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Scunthorpe and its Environs

Air photo and lidar mapping and interpretation

Alison Deegan



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Summary

This project generated a detailed map and records of archaeological and historical features that are visible on aerial photographs and lidar imagery. This report outlines the methods employed and the sources used to achieve this outcome. This is followed by period and thematic discussions of the project results. There are sections concerning the known and possible Neolithic and Bronze Age burial and ritual monuments; the distribution and visibility of Iron Age and Roman landscapes; medieval and post medieval sites and landscapes and 20th-century military installations.

Particular attention is given to the physical remains that survive from warping and the iron and steel industry. Warping was a process of land improvement practised in the Trent Valley in the 18th and 19th centuries. Historical aerial photographs have proved to be a valuable resource in the study of near-recent industrial remains.

This report closes with an overview of the project outcomes.

Contributors

The mapping project was undertaken for Historic England by Alison Deegan, an independent Air Photo and LiDAR Interpreter. This report was produced by Alison Deegan and benefitted from comments from several Historic England readers.

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Front cover image: Aerial photograph looking north-east across the demolished North Lincolnshire Iron Works, the Redbourn Hill Works and in the distance, the Appleby Works. EPW049758 1-Mar-1936 © Historic England. Aerofilms Collection.

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This desk-based survey was undertaken between February 2022 and January 2024. Research for this report was carried out during the survey stage and until March 2024. The report was written in December 2023 to April 2024.

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Contents

Introduction	1
Background to the project area	2
Geology and soils	2
Rivers and topography	3
Current land use	3
Archaeological visibility	4
Archaeological background	4
Project scope and methodology	5
Archaeological scope of the survey	5
Sources	5
Methodology	7
Neolithic and Bronze Age	10
Monuments	11
Concluding remarks	15
Iron Age and Roman settlement and landscapes	16
Overview	16
Holme	20
Conclusion	24
Sites and landscapes of known or possible medieval or post medieval origin	25
Medieval settlements	26
Thornholme Priory & its environs	31
Retting pits	35
Discussion	38

Warping in the Lower Trent Valley.....	39
Introduction.....	39
Geological and topographical background.....	39
Overview of wet warping process.	40
Warping infrastructure.....	43
Absence of warping	47
Discussion	48
The iron and steel industries at Scunthorpe.....	50
Introduction.....	50
Iron smelting, working and ore extraction before the late 19th century.	52
Iron ore mining.....	53
The first iron works at Scunthorpe.	58
Conclusion.....	73
20th-century military remains	74
Introduction	74
Possible First World War sites	74
Second World War Sites and Installations.....	76
Project products and outcomes.....	81
Project products.....	81
Other outputs	82
Project outcomes	83
Appendix 1 Structure of the spatial data	86
Appendix 2 Survival potential on the sites of the 19th-century iron works..	87
References	90

Illustrations

Figure 1: The Scunthorpe and its Environs Air Photo and Lidar Mapping Project and similar projects in the region.	1
Figure 2: Simplified geology of the Scunthorpe and its Environs Air Photo and Lidar Mapping Project area.	2
Figure 3: Distribution of known and possible Neolithic and Bronze Age monuments.	10
Figure 4: Cropmark of a large circular feature of uncertain origin, south of Twigmoor. .	14
Figure 5: A distribution map of sites of known or possible Iron Age or Roman date.	17
Figure 6: Iron Age and Roman features recorded in the area around Holme Hall.	21
Figure 7: Distribution map of medieval settlements and other medieval and post medieval sites mentioned in the text.	26
Figure 8: A vertical aerial photograph of Gokewell Priory taken in 1956.	28
Figure 9: A vertical aerial photograph of Castlethorpe taken in 1956.	30
Figure 10: A vertical aerial photograph of Thornholme Priory taken in 1956.	32
Figure 11: The topographic setting of Thornholme Priory.	34
Figure 12: Examples of retting pits.	36
Figure 13: The Humber Estuary and its tributaries.	40
Figure 14: The main warping drains, villages, key sites and features discussed in the text.	41
Figure 15: Cropmarks showing the levelled remains of a section of Earl Beauchamp's Warping Drain.	44
Figure 16: Warping drains between West Butterwick and Tripling Howes.	45
Figure 17: Earthwork drains and rig in fields between Bottesford Beck and West Common North Drain.	46

Figure 18: Distribution map of archaeological and historical evidence for iron ore mining, iron smelting and the locations of the late 19th- and early 20th-century iron works. 51

Figure 19: A mosaic of RAF vertical aerial photographs showing the position of the six 19th-century iron works and the extents of surface mining in the late 1940s. 55

Figure 20: Trent Iron Works in the 1870s, looking north from the Dawes Lane area. 60

Figure 21: Ruined buildings and structures at the Trent Iron Works in 1936. 61

Figure 22: The Frodingham Iron Works in c. 1890. 62

Figure 23: The Frodingham Iron Works in 1936. 63

Figure 24: The site of the Frodingham Iron Works in 2016. 64

Figure 25: The Lindsey Iron Works in the 1890s. 65

Figure 26: The Redbourn Hill Iron Works in the 1880s. 66

Figure 27: Earthworks and the low structural remains on the site of the former Redbourn Hill Iron Works (NMR 19396/06 02 November 1999 © Historic England Archive). 67

Figure 28: The North Lincolnshire Iron Works in the late 19th or early 20th centuries... 68

Figure 29: Looking east across the Appleby Iron Works. 69

Figure 30: Earthworks and the low remains of structures on the site of the Appleby Iron Works. 70

Figure 31: Looking south-east across Lysaght's Steel Works. 71

Figure 32: Possible First World War earthworks near Rowmills Plantation. 75

Figure 33: Distribution of 20th-century military sites and installations. 76

Figure 34: The four blast furnaces at Scunthorpe. 83

Tables

Table 1: Second World War Military sites 81

Introduction

The Scunthorpe and its Environs Air Photo and Lidar Mapping Project (hereon the Scunthorpe Project) began in February 2022. It was funded by Historic England's National Heritage Protection Commissions Programme (NHPCP). This project was completed to the standards developed by Historic England (and its predecessors) as part of the national programme of mapping and monument recording from aerial photographs and lidar imagery.

