 The excavation of four trenches between 2013 and 2015 within the Dam Banks south sluice subsidiary pond revealed the even sloping base of the pond, and evidence for at least two attempts to build up the banks on either side of the pond. These construction events coincide with a build up of silt on the base of the pond, possibly due to a lack of use once the cotton mills went out of use in the 1830's when the mills were closed by Hopper, Glover & Co. After this time, Top Mill was retained as a corn mill, and the site may have been maintained to prevent flooding problems.
- 4.11.2 A potential ditch and a posthole were revealed in section, which might relate to the funnelling of water to a trough which spanned the width of the south sluice, however, this interpretation remains speculative.
- 4.11.3 If work could be continued in this area, then a bore hole survey of the holding and subsidiary ponds to establish flood events, or rate of silt deposition, and targeted excavations to reveal more post holes or stonework relating to the trough would be recommended.

4.12 Grange Cottages Pond, Moor Pond Woods, Papplewick, Nottinghamshire: Report on an Archaeological Investigation – PMP8a (Binns, 2015)

- 4.12.1 A 7x4m trench was excavated in 2014 in Grange Cottages Wood to a total depth of 2.4m into the western edge of what used to be a pond. This was to establish the original depth and profile of the Grange Cottages pond and to ascertain how the pond was established, whether it was once a part of a large pond that had been cut in two by the embankments north of Grange cottages sluice, or whether the pond formed in a pit that had been created when the material was excavated to build the embankments, otherwise known as a 'borrow pit'.
- 4.12.2 The gentle sloping base of the pond was uncovered at an approximate maximum depth of 67.39m OD at the north east corner of the excavation area, however the pond could be deeper towards the centre of the field where no excavations took place
- 4.12.3 The slope of the base of the pond seemed to be consistent with the bank of the leat to the west of the excavation, which suggests that the pond was excavated so that the material could be used to build up the embankment. This would confirm the pond to have been a

borrow pit rather than a larger constructed millpond. This could therefore be an indication that the two features are contemporary with each other.

- 4.12.4 Grange Cottage pond would have still been a visible feature into the mid 19th century and could potentially still have been retaining water. It is unclear as to whether the pond had already silted up prior to a large hole being dug to deposit refuse, or whether the material was dumped into the existing depression of the pond. The dateable evidence from these ash and clinker deposits suggests that refuse was no longer dumped on the pond site after the mid 20th century. The trench can also be seen on Figure 10.

4.13 Papplewick Moor Pond Sluice Survey – PMP9 (Townsend, 2015)

- 4.13.1 In 2015 the Grange Cottages sluice and culvert were surveyed using two different methods, a high resolution laser scan and structure from motion photogrammetry
- 4.13.2 The majority of the site was surveyed using a Leica HDS6100 phase-based terrestrial laser scanner. 13 overlapping and intervisible laser scanner survey stations provided coverage of all surveyable areas. Panoramic digital photographs from each scan position and these images were used to texture the point cloud with photorealistic colour.
- 4.13.3 The sluice gate was also surveyed using *structure from motion photogrammetry*. This technique uses multiple digital photographs from many angles to create a three-dimensional textured model.

4.14 Papplewick Lane leat – Works Ongoing

- 4.14.1 In 2015, work began on the leat terminus to the north of Papplewick lane and the open brick shaft. A 6 x 2.5m trench has been excavated in stages, extending the trench as more archaeology was revealed. Stonework was uncovered in the southern half of the trench. A battered stone wall measuring 1.35m long, was recorded running in to the north facing section. The northern part of this wall seemed to have been disturbed by a cut across the width of the trench. The leat base also seems to have been cut through along the same trajectory. The wall is in line with the edge of the leat. A large stone slab was found below this. The stonework was backfilled with silt, clay and a very frequent large angular stones that could have come from a demolished structure.
- 4.14.2 The stonework and slab may be part of a structure which funnelled the water across the road. The lack of any structure on the west bank of the leat suggests that water may be turning toward the west. However it is still uncertain if the water is projected toward the brick shaft or the Papplewick lane wall, or if the stonework has been introduced to alter the direction and the speed of the water coming down the leat.

4.15 Grange Cottage leat – Works Ongoing

- 4.15.1 In 2016, a 2 x 1m test pit was excavated across the leat floor to record the profile of the leat, approximately 26m northwest of the Grange Cottages sluice. The base was surveyed for an absolute height above sea level and the sections was photographed and drawn.

5 The Early Industrial Revolution in the Leen Valley, Nottinghamshire. A study by S. Walker

5.1 Study summary

- 5.1.1 A study by S. Walker has been completed analysing the chronology and effects of industrialisation and associated urbanisation of the Leen Valley, between 1750 and 1830 (Walker 2017).
- 5.1.2 Walker addresses the question of when, where and what constituted the Industrial Revolution in Leen Valley by analysing documentary sources alongside archaeological and chronological information about existing industrial remains, and placing them in the socio-economic context of the people who created and operated the Robinson enterprises. The upper valley has not been redeveloped since the decline of the system in the early 19th century and this allowed the detailed investigation to be carried out, and reveal important information about the physical attributes of early spinning-mills and their water system. Walker uses 'reverse engineering' to deduce how the Robinson system operated. Adopting this multidisciplinary approach has enabled a comprehensive picture to emerge of the impact the Robinsons had on the landscape and socially.
- 5.1.3 During the study, Walker reviews the surviving structures of the Leen Valley. Walker compiles a summary of structures for each section of the Valley, including the Moor Pond Wood project area. Walker discusses evidence for the physical operation of the mills that has been obtained from archaeological exploration in Moor Ponds Woods and from contemporary mapping. Moor Pond Woods provided evidence of the modification and evolution of the system of ponds and leats. This study has established how the system worked and the spatial extent of the mills, ancillary structures and water-system. It has been demonstrated that such a system could be constructed at relatively little expense, because the whole system cost around the same as a mill. In particular, it has been possible to assess the way in which the builder harnessed the pre-industrial landscape, and how the design of the leats evolved to ensure the efficient flow of water to the mills.
- 5.1.4 This evidence has enabled Walker to establish that George Robinson and sons created a network of 15 reservoirs and it can be estimated that the ponds covered an area of 12.7 hectares and stored more than 190,000m³ of water. Survey data has established the position of key control features, such as sluice gates, and understanding of the relative altitude of those features.
- 5.1.5 Archaeological excavation has revealed that the system underwent several phases of modification. Ponds at Walk Mill, Forge Mill and Springfield Works, seem to have been existing structures that were reused. In Dam Banks and to the north of Grange Cottages, they created elongated ponds that were little more than enlarged leats. The ponds northeast of Grange Cottages and north of Moor Pond seem to have been flooded 'borrow pits'. Walker lists an estimate of the earthworks that were constructed from 1778 to 1830. The combined evidence has permitted a model chronology for the water-system to be devised, which can be found in Figure 12. The model identifies sites where additional exploration of the leats and ponds may lead to further understanding.
- 5.1.6 Within his thesis, Walker proposes that there were three phases of system development, with phase two likely to have been carried out in two sub-phases, these can be seen in figures 13, 14a, 14b and 15.
- 5.1.7 Walker proposes phase one to be the original development of a leat to carry water from Walk Mill Pond to power the Grange Mill in 1778.
- 5.1.8 Phase two is defined as the construction of Top Upper pond and Upper pond to feed Top Mill and a leat feeding water from Top Upper pond down to Grange Mill. This work was

possibly completed in 1782. Alterations were again made in 1785, following the major disagreement with Lord Byron, in the form of Moor Pond, which was constructed for water storage.

- 5.1.9 Phase three is defined as the modification of the system in order to raise the water level to feed a new overshot water wheel with a diameter of 42 feet at Grange mill, installed between 1785 and 1790. These modifications include additional ponds at Dam Banks and a new leat to supply Grange Cottages Sluice.
- 5.1.10 Walker concludes that the thesis has more clearly established the extent of the Robinson's business, in terms of the capital investment, landscape impact and the scale of the operation. It has also confirmed the location of company housing that was constructed to provide accommodation for the labour force. The mass-construction of housing would therefore be an indicator of industrialisation. The brief spell of urbanisation and industrial activity in the upper valley, reverted back to cottage industries when the parishes of Papplewick and Linby became depopulated in the 1830's and 40's.

5.2 Recommendations for future work

- 5.2.1 A number of recommendations for future work can also be deduced from the study,, which are described below.
- 5.2.2 The archaeology of the mill-sites should be a particular target for exploration. Walker proposes the layout of the Papplewick Grange Mills in Figure 16, based on the 1847 Linby estate map and drawings from the Boulton and Watt portfolio archives. Excavations will be able to reveal its exact form, especially the correct location of the waterwheels. Excavations will also able to reveal the exact location of the Boulton and Watt steam engine built in the 1790's, intended to pump water onto the new larger waterwheel. There are also a number of buildings and workshops associated with the Grange mill complex, detailed in the Robinsons' insurance documents, that were demolished before 1847. These have also not yet been identified or investigated.
- 5.2.3 A number of connections within the water system have also been lost through landscaping, but further investigations may provide more information. One example provided by Walker is at Grange cottages pond, where there is no reference on the maps that a channel led from the pond. It may have supplied water, but there is no evidence to support this. There is also no evidence for how water travelled southwards from the Grange Cottages wood sluice to the Grange mill site. It seems likely that there was originally a wooden and/ or iron spillway along the crest of the bank, but there is currently not evidence for this. Another channel on the 1847 map was shown turning westwards to join a channel running from Walk Mill pond. It may have been a spillway, collecting water overflowing from the channels in Dam Banks, but its survival needs investigating.
- 5.2.4 The location of some sluices has been established by excavation whilst the position of others can be inferred from the proposed system layout in figure 12. The suggested locations should be investigated to confirm their presence.
- 5.2.5 The study has made apparent the extent of the mill housing in Papplewick parish, but targeted archaeological exploration may provide additional evidence concerning, for example, whether there were different types and quality of housing, and the standard of living of those early workers.
- 5.2.6 The investigation of the leat and pond floors needs to continue more thoroughly in order to determine the absolute depths and the maximum capacities of these features, using test pits and boreholes. Such work has been started as described by Walker (2017). This will also help to assist the creation of a flow model for the water system.

