



Kirkthorpe Weir Wakefield West Yorkshire

Historic Building Recording



Ref: 115030.01
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**Kirkthorpe Weir
Wakefield
West Yorkshire**

Historic Building Recording

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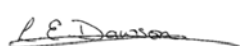
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Summary

Wessex Archaeology were commissioned by Yorkshire Hydropower Limited to undertake a Photographic Survey of the Grade II listed Kirkthorpe Weir and Sluice Gates, Wakefield, West Yorkshire, centred on National Grid Reference (NGR) 435784, 421245.

The site is located on the River Calder approximately 800 m to the north-west of the village of Kirkthorpe, and to the north-east of the centre of Wakefield, West Yorkshire. The extant weir and its sluices were constructed in 1827 and was granted Grade II listed status in 1986.

In late 2015 Wakefield Council granted permission to Yorkshire Hydropower Limited to build and operate a new low head hydropower station adjacent to Kirkthorpe Weir on the River Calder. The hydropower scheme will use the flow of the river to power a single 500kW axial turbine to generate approximately 2.3 million units of electricity per year.

As the scheme involved the construction of the hydropower plant adjacent to the Grade II listed weir only, with no direct impact to the fabric of the weir or sluices, there was no requirement for pre-construction recording of the structure. A scheme of emergency historic building recording was decided upon following the unexpected movement of the central sluice pier at the north-east of the structure on the 1st September 2016. Wessex Archaeology carried out the photographic survey of the sluices during November 2016. The aim of the survey was to produce a record of the structure and its setting in its current form through a series of photographs. Rapid archival and documentary research has also been undertaken to provide a historical context for the structure.

The historic building recording archive is currently held in the Wessex Archaeology Sheffield Office under the project code 115030. This archive will be deposited along with a copy of the final version of this report with West Yorkshire Archives Wakefield Office. The photographic negatives will be archived with West Yorkshire Archaeology Advisory Service.



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Acknowledgements

The project was commissioned by Yorkshire Hydropower Limited, a subsidiary of Barn Energy and Wessex Archaeology is grateful to Mark Simon in this regard. Chris Tetlow and Jim Baldwin of Eric Wright Civil Engineering are also thanked for their assistance on site. David Hunter of West Yorkshire Archaeology Advisory Service is also acknowledged.

The site survey archive research, analysis and report compilation was undertaken by Lucy Dawson. Illustrations were prepared by Chris Swales. The project was managed for Wessex Archaeology by Lucy Dawson.



Kirkthorpe Weir Wakefield West Yorkshire

Historic Building Recording

1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology was commissioned by Yorkshire Hydropower Limited (hereafter 'the Client') to undertake a scheme of historic building recording of the Grade II listed Kirkthorpe Weir and Sluice Gates, Wakefield, West Yorkshire, centred on National Grid Reference (NGR) 435784, 421245 (hereafter 'the Site', Figure 1).
- 1.1.2 The Site comprises a Grade II listed stepped and curved stone weir with three sluices positioned across the River Calder. It was constructed in 1827 with large ashlar blocks and cast iron sluice winding gear. The Grade II structure is owned by the Canal and River Trust (CRT). A new low head hydropower station was in the process of being constructed adjacent to the east of the extant weir and sluices, when on the 1st September 2016, it was noted that the central sluice pier had shifted, subsiding into a scour hole that had formed rapidly within the riverbed beneath it. The downstream toe of the central pier sank, causing the upstream top of the pier to rotate in a downstream direction by approximately 500 mm (CRT 2016).
- 1.1.3 Following the pier's movement, a programme of stabilisation works was agreed upon between the Canal and River Trust, Wakefield Council and the Client. A programme of emergency historic building recording in the form of an archaeological photographic survey of the weir sluices was requested by Wakefield Council.
- 1.1.4 All works were carried out in accordance with the '*Generic specification for archaeological photographic recording*', produced by West Yorkshire Archaeology Advisory Service (WYAAS) (2016) which set out the requirements and methodologies for the survey. This specification can be found at the back of this report in Appendix III. The specification was produced in line with Historic England guidelines (2016).
- 1.1.5 A scheme of archaeological recording was undertaken by Wessex Archaeology in November 2016, the results of which comprise this report. All works were carried out in accordance with industry standards and best practice.

2 THE SITE

2.1 Site location and description

- 2.1.1 The Site lies on a meander of the River Calder approximately 800 m to the north-west of the village of Kirkthorpe and c. 2.5 km to the north-east of the centre of Wakefield (Figure 1). The site is bound by the banks of the River Calder, forming part of the Southern



Washlands Nature Corridor that comprises open water, swamp, marshy grassland, neutral grassland scrub and woodland (Wakefield Council: Southern Washlands Nature Corridor).

- 2.1.2 Principal access to the Site is from a newly created, custom built, small roadway that runs from the Welbeck Reclamation and Landfill site access road, adjacent to the north side of the Lancashire and Yorkshire Railway line.
- 2.1.3 The Site is situated on an elevation of approximately 19.50 m above Ordnance Datum (aOD) which drops down to approximately 15.36 m aOD at the bottom of the weir. The Site is underlain by bedrock geology of the Pennine Middle Coal Measures formation – mudstone, siltstone and sandstone (British Geological Survey (BGS)).

3 AIMS AND OBJECTIVES

3.1 Historic building recording

- 3.1.1 The principal aim of the archaeological works was to identify and objectively record by means of photographs any significant architectural features and evidence for the original and subsequent historical form and functions of the structure, and to place this record in the public domain by depositing it with the West Yorkshire Historic Environment Record (WYHER).
- 3.1.2 Specific aims of the work were:
- *to produce a photographic record of the structure;*
 - *to produce a written account of the structure; and*
 - *to produce a report which will present the results of the historic building survey in sufficient detail.*
- 3.1.3 The objective of the works was to place the crossed referenced, long-term record of the structure in the public domain by depositing it with West Yorkshire Historic Environment Record and West Yorkshire Archaeology Advisory Service (WYAAS).

4 METHODOLOGY

4.1 Scope of the historic building recording

- 4.1.1 The scope of the recording works has taken the form of three elements: rapid archival and documentary study; a photographic survey of the structure; and use of existing architectural drawings for inclusion within this report.

4.2 Documentary research

- 4.2.1 Documentary research was previously carried out by the Client at the Canal and Rivers Trust Archives, the information from which has been passed on to Wessex Archaeology for inclusion within this report. In addition, Wessex Archaeology has carried out a rapid historic map regression of the Site, supplemented by online research and sources within the Wessex Archaeology in-house library. This research has helped to inform a narrative which sets the building within its historical context.
- 4.2.2 Relevant historic maps are reproduced to illustrate this report (Figure 6).

4.3 Photography

4.3.1 The photography of the Site was based on the requirements for archaeological photographic recording, specified by WYAAS (2016: Appendix III) and comprised:

- *general oblique views of the structure in its wider setting;*
- *detailed photographs of all features of archaeological and architectural interest identified during the recording process;*
- *detailed photographs of any significant change in construction material; and*
- *detailed photographs of evidence for phasing, and for historical additions and alterations to the structure.*

4.3.2 The photographic record comprises 35mm and medium format black and white film and colour digital. A photographic scale of appropriate size was included in all detailed and general views produced by Wessex Archaeology.

4.3.3 The location and direction of each photographic viewpoint was recorded onto the corresponding Site plan. These have been complemented by photographic registers which, as a minimum, give the direction of the view and a brief description of the subject, and are included at the back of this report in Appendix I. Each viewpoint of the photographic record produced by Wessex Archaeology has been used to illustrate this report. In addition, due to the nature of the works, digital photography of the Site provided by the Client has also been encompassed within the project archive and to illustrate this report.

4.3.4 The photographic record of the Site can be found in Plates 1-69, whilst plate viewpoints can be found on Figure 2.

4.3.5 The full photographic record, together with copies of the marked up plans and photographic registers will be included in the Site archive.

4.4 Drawn record

4.4.1 Site plans, supplied by the Client were utilised by Wessex Archaeology in accordance with the specification (WYAAS 2016: Appendix III).

4.4.2 The Site plans have been used to illustrate this report (Figure 2).

5 HISTORICAL BACKGROUND

5.1 Introduction

5.1.1 Information was gathered by the Client from the Canal and River Trust Archives, and this has been supplemented by further research by Wessex Archaeology to enhance the understanding of the use and development of the Site within its local and national context.

5.2 Early Wakefield

5.2.1 The city of Wakefield is situated on the ford of a Roman road leading from Pontefract to Manchester. It was settled by the Angles during the 5th and 6th century but later became controlled by the Vikings in what is now known as the *Danelaw*. The Viking administration of wapentakes lasted for centuries after their control ceased, with Wakefield belonging to

the wapentake of Agbrigg. The name Wakefield derives from the Old English '*wacu*' and '*feld*' meaning open land where festivals take place (Mills 1991). The street names Kirkgate, Westgate, and Northgate all contain the suffix '*-gate*' being the Old Norse name for '*street*'. All of which attests to the development of the city during the Anglo-Saxon period.