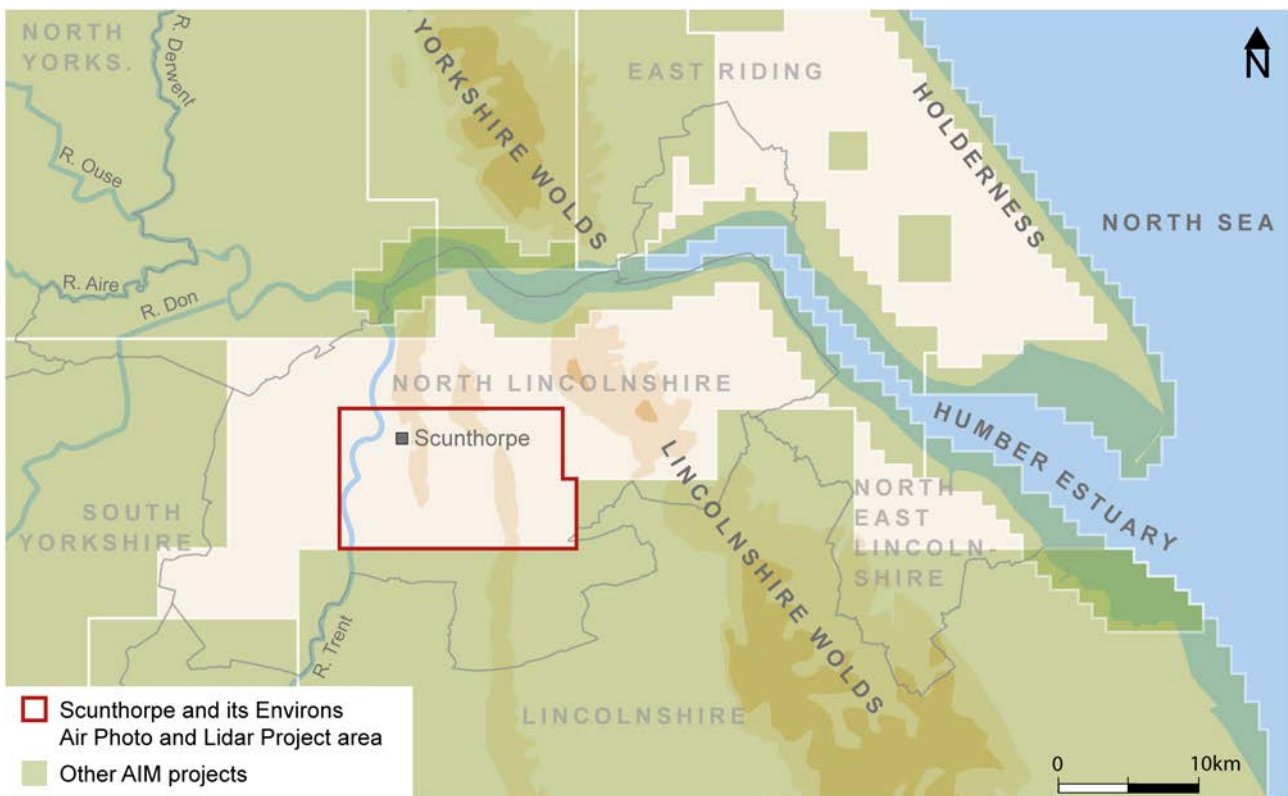


Figure 1: The Scunthorpe and its Environs Air Photo and Lidar Mapping Project and similar projects in the region.

The Scunthorpe Project covered an area of 165sq km, contained entirely within the administrative boundary of North Lincolnshire (see Fig. 1).

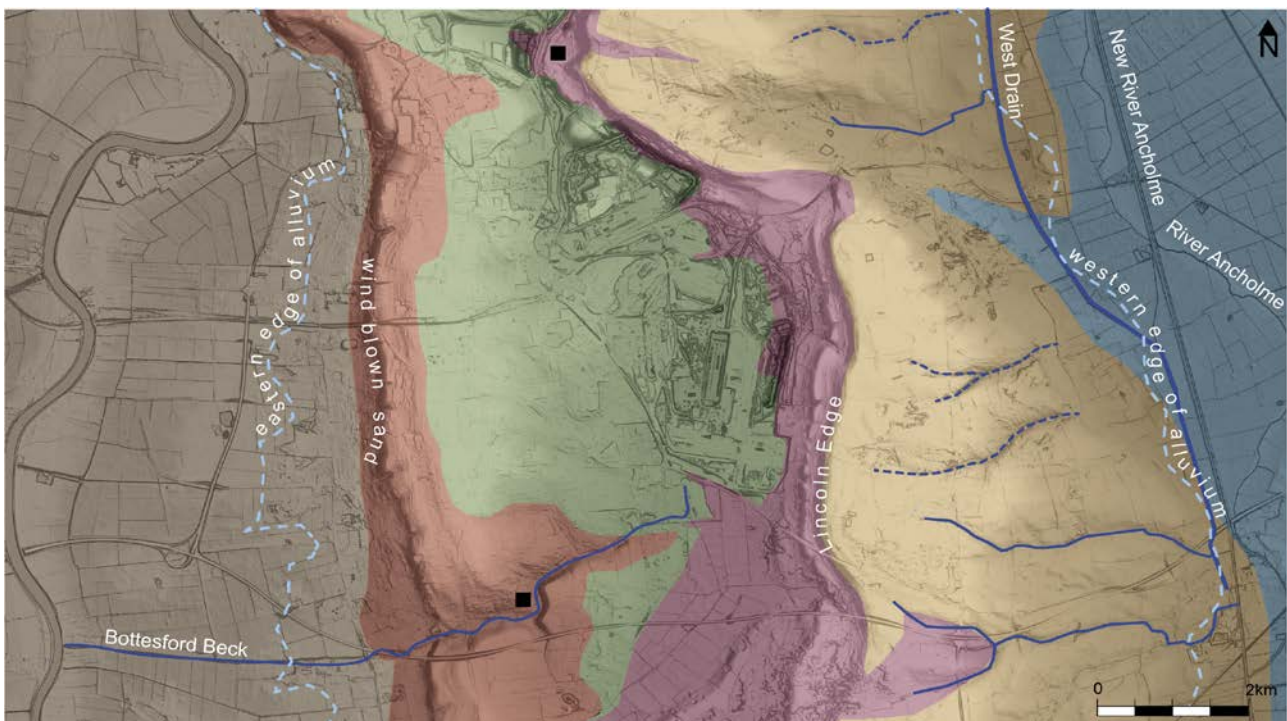
The project was carried out by Alison Deegan and based with Historic England's Aerial Survey Team in York. It was completed in April 2024. The Project Assurance Officer for Historic England was Matthew Oakey.

Background to the project area

The project area covers diverse landscapes, moving west to east it crosses the the following National Character Areas (NCA): the Humberhead Levels ([NCA 39](#)), the Northern Lincolnshire Edge with Coversands ([NCA 45](#)) and the Central Lincolnshire Vale ([NCA 44](#)).

Geology and soils

Figure 2 shows the broad geological trends encountered in this project area.