- 5.2.7 More work needs to be done on the dam banks terraces to determine whether the ridge and hollow earthworks are borrow pits from where the material to construct the embankment had been quarried, or small ponds created to assist bleaching, washing and stretching cloth.
- 5.2.8 The Moor Pond Woods project area is only a part of the entire Robinson system. The project could be used as a pilot study to be expanded into the Lower mill and Forge mill complexes. A little further south, there are houses on the west side of Moor road, halfway between the Grange and Lower Mill, known as Cobbler's Hill, which could be investigated and recorded. Springfield bleach works, Forest mill, other contemporary sites in Basford could also be explored through excavations.

6 Walkover Survey Aims and Objectives

6.1.1 The main aims of the walkover survey within the Moor Pond Wood project area were:

- To confirm the presence of any more features that have not as yet been investigated and recorded within previous works
- To locate newly discovered features onto relevant maps and record them with photography
- To locate and record any evidence of features, such as remnants of stonework, that have been found by the Friends but have not as yet been located or investigated.
- To provide the local community with opportunities to become involved with the project by offering training in recording and surveying techniques to volunteers and by interpreting the structures uncovered and making this information accessible to all.

7 Walkover Survey Methodology

- 7.1.1 The walkover survey was carried out between September 2016 and November 2016 by members of Trent and Peak Archaeology, the Friends of Moor Pond Wood and the Leen Valley Conservation Volunteers (LVCV).
- 7.1.2 All work met with requirements and standards set out in Management of Research Projects in the Historic Environment Project Planning Note 3: Archaeological Excavation (MoRPHE PPN3) (English Heritage 2008), and the requirements and standards set by the Chartered Institute for Archaeologists (CIfA) in their Standard and Guidance for archaeological field evaluation (CIfA 2014a) Standard and Guidance for the collection, documentation, conservation and research of archaeological material (CIfA 2014b); Code of Conduct (CIfA 2014c) and Standard and Guidance for the creation, compilation, transfer and deposition of archaeological archives (CIfA, 2014d).
- 7.1.3 Three areas of Moor Pond Wood were chosen as the sites with the most potential for further investigation. These three areas were Upper Dam, located north of Linby Lane, Dam Banks and the subsidiary pond, and the Grange Cottages wood area, both south of the sluice consolidated in 2015 and toward the north at Papplewick Lane where the water supply would have crossed the road,
- 7.1.4 Volunteers systematically walked each area as far as the undergrowth would allow, looking for anything that may have not as yet been noticed and recorded.
- 7.1.5 When a feature was uncovered, photographs were taken and the feature would be located on a plan of the site, using GPS, compass bearings and tape measures where appropriate. Photograph locations were also recorded on the plan
- 7.1.6 Hollows and banks were also checked against plans from previous works to make sure that they still accurately represented what was seen on the ground. Alterations and additions were made if this was found not to be the case, for example, the steepness and the break of slopes.

8 Walkover Survey Results

8.1 Upper Dam

- 8.1.1 All of the Upper Dam features described below can be seen on Figure 7.
- 8.1.2 A linear mound of stonework (7) has been recorded approximately 8m north of Linby Lane, measuring 3.6m long and 0.7m wide. It has been noted during previous works (Sheppard 2003), and is thought to be remains of the method used to manoeuvre water across Linby lane. How the watercourse crossed is unknown, as the road has been widened and the connection between the two sides of the roads lost, this stone could be the remnants of such a structure.
- 8.1.3 Approximately 160m north of Linby lane, a longer yet intermittent line of stonework (1), (2) and (3), was recorded forming an edge to the shallow millpond to the west of the heavily silted leat. The southernmost part of the stonework (4) formed a crudely built dry stone wall, whilst the rest of the stonework was found to be loose on the surface. However the alignment of both forms of stonework could indicate some form of linear structure.
- 8.1.4 Two land drains (5) and (3) have been laid down east to west from the fields and into the leat banks to empty water into the low lying former mill pond area. The south drain (5), approximately 87m north of Linby lane has been excavated through the leat banks to a depth of 1m, the north drain (3) is sat on the silted base of the leat and therefore is only intruding on the eastern bank of the leat at this point. Both drains have been recorded on the plan.
- 8.1.5 More stonework was uncovered at the western side of the Upper Dam site. The stonework is thought to be a drain (1), with 1 x 1m exposed in the side of the western edge of the former mill pond.

8.2 Dam Banks

- 8.2.1 All of the Dam Banks features described below can be seen on Figures 8 and 9.
- 8.2.2 A 21m long bank (9) was recorded parallel with a boundary fence within the subsidiary pond area of Dam Banks. It measures approximately 2.5m wide however is very uneven in height. It is possible that the feature continues into the wooded area to the east however the undergrowth prevented any investigation of this.
- 8.2.3 The area of Dam Banks to the west of the leat and footpaths were briefly walked over and a few alterations were made to the topographical survey completed in 2011 (Walker and Sheppard, 2011). Images of the ditch (8) running along the west and south of this area can be found on plates 8-11.
- 8.2.4 The remnants of the East sluice (10) that are visible were inspected and photographed in order to establish the likelihood of re-evaluating this part of the site and conserving the structure that was backfilled in 2005. The presence of a large tree on the southern edge of the sluice may make this process difficult but its removal could prevent any more damage to the structure below.

8.3 Grange Cottages

- 8.3.1 All of the Grange cottages features described below can be seen on Figure 10.
- 8.3.2 A stone revetment was recorded on the south side of Papplewick lane to the west of the leat bank (12). It was within a steep side slope and could be disturbance from road widening.

- 8.3.3 A ditch (13) was recorded within the sunken floor of the former Grange Cottages west pond.
- 8.3.4 Hollows and banks were also checked against plans from previous works to make sure that they still accurately represented what was seen on the ground. Alterations and additions were made to the area around the Grange Cottage Sluice (14) to represent what is on the ground more accurately.

9 Recommendations for Future Work

9.1 Upper Dam

- 9.1.1 Exploratory test pits should be used to investigate the purpose of the stonework found on the eastern side of the former mill pond. Investigations should also commence alongside the stonework 8m north of Linby Lane in order to establish if this stonework is a part of the water management system and whether it is related to the movement of water across the road and how they did this.
- 9.1.2 Sheppard suggested the stonework near to Linby Lane should be investigated in his appraisal of 2004 and a trench should be excavated across the leat in order to determine whether the leat was lined or contained pipe-work or masonry. However previous reports suggest that no intrusive works have taken place within the Upper Dam area as yet. It is recommended that more work should be done within the leats and holding ponds as a whole to obtain original floor levels for the entire water system to understand the speed at which the water moved through the system.

9.2 Dam Banks

- 9.2.1 Exploratory work should be conducted around the bank to determine whether it is a feature associated with the water supply system or whether it is a by-product of the boundary being put in and maintained.
- 9.2.2 It is recommended that the East sluice should be re-excavated and conserved to the same standard as the South sluice, creating another interesting feature in the landscape that can hopefully, over time, provide some answers to the number of questions still surrounding this area of the site.

9.3 Grange Cottages

- 9.3.1 A more detailed examination of the leat should be continued, to establish its true profile at varying points north and south of Grange Cottages sluice. This can be done by excavating more test pits in the base of the leat and surveying their heights. Permission would have to be obtained from Grange Cottages home owners to access the leat as it approaches the site of Old and New Mill, and an earlier low lying leat, as the features are within property boundaries. This phase of works would be a test pitting project which would involve more members of the public, especially those within gardens of the cottages.
- 9.3.2 A detailed examination of the slope at the southern end of the sluice should be undertaken to establish how the water was fed to the Grange Mill.
- 9.3.3 Examinations should be made of the stonework (12) located immediately south of Papplewick lane in order to establish itself association with the method used by the Robinsons to get water from the north to the south of the road.
- 9.3.4 The ditch (13) within the sunken floor of the former Grange Cottages west pond should be investigated to establish any potential evidence of the existence of the phase one leat to the south of Papplewick Lane, connecting Walk Mill pond Grange Mill in 1778
- 9.3.5 The bank and ridge (14) to the south of the Grange Cottage sluice needs to be investigated for evidence of the existence of a spillway or launder that provided water to the mill wheels.

9.4 Other areas of interest

- 9.4.1 The excavations at Papplewick Lane leat terminus should be continued in order to attempt to establish the complex relationship between the leat, the shaft, the drain in the Papplewick lane wall and the outlet leading from the south west corner of Moor Pond.