5.3 Medieval – post-medieval period

- 5.3.1 The Manor of Wakefield was in royal possession before the conquest of 1066. As such it passed directly to William I and is listed with his land in the Domesday Book of 1086. The area suffered during the 'harrying of the north' between 1069-1070 and it is noted that the land had devalued from £60 before the conquest, to £15 in 1086 (Williams and Martin 1992). The manor later passed to William de Warenne, 1st Earl of Surrey, like much of Yorkshire.
- 5.3.2 The Domesday Book of 1086 (Williams and Martin 1992) notes two churches in the Manor; one at Wakefield and one in Sandal. Whilst in addition, the castle at Sandal was constructed during the 12th century and Wakefield received a Charter to hold a market in AD 1203, attesting to the development of the area.
- 5.3.3 The village of Kirkthorpe, located on the south bank of the River Calder, on the outskirts of Wakefield, was historically a small hamlet comprising church and vicarage, hospital and almshouses and a few cottages. Kirkthorpe, although not mentioned within the 1086 Domesday Book, lies within the parish of Warmfield-cum-Heath which was owned by the Archbishop of York in 1086 (Williams and Martin 1992). The name Kirkthorpe derives from the old Scandinavian words '*kirkja*' meaning church and '*thorp*' meaning outlying farmstead or hamlet (Mills 1991).
- 5.3.4 The historic core of Kirkthorpe is located directly south-east of the Site and to the east of the former route of a meander of the River Calder, now known as Half Moon Pond. Kirkthorpe expanded in the late 1950s-early 1960s, when council houses were constructed to the north-east of the historic hamlet. The historic Kirkthorpe comprises the Grade I listed Frieston's Hospital and Almshouses which are 16th century in date, as well as the Grade II* listed Church of St Peter, dating back to the 14th century, whilst its Grade II listed vicarage, Kirkthorpe Hall, dates to the late 18th century (Historic England: National Heritage List for England).
- 5.3.5 Throughout the medieval period Wakefield continued to grow and became a centre for the woollen and tanning trade, whilst in 1765 a cattle market opened and became one of the largest in northern England. The town continued to expand well into the post-medieval period becoming an inland port and centre for trade. During the Industrial Revolution, Wakefield saw great expansion with the construction of woollen mills, breweries, glass works, engineering works, soap works, and bricks yards.

5.4 The River Calder and the Aire and Calder Navigation

- 5.4.1 As the Wakefield area became a centre for the woollen and tanning trade, in 1699 an Act was passed in parliament to improve the navigability of the River Calder from Castleford to Wakefield (Stanley History Online), and became the Aire and Calder Navigation. This work involved the creation of weirs bypassed by shortcuts fitted with locks, with the creation of towpaths and the rights to buy and demolish mills and weirs along the route. John Hadley was the appointed engineer for the works and by 1704 the initial planned

works were complete. These included 12 locks on the Aire between Haddesley and Leeds, and four locks on the Calder. One of these locks on the Calder was located at Kirkthorpe, along with a weir. A map dated to 1767, viewed online (not reproduced), depicts the shortcut made along the Calder at Kirkthorpe (Stanley History Online). Although dated to 1767, the map appears to be very similar Jeffery's 1771 Map of Yorkshire.

- 5.4.2 The early trade along the route mainly consisted of woollen goods from Leeds, Wakefield, Halifax and Bradford with wool and corn from Lincolnshire and East Anglia travelling in the opposite direction, with substantial quantities of coal transportation by the 1720s.
- 5.4.3 The original weir across the river, which was an oblique structure with two sluices, was completely replaced in 1827 by the extant structure that comprises a curved and stepped weir with three sluices (Figure 3). The original designs for the 1827 structure are held at the Canal and River Trust Archives and are reproduced as Figures 3-5. The plans show the details of the ashlar stepped curved weir, with three sluices comprising stepped piers located to the east of the weir structure, and the plan form of the ashlar stone wingwalls.
- 5.4.4 The first edition OS map of 1852 (Figure 6) depicts the now disused shortcut on the Calder to the south-east of the weir with 'Old Lock', 'Old Lock House' and 'Old Swing Bridge (Wooden)'. The curved weir is marked, and the Lancashire and Yorkshire Railway line is depicted running south-west to north-east to the south of the River Calder which was diverted for the railway's construction in the late 1830s. This diversion of the river removed a southern section of a meander to the south of the weir. Remnants of the old course of the southern section of the meander became known as 'The Half Moon', which is now called 'Half Moon Pond'.
- 5.4.5 By 1893 (Figure 6) the weir and three sluices are clearly shown and labelled, whilst remnants of the former shortcut to the south-east are still seen, but only the 'Old Lock House' is labelled. This remains largely unaltered by the production of the 1907 OS map (Figure 6). However, by 1932 (Figure 6) very little of the former shortcut is depicted and the Old Lock House has been demolished.
- 5.4.6 No other significant changes at the Site are noted on historic mapping following 1932.

6 BUILDING DESCRIPTION

6.1 Introduction

- 6.1.1 The historic building recording was carried out on the 9th and 14th November 2016. At the time of the survey the structure was undergoing continuous work to stabilise the central sluice pier and to complete the adjacent hydropower plant, which limited the ability to photographically capture some areas of the sluices. The photographic survey can be found in plates 1-69.

6.2 Kirkthorpe Weir and Sluice Gates

- 6.2.1 The weir is a curved, stepped structure with three sluices located at the eastern end beyond which the structure terminates with ashlar stone wingwalls to the eastern and western banks of the river (Plates 1-22). The curved weir has seven steps below the crest, whilst the three sluices to the east are divided by stone piers, each with six large steps to the north, whilst the westernmost pier which abuts the stepped weir structure, is also

stepped to the south, with seven steps. Each pier is finished to the south (downstream) with pointed-arched cutwaters (Plates 23-25, 31-34, 37-50).

- 6.2.2 The two easternmost sluices have retained original 1827 cast iron winding gear, each displaying the name and date: 'HEWES & WREN MANCHESTER 1827' on both the north and south faces of the cast iron plates surrounding the gear (Plates 48-52, 59-61). Unfortunately, the cast iron fittings of the winding gear have broken in several places within the central sluice, due to the movement of the central pier. In addition, located downstream on the inner faces of ashlar piers for each sluice were recess, with angled return on the western recess, in order for timbers to be placed within the slots (Plates 59,62, 63, 65-68).
- 6.2.3 The westernmost sluice had not retained the cast iron winding gear and cogs, but remnants of the cast iron fixings were still *in-situ* attached to the inner elevations of the sluice (Plates 65, 67-69). In addition, below the sluice gate, at the base, was an arched opening (Plates. 47, 67), presumably to be used as a small controlled channel/outflow for the water.

7 DISCUSSION

7.1 Conclusions

- 7.1.1 The programme of recording has produced a photographic record of Kirkthorpe Weir and Sluices which form the long term record of the Site which is subject to remedial works, preserving it by record. This long-term record will be placed in the public domain by depositing it with West Yorkshire Archives, along with a copy of this report.
- 7.1.2 Weirs, especially those constructed prior to the 20th century, were usually constructed to aid in water level management, most notably in connection with navigation and water supply to mills (Rickard et al. 2003), and Kirkthorpe Weir is no exception. The primary impact, and function, of a weir is the raising of upstream water level above the natural level. Types of weirs vary (Rickard et al. 2003, ECUS 2015), although at Kirkthorpe, the weir comprises a stepped structure that forms a cascade for low flows, and is curved which increases the length of the weir crest, being visually more attractive.
- 7.1.3 The improvements to the navigability of the River Calder in the early 18th century were essential for trade and the development of the area. The original weir was replaced in 1827, although by the time of the 1852-1854 OS map, the infrastructure along the River Calder was in decline, likely due to the introduction of the Lancashire and Yorkshire Railway in the late 1830s.
- 7.1.4 The weir and its sluices have remained largely intact for the last 200 years almost, and are the property of the Canal and Rivers Trust. An unfortunate scour hole beneath the central sluice pier has caused the movement of the pier, which has in turn provided an opportunity for the archaeological recording of the structure during a time when an unprecedented amount of the structure is visible.

7.2 Archive

- 7.2.1 The recording of Kirkthorpe Weir and Sluices has produced a written and photographic archive which is currently held in Wessex Archaeology's Sheffield Office and will be delivered to the West Yorkshire Archives for deposition in due course. The photographic



negatives will be deposited with WYAAS. If necessary, the paper records of the site archive will be security microfilmed prior to deposition.

- 7.2.2 An OASIS form will be completed at <http://ads.ahds.ac.uk/projects/oasis> for inclusion in the ADS database. This will include an electronic copy of this report in PDF format which will be accessible six months after deposition.

