



Report on a Programme of Archaeological Works at Fernhurst Furnace, Fernhurst, West Sussex

September 2022

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NON-TECHNICAL SUMMARY

This document sets out the results from a programme of archaeological works carried out during conservation works at Fernhurst Furnace, Fernhurst, West Sussex. The north sluice and south spillway through the furnace dam formed the focus of these works, although in the case of the former, little was added to what had been revealed during the course of the 1989-93 archaeological excavations. In the case of the spillway, the opportunity was taken to more fully record the masonry remains, with previously unknown stretches of its western wing walls being exposed, together with a stone apron to its eastern front. A slight revision to the earlier proposed phasing of the site is suggested, with an initial timber phase for the wheel-pits, and a stronger emphasis on an 18th century or earlier date for the spillway's stonework.

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BACKGROUND

1. Fernhurst furnace lies within the parishes of Fernhurst and Linchmere, approximately 1.5 miles to the west of the village of Fernhurst and 5 miles to the north of Midhurst, in West Sussex (see Figures 1 & 2). The top of the dam to the furnace pond lies at 64.5m aOD and is centred at NGR SU8792 2817. The geology is Lower Cretaceous Weald clay, with sandstone pockets.



Figure 1 Site location. © Crown copyright. All rights reserved. License number: AL100036068

2. Excessive and poorly controlled water flow through the remains of the furnace works at Fernhurst has led to significant past damage to the monument, leading to its inclusion on Historic England's Heritage At Risk Register. As a response to this ongoing threat, the landowners of the dam and furnace works have obtained funding from Historic England to undertake essential repairs in order to stabilise the remains and better control the flow of water.
3. Fernhurst furnace is a Scheduled Monument (SM 30909/1021403). The works are being undertaken under an Historic England grant, which itself confers Scheduled Monument Consent, but this includes a condition that any works be carried out in accordance with an approved Written Scheme of Investigation (WSI) covering the archaeological recording aspects of the works. West Sussex Archaeology Ltd (WSA) was appointed by the landowner to draw up such a WSI (WSA 2020) and to carry out the ensuing archaeological works.

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4. The archaeological works were undertaken in three stages: Stage 1, undertaken from 21st-31st May 2019, consisted of the excavation of two geotechnical test pits behind the west wing walls of the spillway and the clearing out and recording of the wheel-pits and tailrace associated with the sluice; Stage 2, undertaken 30th September – 4th October 2019, consisted of the partial backfilling of the wheel-pit area of the sluice with slag borrowed from the stream bed to the east of the spillway in order to protect the surviving archaeological remains from winter storm damage; Stage 3, undertaken 17th June – 26th July & 30th October 2021 and 28th March 2022, consisted solely of works to the spillway, including the exposure of the barrel vault and the deconstruction of its east walls.