Continuing work here would also help to establish exactly how the water got from one side of Papplewick lane to the other. It is hoped that a final report can be produced for this part of the site in the next year.

9.5 Other recommendations

- 9.5.1 It is apparent that more work needs to be done concerning Walk Mill and the Grange Mill complexes, especially as the Grange mill site is still threatened with building development (Walker, 2017). The site could be subjected to a geophysical survey in order to establish the extent of the structural remains, before being fully excavation and recorded.
- 9.5.2 It is also recommended that a digital walkthrough of the archaeology and its location within Moor Pond Woods should be produced in light of a recent spate of vandalism. It would also make the site more accessible to those less able to physically visit the archaeology

10 Conclusions

- 10.1.1 It is clear that, despite the large amount of work that has been done on the site, there are still a number of sections to the project area that need investigating, recording and, in places, conserving.
- 10.1.2 Approximately 100 volunteers have been involved at some stage since the start of the Moor Pond Wood project in 2000, through which they have learned new skills, including excavation, finds processing and interpretation. The project has also featured a number of times within the Council for British Archaeology's (CBA) Festival of Archaeology, using displays and tours of the site to help local people become more aware of their local heritage.
- 10.1.3 It is hoped that this document has provided and collated enough information and recommendations to help the production of a new set of research aims with which to approach the Heritage Lottery and other funders for grants to continue work in the Moor Pond Wood Project area. The successful application for more funding will allow the support, interest and involvement in the site to increase, and continue the work to improve accessibility to the site for those who are disabled and who have mobility issues.

11 Acknowledgements

- 11.1.1 Thanks are extended to the Friends of Moor Pond Wood and the Leen Valley Conservation Volunteers, led by Lee Scudder, for their invaluable assistance with the site survey. Thanks are also extended to Stephen Walker for his support with the interpretation and evaluation of the site, to Richard Sheppard for his continuous input and Gareth Davies who managed the project.

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Plates



Plate 1: Sluice at the north end of the site in Upper Dam, looking north (L. Binns 2016)



Plate 2: Weir at the north end of the site in Upper Dam, looking northwest (L. Binns 2016)



Plate 3: Drain found at the north west end of the site in Upper Dam, looking northwest (L. Binns 2016)



Plate 4: Stonework found on the eastern edge of the former mill pond, Looking north east (L. Binns, 2016)



Plate 5: Stonework found on the eastern edge of the former mill pond, Looking east (L. Binns, 2016)



- Plate 6 (Above): Cut through leat bank for drain Looking west (L. Binns, 2016)



Plate 7 (Left): Stonework located north of Linby Lane, Looking North (L. Binns, 2016)



Plate 8 (Above): Leat/ ditch running north to the west of Dam Banks, Looking North (L. Binns, 2016)



Plate 9 (Left): Leat/ ditch turning and running east to the south of Dam Banks, Looking east (L. Binns, 2016)



Plate 10 (Above): Leat/ ditch turning south to the west of Dam Banks, Looking North east (L. Binns, 2016)



Plate 11 (Left): Leat/ ditch running south to the west of Dam Banks, Looking south(L. Binns, 2016)



Plate 12: Potential bank/ mound running close to the fence north of the subsidiary pond. Looking east, (S. Walker, 2016)



Plate 13: The visible remains of East sluice north wall. Looking northeast (L. Binns, 2016)



Plate 14: The visible remains of East sluice south wall. Looking southeast (L. Binns, 2016)



Plate 15: Loose stonework found north of Dam Banks south sluice Looking west (L. Binns, 2016)



Plate 16: Raised bank feature south of Grange Cottages Sluice, looking south (S Walker, 2016)



Plate 17: Raised bank feature looking north (S. Walker, 2016)

Figures

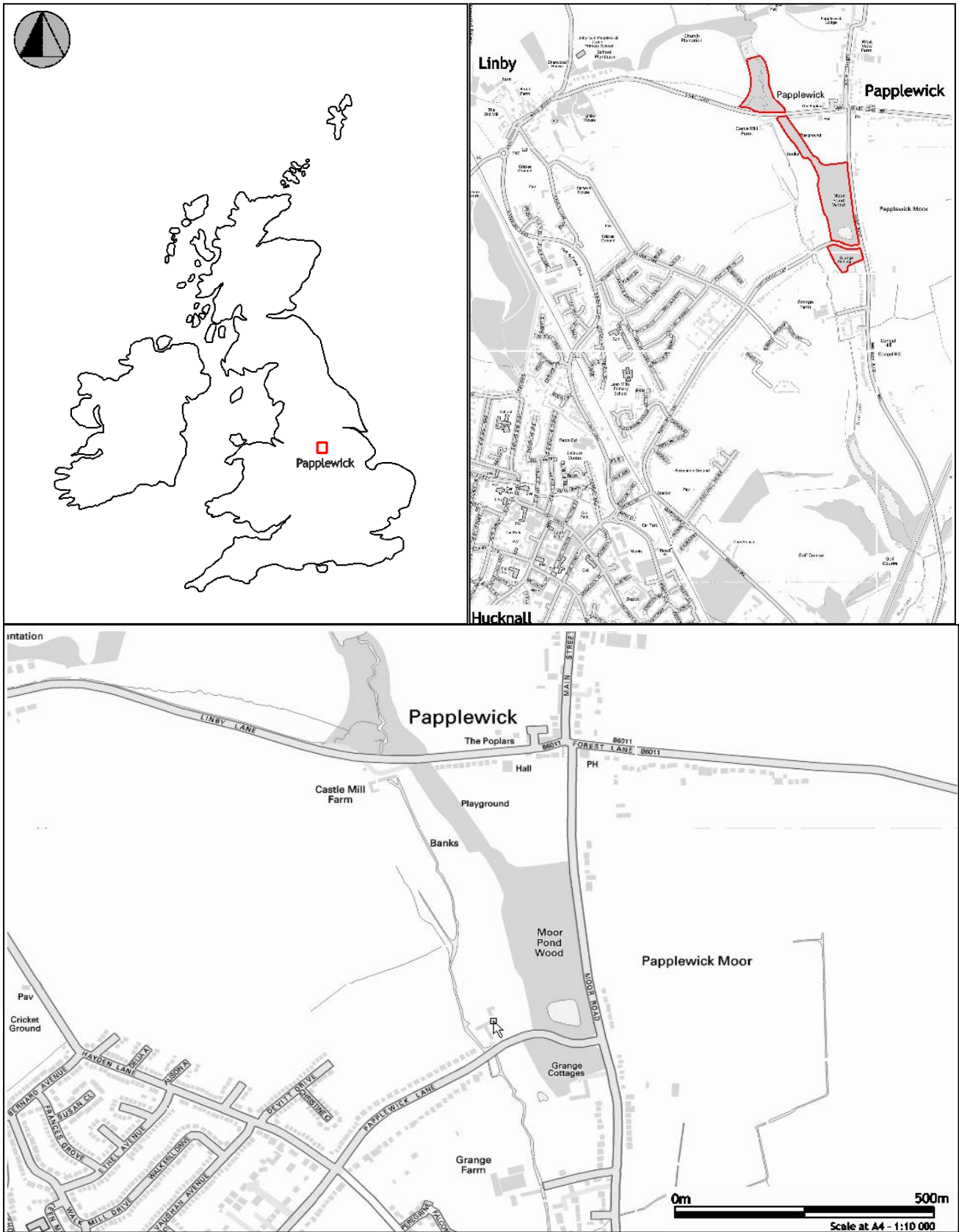


Figure 1: The location of Moor Pond Woods project area, Papplewick, Nottinghamshire. (Ordnance Survey map reproduced with the permission of Her Majesty's Stationery Office © Crown Copyright Licence No. AL 100020618).



Figure 2: Chapman's map of Nottingham 1774. A mill and associated pond can be seen south of Papplewick on the River Leen. Not to regular scale