8 BIBLIOGRAPHY

8.1 References

- Canal and River Trust (CRT), 2016. *Kirkthorpe Weir: Repair of damaged sluices*. Unpublished correspondence
- ECUS, 2016. *South Yorkshire's Historic Water Management Assets in Relation to Wayet Framework Directive Requirements*
- Historic England, 2016, *Understanding Historic Buildings: A guide to good recording and practice*
- Mills, A. D., 1991, *A Dictionary of English Place-Names*
- Rickard, C., Day, Rodney, D., and Purseglove, J. 2003. *River Weirs – Good Practice Guide*. Environment Agency
- West Yorkshire Archaeology Advisory Service (WYAAS), 2016. *Generic Specification for Archaeological Photographic Recording*
- Williams, A and G. H. Martin eds., 1992, *Domesday Book: A Complete Translation*. Penguin, London

8.2 Consulted online sources

- British Geological Survey: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>
- Department for Environment, Food and Rural Affairs: <http://magic.defra.gov.uk/home.htm>
- Historic England: National Heritage List for England (NHLE): <https://historicengland.org.uk/listing/the-list/>
- Stanley History Online: Department for Environment, Food and Rural Affairs: <http://magic.defra.gov.uk/home.htm>
- Wakefield Council: Southern Washlands Nature Corridor: <http://www.wakefield.gov.uk/residents/sport-and-leisure/parks-and-countryside/parks/southern-washlands-nature-corridor>

8.3 Consulted cartographic sources

- 1767 map (Jeffery's 1771 Map of Yorkshire)
- 1852-1854 OS
- 1893 OS
- 1894 OS
- 1907 OS



- 1914 OS
- 1932 OS
- 1933 OS
- 1938 OS
- 1956 OS
- 1964 OS



9 APPENDIX I: PHOTOGRAPHIC REGISTERS

Film 01					
Format	35mm	Type	B&W	Photographer	L. Dawson
Frame	Description	View from	Date	Report Plate (D=duplicate)	
1	General view of the downstream easternmost sluice pier and wingwall	W	14.11.16	D56	
2	General view of the downstream easternmost sluice pier and wingwall	W	14.11.16	D56	
3	General view of the westernmost sluice from downstream	NW	14.11.16	D65	
4	General view of the westernmost sluice from downstream	NW	14.11.16	D65	
5	Detail of the westernmost sluice from downstream	NW	14.11.16	D67	
6	Detail of the westernmost sluice from downstream	NW	14.11.16	D67	
7	Detail of sluice groove with angle, western pier of the westernmost sluice - downstream	N	14.11.16	D68	
8	Detail of sluice groove with angle, western pier of the westernmost sluice - downstream	N	14.11.16	D68	
9	Detail of cast iron sluice fixings of the westernmost sluice - downstream	N	14.11.16	D68	
10	Detail of cast iron sluice fixings of the westernmost sluice - downstream	N	14.11.16	D68	
11	View of the central sluice pier showing subsidence - downstream	N	14.11.16	D62	
12	View of the central sluice pier showing subsidence - downstream	N	14.11.16	D62	
13	Detail of sluice groove with angle, central pier - downstream	N	14.11.16	D62	
14	Detail of sluice groove with angle, central pier - downstream	N	14.11.16	D62	
15	Detail of central sluice mechanism - downstream	NW	14.11.16	D64	
16	Detail of central sluice mechanism - downstream	NW	14.11.16	D64	
17	Detail of sluice groove within the easternmost pier of the central sluice - downstream	NW	14.11.16	D63	
18	General view of the central sluice - downstream	NW	14.11.16	D61	
19	General view of the central sluice - downstream	NW	14.11.16	D61	
20	General view of the easternmost sluice with wingwall and pier	NW	14.11.16	D58	
21	General view of the easternmost sluice with wingwall and pier	NW	14.11.16	D58	
22	General view of sluices from downstream	N	14.11.16	D53	
23	General view of sluices from downstream	N	14.11.16	D53	
24	General view of sluices from upstream	S	09.11.16	D48	
25	View of westernmost sluice from upstream	S	09.11.16	D48	
26	View of top three steps of westernmost sluice pier from upstream	S	09.11.16	D48	
27	General view of sluices from upstream	S	09.11.16	D48	
28	General view of sluices from upstream	S	09.11.16	D48	



Film 02

Format	Medium Format	Type		B&W		Photographer	L. Dawson		
Frame	Description	View from	Date	Report Plate (D=duplicate)					
1	General view of sluices from upstream	S	09.11.16	D49					
2	General view of sluices from upstream	S	09.11.16	49					
3	General view of sluices from upstream	S	09.11.16	D49					
4	General view of sluices from upstream	E	09.11.16	D41					
5	General view of sluices from upstream	E	09.11.16	D41					
6	General view of sluices from upstream	E	09.11.16	D41					
7	Detail of central sluice from upstream	S	09.11.16	D51					
8	Detail of central sluice from upstream	S	09.11.16	D51					
9	Detail of central sluice from upstream	S	09.11.16	D51					
10	Detail of central sluice from upstream	S	09.11.16	51					

Film 03

Format	Medium Format	Type		B&W		Photographer	L. Dawson		
Frame	Description	View from	Date	Report Plate (D=duplicate)					
1	General view of sluices and piers from downstream	NE	14.11.16	D53					
2	General view of sluices and piers from downstream	NE	14.11.16	53					
3	General view of sluices and piers from downstream	NE	14.11.16	D53					
4	View of easternmost sluice with wingwall and pier – downstream	NW	14.11.16	D58					
5	View of easternmost sluice with wingwall and pier– downstream	NW	14.11.16	D58					
6	View of easternmost sluice with wingwall and pier– downstream	NW	14.11.16	D58					
7	View of central sluice– downstream	NW	14.11.16	D61					
8	View of central sluice– downstream	NW	14.11.16	D61					
9	View of central sluice– downstream	NW	14.11.16	D61					
10	General view of the westernmost sluice from downstream	NW	14.11.16	D65					

Film 04

Format	Medium Format	Type		B&W		Photographer	L. Dawson		
Frame	Description	View from	Date	Report Plate (D=duplicate)					
1	General view of the westernmost sluice from downstream	NW	14.11.16	D65					
2	General view of the westernmost sluice from downstream	NW	14.11.16	D65					
3	General view of the downstream easternmost sluice pier and wingwall	W	14.11.16	56					
4	General view of the downstream easternmost sluice pier and wingwall	W	14.11.16	D56					
5	General view of the downstream easternmost sluice pier and wingwall	W	14.11.16	D56					



Film Digital					
Format	Digital	Type	Colour	Photographer	L. Dawson
JPG no.	Description	View from	Date	Report Plate (D=duplicate)	
IMG_0206	General view of sluices from upstream	S	09.11.16	D48	
IMG_0207	General view of sluices from upstream	S	09.11.16	48	
IMG_0208	General view of sluices from upstream	S	09.11.16	D48	
IMG_0209	General view of sluices from upstream	S	09.11.16	D50	
IMG_0210	Detail of central sluice cast iron mechanism	SE	09.11.16	D52	
IMG_0211	Detail of central sluice cast iron mechanism	SE	09.11.16	52	
IMG_0212	General view of sluices from upstream	S	09.11.16	50	
IMG_0213-0218	General view of sluices from downstream	N	14.11.16	D54	
IMG_0219-0224	General view of sluices from downstream	N	14.11.16	54	
IMG_0225-0227	General view of the easternmost sluice with pier and wingwall - downstream	W	14.11.16	58	
IMG_0228-0229	General view of the central sluice - downstream	W	14.11.16	61	
IMG_0230	General view of the downstream easternmost sluice pier and wingwall	W	14.11.16	57	
IMG_0231-0233	General view of the westernmost sluice - downstream	NW	14.11.16	65	
IMG_0234-0237	View of the central and easternmost sluice showing piers and wingwall	NW	14.11.16	55	
IMG_0238-0240	Detail of westernmost sluice - downstream	NW	14.11.16	67	
IMG_0241-0242	Detail of sluice recess with angle within the western pier of the westernmost sluice-downstream	N	14.11.16	68	
IMG_0243-0244	Detail of cast iron sluice fixings to the central pier of the westernmost sluice - downstream	W	14.11.16	69	
IMG_0245-0246	Detail of the west elevation of the central pier within the westernmost sluice, showing recess and collapse damage - downstream	SW	14.11.16	66	
IMG_0247-0248	View of the east elevation of the central pier within the central sluice, showing recess and collapse damage - downstream	N	14.11.16	62	
IMG_0249-0250	Detail view of the central sluice - downstream	NW	14.11.16	D64	
IMG_0251-0252	Detail view of the central sluice - downstream	W	14.11.16	63	
IMG_0253-0255	Detail view of the central sluice - downstream	NW	14.11.16	64	
IMG_0256	Detail of cast iron and timber fixings to the west side of the central sluice - downstream	NE	14.11.16	D62	
IMG_0257-0258	Detail view of the central sluice - downstream	NW	14.11.16	D64	
IMG_0259-0264	View of the easternmost sluice – downstream	NW	14.11.16	59 & 60	