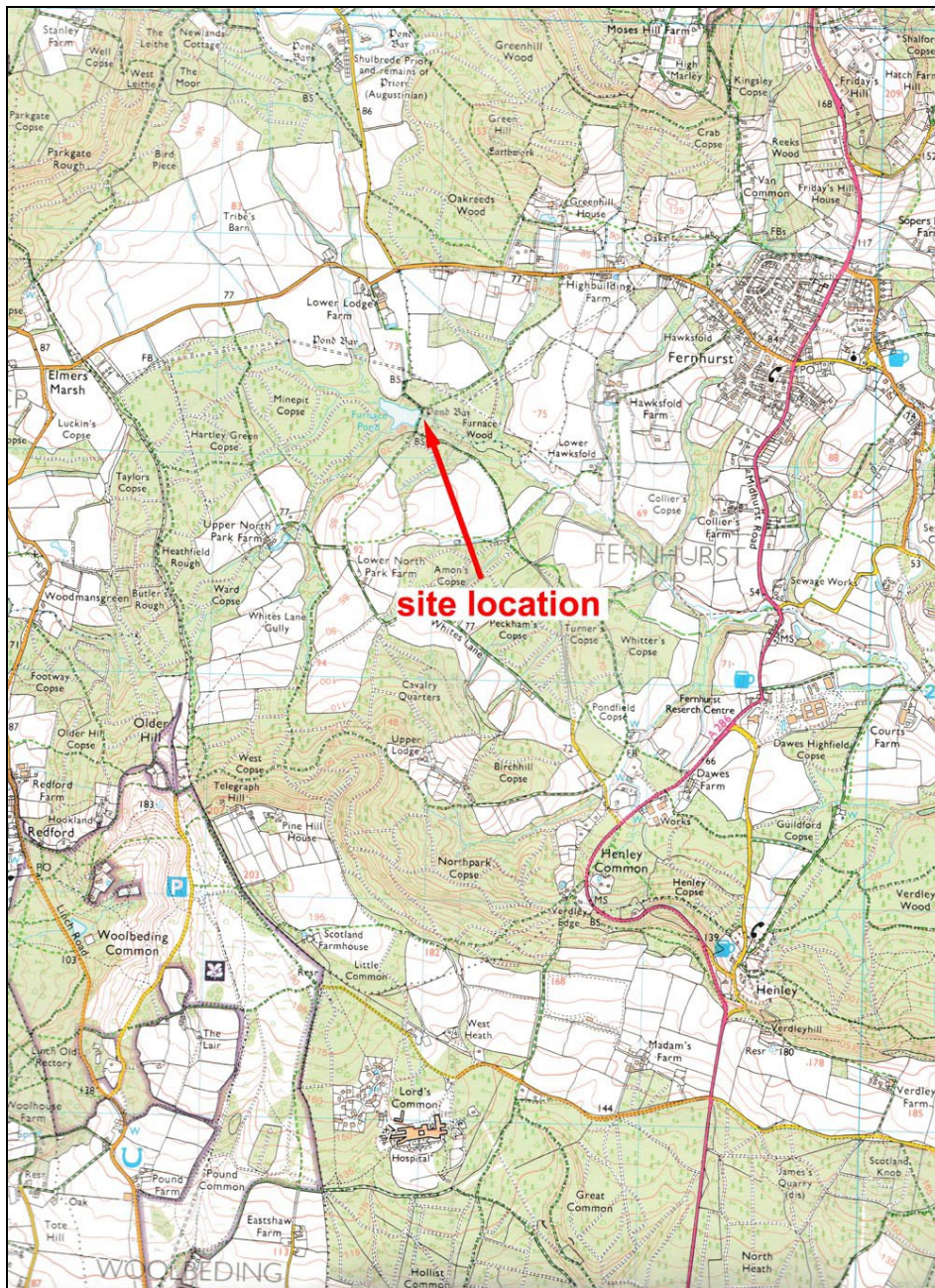


Figure 2 Site location. © Crown copyright. All rights reserved. License number: AL100036068

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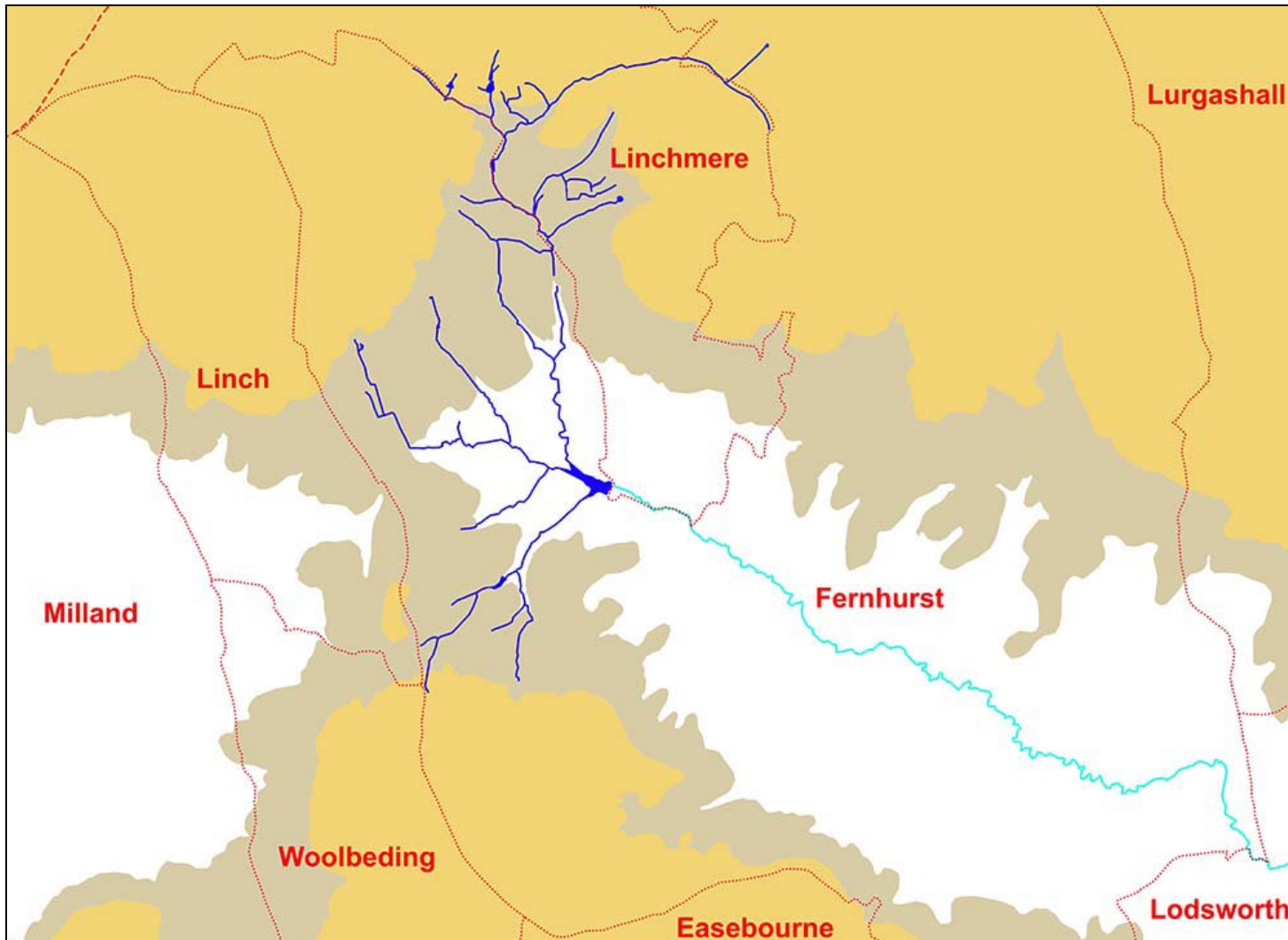