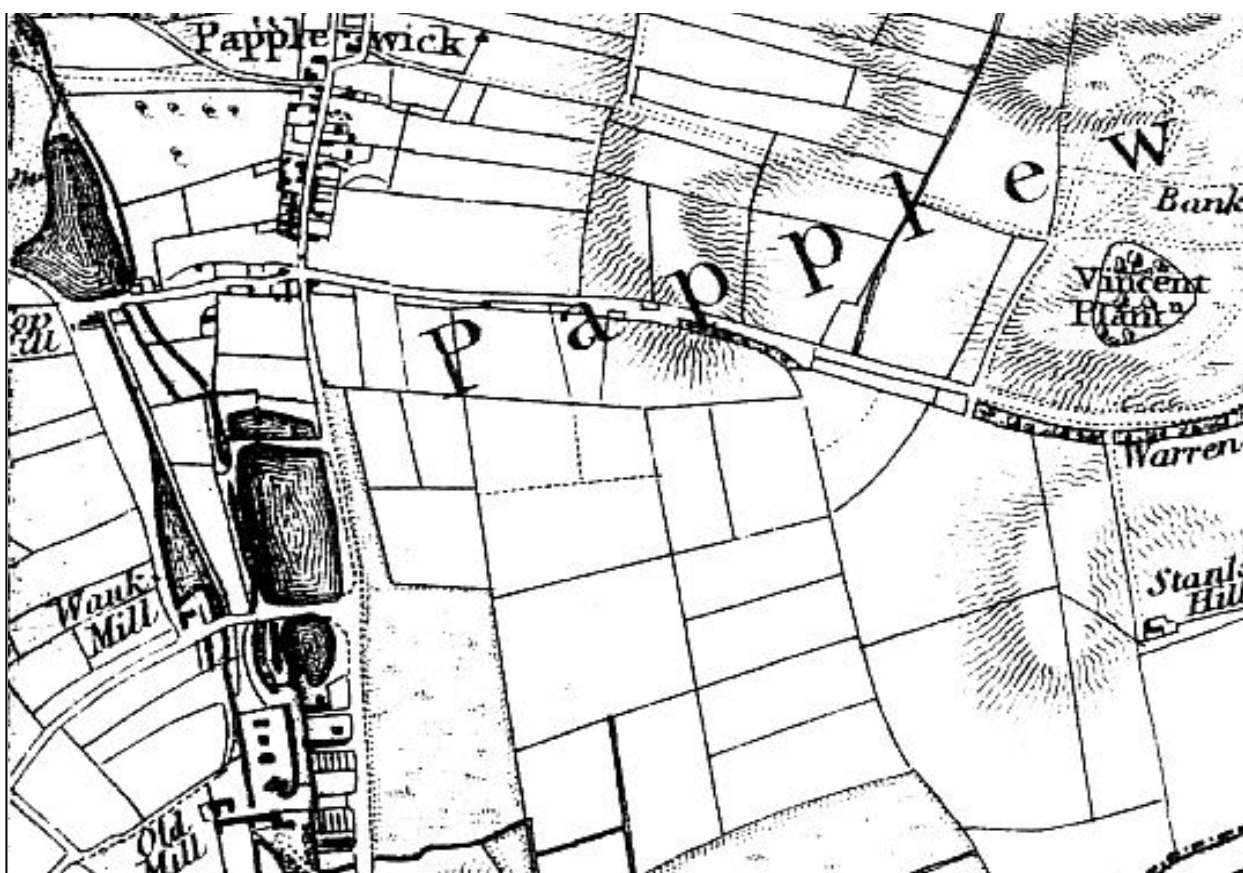
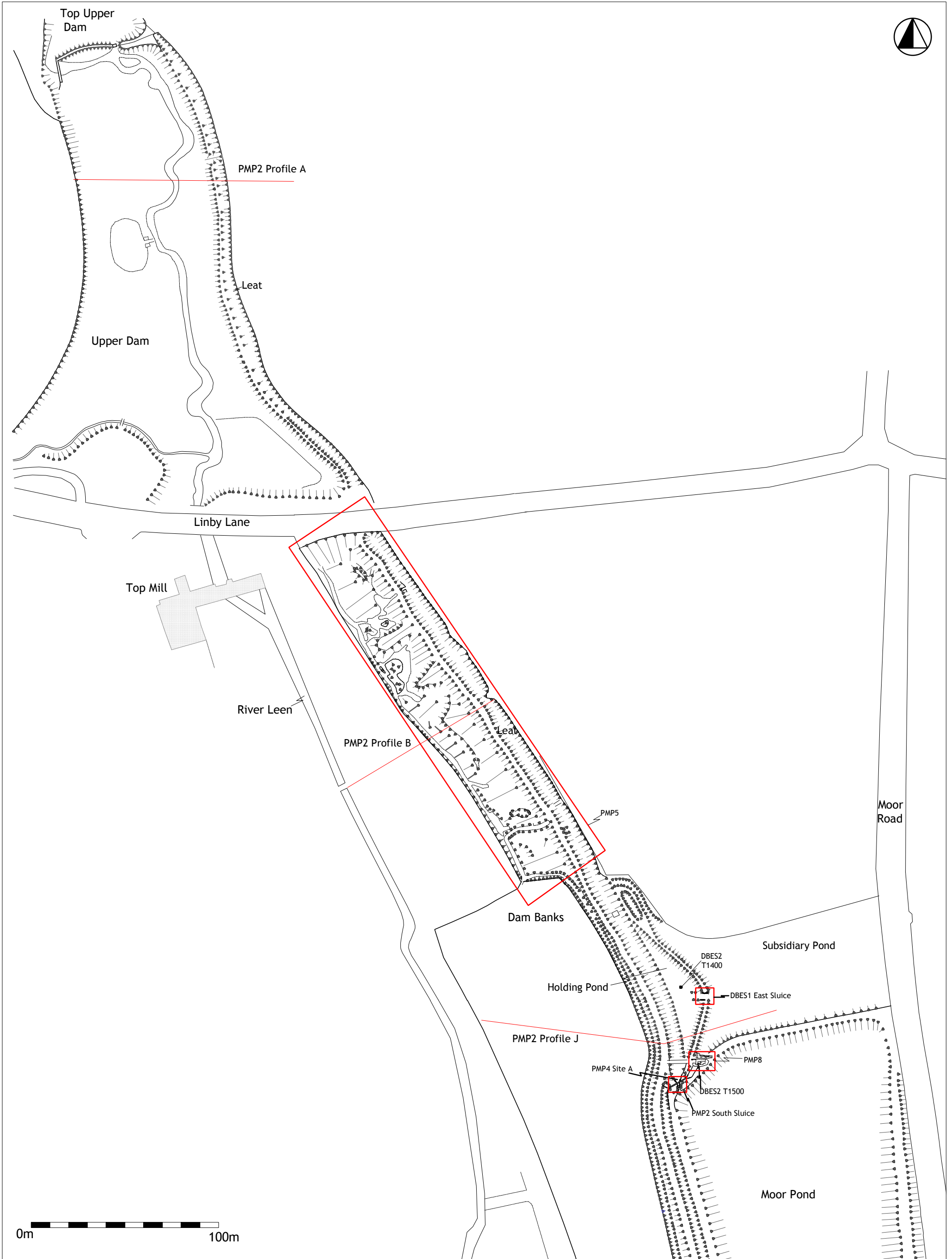
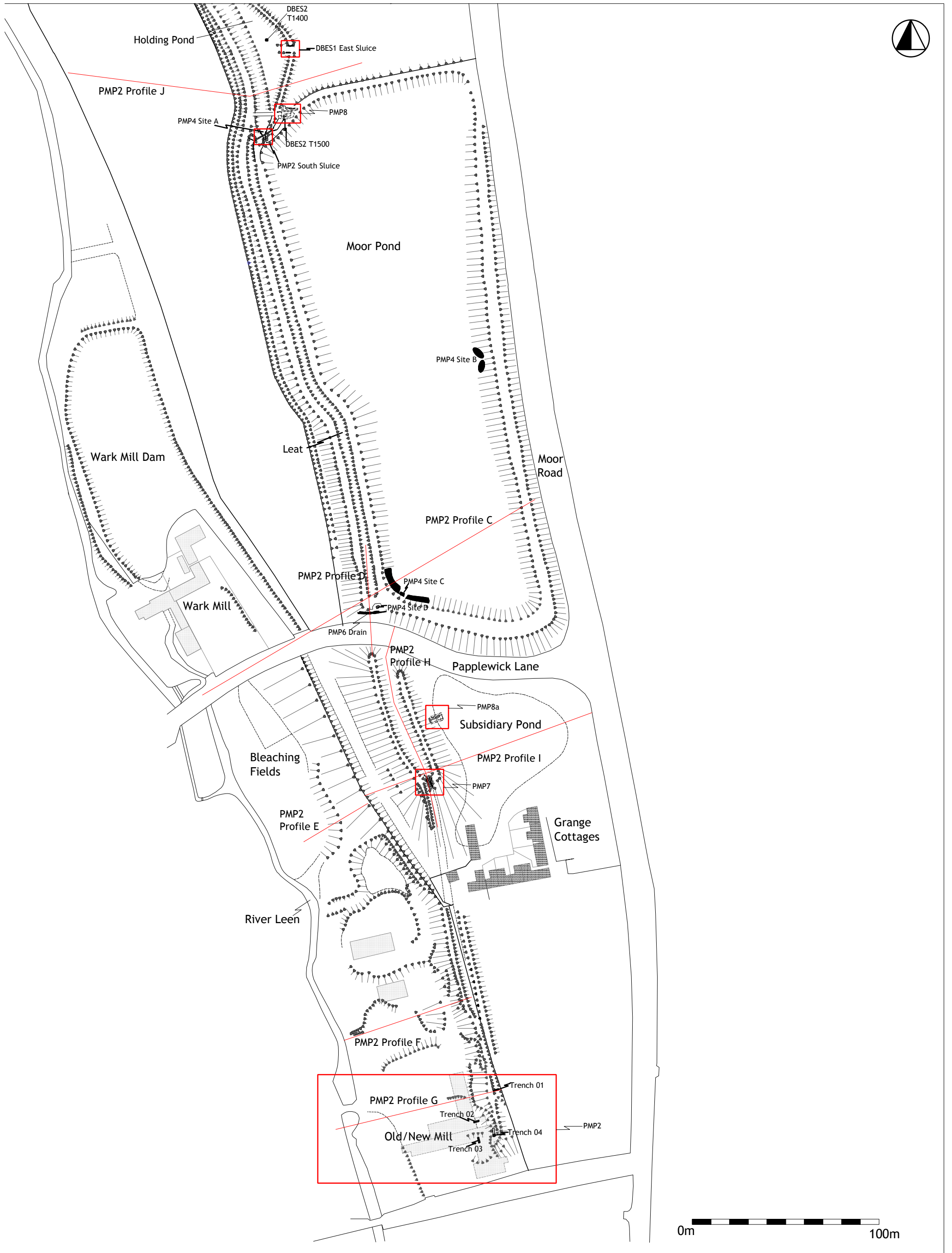
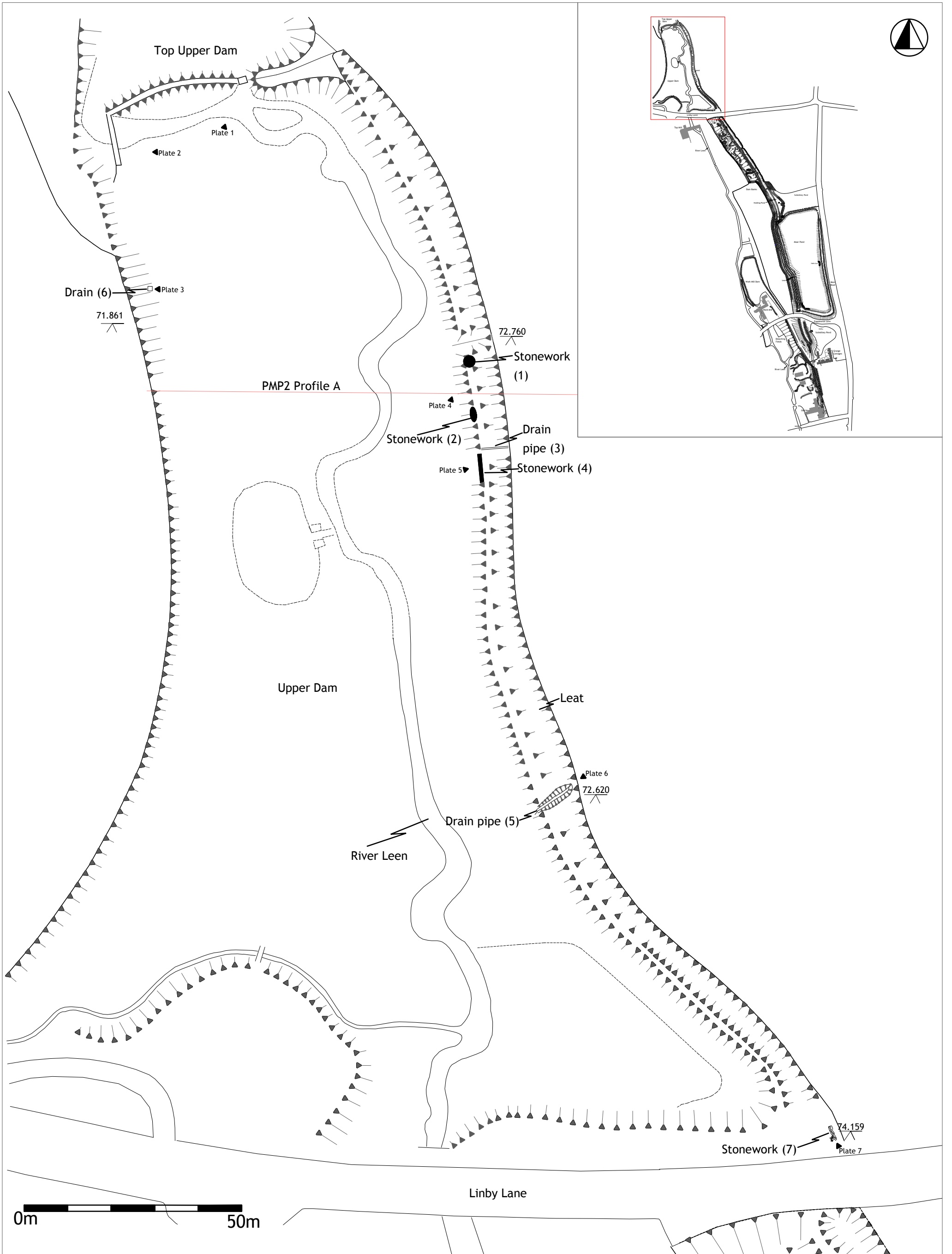