Client Digital							
Format	Digital	Type	Colour	Photographer	-		
Frame	Description	View from	Date	Report Plate (D=duplicate)			
1	General aerial view of the sluices and eastern wingwall prior to works	NW	n/a	1			
2	General view of the sluices and weir beyond prior to works	N	n/a	2			
3	General view of sluices and weir – upstream – prior to works	NE	n/a	3			
4	Detail of sluices prior to works - upstream	NE	n/a	4			
5	General view of sluices and weir – upstream – prior to works	SE	n/a	5			
6	General view of sluices and weir – upstream – prior to works	E	n/a	6			
7	General view of sluices and weir – upstream – prior to works	SE	n/a	7			
8	General view of sluices and weir – downstream – prior to works	N	n/a	8			
9	General view of sluices and weir – downstream – prior to works	NW	n/a	9			
10	General view of sluices and weir – downstream – prior to works	NW	n/a	10			
11	Detail of easternmost sluice and mechanism – downstream – prior to works	N	n/a	11			
12	Detail of the central sluice and mechanism – downstream – prior to works	N	n/a	12			
13	Detail of easternmost sluice and mechanism – downstream – prior to works	W	n/a	13			
14	General view of sluices during works - downstream	NW	n/a	14			
15	Aerial view of sluices and weir at high water during works	N	n/a	15			
16	General view of sluices during works - downstream	NW	n/a	16			
17	Aerial view of sluices during works - downstream	NW	n/a	17			
18	Aerial view of sluices during works	W	n/a	18			
19	Aerial view of sluices during works	S	n/a	19			
20	Aerial view of sluices and weir during works - upstream	S	01.09.16	20			
21	Aerial view of sluices and weir during works - downstream	N	01.09.16	21			
22	Aerial view of sluices and weir during works - downstream	NW	01.09.16	22			
23	Aerial view of sluices during works - downstream	W	01.09.16	23			
24	Aerial view of sluices during works	W	01.09.16	24			
25	Aerial view of sluices during works	NW	01.09.16	25			
26	Aerial view of sluices during works	NW	01.09.16	26			
27	Detail of sluice piers following subsidence of central pier - downstream	N	01.09.16	27			
28	Detail of central sluice and damage to pier - downstream	N	01.09.16	28			
29	Detail of sluice piers following subsidence of central pier - downstream	N	01.09.16	29			
30	Aerial view of new hydropower site and adjacent wingwall and sluices post-piling	S	n/a	30			
31	Aerial view of wingwall and sluices post-piling	SW	n/a	31			
32	Aerial view of wingwall and sluices post-piling	S	n/a	32			
33	Aerial view of wingwall and sluices post-piling	-	n/a	33			
34	Aerial view of wingwall and sluices post-piling	-	n/a	34			
35	View of the sluices and piers post-piling - downstream	NW	n/a	35			
36	General view of the sluices and weir from the hydropower site post-piling	E	n/a	36			
37	View of the sluices from upstream post piling	S	n/a	37			
38	View of the sluices from upstream post piling	S	n/a	38			
39	Detail of timber boards of westernmost sluice	S	n/a	39			
40	View of the sluices from upstream post-piling, showing westernmost stepped upstream side	NE	n/a	40			
41	View of the sluices from upstream post-piling, showing levels for new concrete slab	NE	n/a	41			
42	View of the sluices from upstream post-piling, showing levels for new concrete slab	SW	n/a	42			
43	Detail of the easternmost sluice from upstream post-piling showing levels for new concrete slab	SW	n/a	43			
44	View of the sluices from upstream post-piling, showing levels for new concrete slab	SW	n/a	44			



45	Detail of the westernmost sluice from upstream post-piling showing levels for new concrete slab	SE	n/a	45
46	Detail of westernmost pier with stepped upstream side showing levels for new concrete slab	SE	n/a	46
47	Detail of exposed arched opening at base of the westernmost sluice - downstream	N	n/a	47



10 APPENDIX II: LISTING DESCRIPTION

KIRKTHORPE WEIR AND SLUICE GATES

List Entry Summary

This building is listed under the Planning (Listed Buildings and Conservation Areas) Act 1990 as amended for its special architectural or historic interest.

Name: KIRKTHORPE WEIR AND SLUICE GATES

List entry Number: 1200709

Location

KIRKTHORPE WEIR AND SLUICE GATES

The building may lie within the boundary of more than one authority.

County:

District: Wakefield

District Type: Metropolitan Authority

Parish: Warmfield cum Heath

National Park: Not applicable to this List entry.

Grade: II

Date first listed: 27-Aug-1986

Date of most recent amendment: Not applicable to this List entry.

Legacy System Information

The contents of this record have been generated from a legacy data system.

Legacy System: LBS

UID: 342413

Asset Groupings

This list entry does not comprise part of an Asset Grouping. Asset Groupings are not part of the official record but are added later for information.

List entry Description

Summary of Building

Legacy Record - This information may be included in the List Entry Details.

Reasons for Designation

Legacy Record - This information may be included in the List Entry Details.

History

Legacy Record - This information may be included in the List Entry Details.



Details

SE32SE WARMFIELD-CUM-HEATH RIVER CALDER

1/108 Kirkthorpe Weir and sluice gates

II

Weir and sluice gates across the River Calder. Probably second quarter C19, sluice gates dated 1827. Ashlar and cast-iron. Segmental curved weir has 8 steps with, to west and east, curved retaining walls of giant ashlar blocks. At east end 3 sluices divided by 6 giant stepped buttresses with pointed-arched cutwaters to the south. Two original sluice gates with circular winding gear and large cog wheel the plates with lettering in relief reading "HEWES & WREN MANCHESTER 1827" to each face. A large and impressive feat of engineering, the sluices in working order.

Partly in the parish of Stanley.

Listing NGR: SE3578421247

Selected Sources

Legacy Record - This information may be included in the List Entry Details

National Grid Reference: SE 35784 21247



11 APPENDIX III: WYAAS SPECIFICATION FOR ARCHAEOLOGICAL PHOTOGRAPHIC RECORDING

GENERIC SPECIFICATION FOR ARCHAEOLOGICAL PHOTOGRAPHIC RECORDING

This specification details the general requirements for an archaeological or architectural photographic record of a building or structure when this level of recording is required, generally as a condition to a planning permission issued by the local planning Authority.

1. Summary

1.1 This specification covers the requirements for a general archaeological or / and architectural photographic record of a building or standing structure & is generally used when a West Yorkshire District Conservation officer believes that this is required in advance of demolition / conversion/ or in an emergency to identify and document items of archaeological and architectural interest prior to alteration / conversion or demolition.

This specification has been written by the West Yorkshire Archaeology Advisory Service (WYAAS), the holders of the West Yorkshire Historic Environment Record.

2. Archaeological / Architectural Interest

For an understanding of relevant archaeological research priorities for school buildings in West Yorkshire please see the historic buildings research agenda available as a PDF document to download from the WYAAS website:

<http://www.archaeology.wyjs.org.uk/wyjs-archaeology-research.asp>

If necessary the archaeologist should also discuss the necessary recording and reporting with the WYAAS.

3. Aims of the Project

5.1 The aim of the proposed work is to identify and objectively record by means of photographs any significant architectural features and evidence for the original and subsequent historical form and functions of the building / structure to be developed, and to place this record in the public domain by depositing it with the West Yorkshire Historic Environment Record (the Registry of Deeds, Newstead Road, Wakefield WF1 2DE; tel. 01924 306797; email wyher@wyjs.org.uk). The building recorder on site should give particular attention to recording as far as possible the functional arrangements and division of the building(s) / structure.

4. General Instructions

4.1 Health and Safety

4.1.1 The building recorder on site will naturally operate with due regard for Health and Safety regulations. Prior to the commencement of any work on site the building recorder may wish to carry out a Risk Assessment on the building / structure in accordance with the Health and Safety at Work Regulations. The building recorder

should identify any contaminants which constitute potential Health and Safety hazards (e.g. chemical drums) and make arrangements with the owner / developer for decontamination/making safe as necessary and appropriate. The WY Archaeology Advisory Service and its officers cannot be held responsible for any accidents or injuries which may occur to outside contractors engaged to undertake this survey while attempting to conform to this specification.

4.2 Confirmation of Adherence to Specification

4.2.1. Unauthorised variations are made at the sole risk of the building recorder. Proposed modifications presented in the form of a re-written specification/project design **will not** be considered. For technical queries see para. 8.1.