Figure 3 The furnace pond and its catchment (dark blue), outflow stream (light blue), parish boundaries (red), and land over 100m (orange) and 75m (brown)

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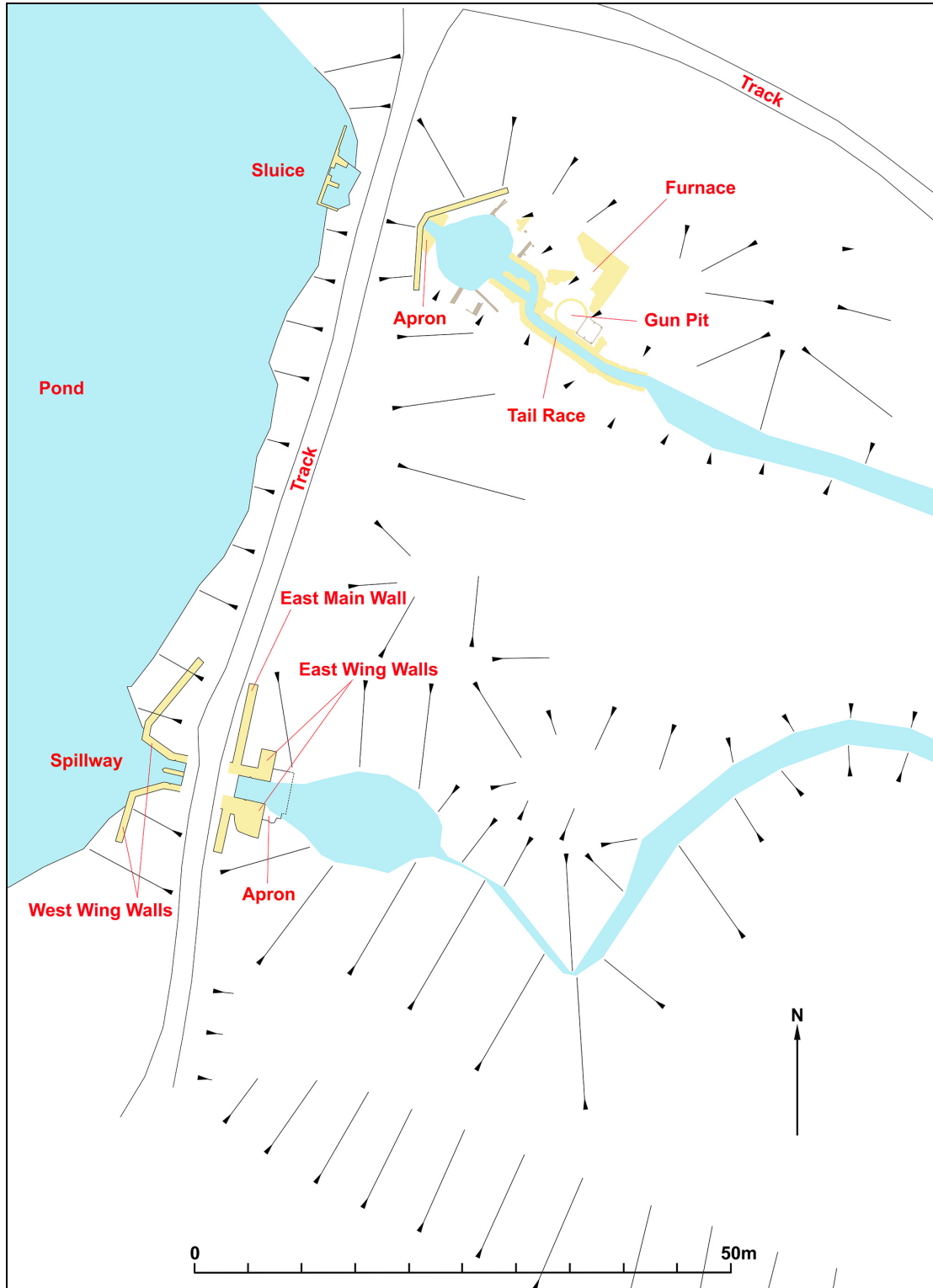


Figure 4 Plan of the furnace site

Historical Background

1. A detailed description of the known history of the furnace and past archaeological works at the site can be found in a monograph produced by Chichester District Council (Magilton 2003). In summary, this states that an iron smelting furnace was in operation at the site by 1614, but it seems likely from documentary and dendrochronology evidence that it began functioning in the 16th century. The furnace continued in operation, with periodic lulls, until falling into disuse in 1776 (Magilton, pps.37-40). Previous archaeological works at the site, carried out subsequent to those of 1989-93 which resulted in the Magilton report, have included: an investigation into the possibility of a shanty town adjacent to the furnace in 2003, which proved negative (Anelay 2003); a watching brief carried out in 2015 during the installation of a relief water pipe through the upper part of the dam (Anelay 2015); and the re-recording of the south bank of the sluice in 2017 (Anelay 2018).