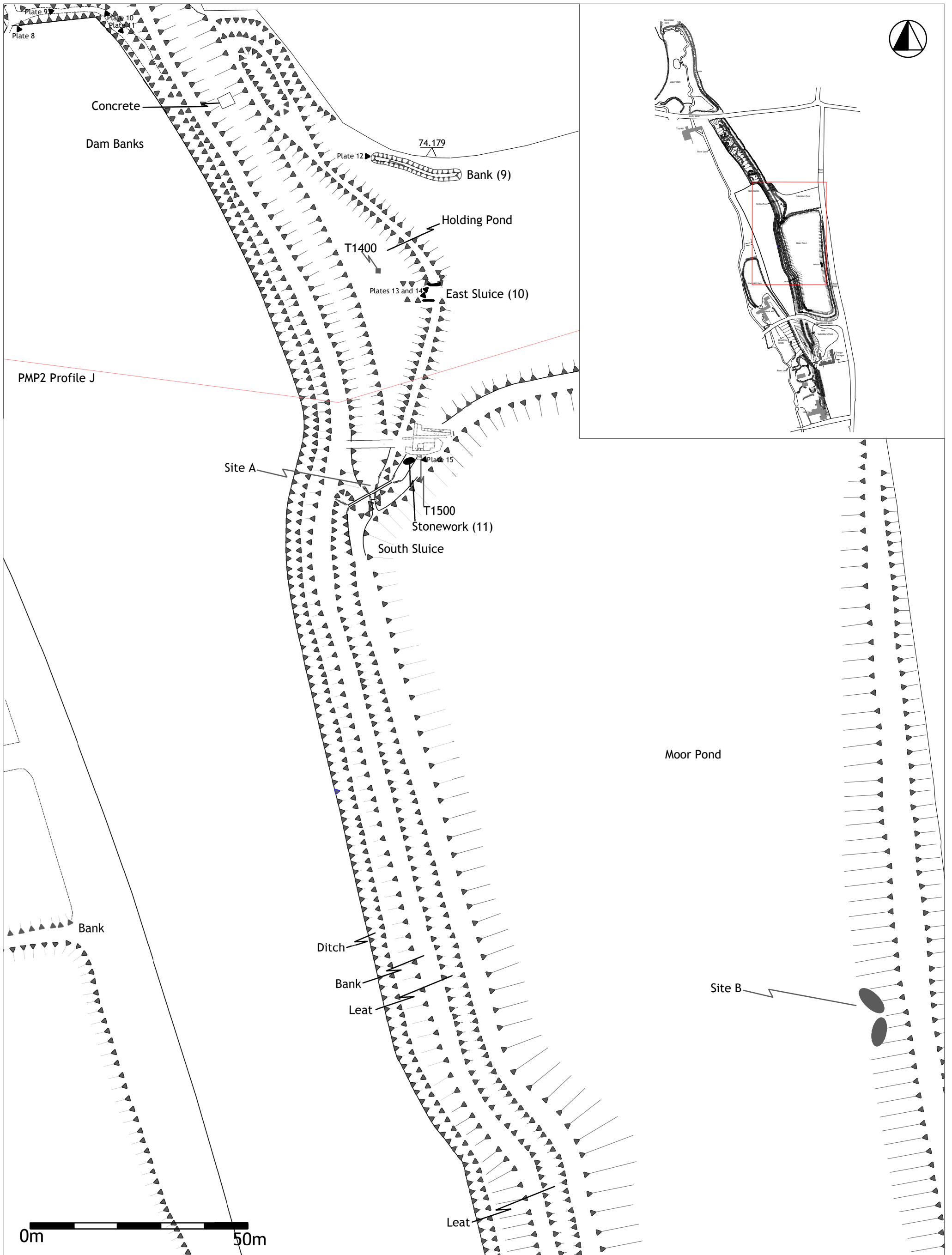
Figure 3: Sanderson's map of Nottingham 1835 showing the full extent of the Robinson's complex water supply system. Not to regular scale