4.3 Confirmation of Timetable and Contractors' Qualifications

4.3.1 Prior to the commencement of *any work*, the building recorder **must** provide the local planning authority and WYAAS **in writing** with:

- a projected timetable for the site work
- details of the staff structure and numbers
- names and CVs of key project members (the project manager, site supervisor, any proposed specialists, sub-contractors *etc.*)

4.3.2 All project staff provided by the building recorder must be suitably qualified and experienced for their roles. In particular, staff involved in building recording should have proven expertise in the recording and analysis of buildings. The timetable should be adequate to allow the work to be undertaken to the appropriate professional standard.

4.4 Notification and Monitoring

The Local Authority and WYAAS should receive at least one week's notice in writing of the intention to start fieldwork.

5 Recording Methodology

5.1 Site preparation

Prior to the commencement of work on site the building recorder should identify all removable modern material (including 20th century partitions, dry-boarding, suspended ceilings, modern machinery *etc.*) which may significantly obscure material requiring a photographic record, and should contact the developer in order to make arrangements for its removal. It is not the intention of this specification that large-scale removal of material of this type should take place with the building recorder's manpower or at that contractor's expense.

5.2 Documentary research

If no detailed heritage statement has been submitted for the building / structure, then prior to the commencement of work on site, the building recorder should undertake a rapid map-regression exercise based on the readily-available map and photographic evidence held by the relevant Local History Library and the West Yorkshire Archive

Service, and a rapid examination of the available 19th- and 20th-century Trades and Postal directories, the appropriate census returns and all other available primary and relevant secondary sources. This work is intended to inform the building recording by providing background information with regard to function and phasing. Please note that this exercise is not intended to be a formal desk-based assessment, and should not represent a disproportionate percentage of the time allowed for the project overall.

5.3 Site/building plans

If as “existing plans” of the building/ structure have been produced then, if appropriate, these plans may be used for any annotation relative to the photographic record (permission of the copyright holder must be sought).

Failing this, an accurate sketch plan of the site/building layout, marked with a north pointer, should be derived from the most appropriate large-scale historic mapping and reproduced at an appropriate scale (not smaller than 1:100). This plan should then be used for any annotation relative to the photographic record.

6. Photographic Record

6.1 External photographs

An external photographic record should be made of all elevations of the building/ structure, from vantage points as nearly parallel to the elevation being photographed as is possible within the constraints of the site. The contractor should ensure that all visible elements of each elevation are recorded photographically; this may require photographs from a number of vantage points. A general external photographic record should also be made which includes a number of oblique general views of the building(s) from all sides, showing it/them and the complex as a whole in its/their setting. In addition, a 35mm general colour-slide survey of the building(s) should also be provided (using a variety of wide-angle, medium and long-distance lenses). While it is not necessary to duplicate every black-and-white shot, the colour record should be sufficiently comprehensive to provide a good picture of the form and general appearance of the building(s) / structure. The colour slide record should also include some internal shots. (See para. 6.5 below for possible use of digital photography.)

6.2 Internal photographs

A general internal photographic record should be made of the building/structure. General views should be taken of *each room* or discrete internal space from a sufficient number of vantage points to adequately record the form, general appearance and manner of construction of each area photographed. In areas which are wholly modern in appearance, character and materials, a single shot to record current appearance will suffice.

6.3 Detail photographs

In addition, detailed record shots should be made of all features of archaeological and architectural interest identified during the process of appraisal. Typically, items of interest would include:

- All original structural elements, roof structures / trusses

- Original doors and window frames and any associated shutters or other fittings
- Original staircases and other access arrangements

But this list should not be treated as exhaustive. The building recorder on site should also identify and note:

- any significant changes in construction material – this is intended to include significant changes in stone/brick type and size
- any blocked, altered or introduced openings
- evidence for phasing, and for historical additions or alterations to the building.

Elements for which multiple examples exist (e.g. each type of roof truss, column or window frame) may be recorded by means of a single representative illustration. **N.B.** Detail photographs must be taken at medium-to-close range and be framed in such a way as to ensure that the element being photographed clearly constitutes the principal feature of the photograph.

6.4 Equipment

General photographs should be taken with a Large Format monorail camera (5" x 4" or 10" x 8"), or with a Medium Format camera that has perspective control, using a tripod. The contractor must have proven expertise in this type of work. Any detail photographs of structural elements should if possible be taken with a camera with perspective control. Other detail photographs may be taken with either a Medium Format or a 35mm camera. All detail photographs must contain a graduated photographic scale of appropriate dimensions (measuring tapes and surveying staffs are not considered to be acceptable scales in this context). A 2-metre ranging-rod, discretely positioned, should be included in a selection of general shots, sufficient to independently establish the scale of all elements of the structure.

6.5 Digital photography

Digital photography: as an alternative for colour slide photography, good quality digital photography may be supplied, using cameras with a minimum resolution of 10 megapixels. Digital photography should follow the guidance given by Historic England in Digital Image Capture and File Storage: Guidelines for Best Practice, July 2015. Note that conventional black and white print photography is still required and constitutes the permanent record. Digital images will only be acceptable as an alternative to colour slide photography if each image is supplied as both a JPEG and a TIFF versions. The latter as an uncompressed 8-bits per channel TIFF version 6 file of not less than 25Mbs (See section 2.3 of the Historic England guidance). The contractor must include metadata embedded in the TIFF file. The metadata must include the following: the commonly used name for the site being photographed, the relevant centred OS grid coordinates for the site to at least six figures, the relevant township name, the date of photograph, the subject of the photograph, the direction of shot and the name of the organisation taking the photograph. Any digital images are to be supplied to WYAAS on gold CDs by the archaeological contractor accompanying the hard copy of the report.

6.6 Film stock

All record photographs to be black and white, using conventional (not chromogenic) silver-based film only, such as Ilford FP4 or HP5, or Delta 400 Pro that is replacing HP5 in certain film sizes (such as 220). Dye-based films such as Ilford XP2 and Kodak T40CN are unacceptable due to poor archiving qualities.

6.7 Printing

6.7.1 Record photographs should be printed at a minimum of 5" x 7". In addition a small selection of photographs (the best of the exterior setting shots and interior shots with important detail) should be printed at 10" x 8". Bracketed shots of identical viewpoints need not be reproduced, but all viewpoints must be represented within the report.

6.7.2 Prints may be executed digitally from scanned versions of the film negatives, and may be manipulated to improve print quality (but **not** in a manner which alters detail or perspective). All digital prints must be made on paper and with inks which are certified against fading or other deterioration for a period of 75 years or more when used in combination. If digital printing is employed, the contractor must supply details of the paper/inks used in writing to the local authority with supporting documentation indicating their archival stability/durability.

6.8 Documentation

A photographic register and photo location plan are required. The photographic register should (as a minimum) include location, direction and subject of shot must accompany the photographic record; a separate photographic register should be supplied for any colour slides and digital photographs. Position and direction of each photograph and slide should be noted on a scaled copy of the building plan (minimum acceptable scale 1:100), which should also be marked with a north pointer. Separate plans should be annotated for each floor of the building/ structure. (See also para. 5.3 above.)

7. Post-Recording Work and Report Preparation

7.1 Report Preparation

7.1.1 Report format and content

A written report should be produced. This should include:

- an executive summary including dates of fieldwork, name of commissioning body, planning application reference and condition number and a brief summary of the results including details of any significant findings
- an introduction outlining the reasons for the survey
- a brief architectural description of the building(s) presented in a logical manner (as a walk around and through the building(s), starting with setting, then progressing to all sides of the structure in sequence, and finally to the interior from the ground floor up)
- a discussion placing the building/complex in its local and historical contexts, describing and analysing the development of individual structures and of the complex as a whole. This analysis should consider the site type as an integrated system intended to perform a specialised function, with particular attention being given to historical plan form, technical layout and process flow.

Both architectural description and historical/analytical discussion should be fully cross-referenced to the photographic record, sufficient to illustrate the major features of the site and the major points raised.

7.1.2 Report Illustrations

Illustrations should include:

- a location map at a scale sufficient to allow clear identification of the building(s)/structure in relation to other buildings in the immediate area
- a complete set of site drawings at a legible scale, on which position and direction of each photograph has been noted
- any relevant historic map editions, with the position and extent of the site clearly indicated
- any additional illustrations pertinent to the site
- a complete set of good-quality laser copies of all photographs. All photographs should be accompanied by detailed captions clearly locating and identifying any pertinent features.

The latter should be bound into the report, appropriately labelled (numbered, and captioned in full) and fully referenced within the report. When captioning, contractors should identify the individual photographs by means of a running sequence of numbers (e.g. Plate no. 1; Plate no. 2), and it is this numbering system which should be used in cross-referencing throughout the report and on the photographic plans. However, the relevant original film and frame number should be included in brackets at the end of each caption.

7.2 Report deposition

7.2.1 The report should be supplied to the client and to the local planning authority and an identical copy (but also including the photographic prints and any colour slides) supplied to the West Yorkshire HER – see para.7.3 below for details). The finished report should be supplied within twelve weeks of completion of all fieldwork unless otherwise agreed with the local authority. The report will become publicly accessible once deposited with the West Yorkshire Historic Environment Record, unless confidentiality is explicitly requested, in which case it will become publicly accessible six months after deposit.