Superficial and solid geology

-  natural and artificial alluvium
-  blown sand (in parts)
Scunthorpe Mudstone Formation
-  blown sand (in parts)
Frodingham Ironstone Member
-  Charnmouth Mudstone, Pecten Ironstone,
Marlstone Rock Bed,
Northampton Sand Formation
-  blown sand (in parts)
Lower Lincolnshire Limestone
-  alluvium, Kellaways
Sand Member & Oxford Clay

Figure 2: Simplified geology of the Scunthorpe and its Environs Air Photo and Lidar Mapping Project area (generated from BGS Geology Viewer and lidar DTM 2018 © Historic England; source Environment Agency).

The broad flood plain of the lower reaches of the River Trent is underpinned by the Mercian Mudstone Group covered with natural and artificial alluvium. At the eastern edge of the flood plain the Scunthorpe Mudstone Formation is exposed in a low escarpment rising up to the Frodingham Ironstone Member. Wind-blown sand

deposits soften the lower slopes of the escarpment and continued eastward across large areas of the ironstone beds.

A second escarpment, known as the Lincoln Edge, exposes narrow outcrops of Charmouth Mudstone Formation, the Pecten Ironstone Bed, Marlstone Rock Formation, Whitby Mudstone Formation and the Northampton Sand Formation. In parts the edge is stepped so there are shelves or terraces where Pecten Ironstone is exposed at Dragonby and Charmouth Mudstone Formation near Holme.

From the high point of the Lincoln Edge the Jurassic limestones, collectively known as the Lower Lincolnshire Limestone dip gently to the east. The high ground has sand cover but this peters out on the lower dip slope which gently transitions into the broad shallow valley of the River Ancholme. Here, alluvium overlies Kellaways Sand Member and Oxford Clay.

Rivers and topography

The lower reaches of the River Trent meander south to north along the western edge of the project area, the River Ancholme followed a similarly wandering course from south to north along the eastern edge. A canal, the New River Ancholme was constructed in the 17th century and takes an impressively straight path through the flood plain. It now carries most of the flow to the Humber and the old river is reduced to a ditch. These rivers enter the Humber Estuary approximately 8km north of this project area. The Lincoln Edge is the watershed between the Trent and the Ancholme catchments.

Bottesford Beck is the only significant tributary of the River Trent in this area. It flowed southward from Crosby Warren and then westward to the River Trent, but it was re-routed and modified to accommodate ironstone mining in the 19th and 20th centuries.

The Lower Lincolnshire Limestone is incised by small becks and dry valleys that run down to the edge of the Ancholme valley. They either join the New River Ancholme or they are intercepted by West Drain, an artificial watercourse that flows northward along the western edge of the flood plain to the Humber Estuary.

Current land use

Land use across the project area is closely connected to the underlying geology and the topography. The lower Trent flood plain is, for the time being, sparsely populated, and dominated by arable cultivation. The small villages cling to the river levees. The Frodingham Ironstone Member is a mix of active and former industrial landscapes and dense residential development as far south as Bottesford Beck, but rural in character beyond that. Woods and warren cloak the sandy deposits on the Lower Lincolnshire Limestone with arable and other crops on the other freely draining soils. Broughton is the only large settlement here, though Sawby is now expanding. The town of Brigg straddles the Old and New River Ancholmes in the south east corner of the project area in an otherwise thinly populated river valley.

Archaeological visibility

This project area is complex and cannot be readily classified into areas of high or low cropmark potential or good or poor earthwork survival. The Frodingham Ironstone Member and Lower Lincolnshire Limestone edge are both free draining bedrocks. However, the former is greatly impacted by surface mining and 20th century developments and the latter carries large areas of woodland cover or unploughed common ground so neither are particularly conducive to cropmark formation. Conversely, the River Trent's flood plain has produced extensive and complex cropmarks. However, these are almost exclusively related to late post medieval land improvement, which has in turn buried more ancient land surfaces and remains.

There are archaeological earthworks in the woods and plantations and on the remaining commons and warrens but the better-preserved village earthworks are all surrounded by intensive arable farming.

Archaeological background

This relatively small area has produced three major research-led archaeological excavations and investigations of regional and national significance: the major Iron Age and Roman settlements at Dragonby (May 1996), the early medieval settlement at Flixborough (Lovelock et al 2019) and Thornholme Priory (Coppack et al 1998). However, discovery and appreciation of the area's rich archaeology had begun a century earlier when finds such as the Brumby Shield were made as a consequence of extensive ironstone mining (MLS1882).

The warrens and commons with their poor sandy soils were left unploughed into the 19th century. Natural aeolian erosion in these areas often exposed the remains of early activity such as hearths and flint scatters. These were a particular interest to a young Derrick Riley, who would return decades later to photograph cropmarks and earthworks in the surrounding areas from the air (Riley 1978, 5).

In the 1990s the two river valleys in this project area were the focus of multi-disciplinary archaeological investigations as part of the Humber Wetlands Project (Van de Noort et al, 1998).

Since the late 1990s most archaeological excavations and other surveys have been instigated in response to threats by development such as quarry, road construction, and house building. Inevitably this has directed attention to the zone with the greatest land use change: the Frodingham Ironstone Member.

North Lincolnshire is part of the East Midlands Historic Environment Research Framework, though previously it was grouped into the Yorkshire and Humberside region. The updated research agenda and strategy was published in June 2012 (Knight et al).

Project scope and methodology

Archaeological scope of the survey

This survey followed the archaeological scope outlined in Historic England's Standards for Aerial Investigation and Mapping (Winton 2019).

Sources

The two main resources used by this project were aerial photographs and lidar imagery. The interpretation of this visual data was supported by existing monument records and historical cartography. The strength in this project, as with others in Historic England's long-standing programme, is to consider simultaneously the wide range of aerial imagery available for a given area. This allows potential features identified on one source to be cross-checked on all the other sources. It produces results with greater integrity than single source surveys that, for example, rely on Google Earth imagery or the lidar data alone.

Aerial photographs

The main sources of aerial photographs were the collections held by the Historic England Archive (HEA). During the course of this work approximately 2,588 vertical aerial photographs and 1,621 specialist oblique aerial photographs were examined. There were no low-level military obliques covering this area. The HEA kindly permitted and arranged for the temporary transfer of this material to Historic England's York office, where it could be examined, considered and re-examined as necessary.

The HEA vertical photographs range in date from the 1940s to the early 2000s. The earliest photographs were taken by the RAF to inform post-war reconstruction of the country. The late-1950s to 1970s Meridian Airmaps Ltd images were taken to facilitate planning for urban and industrial growth and infrastructure. From the 1960s the Ordnance Survey flew regular sorties for cartographic purposes. Together these vertical aerial photographs provide complete coverage of the whole of the project area for most decades. They were not taken for archaeological purposes but often record archaeological cropmarks, soilmarks, earthworks and structures of historical significance. All of the HEA vertical aerial photographs were supplied as prints.