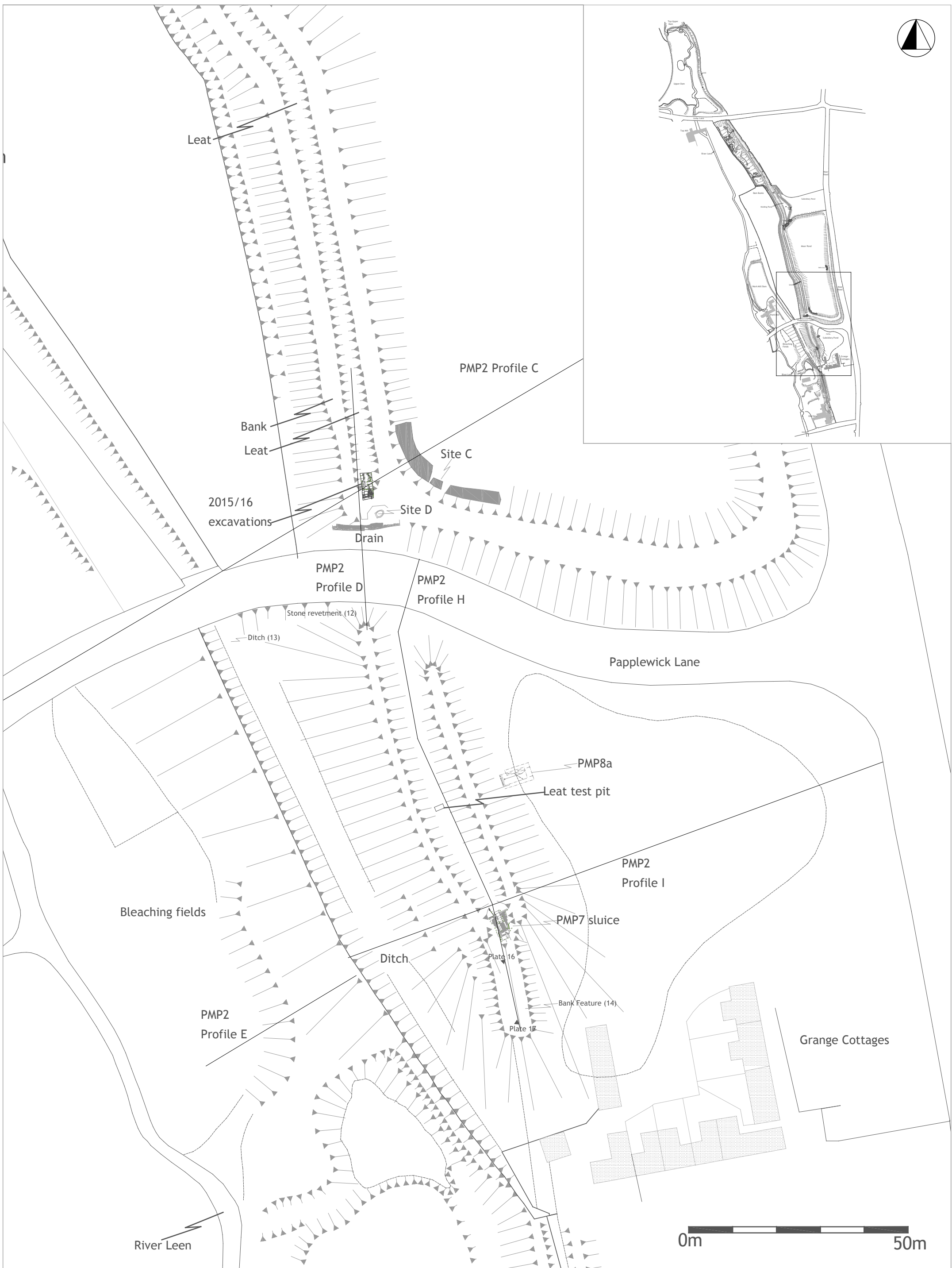


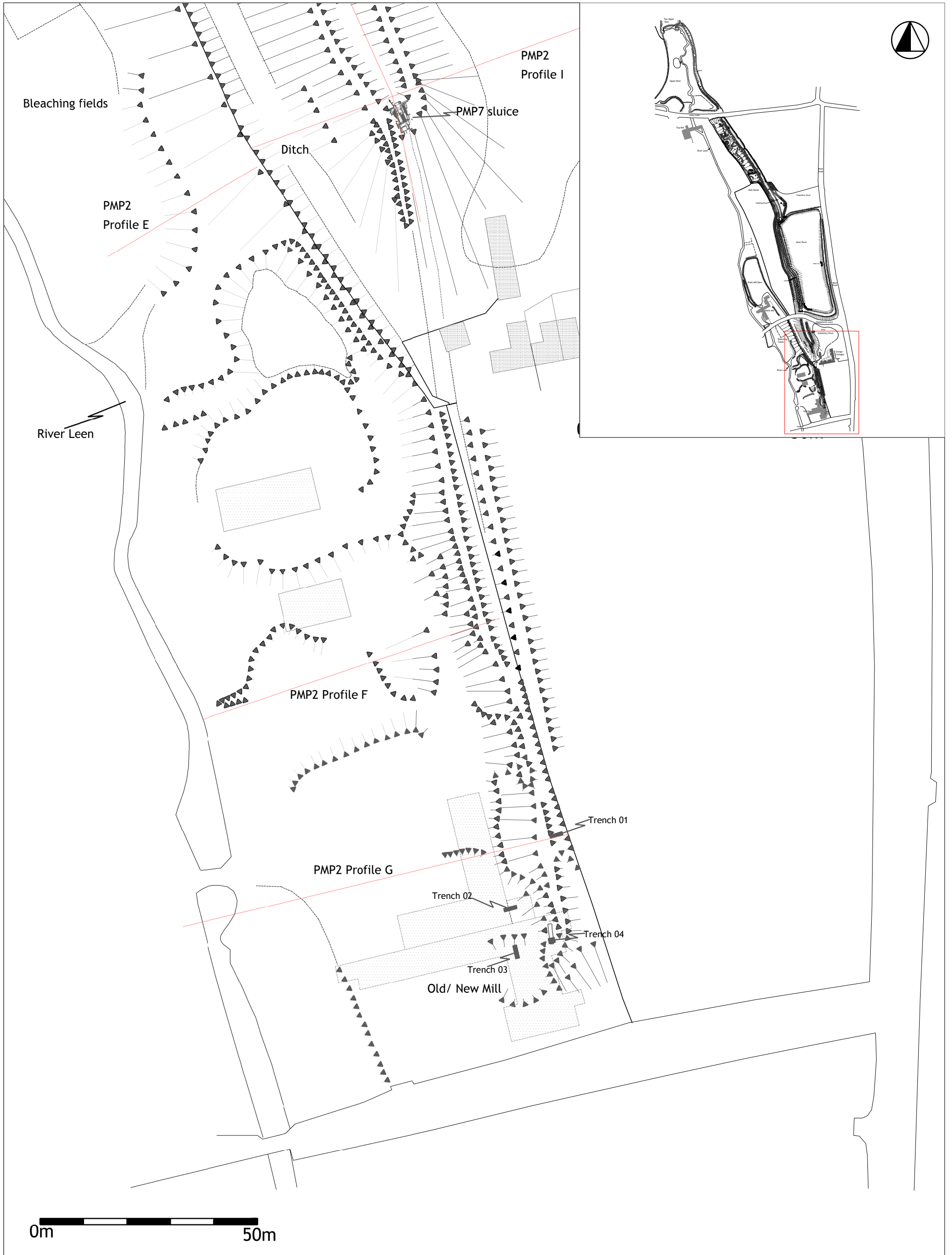












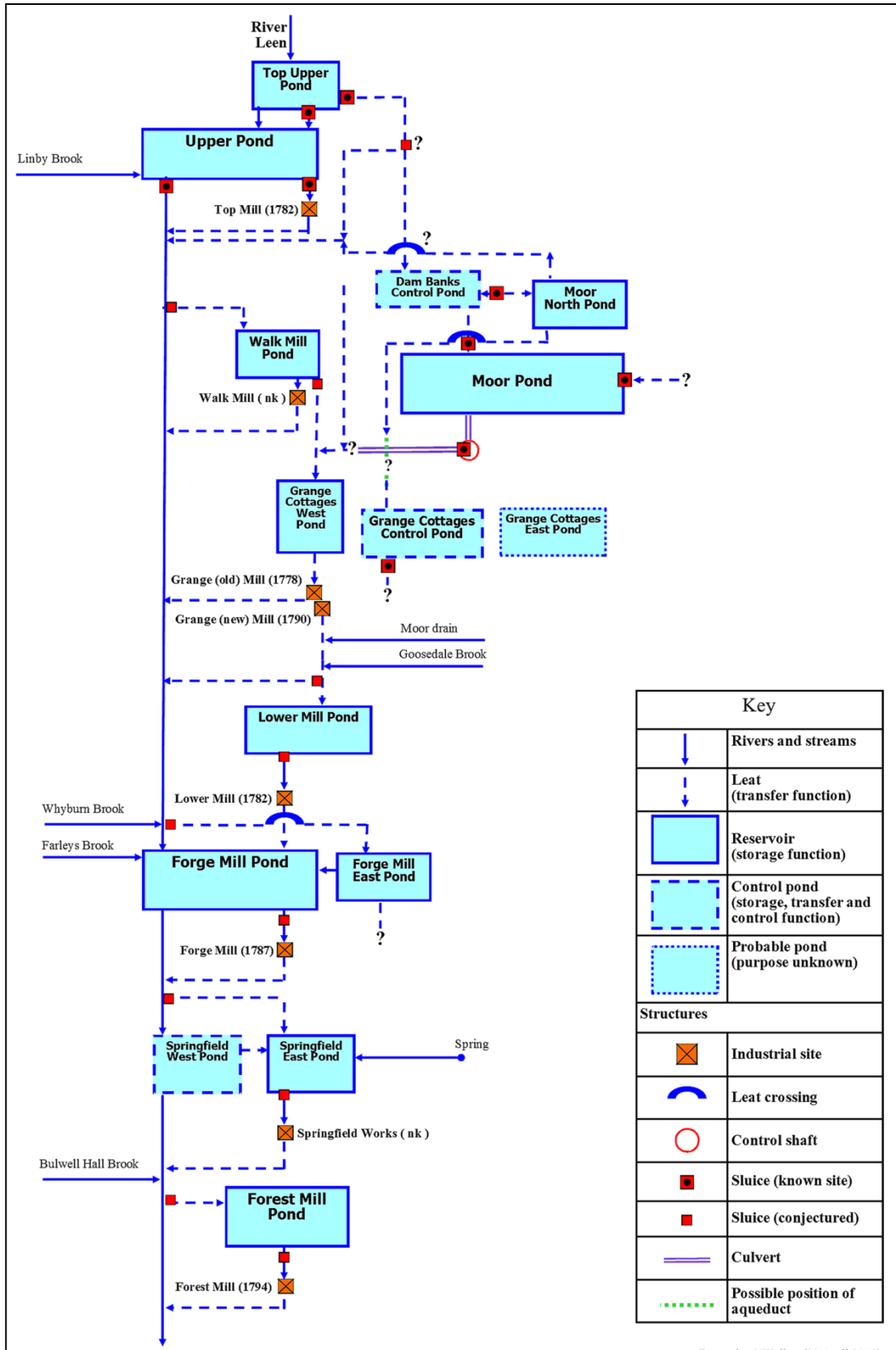


Figure 12: A diagram of the proposed system feeding the Leen Valley mills. From S. Walker, 2017.