RESULTS

Sluice

1. Works to the sluice involved the clearance of all the stone and brick debris lying between the dam's existing concrete east wall and the surviving above ground remains of the tail race, together with the removal of the concrete apron extending out from the sluice pipe. This area had not been investigated in 1989-93 and it was hoped that further evidence for the iron furnace's waterwheel(s) might be found.
2. In the event little further was revealed than had already been noted in the earlier excavations, due to historic and ongoing water erosion. The only significant additions to what was already known being four timbers underlying the south wheelpit, two of which projected beyond it to the north-west, and three upright timber posts to the north-east of the north wheelpit. All trace of the original wheelpits to the north-west, beyond what was recorded in 1993, had evidently been completely scoured away by previous flooding episodes, with only bare clay remaining.
3. The timbers recorded in both 1989-93 and 2019 suggest that the wheels were probably supported on a timber framework tied into the clay dam, which only survives now at its lowest level, and only then in part, for it is evident that some of its north-western and central timbers have been lost or seriously eroded, as is the case with the two projecting north-westwards from the south wheelpit. It would appear that the surviving stone walls represent a later phase of the furnace's development since a number of mortice holes in the timbers have been covered by their construction. It would seem probable that in its earliest phase the wheelpits and associated framework were entirely of wood.



Figure 5 Plan of the sluice works

4. A number of changes were noted to the surviving remains from the drawings that had been made in 1989-93, all resulting from subsequent flood events. The most significant had occurred to the series of timbers to the north of the wheelpits, with the loss or burial of a number of timbers, and the movement of two of the surviving three. To the south, a short length of timber associated with the western of the two large beams protruding from the dam had also disappeared. The stone walls of the two extant wheelpits exhibited some alterations, with the ends of the southern and northern walls pushed outwards, and c.0.75m of the central wall completely washed away.
5. The removal of the debris from in front of the existing dam, together with the majority of the concrete apron that extended to the east of it, revealed more of its earlier structure, including the remains of the sluice which it had replaced. This was found to be composed of a large bore brick-lined pipe, partially incorporated into the 1941 dam. Its eastern end survived only at its base, supported upon Lower Greensand blocks. It is thought probable that it originally sat within a straighter wall than the current angled concrete wall. On the west side of the dam the opposite end of the brick lined pipe is still visible, again set within Lower Greensand blocks, with a date stone of "1800" above.



Figure 6 The wheelpit area looking north-east after removal of all the brick and stone debris onto the natural clay



Figure 7 The entrance to the surviving wheelpits, looking south-east, showing the displacement of the outer walls, and the diminished central wall

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- 17th century mapping (Speed 1610 & Morden 1695) shows the furnace pond, but the Ordnance Survey map of 1808 does not, with the pond not reappearing until after the 1896 Ordnance Survey edition. Providing these maps are an accurate record, it would seem that the pond was emptied at some point shortly after the furnace was abandoned in the later 18th century, and that the works undertaken in 1800 were primarily aimed at channelling the stream that now presumably flowed unhindered through the new brick pipe spanning the dam. The existing brick wall across the western entrance to the pipe, which now holds the sluice gate, is certainly later than 1800, and presumably dates to the time when the pond was re-instated.
- As a result of erosion since the 1989-93 works, a further length of the tail race was exposed at its eastern end, indicating that it once continued beyond the existing bend in the stream, its course now covered by the slumped southern bank.



Figure 8 The east end of the tail race, to the right it continues into the slumped bank.

Spillway

- The focus of the archaeological work at the spillway was to record those portions of the stone eastern main wall to the dam not recorded in 1989-93, essentially the lower courses then covered by soil and slag. Opportunity was also taken to photograph the exposed barrel vault and western wing walls, including the outward extension of the latter which had previously been hidden by undergrowth and topsoil.