The Specialist Collection comprises aerial photographs, mainly obliques, from the historical Aerofilms Collections, aerial reconnaissance conducted by Historic England (and its predecessors) and Derrick Riley and a small number of duplicate prints from other collections. Some of the Specialist Collection was available as prints and but newer photograph and the Aerofilms Collection were only available in digital format.

The conventional aerial photographs were complimented by more recent orthophotography supplied via the Aerial Photography for Great Britain (APGB) agreement by Next Perspectives™, and Google Earth™. Most areas had APGB coverage taken in at least two different years. The earliest Google Earth™ coverage for this area was taken in 2003 and there was a varying frequency and date of repeat coverage. Imagery continues to be added to Google Earth but once this resource had been consulted for a mapping area it was not feasible to monitor for and examine subsequent coverage.

North Lincolnshire HER holds a collection of aerial photographs taken from the 1950s to the present day. This collection includes photographs taken by Derrick Riley, Ed Dennison, Jim Pickering and Chris Cole (Innervisions) as well as duplicates from the CUCAP collection and Historic England. Vertical sorties flown by JASAIR, BKS Surveys, Clyde Surveys, Hunting Survey and Meridian Airmaps Ltd are also part of this collection. These aerial photographs were examined towards the end of the project and in the HER's office in Scunthorpe.

Environment Agency lidar imagery

Environment Agency lidar data was consulted alongside the aerial imagery described above. From the outset of this project this data was freely available in GeoTIFF format. Lidar data at 1m resolution was available for the whole project area.

Existing monument records

Monument records for this project area are maintained by Historic England and North Lincolnshire Environment Record. These records were used routinely to inform mapping and interpretation.

Historical cartography

Ordnance Survey Six Inch and 25 Inch scale maps dating from the late 19th and early 20th century were referred to throughout the course of this project. They provided a timeframe for the development of iron ore mining and the iron and steel industries. These maps were accessed via the National Library of Scotland website.

Methodology

Image capture, processing and examination

Due to the large volume of aerial photographs and complex and changing land use the overall project was divided into smaller more manageable mapping areas up to 25sq km in size. These mapping areas were tackled and completed in turn. The resources were collated at the start of the mapping process for each area. All of the digital resources were assembled within the GIS, photographic prints were arranged in sorties or kilometre squares so that all material was readily on hand throughout the mapping process. The aerial photographs held by North Lincolnshire HER were examined towards the end of the mapping and recording stage, when all other sources had been dealt with.

The process usually started with the generation of the lidar visualisations in the [Relief Visualisation Toolbox v2.2.1](#). As a matter of course 16-direction hill-shade models were created for the Digital Surface Model (DSM, data including trees and structures) and the Digital Terrain Model (DTM, data excluding the trees and structures). In addition, a Simple Local Relief visualisation was created from the DTM. Other visualisations were generated on an ad hoc basis, if it was considered to be useful for the interpretations of a particular earthwork. The three lidar visualisations were examined in turn in 1km swathes from north to south, south to north across a mapping area. These visualisations were retained in the GIS and referred to during examination of the other sources. The DTM hill-shade model was examined again towards the end of the mapping process to assess and record the latest known condition of a monument.

After the initial analysis of the lidar visualisations the Historic England Archive specialist and vertical aerial photographs were examined. All prints were examined under magnification and stereoscopically where possible. Where digital images were supplied in lieu of prints, these were examined on-screen on a high-resolution 20-inch monitor.

The locations of potential cropmark, soilmark and earthwork features were checked on the orthophotography, Google Earth™ imagery and lidar visualisations to see if these sources offered better or additional information. Selected prints were scanned at 400dpi. These scans or digital images were rectified using Aerial 5.36 and control points were derived from the OS MasterMap. Aerial 5.36 can use height data to improve its rectification calculations, but this often produced incorrect transformations. This appears to be due to the very considerable changes in terrain between the historical topography and latest height data. Height models were not routinely employed except where a standard rectification was clearly deficient, and the height data improved the result. In practice, this was very rare. Rectified images were imported into the GIS for digitisation of features.

Once all the prints had been examined and processed the APGB and Google Earth imagery were closely and systematically examined on screen in 1km swathes. Features observed on the former were digitised directly into the GIS, the later were captured as jpeg images and rectified using Aerial 5.36 as described above.

Mapping

Digitisation of features from the various sources was usually undertaken at the point of discovery following image capture and rectification. Banked and ditched features were depicted as seen and with closed polygons or regions. Particular attention was given to the relative widths of features, the relationships between abutting and intersecting features and corners, in so far as the visible cropmarks and earthworks are representative of these. For standing buildings and structures the outline footprint was digitised. For earthwork slopes a simplified T-hachure line convention was used to indicate the top of slope, and the direction and length of slope. Ridge and furrow was recorded by a simple closed polygon outline around adjacent plough ridges of common alignment with a simple polyline to show the direction of ploughing.

Data, including monument record numbers, period, type and sources was attached to each mapped object to enable interrogation and traceability. A full list of the data is provided in [Appendix 1](#).

Monument recording

Monument records were generated to compliment the spatial objects and summary information in the GIS data. They were an opportunity to provide a brief description of archaeological features and their relationship to one another and the landscape, the rationale of the interpretation and the contribution of other sources beyond the aerial imagery, such as finds, geophysical surveys, excavations. The monument records are linked to the GIS data by a unique identifier. All monument recording was input directly into the North Lincolnshire HER. Where there was an existing monument record for a feature or group of feature this record was updated with new information arising from this project including the addition of key sources. If there was no existing HER monument record for a feature then a new monument record was created.

Quality assurance

Quality assurance checks were undertaken across a minimum of 5% of the project area by the Historic England Aerial Survey Team. These were undertaken at intervals during the lifespan of the project so that any issues could be readily addressed retrospectively and in subsequent work.

Resources referenced in this report

In this report the following prefixes are used to indicate the sources of records and images.

MLS - North Lincolnshire Historic Environment Monument Record

MLI - Lincolnshire Historic Environment Monument Record

HE RR - Historic England Research Records

NHLE - a site or building on the National Heritage List for England

s - an image in the [North Lincolnshire Museum Service Image Archive](#)

Neolithic and Bronze Age

This project has recorded a number of sites that may date to the Neolithic or Bronze Age. They are visible as cropmarks, soilmarks or occasionally earthworks on aerial photographs or lidar imagery. Some of these monuments are of such characteristic form that they may be attributed to these periods with some confidence. The origin of others is far less secure.