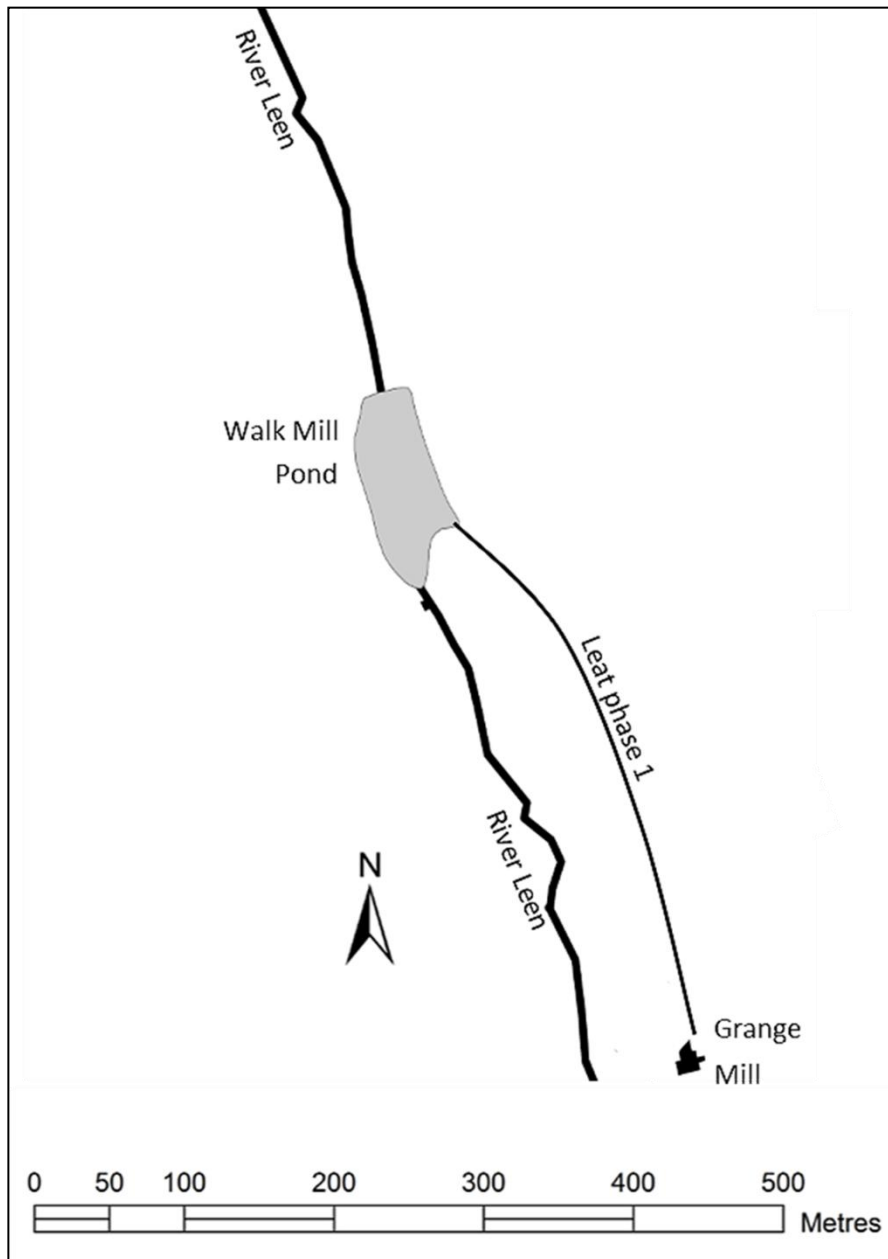


Figure 13: A diagram of the proposed first phase of Robinson's water system. From S. Walker, 2017.

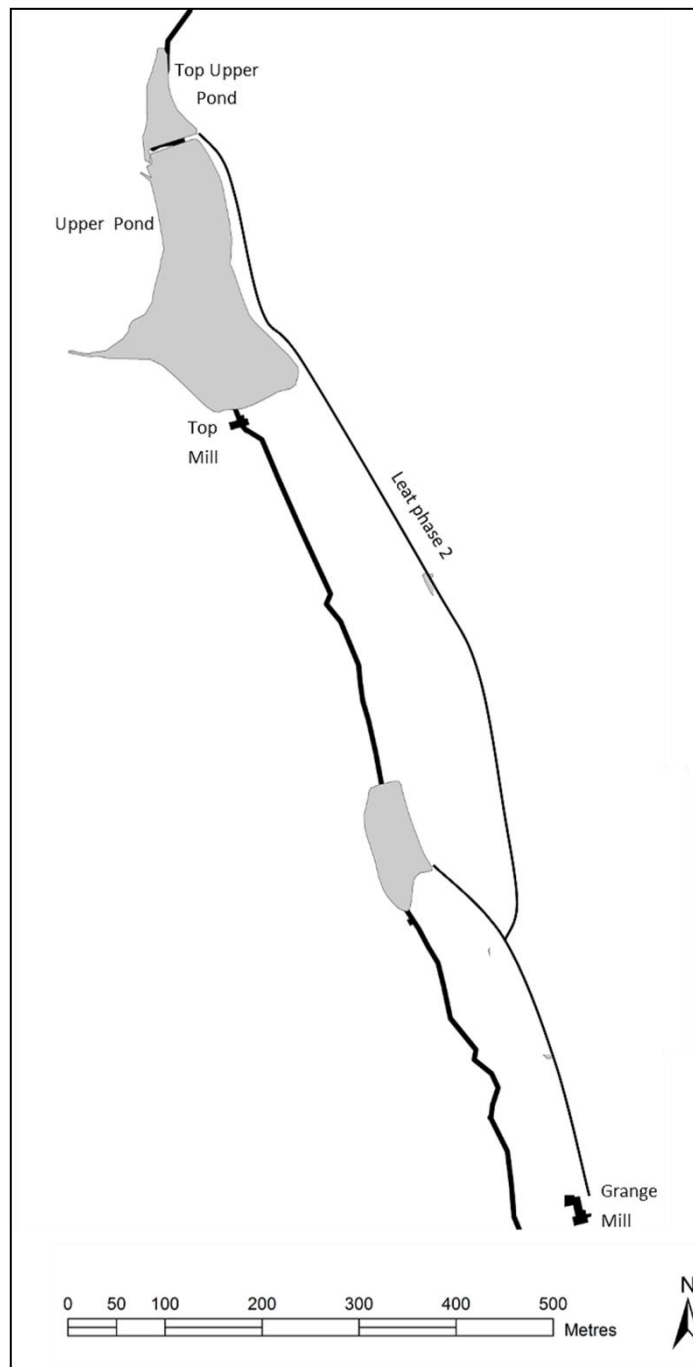


Figure 14a: A diagram of the proposed second phase (Sub phase one) of Robinson's water system. From S. Walker, 2017.