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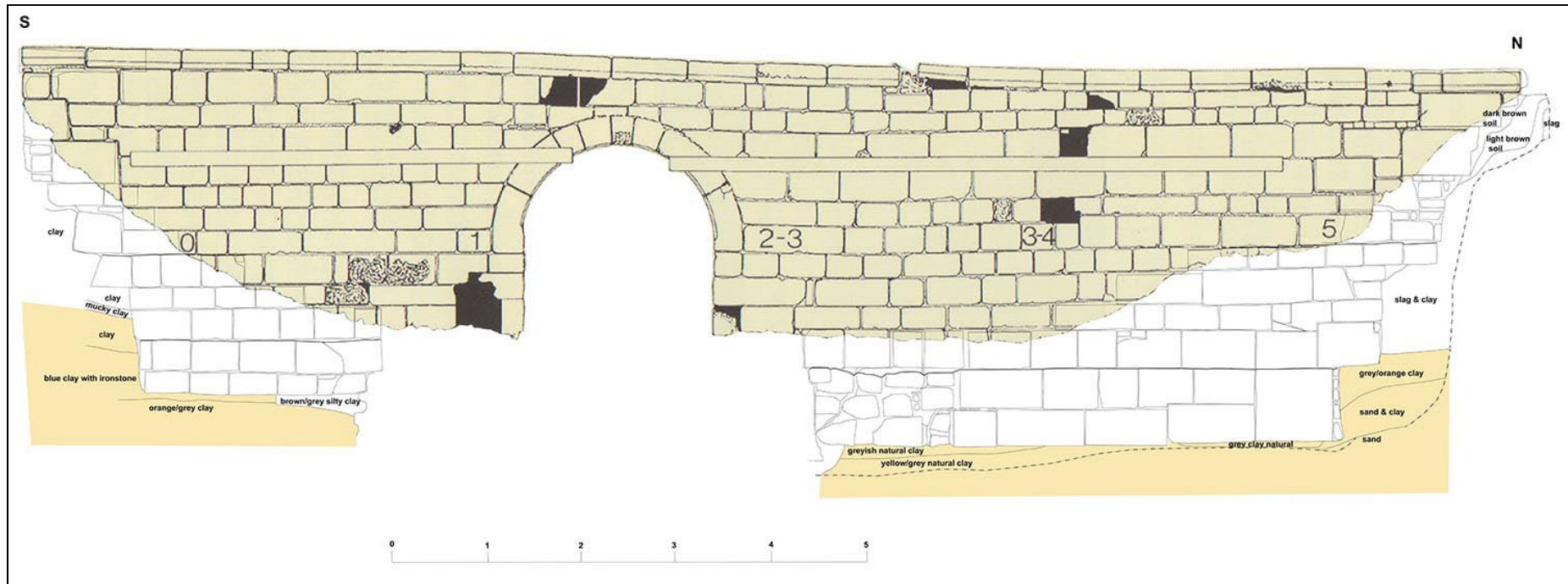


Figure 9 The eastern main wall of the spillway, with the stonework recorded in 2021 added to that drawn in 1989-93

2. The main east wall, composed entirely of Lower Greensand stones, holds the opening to the tunnel vault through the dam, which inevitably splits the wall into two parts below the level of its arch, effectively after the top two courses of the wall. The upper course, which drops noticeably as it passes northwards over the arch, is composed of coping stones, chamfered on their outer edge. The coursing does not form a true level until just below the top of the arch, at the base of the third course, a level it retains for only one more course after which the two sections either side of the arch diverge. The base of the northern section of the wall lies 0.55m lower than its southern counterpart, reaching a total height of 3.9m, whereas the southern is only 3.61m high, rising to 0.26m above the northern end. Despite this difference in height both sides contain thirteen courses, ranging in height from 0.22 – 0.4m. With the exception of a small section immediately adjacent to the rear of the northern wing wall, the facing stones are all well dressed and range in width from 0.3 – 1.2m.



Figure 10 The upper step in the main east wall of the spillway at its southern end

3. As the wall progresses upwards, it steps back twice on the front face, each time by less than 10cm. The first of these steps, on both sides of the arch, was at the top of the second course, as counted from the base of the wall. The second was at the top of the sixth course on the northern side, and the top of the fifth on the southern (see Figure 10). Due to the difference in starting heights, the first step was uneven, but the second, although on different courses, was near to being consistent along the whole length of the wall. The overall wall thickness, as a result of these steps, increases from c.0.7 - 0.75m at the top to c.0.8 – 0.85m at the base, but with the facing stones making up less than half

that width. It would appear that the laying of the facing stones themselves began at the inner ends of the wall, adjacent to the backing to the pre-existing wing walls, and then progressed outwards, since at both outer ends the final stones are often irregular or do not fit with the overall coursing; presumably laid to suit whatever gap was left between the wall and the neighbouring bank or dam as cut back for the works. Wooden wedges had occasionally been used to level up individual facing stones (see Figure 11).



Figure 11 Three wooden wedges in the main east wall of the spillway

4. The section of wall to the north of the arch, at its lowest level, was cut into the underlying Wealden clay, but at the height of its third course was then cut into the base of the dam, here composed of re-deposited Wealden clay containing some fragments of slag, clearly indicating that the stonework post-dates not only the formation of the dam, but also at least its early use for the iron works. The wall itself, at its base, extends 6.5m to the north of the inner north face of the barrel vault, increasing to 8.5m at the top. As stated above, it was faced with dressed Lower Greensand blocks, with the single exception of a block of masonry at its southern end, 1.5m wide and 0.8m high, butting up to the backing of the northern wing wall (see Figure 12). This section was composed of irregularly shaped Lower Greensand blocks set in a significantly greater amount of lime mortar. It is not clear why this should be, although it is possible that there were not enough of the larger stones used exclusively in the lowest two courses.



Figure 12 The lowest courses of the north end of the main east wall of the spillway, showing the undressed section of wall in the foreground

5. The southern section of the main east wall, to the south of the barrel vault, was again cut into the Wealden clay, but its base was 0.55m higher than that to the north. At this end the Wealden clay rose to a greater height, with a slight slope down to the north, which may explain why the base of this southern arm of the main wall ran for only 3.85m from the south of the inner face of the barrel vault, 2.65m shorter than on the north, for here the slope of the stream valley obviated the need for a longer section of wall. At its top the wall runs for 5.3m, again shorter than the section of wall to the north of the barrel vault, and with its end also rising more steeply.