7.2.2 The West Yorkshire HER supports the Online Access to Index of Archaeological Investigations (OASIS) project. The overall aim of the OASIS project is to provide an online index to the mass of archaeological grey literature that has been produced as a result of the advent of large-scale developer funded fieldwork. The building recorder must therefore complete the online OASIS form at <http://ads.ahds.ac.uk/project/oasis/>. Contractors are advised to contact the West Yorkshire HER officer prior to completing the form. Once a report has become a public document by submission to or incorporation into the HER, the West Yorkshire HER may place the information on a web-site. Please ensure that you and your client agree to this procedure in writing as part of the process of submitting the report to the case officer at the West Yorkshire HER.

7.2.3 With the permission of the client, the building recorder is encouraged to consider the deposition of a copy of the report for this site with the appropriate Local History Library.

7.3 Deposition with WYAAS (as holders of the West Yorkshire Historic Environment Record)

The report copy supplied to the WY Archaeology Advisory Service (see address at the base of this document) should also be accompanied by both the photographic negatives and a complete set of labelled photographic prints (mounted in KENRO display pockets or similar, and arranged in such a way that labelling is readily visible) bound in a form which will fit readily into a standard filing cabinet suspension file (not using hard-backed ring-binders). Labelling should be on the *back* of the print in pencil giving film and frame number only (taking care not to damage the print) and on applied printed labels stuck on the front of the relevant photographic sleeve and which should include:

- film and frame number
- date recorded and photographer's name
- name and address of building
- national grid reference
- specific subject of photograph.

Negatives should be supplied in archivally stable mounts (KENRO display pockets or similar), and each page of negatives should be clearly labelled with the following:

- national grid reference
- Site name and address
- Date of photographs (month/year)
- Name of archaeological contractor
- Film number

Colour slides should be mounted, and the mounts suitably marked with the 'site name' at the top of the slide; grid reference at the bottom; date of photograph at the right hand side of the mount; subject of photograph at the left hand side of the mount. Subject labelling may take the form of a numbered reference to the relevant photographic register. The slides should be supplied to the WY Archaeology Advisory Service in an appropriate, archivally stable slide hanger (for storage in a filing cabinet). In all other respects, standards for archive compilation and transfer should conform to those outlined in *Archaeological Archives – a guide to best practice in creation, compilation, transfer and curation* (Archaeological Archives Forum, 2007).

7.3.3 **Copyright** - Please note that by depositing this report, the contractor gives permission for the material presented within the document to be used by the WYAAS, in perpetuity, although The Contractor retains the right to be identified as the author of all project documentation and reports as specified in the *Copyright, Designs and Patents Act 1988* (chapter IV, section 79). The permission will allow the WYAAS to reproduce material, including for use by third parties, with the copyright owner suitably acknowledged.

8. Technical Queries

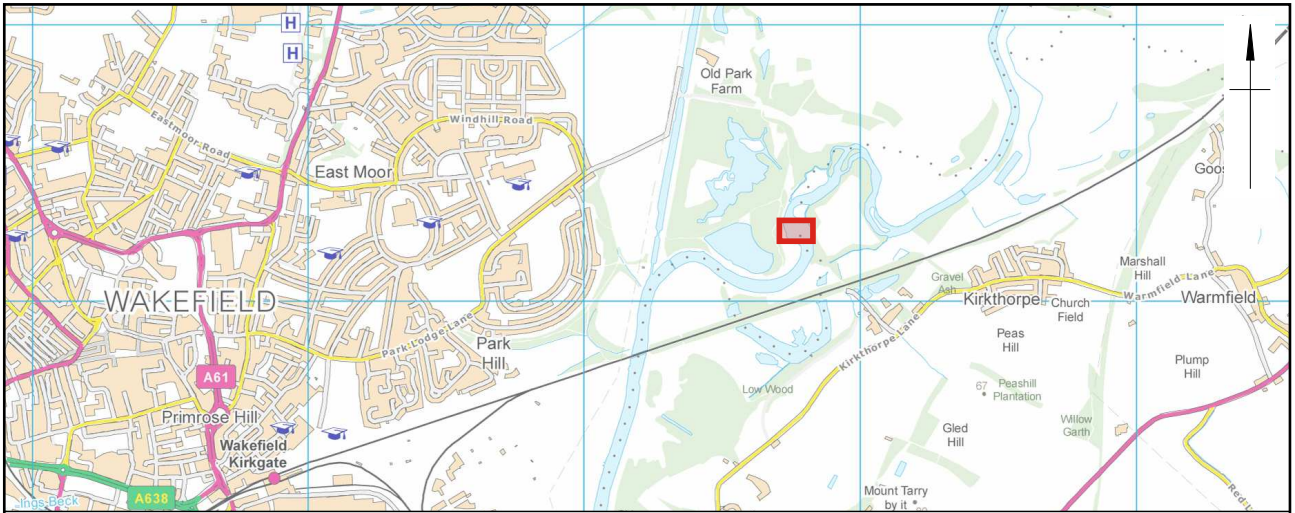
8.1 Any technical queries arising from the specification detailed above, should be addressed to WYAAS without delay.

9. Valid Period of Specification

9.1 This specification is valid for a period of one year.

David Hunter
West Yorkshire Archaeology Advisory Service
West Yorkshire Historic Environment Record
Registry of Deeds
Newstead Road
Wakefield
WF1 2DE

Telephone: (01924) 306798
Fax: (01924) 306810
E-mail: david.hunter@wyjs.org.uk



 Site location

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Site location

Figure 1



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Site plan showing plate viewpoints

Figure 2



The Boat Museum, Ellesmere Port

DOCUMENT REQUEST FORM - Please fill in one triplicate slip per item and retain bottom copy for reference

Document Ref. No. EW91/9/34 6492/190	Brief Description Kirkthorpe Dam - 1827
Date Required 5/9/16	Name (in capitals) Ant Conserving Work Item
For Office Use Only:	
Location R251/51/51 112f	Withdrawn by: Date:
	Replaced by: Date:

RIVER CALDER
AT
KIRKTHORPE DAM.

Taken 6th April 1827
F.H. Southey

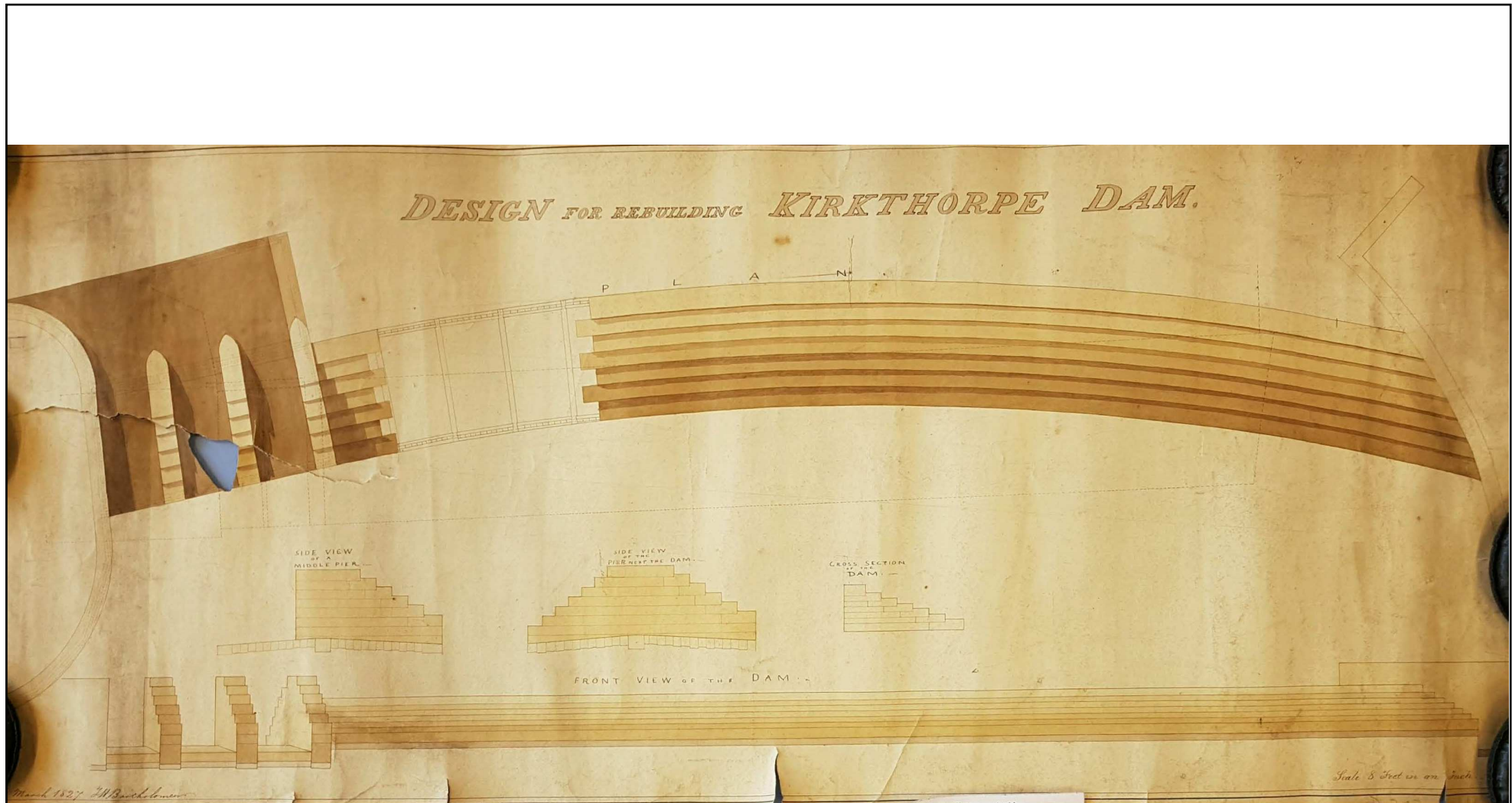


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1827 plan of Kirkthorpe Weir on the River Calder