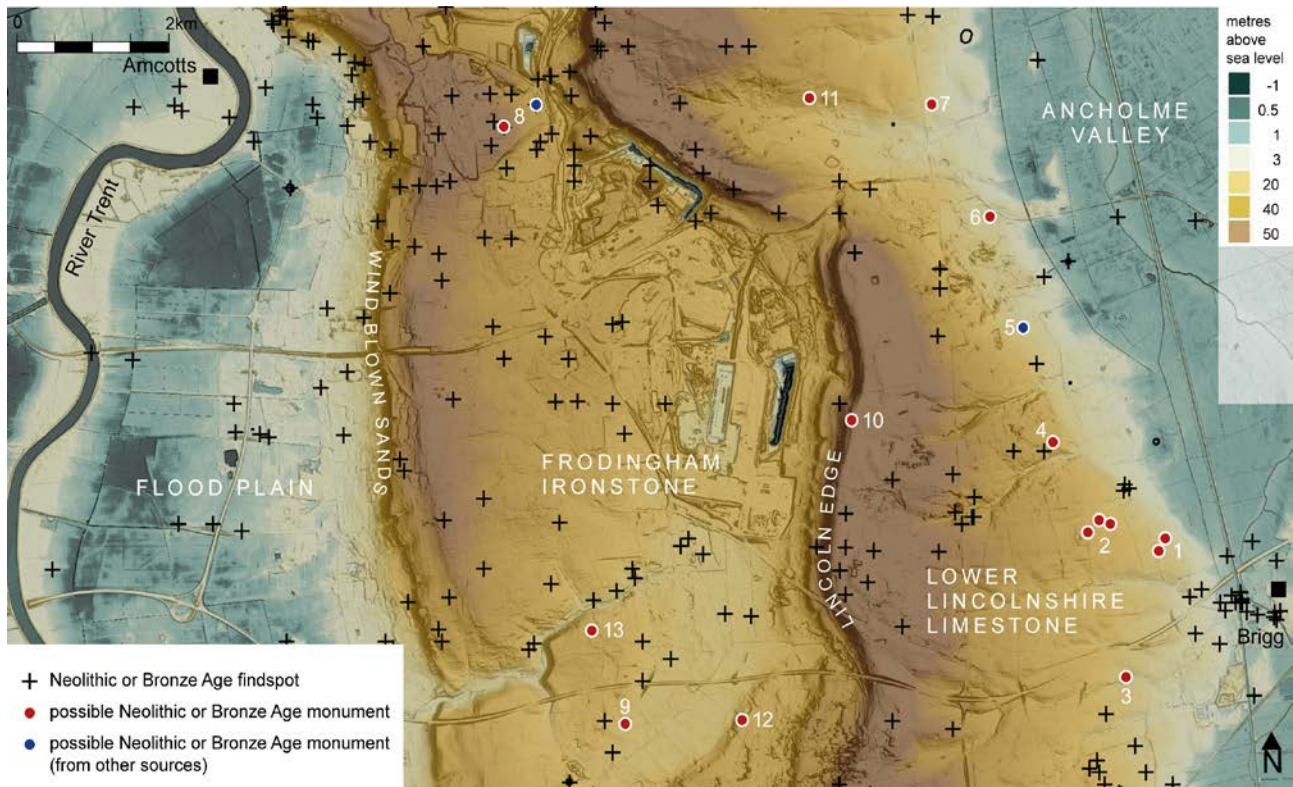


Figure 3: Distribution of known and possible Neolithic and Bronze Age monuments. (1 Neolithic long barrow and possible mortuary enclosure MLS19440, 2 possible Bronze Age ring ditches MLS21472, 3 possible Bronze Age ring ditch MLS10649, 4 Bronze Age barrow MLS20436, 5 Broughton Common barrow cemetery MLS1804, 6 possible mounds in Keb Wood MLS26823, 7 possible Neolithic pit circle MLS22774, 8 Ring ditch and putative barrow Lodge Hill MLS20612 & MLS61160, 9 possible Bronze Age ring ditch MLS1842, 10 possible Bronze Age ring ditch MLS22718, 11 possible circular enclosure MLS26785, 12 possible circular enclosure MLS10763, 13 circular enclosure MLS20390). (Background generated from lidar DTM 2018 © Historic England; source Environment Agency).

The general distribution of the Neolithic and Bronze Age findspots and flint scatters recorded in the North Lincolnshire HER suggests that there was activity on the windblown sands along the eastern edge of the Lower Trent flood plain, across the Frodingham Ironstone and the Lower Lincolnshire Limestone (Fig. 3). Little evidence

has been recovered from eastern flood plain of the River Trent, though there is a small concentration of finds on the river levee near Amcotts. There is a similar dearth of surface finds from the river flood plains.

However, these distributions are subject to several significant biases. Large areas of the Lower Trent flood plain were deliberately covered with alluvium or 'warp' in the late 18th and early 19th centuries (see below). Any material here that might otherwise have been disturbed and thus recovered from the surface is now buried well-below plough depth.

The widespread open mining of iron ore across the Frodingham Ironstone disturbed vast tracts of land and thus increased the chance recovery of archaeological remains. As Dudley noted in respect of Bronze Age cinerary urns and a notable bronze shield 'it is only right to acknowledge that much of this material could never have been secured had it not been revealed by ironstone quarrying' (1949, 20). Up until the early 20th century mining was still a largely manual process so there was plenty of opportunity for the serendipitous discovery of artefacts.

The Frodingham Ironstone has experienced the greatest residential and industrial expansion since the late 19th century and this again increased the likelihood of chance encounters and, since the late 20th century, the opportunities for planned archaeological investigations.

The absence of evidence in the Ancholme Valley may be due to the naturally-accumulated alluvial deposits that have buried past land surfaces. Furthermore, this area is sparsely populated and thus there has been less general disturbance. However, the wooden craft and structures discovered at Brigg attest to the importance of this area in prehistory (MLS63311, MLS63307 & MLS63318).

Monuments

The most typical of the Neolithic monuments are a long barrow and possible mortuary enclosure north of Castlethorpe (MLS19440). The long barrow is near oval in plan with a broad outer ditch narrowing slightly in parts to give a waisted appearance. It is 52m long and oriented near east to west. The mortuary enclosure lies 150m to the north-east of the long barrow. It is rectilinear in plan and defined by a single ditch. It measures 60m by 38m and is aligned near north to south. The long barrow sits at the break of slope overlooking the Ancholme Valley to the east and also a small tributary to the south. The possible mortuary enclosure lies slightly closer to the edge of the Ancholme Valley. The long barrow is a scheduled monument, but the possible mortuary enclosure is not covered by this protection. Similar pairings have been observed on the Lincolnshire Wolds at Hoe Hill, Swinhope (HE RR353302 & HE RR115035) and Normanby Le Wold (HE RR1044184 & HE RR1044185) (Jones 1998, Fig. 6).

Approximately 850m upslope from the long barrow there is a loose group of possible ring ditches. The largest of this group sits on a slight rise at Sinny Hill Plantation (MLS21472). It has a diameter of approximately 40m but the western half is obscured and probably destroyed by disturbances in the wood. The lidar data indicates a slight prominence at this location but it does not quite coincide with the interior of the putative ring ditch and may be a natural mound. To the east there is a short arc of ditch and a near-complete circuit of a ring ditch about 8m in diameter (MLS26881). These features are very tentatively identified as possible Neolithic or Bronze Age round barrows, but the credibility of this interpretation relies heavily on their proximity to the long barrows.