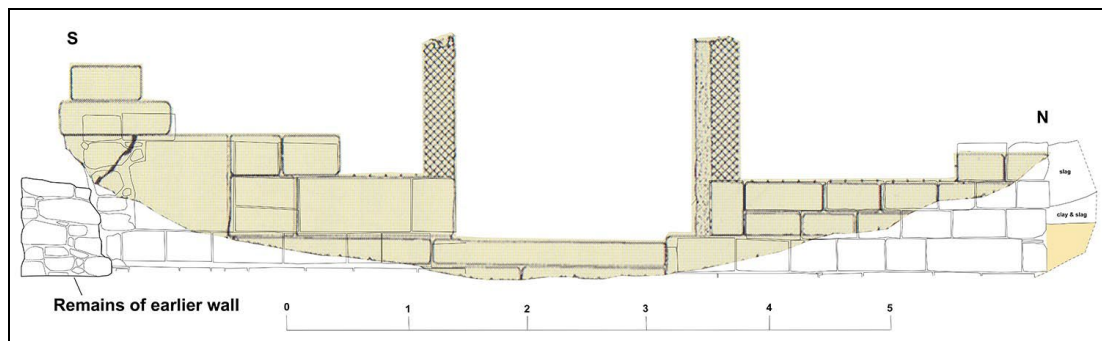


Figure 13 The eastern wing walls of the spillway, with the stonework recorded in 2021 added to that drawn in 1989-93

6. The eastern wing walls began as continuations of the barrel vault's north and south walls before turning north and south as the spillway terminated. The wing walls, and indeed the barrel vault, had clearing been constructed after the base of the spillway since the latter extended beneath. The northern wing wall was c.1m thick as it ran eastwards, and then 1.35m thick after its turn to the north, with its outer face lying 3m east of the main wall (see Figure 14). The southern wing wall was c.1.5m wide as it ran eastwards, and then tapering from 2.64m to 2.05m wide as it ran southwards, with its outer face 2.9m from the main wall. The reason for the significant difference between the thickness of the two wing walls is unknown, although it is possible that an earlier void was being infilled, possibly linked to a previous phase of spillway.



Figure 14 The top of the north wing wall on the eastern side of the spillway, looking south

7. Both wing walls were composed of dressed Lower Greensand blocks for their facing stones, behind which was a backing of undressed and uncoursed Lower Greensand set in lime mortar. The base of neither wall was exposed during these works. Both wing walls originally extended to six courses high above the level of the east end of the spillway, but on their front faces over half of this has been lost. Presumably having been washed away or robbed.
8. The north wing wall extended c.2.8m to the north of the spillway, while the south wing wall extended c.3.1m. The former, above the level of the spillway, consisted of three courses of Lower Greensand ashlar, although only two stones remained of the top course (see Figure 15). The stones of this upper course were 30cm thick, whilst those of the

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lower two courses were only 23cm thick; the length of all varied between 0.28 – 0.68m. The exception to this being at the southern end of this wing wall, where the stone lining the spillway was of double height, spanning the lower two courses. As with the main dam wall to the west, the wing wall was cut into the Wealden clay.



Figure 15 The north wing wall on the eastern side of the spillway



Figure 16 The south wing wall on the eastern side of the spillway

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9. The southern wing wall consisted of four courses of Lower Greensand ashlars, with the lower three courses of similar dimensions to those on the north side, the upper being of the 23cm thickness (see Figure 16). As with the north side a double height stone flanked the spillway. A difference on this south side, however, was that two larger stones, one double height and another triple height, were included within the coursing. In addition the south end of this wall was made up of undressed and uncoursed stones set in lime mortar, rather than the usual ashlars. This may be due to the presence of an earlier stretch of wall against which the wing wall butted. Only a fragment appeared to remain of this earlier wall, just 0.75m north-south, with its top 0.5m below that of the adjacent wing wall and projecting c.0.15m to the east of it (see Figures 13 & 17). It was composed of undressed and uncoursed Lower Greensand rubble set within a lime mortar of a deeper yellow colour than the wing wall. It would appear to pre-date the wing wall and be cut by it, and may be all that remains of an earlier facing to the dam, possibly supporting a previous phase of spillway.



Figure 17 The remains of the earlier wall adjacent to the southern wing wall on the eastern side of the spillway, looking south-west

10. Stretching across the whole width of the wing walls, and forming the base to the spillway, was a single course of Lower Greensand ashlars, c.0.26m thick, below which further courses lay to an unknown depth. The stones forming the base of the spillway itself had been worn down by c.6cm, presumably through the agency of the water flowing over them, with the mortar beneath also washed away, causing them to drop onto the course below (see Figure 19).

11. The base of the spillway, as noted above, seems to have been the first element to have been built, with the barrel vault and facing walls placed on top. It was originally composed of stone rubble with Lower Greensand slabs laid above (see Figures 18 & 19). These sloped down from west to east, before levelling out to a flat platform beyond the vault's eastern end. Many of the stones within the sloping section have now been lost, which has clearly caused significant erosion of the rubble beneath, a problem countered in the later 20th century by pouring concrete into the voids beneath.