Figure 3



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1827 design for rebuilding Kirkthorpe Weir

Figure 4

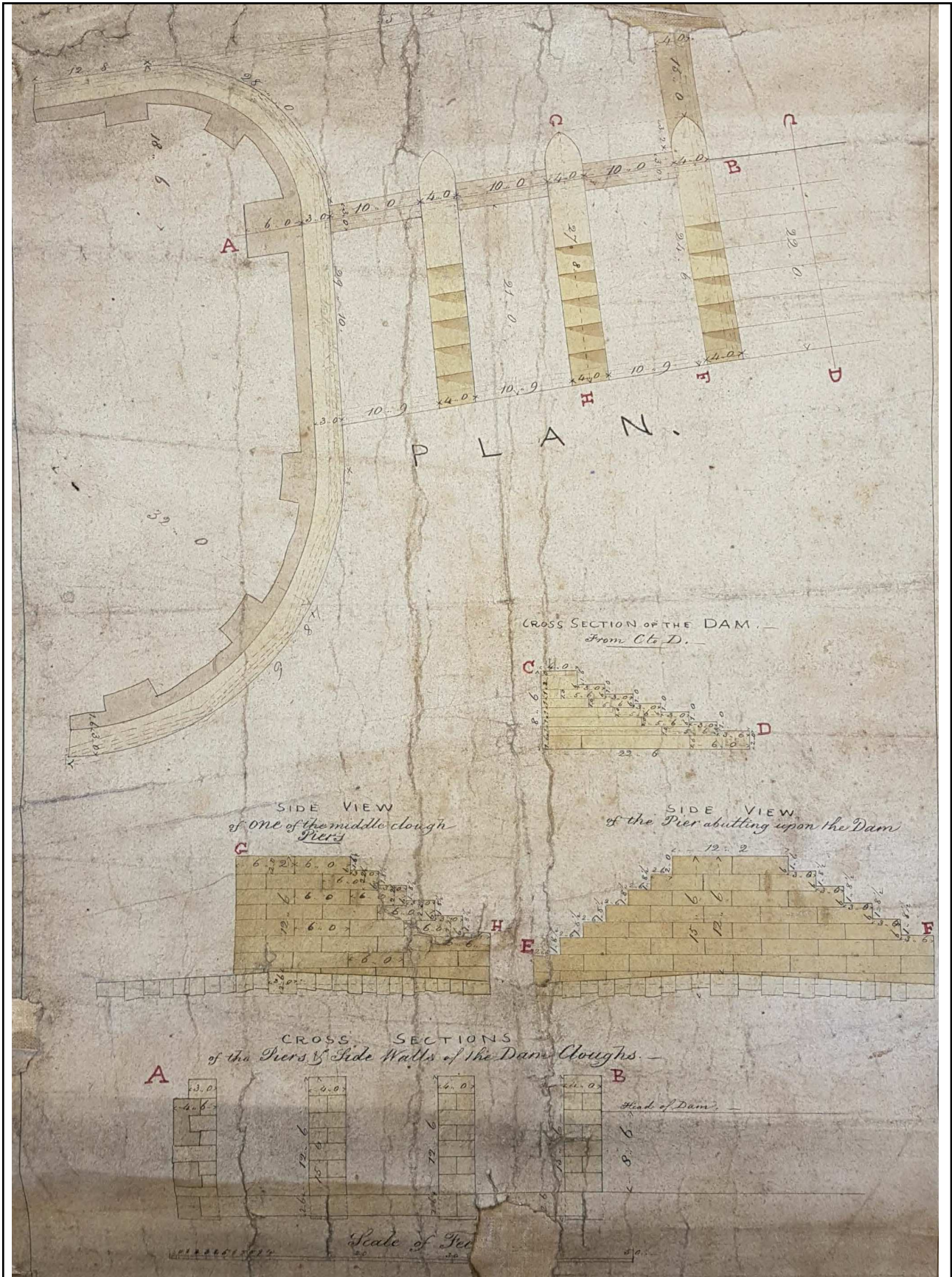


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Historic mapping: 1852-1854 OS, 1893 OS, 1907 OS, and 1932 OS

Figure 6



Plate 1: Aerial view of Kirkthorpe Weir showing the sluices and east wingwall prior to works (Client Digital 1)



Plate 2: General view of the sluices and weir beyond prior to works (Client Digital 2)


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Plate 3: General view of the upstream side of the sluices with weir beyond, looking across the River Calder prior to works (Client Digital 3)

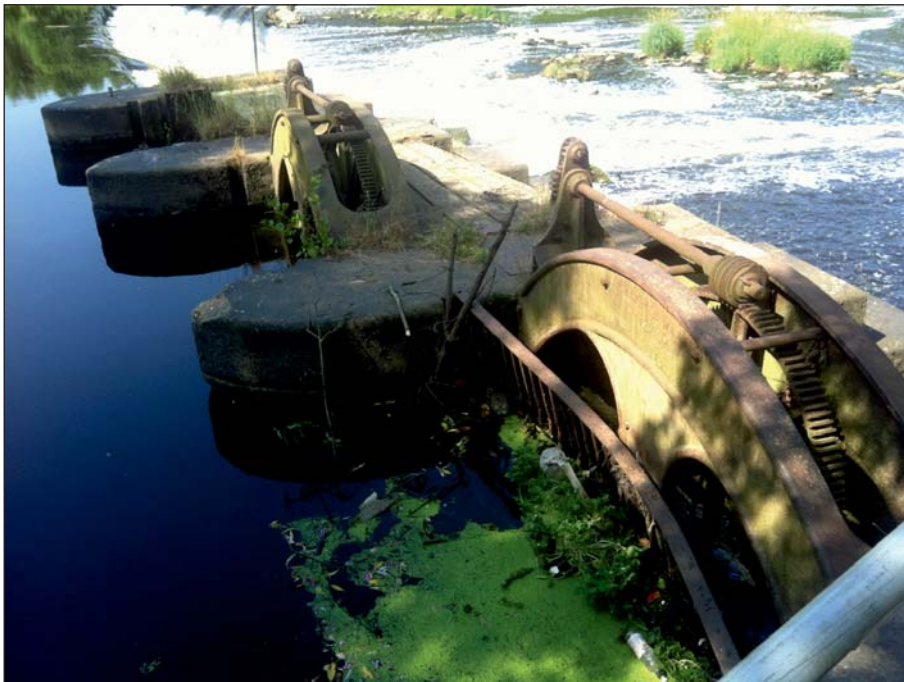


Plate 4: Detail of upstream side of the sluices prior to works (Client Digital 4)


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Plate 5: View of sluices from upstream prior to works (Client Digital 5)



Plate 6: View of the sluices and weir from upstream prior to works (Client Digital 6)


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Plate 7: View of the sluices and weir from upstream prior to works (Client Digital 7)



Plate 8: General view of the sluices from downstream prior to works (Client Digital 8)


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Plate 9: General view of the sluices from downstream prior to works (Client Digital 9)



Plate 10: General view of the sluices from downstream prior to works (Client Digital 10)


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Plate 11: Detail of easternmost sluice and mechanism from downstream, prior to works (Client Digital 11)



Plate 12: Detail of the central sluice and mechanism from downstream, prior to works (Client Digital 12)


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Plate 13: Detail of easternmost sluice and mechanism from downstream, prior to works
(Client Digital 13)



Plate 14: General view of sluices from downstream following commencement of works
(Client Digital 14)


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Plate 15: Aerial view of sluices and weir during high river waters during works (Client Digital 15)



Plate 16: General view of sluices from downstream during works (Client Digital 16)


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Plate 17: Aerial view of sluices during works (Client Digital 17)