A little further south and still on the Lower Lincolnshire Limestone dip slope there is a possible ring ditch (MLS10649). It lies on the north bank of the beck running through Scawby Park. The cropmark of the circuit is 27m in diameter and rather irregular: small sections are narrow; others bulge and there are two opposed gaps in a near east to west orientation. It encircles a very low mound. This cropmark may indicate a buried ditch but it also coincides with a geological anomaly; a small oval area of Raventhorpe Beds exposed through the overlying Santon Oolite, as recorded on British Geological Survey large scale maps. Although the BGS has retired the Raventhorpe Beds classification, this localised change in geology may still be relevant.

Also of note in this area are the numerous well-defined circular mounds that are visible on the lidar imagery between Ermine Street and the A18 and a smaller cluster a little further to the north. The mounds, averaging 30m in diameter, superficially resemble a large and extensive barrow cemetery, and some have been mistaken for barrows in the past (MLS7552). However, these are the eroded remains of coral knolls in the Kirton Cementstones (this term is also now obsolete).

Moving northward there is a large earthwork mound on a south-facing slope overlooking Moor Beck (also Ella Beck) (MLS20436). It is approximately 30m in diameter and likely to be the remains of a Bronze Age barrow. A patch of gorse is marked on the OS Six Inch map of 1907 at the site of this feature.

Eight denuded mounds on Broughton Common were excavated in 1850 (MLS1804). Five contained items consistent with them being Bronze Age barrows including cremated remains and collared urns (Dudley 1949, 83-84). The aerial photographs show that the site was under woodland from the 1950s and there is no indication of these or other mounds visible on the lidar imagery.

However, the lidar data does suggest that there is a small cluster of mounds in Keb Wood, approximately 1.5km north of Broughton Common (MLS26823). Like the Broughton Common cemetery, this group is located on the Lower Lincolnshire Limestone but very close to the edge of the River Ancholme flood plain. There appear to be nine small mounds, however, in the absence of any other evidence this interpretation should be treated with caution.

In 2013 aerial reconnaissance by English Heritage (now Historic England) recorded the faint cropmarks of a small pit circle on Appleby Carr (MLS22774). It comprises a ring of ten or more pits, 20m in diameter. The cropmarks suggest the individual pits are up to 4m across and oval to rectilinear in plan. Like most of the examples described so far this monument is located on the edge of the Lower Lincolnshire Limestone, before the land falls away into the Ancholme Valley. It also overlooks the shallow valley of an unnamed beck.

Elsewhere there are three dispersed ring ditches that may be the remains of round barrows. One lies to the south of Conesby Farm in a small area that is surrounded by ground disturbed by iron ore mining and Lysaght's (Normanby) Steelworks. It appears as a simple ring ditch approximately 15m in diameter (MLS20612). A small scatter of possible worked flint has been recovered from the area to the immediate north, as has Roman and later material (MLS25897 & MLS25898). This ring ditch is also close to a purported tumulus known as 'Lodge Hill', though investigation prior to its destruction in 1911 did not provide any evidence of its origins.

An irregular ring ditch at Holme sits on the northern edge of the shallow basin that lies between Holme and the Pecten Ironstone escarpment. Again, it is visible only as a circuit, no mound is detected (MLS1842). At 14m diameter it is only slightly larger than the numerous hut circles that are visible in the nearby Iron Age and/or Romano-British settlement and it is conceivably of similar rather than earlier date.

A third sits high on the Lincoln Edge near Gokewell (MLS22718). This position has commanding views to the west across the Frodingham Ironstone plateau and beyond to the River Trent and to the east across the Ancholme Valley. It comprises a simple ditched circuit approximately 20m in diameter.

There are three larger circular monuments. One lies approximately 1.25km of the Holme ring ditch and overlooks Bottesford Beck to the north and across a shallow basin to the south. The enclosure is approximately 35m in diameter and the recent aerial photographs show it at the intersection of two straight ditches. Aerial photographs in 1953 also show other faint marks that suggest it lies within a large elongated enclosure. Whilst it is possible that these marks may indicate infilled ditches, they are not visible on any other photographs so a superficial cause cannot be discounted.

The final two monuments are unusual in the manner of their appearance and all the more dubious for it. The first lies 1.6km west of the pit circle at Appleby Carr and overlooks the same unnamed stream. It was revealed as narrow marks in bare soil when the area was partly stripped for turf in 2009 (MLS26785). These soilmarks suggest a circular enclosure approximately 50m in diameter and, within that, an arc of ditch, either a non-concentric inner circuit or part of another sub-circular enclosure. Further

evidence is required to corroborate the existence of these features, but if these ditches are of archaeological origin then they may be the remains of a monument of Neolithic or Bronze Age date.

Aerial photographs taken in 1995 show a large circular feature amongst other ditches in a field to the south of Twigmoor Hall (MLS10763). It sits near the centre of the field and is marked by two slightly irregular circuits of darker crop, approximately 125m and 110m in diameter with a circuit of riper crop between them (Fig. 4). This might suggest two ditches with a bank or berm between them. However, these marks are not visible on any of the other aerial photographs taken on different dates and so it is not certain that the cropmarks are of archaeological origin. The circuit straddles the outcrop of Pecten Ironstone that runs south-west to north-east through this field and there is a difference in height of 9-10m between the north-west and south-east sides of the enclosure. This cropmark is unexplained but there remains a small possibility that it is a monument of Neolithic or Bronze Age date.



Figure 4: Cropmark of a large circular feature of uncertain origin, south of Twigmoor (NMR12730_002 28 July 1995 © Crown copyright. Historic England Archive).

Concluding remarks

Despite the relatively small survey area and small corpus of monuments there is an emerging pattern of sites located along the western margin on of the Ancholme Valley, just upslope from flood plain and often overlooking a small tributary. Further survey work and analysis is required to see if this trend extends further north and south of this project area.

There are a number of features discussed above that require further investigation to ascertain their validity as archaeological features. This would require costly interventions at putative circular enclosures west of Appleby Carr and the circular enclosure south of Twigmoor Hall, potentially for very little gain if they are disproved. However, it might be possible to confirm the presence of the earthworks in Keb Wood with a simple visit.

The long barrow near Broughton was given scheduled monument status in 2022 and the potential mortuary enclosure was excluded from the listing. No further evidential information has come to light from this project that would warrant a re-consideration of that decision.