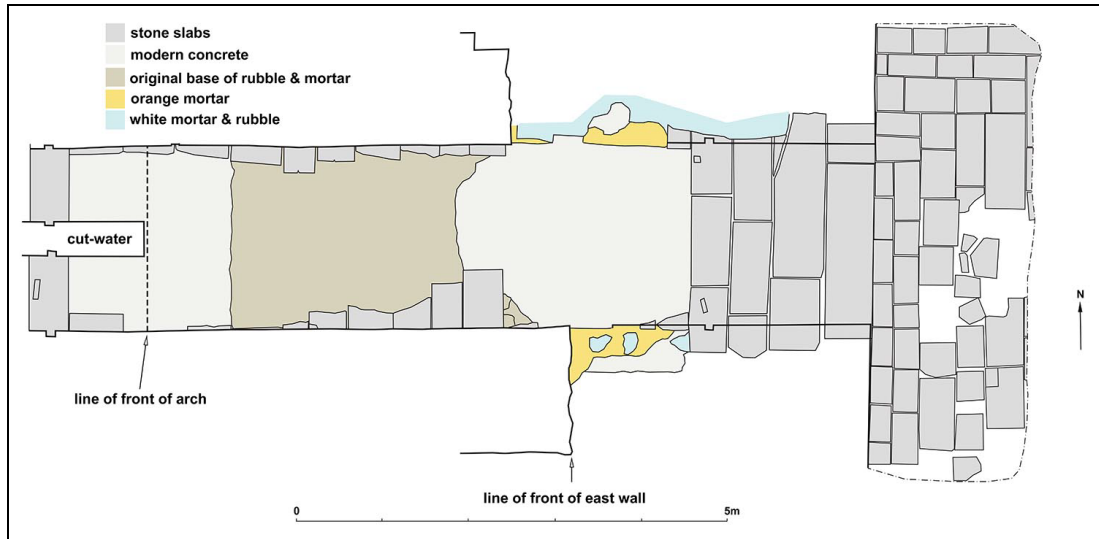


Figure 18 The base of the spillway and its apron



Figure 19 The spillway looking west, showing the remaining slabs at its base

12. To the east of the wings walls an apron composed of Lower Greensand slabs was recorded, extending c.1.5m to either side of the spillway, c.2m to the east and lying 0.7m below the level of the spillway's eastern lip (see Figure 20). A number of its slabs were missing or disarranged, presumably as a result of uncontrolled water flow.



Figure 20 The stone apron to the east of the spillway, looking north

13. The dam between the east and west facing walls was composed of clay at its core, but this had clearly been supplemented at a later date with slag, either mixed in with clay or alone, and dumped on the outer and upper surfaces of the original clay dam. The barrel vault through the dam was constructed in the same manner as the outer walls of the dam, with inner facing stones of dressed and coursed Lower Greensand blocks backed by uncoursed and undressed lower greensand stones set in a pale yellow mortar (see Figures 21 & 22). Its two sides were stepped at least once as it sloped from west to east. At both its ends it was found to have separated from the outer walls, with large cracks extending from top to bottom.



Figure 21 The exterior of the barrel vault, looking north



Figure 22 The exterior of the barrel vault, looking south-west

14. The western end of the barrel vault is set back from the outer stone wing walls of the dam, the latter previously thought to extend only a short distance to the north and south. However during these works their original length was revealed, hidden beneath undergrowth and topsoil. It can now be seen that they broadly mirrored the eastern dam wall, extending the same distance to the south and north of the spillway (see Figures 4, 23 & 24). It had previously been noted during the 1989-93 work that this western wall shows evidence for a significant reconstruction, and it would seem that these repairs were undertaken on a narrower compass than the original, with the newly revealed stretches of wall clearly being considered not worth repairing. Unlike the replacement walling, they are constructed in the same fashion as the eastern wall, with dressed and coursed Lower Greensand ashlar fronting a rubble backing set in pale yellow mortar.