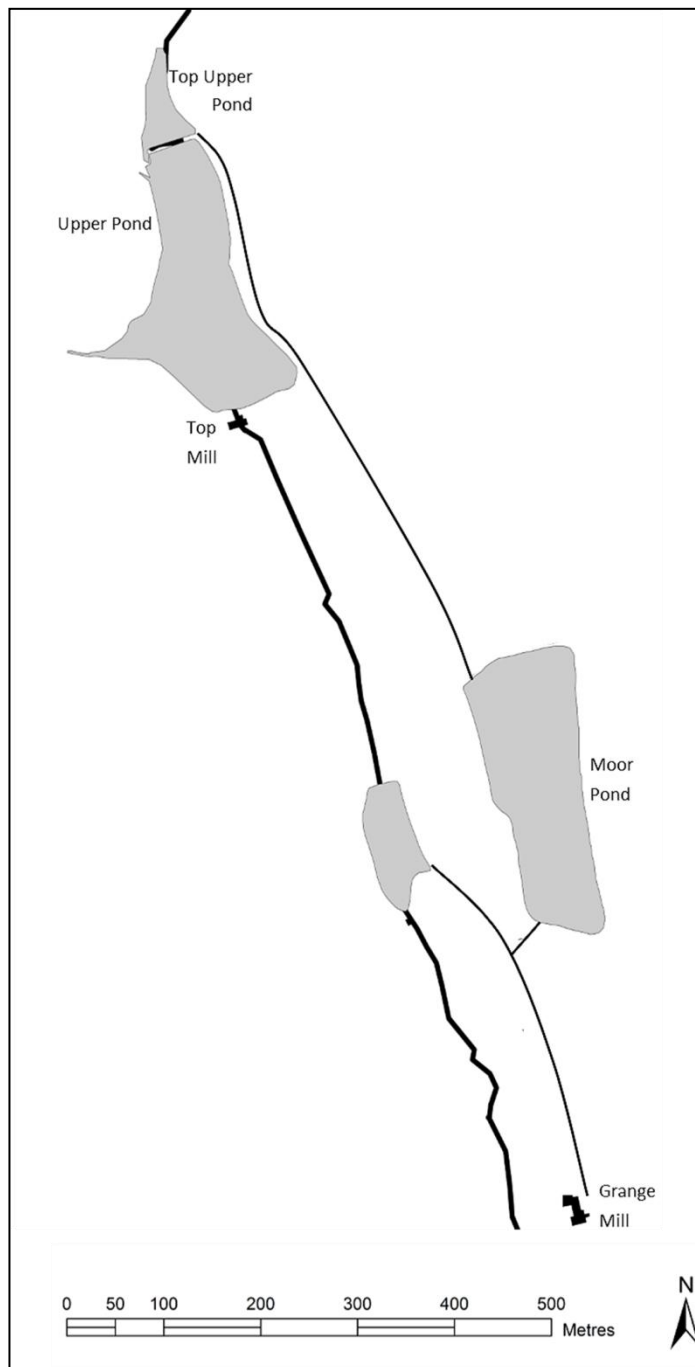


Figure 14b: A diagram of the proposed second phase (Sub phase two) of Robinson's water system, showing the addition of Moor Pond. From S. Walker, 2017.

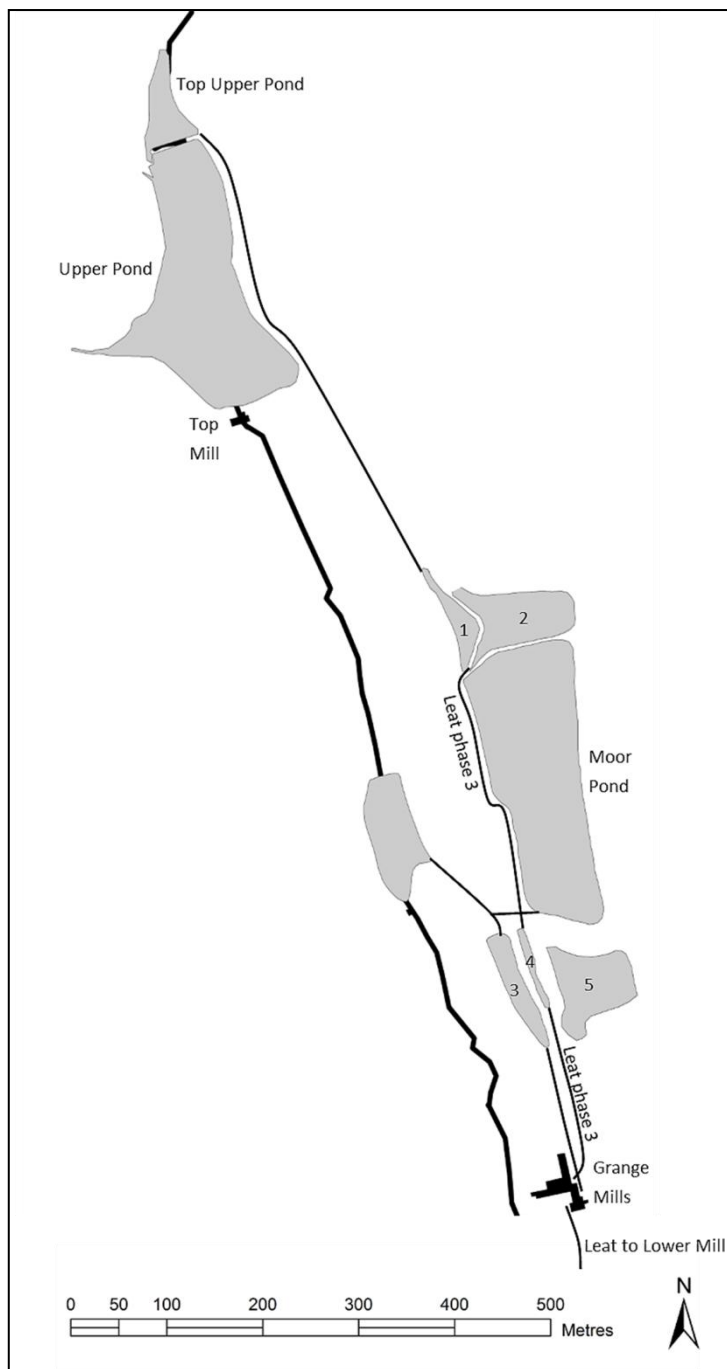


Figure 15: A diagram of the proposed third phase of Robinson's water system. From S. Walker, 2017.

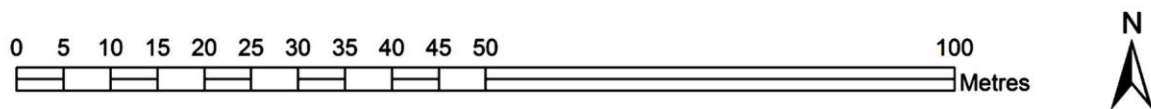
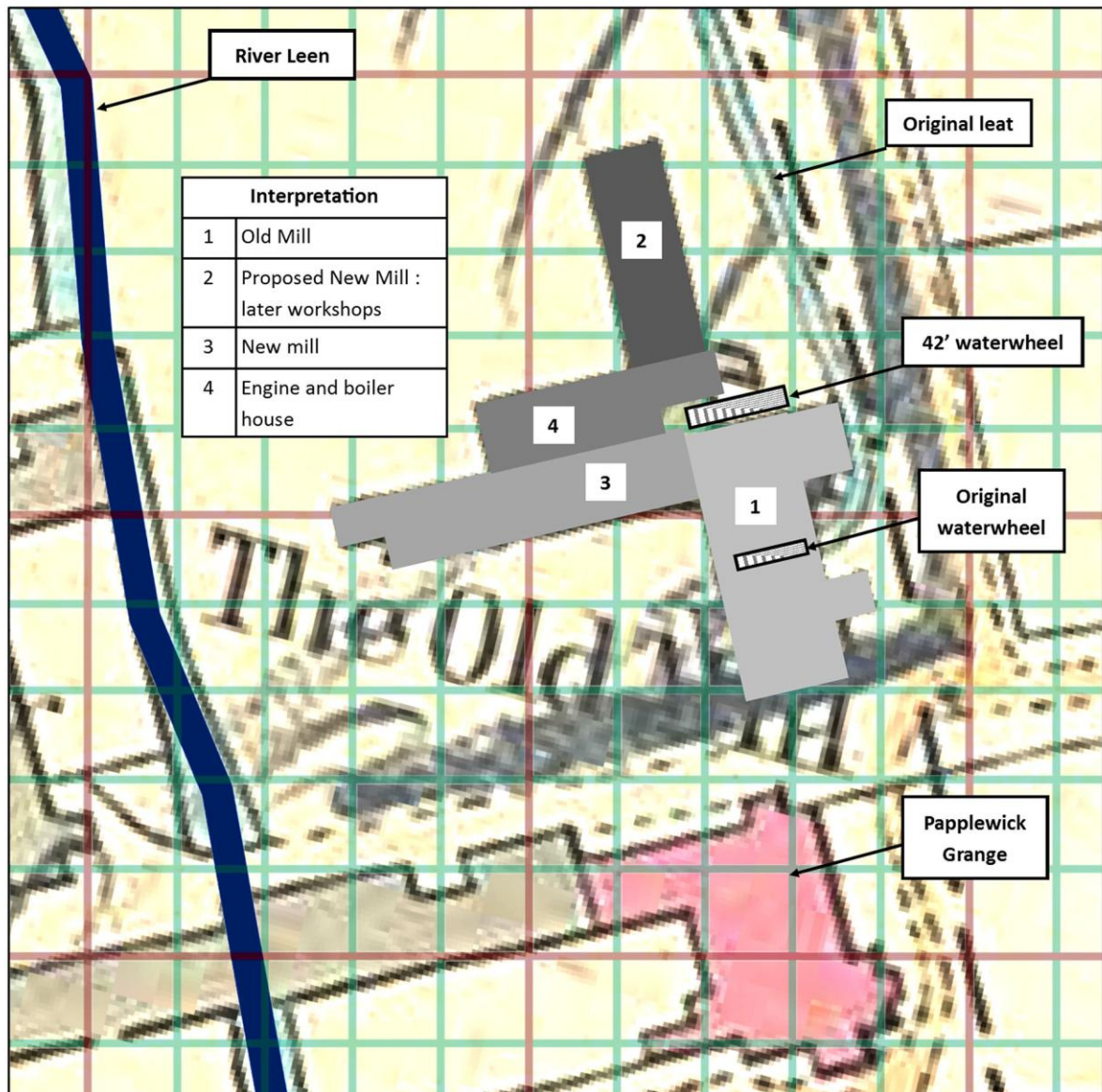


Figure 16: A diagram of the suggested layout of Papplewick Grange mills (Old Mill and New Mill). From S. Walker, 2017.