Iron Age and Roman settlement and landscapes

Overview

The small village of Dragonby, to the north-west of Scunthorpe, was built in the early 20th century but it lends its name to the significant Iron Age and Romano-British settlement in neighbouring fields (Fig. 5). The site of this settlement, also known as 'Money Field' and 'Coin Field' was revealed not only by its numismatic bounty but by the lines of white limestone that were brought to the field surface by ploughing (Dudley 1949, 183). Investigations showed that the limestone was the remains of a Romano-British building and this prompted a long sequence of archaeological surveys and excavations, prosaically reported as 'spade-work' by Dudley in 1949 and comprehensively described by May in 1996.

The aerial photographs of this site, mostly taken much later than the period of intense excavations, reveal a nucleated settlement arranged around a network of gently curving metalled roads. The two areas of open excavations were further to the west where there was poor cropmark evidence. May asserts that the cropmarks that are visible across Money Field do not come close to reflecting the density of the features nor the complexity of their relationships observed in the excavated areas.

By the early 1960s ironstone mining had already destroyed an unknown portion of the settlement and rescue excavations were initiated in 1964 to record features under imminent threat (May 1996, 4). The eastern side of 'Money Field' is now Scheduled but the site is repeatedly included on the Heritage At Risk Register due to damage caused by arable ploughing (HAR 2023).

The land to the west and south of Dragonby has been heavily impacted by ironstone mining. A small plateau at Conesby Farm has escaped mining and has yielded evidence of Roman settlement (MLS26092) but there is very little cropmark evidence. East of the settlement the land rises up to the Lower Lincolnshire Limestone where there are dispersed and fragmentary linear cropmarks that may indicate Iron Age or Romano-British fields (MLS19625 & MLS26846). This cropmark-amenable land quickly gives way to the windblown sands of Risby Warren where the visibility of buried features of all dates is heavily compromised.

The project area is traversed by two significant routes: Ermine Street and the Jurassic Way. The latter is a hypothesised long-distance trackway from Lincoln to the Humber Estuary at Winteringham and thought to be of Iron Age or earlier origin (MLS20003). In this project area it is thought to follow the Lincoln Edge to Risby Warren and from there maintain a near northerly orientation where the escarpment veers to the north west. A branch or alternative route takes it across the Frodingham Ironstone beds. There are long linear features that lie on or close to this purported trackway (MLS26801, MLS26789, MLS26789 & MLS26917) but these may have been known to those who theorised the route and therefore are not evidence of its existence.

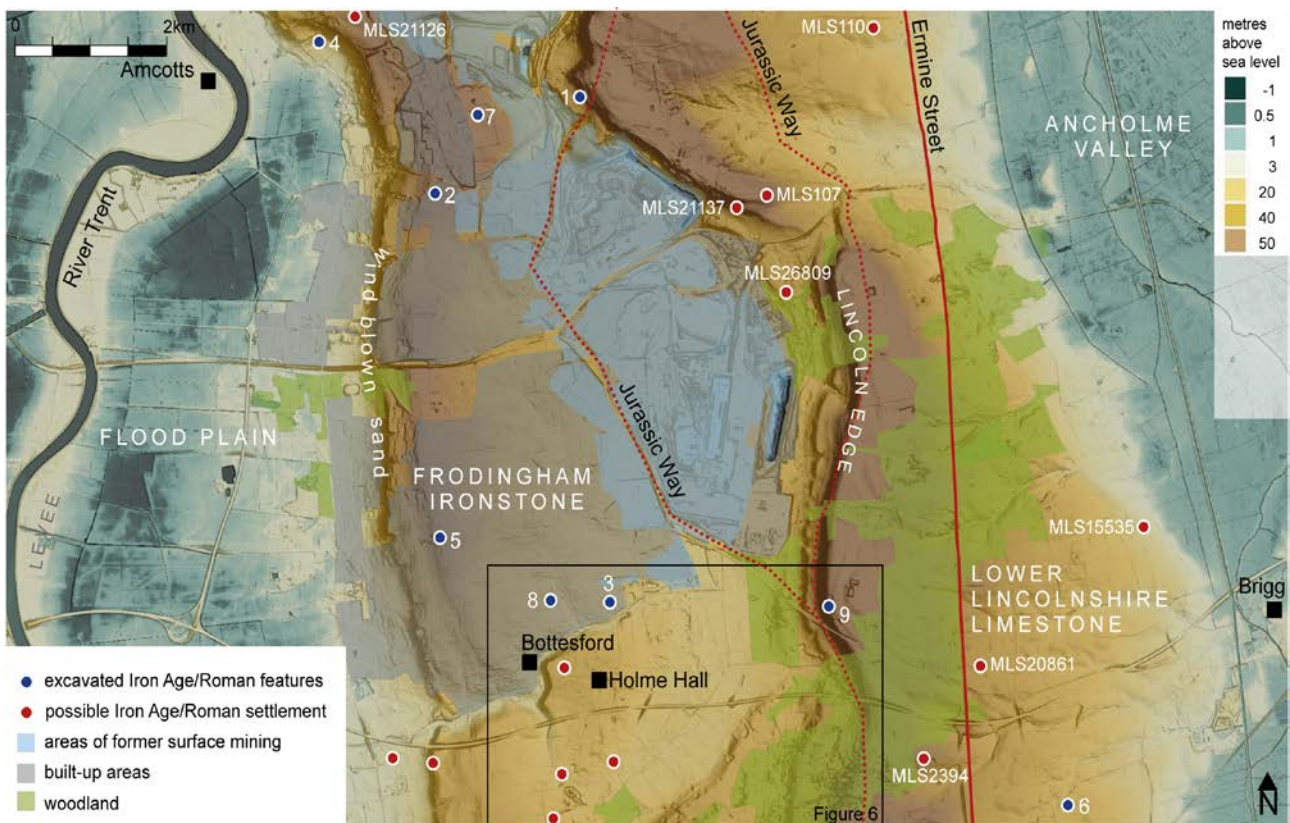


Figure 5: A distribution map of sites of known or possible Iron Age or Roman date. The excavated sites are: 1 Dragonby, 2 Land off Phoenix Parkway 3 Timberland 4 Flixborough Sand Quarry 5 Burringham Road 6 Scawby 7 Conesby 8 Frederick Gough School 9 Ravensthorpe. (Background generated from lidar DTM 2018 © Historic England; source Environment Agency, also includes North Lincolnshire HER data).

Ermine Street (MLS100) also runs from Lincoln to the Humber Estuary at Winteringham. In this project area it runs near north to south from a point west of Scawby to Appleby. For the most part it is still in use but at Broughton the modern road deviates a little to the east and there are earthworks in Manby Wood that may be remnants of earlier iterations of the road. (MLS19644). Three hundred metres further north, in the same woods, the lidar imagery has revealed a series of shallow scoops flanking the western edge of the road (MLS26870). These roadside pits may be of Roman origin and associated with either its construction or maintenance, but a later date cannot be discounted on the available evidence.