Figure 23 The southern of the western wing walls to the spillway, looking east



Figure 24 The northern of the western wing walls to the spillway, looking south

CONCLUSION

1. In the event little intrusive work was undertaken on the sluice and consequently not much can be added to the conclusions of the 1989-93 work concerning its date, form and function. The excavation of the wheel-pit area produced no fresh evidence for the simple reason that previous flooding episodes appear to have washed it all away. The presence of timbers beneath the surviving walls of the southern wheel-pit suggest an earlier phase of use, which can perhaps be placed before Magilton's Phase 1. No further evidence was found to support his posited Phase 3, with its third wheel-pit to the south of the others, and it is considered possible that Phases 2 – 4 could potentially be combined into one, all associated with the construction of the cannon casting pit. This would result in three phases, the earliest tied to an all-timber construction, dating to the 16th century, the second to a rebuilding in stone with the southern wheel-pit constructed on top of the earlier timber structure. The third phase would be that tied to the later 18th century cannon casting pit, which necessitated the re-routing of the tail race and may have utilised two wheels.
2. The most significant works were undoubtedly those to the spillway, however it is disappointing that while much new evidence has been recovered concerning how it was constructed, no new conclusive dating has been forthcoming to answer the question as to whether it is tied to the furnace's use or disuse. However, a review of what is already known would strongly suggest the former, since the datestone of "1800" found set into the west face of the sluice and associated with a Lower Greensand rubble construction very similar to that found in the repair works to the spillway's west wall, would indicate that the earlier ashlar work must be 18th century at the latest. The furnace would appear to have been functioning until at least 1777 (Magilton, p.40), and it would seem highly unlikely that a major programme of construction would have been undertaken between that date and 1800, particularly since it would have had to have deteriorated to such an extent that it required major repairs only a few years later. This latter argument might, in fact, suggest an earlier date than the later 18th century often assumed for the spillway's fine ashlar walls, perhaps fitting into the second phase suggested above. It is not impossible that the sluice too was faced with similarly fine quality ashlars, now all lost presumably before the re-constructions of 1800 (see below).
3. Whatever the date of its construction, the spillway undoubtedly testifies to a major injection of capital, with all, or nearly all, trace of an earlier spillway removed as a large hole was carved out of the dam and into the underlying clays. A new base to the spillway was then laid, formed of slabs set on a rubble platform, before a tunnel and wing walls were added, and finally the main east wall.
4. As an adjunct to the fieldwork associated with this project, the opportunity was also taken to pursue some limited documentary work

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with a view to shedding more light upon the origins of the furnace. A manorial document dating to 1568 refers to “North Park” as the second of two parks in the possession of Lord FitzWilliam (WSRO Cowdray Mss 307). The outline of this park can be traced on later historic maps (WSRO Cowdray Mss 1640 & 1662), with Figure 25 marking its bounds. The furnace appears to have been built immediately adjacent to the eastern pale of the park at the point it crossed a stream, with the furnace pond dam possibly built up from the pale’s bank. The majority of the pond’s catchment then lay within the park, where it could be more easily controlled, while the furnace works lay just outside. The construction of iron furnaces within or on the edge of deer parks can be seen elsewhere, for example within Down Park in Harting, and Floodgates Farm, Knepp. It would seem to have been a lucrative and viable option for a change of land-use within deer parks, just at that time in the 16th and 17th centuries when they were going out of use, provided there was a suitable source of iron. The advantages that deer parks offered to iron workings was normally a relatively plentiful supply of wood for charcoal and almost always a reliable water source, all within a plot of land directly managed by one owner.

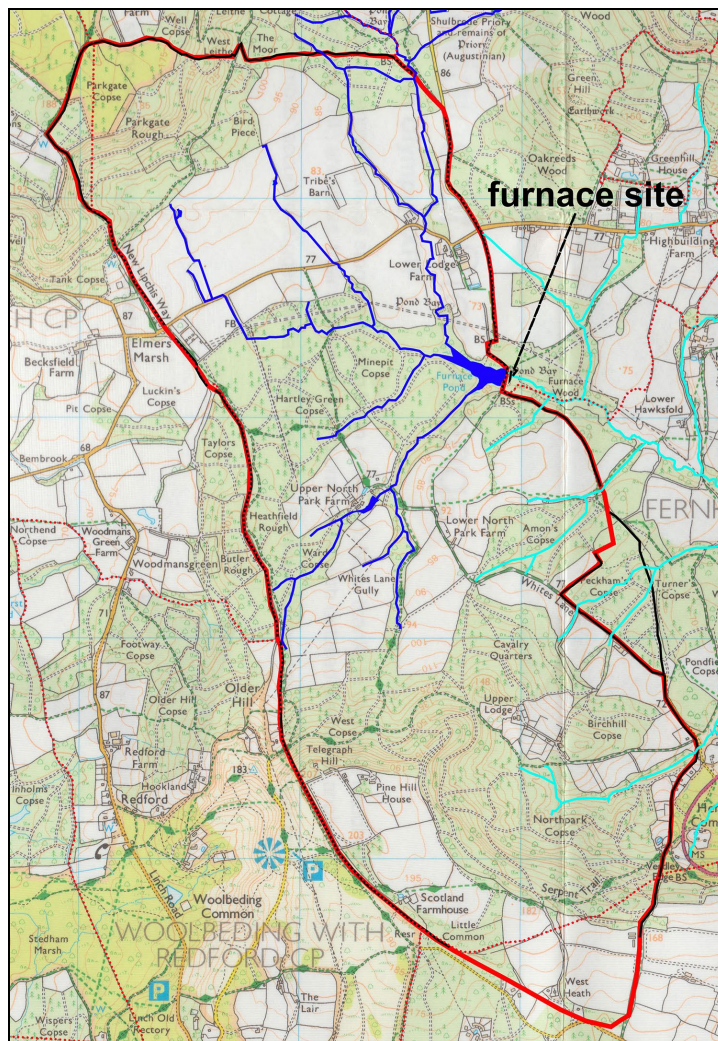


Figure 25 The bounds of the medieval deer park of North Park (marked in red) in relation to the furnace site

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