Plate 18: Aerial view of weir, sluices and new hydropower station site during works (Client Digital 18)


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Plate 19: Aerial view of sluices and weir during works (Client Digital 19)



Plate 20: Aerial view of weir, sluices and new hydropower station site during works on 1st September 2016 following movement of central pier (Client Digital 20)


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Plate 21: Aerial view of weir, sluices and new hydropower station site during works on 1st September 2016 following movement of central pier (Client Digital 21)



Plate 22: Aerial view of weir, sluices and new hydropower station site during works on 1st September 2016 following movement of central pier (Client Digital 22)


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Plate 23: Aerial view of weir, sluices and new hydropower station site during works on 1st September 2016 following movement of central pier (Client Digital 23)

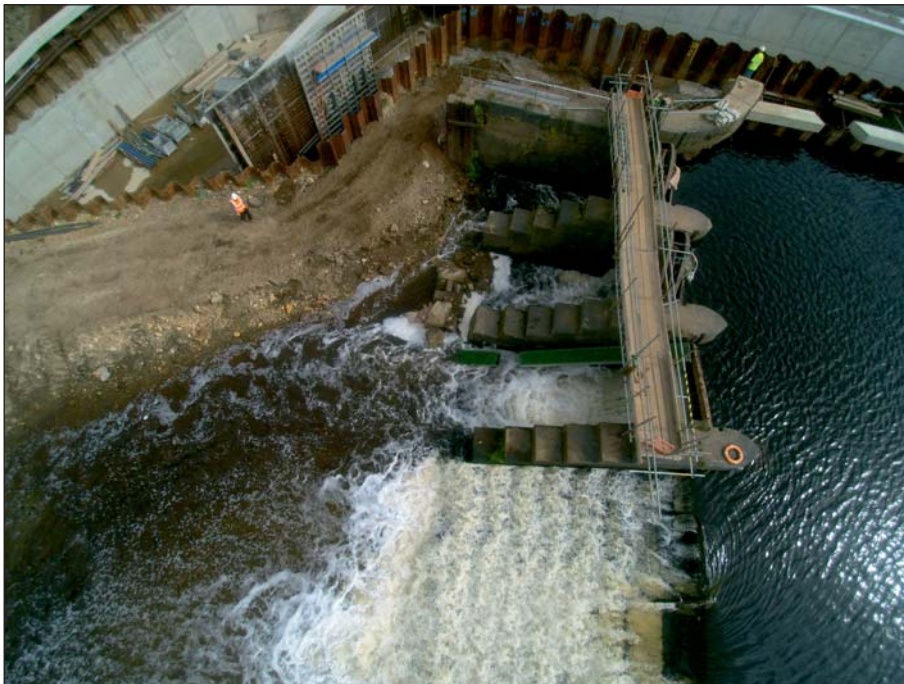


Plate 24: Aerial view of weir, sluices and new hydropower station site during works on 1st September 2016 following movement of central pier (Client Digital 24)


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Plate 25: Aerial view of weir and sluices during works on 1st September 2016 following movement of central pier (Client Digital 25)



Plate 26: Aerial view of weir and sluices during works on 1st September 2016 following movement of central pier (Client Digital 26)


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Plate 27: Downstream detail of sluice piers following subsidence of central pier (Client Digital 27)



Plate 28: Downstream detail of central sluice and damage to pier (Client Digital 28)


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Plate 29: Downstream detail of sluice piers following subsidence of central pier (Client Digital 29)



Plate 30: Aerial view of new hydropower site and adjacent wingwall and sluices post-piling (Client Digital 30)


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Plate 31: Aerial view of wingwall and sluices post-piling (Client Digital 31)



Plate 32: Aerial view of wingwall and sluices post-piling (Client Digital 32)


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Plate 33: Aerial view of wingwall and sluices post-piling (Client Digital 33)



Plate 34: Aerial view of wingwall and sluices post-piling (Client Digital 34)


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Plate 35: View of the sluices and piers from downstream post-piling (Client Digital 35)



Plate 36: General view of the sluices and weir from the hydropower site, post-piling (Client Digital 36)


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Plate 37: View of the sluices from upstream post-piling (Client Digital 37)



Plate 38: View of the sluices from upstream post-piling (Client Digital 38)


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Plate 39: View of the timber boards of westernmost sluices from upstream post-piling (Client Digital 39)



Plate 40: View of the sluices from upstream showing westernmost stepped pier upstream side post-piling (Client Digital 40)


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Plate 41: View of the sluices from upstream post-piling, showing levels for new concrete slab (Client Digital 41)



Plate 42: View of the sluices from upstream post-piling, showing levels for new concrete slab (Client Digital 42)


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Plate 43: Detail of easternmost sluice from upstream post-piling, showing levels for new concrete slab (Client Digital 43)



Plate 44: View of the sluices from upstream post-piling, showing levels for new concrete slab (Client Digital 44)


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Plate 45: Detail of westernmost sluice from upstream post-piling, showing levels for new concrete slab (Client Digital 45)



Plate 46: Detail of westernmost pier with stepped upstream side showing levels for new concrete slab (Client Digital 46)


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Plate 47: Detail of exposed arched opening at the base of the westernmost sluice from downstream (Client Digital 47)



Plate 48: General view of sluices from upstream (Digital IMG_0207)


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Plate 49: General view of sluices from upstream (Film 2.2)



Plate 50: General view of sluices from upstream (Digital IMG_0212)


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Plate 51: Detail of central sluice from upstream (Film 2.10)



Plate 52: Detail of central sluice cast iron mechanism from downstream (Digital IMG_0211)



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Plate 53: General view of sluices and piers from downstream (Film 3.2)



Plate 54: General view of sluices and piers from downstream (Digital IMG_0219)

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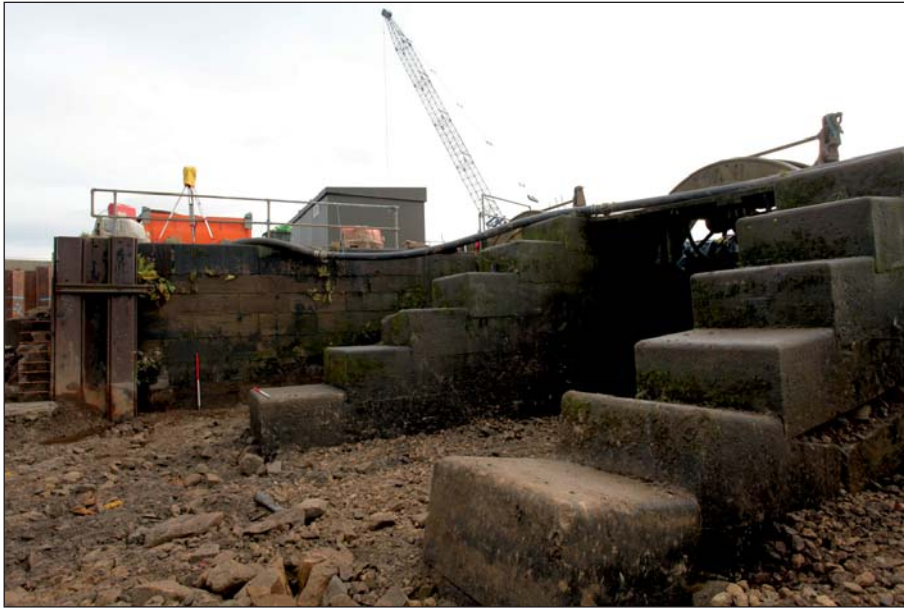


Plate 55: View of central and easternmost sluices showing piers and wingwall (Digital IMG_0237)



Plate 56: General view of the downstream easternmost sluice pier and wingwall (Film 4.3)


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Plate 57: General view of the downstream easternmost sluice pier and wingwall (Digital IMG_0230)



Plate 58: General view of the easternmost sluice with pier and wingwall from downstream (Digital IMG_0227)


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Plate 59: View of the downstream easternmost sluice (Digital IMG_0263)



Plate 60: View of the downstream easternmost sluice (Digital IMG_0261)


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Plate 61: View of the downstream central sluice (Digital IMG_0229)



Plate 62: View of the east elevation of the central pier within the central sluice, showing recess and collapse damage (Digital IMG_0248)


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Plate 63: Detail view of the downstream central sluice (Digital IMG_0251)



Plate 64: Detail view of the downstream central sluice (Digital IMG_0255)


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Plate 65: Detail view of the downstream westernmost sluice (Digital IMG_0231)



Plate 66: Detail of the west elevation of the central pier within the westernmost sluice, showing recess and collapse damage from downstream (Digital IMG_0245)


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Plate 67: Detail view of the downstream westernmost sluice, showing arched opening (Digital IMG_0238)



Plate 68: Detail of sluice recess with angle within the western pier of the westernmost sluice from downstream (Digital IMG_0242)



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Plate 69: Detail of cast iron sluice fixings to the central pier of the westernmost sluice from downstream (Digital IMG_0244)

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