There have been many archaeological interventions across the wider project area: geophysical survey, trial trenching and excavation have uncovered other Iron Age and Roman sites. Many of these interventions were commissioned in advance of development. As a consequence there is a bias in the distribution of these settlements towards the Frodingham Ironstone, because this is where development in the late 20th and 21st century has been greatest.

These sites include:

- Land off Phoenix Parkway, Early to Middle Iron Age activity represented by a small number of ditches (MLS21265). A small number of features with an artefactual assemblage that indicates more intensive activity and possibly settlement to the north (Allen 2010, 14). The site and land to the north was open fields in the late 1940s but the land to the south had already been built on.
- Timberland Late Iron Age to Roman period settlement (MLS19772). The consolidated results from over 13 years of excavations and geophysical surveys reveal a possible Middle to Late Iron Age 'banjo' enclosure, Late Iron Age rectilinear enclosures with hut circles abutting a boundary ditch and, in the Late Iron Age/early Roman period, the superimposition of a large double-ditched rectangular enclosure (Richardson 2009, 40-43). Portions of this site were preserved in situ and thus some interpretation is speculative. The area of these excavations was still under arable cultivation and pasture in the 1940s and early 1950s but none of these features were visible on the aerial photographs.
- Flixborough Sand Quarry (MLS19690). Comprising possible Late Iron Age occupation layers and pits sealed by sand deposits and thus not visible from the air.
- Burringham Road, part of a landscape that was probably peripheral to the settlement(s), in use from the Late Iron Age through to the later Roman period (MLS20111). A short and narrow transect revealed droveways, small enclosures and corn dryers and a short section of a possible substantial settlement enclosure (Boyer et al 2009). The site was obscured by garden landscaping in the late 1940s and land to the north and west was given to houses and allotments, fields to the south and south-west were under arable and pasture, no features were visible.
- Scawby multi-phase early Roman farmstead (MLS26746) comprising rectangular enclosure and other ditches (ARS Ltd 2021). This area was arable or pasture in the 1940s but no features were visible on the aerial photographs.
- Conesby Farm Roman building and settlement (MLS26092). This site has been under pasture or arable cultivation since the earliest aerial photographs but no cropmarks or earthworks pertaining to these remains have been observed.

- Frederick Gough School produced evidence of Roman agricultural activity, likely to have been at the margins of an unknown farmstead (MLS22438). Pollen data has been used to reconstruct the environment conditions of the time. This site was under pasture in the 1940s and 1950s.
- Ravensthorpe rectilinear enclosure of Roman date (MLS26072). Finds within the ditches suggest the presence of a substantial building nearby. One side of the enclosure is visible on aerial photographs

In general, none of the Iron Age or Roman period features that have been excavated on these sites were visible on the available aerial photographs as cropmarks, soilmarks or earthworks. Although the overall form and layout of settlements at Dragonby, Timberlands and Scawby are understood from the excavations and geophysical surveys, at other sites the windows onto these landscapes are constrained by the developments that they mitigate for, rather than the logical limits of the archaeological features. In short there is a dearth of spatial data from the excavated sites against which to compare the layout, shape and size of the sites that appear as cropmarks. As a consequence, cropmark and soilmark sites are attributed to the Iron Age or Roman periods with the important caveat that these are untested interpretations.

There is a small area of complex rectilinear cropmarks on the northern edge of the project area at Flixborough (MLS21126). They suggest a linear arrangement of enclosures, but it is unlikely that these cropmarks reflect the full extent and complexity of the underlying archaeological ditches. Topographically, the site holds a commanding position over the flood plain and River Trent and also the ground to the east. In this respect it is similar to the Land Off Phoenix Parkway settlement, which lies 2.5km to the south.

Above High Santon, two large polygonal enclosures, possible smaller enclosures and field boundaries span the stepped escarpment (MLS21137 & MLS107). These and the fragments of field system observed east of Dragonby (MLS19625) may be the remains of Iron Age or Roman farming landscape and some elements may pertain to occupation.

Moving west, and circumventing the area south of Bottesford Beck for now, there are a handful of sites lying to either side of Ermine Street. The farmstead at Scawby is described as being in 'agricultural hinterlands east of Ermine Streets' and this might be applied to these putative Roman settlements.

West of Ermine Street at Appleby a small near square enclosure sits amongst possible contemporary field boundaries beside a possible long-lived trackway (MLS110). The trackway is one of several in the area that appear to use natural routes through the landscape. These continue further north beyond the area of this project and warrant further investigation. To the west of the trackway traces of possible hut circle may indicate a phase of unenclosed settlement (MLS110).

Further to the south and just east of Ermine Street very fragmentary cropmarks hint at a Roman settlement with a rectilinear building (MLS20861). Further reconnaissance of this site and the fields around it may prove productive.

To the south-west, cropmarks of rectilinear enclosures near Top Moor Farm coincide with surface finds including limestone rubble and tile fragments and pottery which strongly point towards the presence of Roman period building (MLS2394). However, the putative cropmarks of a building are unconvincing.

Arrangements of linear cropmarks have been recorded along the western edge of the Ancholme Valley, however many of these are thought to be field boundaries or drainage ditches of late post medieval origin. A possible exception is small group of features south of Brickhill Farms (MLS15535). The recovery of a Romano-British quern and greyware sherd from two locations in the vicinity lends a little credibility to this interpretation.

Disentangling features of possible Iron Age or Roman date from field boundaries and drainage ditches of significantly later date has been a particular challenge in the Holme area.

Holme

This area lies in the central southern part of this project and contains some of the more complex archaeological cropmarks recorded by this project. Topographically, it is an interesting area. Figure 6 shows a transect across the broadly north to south aligned geological and topographical transitions: the eastern edge of the flood plain to the west, a low escarpment onto the Frodingham Ironstone then the stepped escarpment of the Lincoln Edge, up to the Lower Lincolnshire Limestone.

Bottesford Beck drains south-westward towards the River Trent along a much straightened and re-routed course. A significant feature in this area is the shallow, flat-bottomed basin on the Frodingham Ironstone. This shallow basin, the beck and a small tributary together isolate the small area of land on which Holme Hall and a few dispersed farms stand. The placename Holme may come from the Old Norse 'holmr' an island, an inland promontory, raised ground in marsh, a river-meadow ([Key to English Place-Names](#)).

Until the 1950s this was a largely rural area and the small village of Bottesford was surrounded by fields, although housing had already begun to push south of Burringham Road and Ashby High Street. Through the second half of the 20th century residential development crept towards the north bank of the beck. In recent decades infilling north of the beck has prompted the archaeological investigations at Burringham Road, Timberlands and Frederick Gough School. The higher ground in the east of this area is far less developed but a green energy scheme prompted the investigations at Raventhorpe Farm.

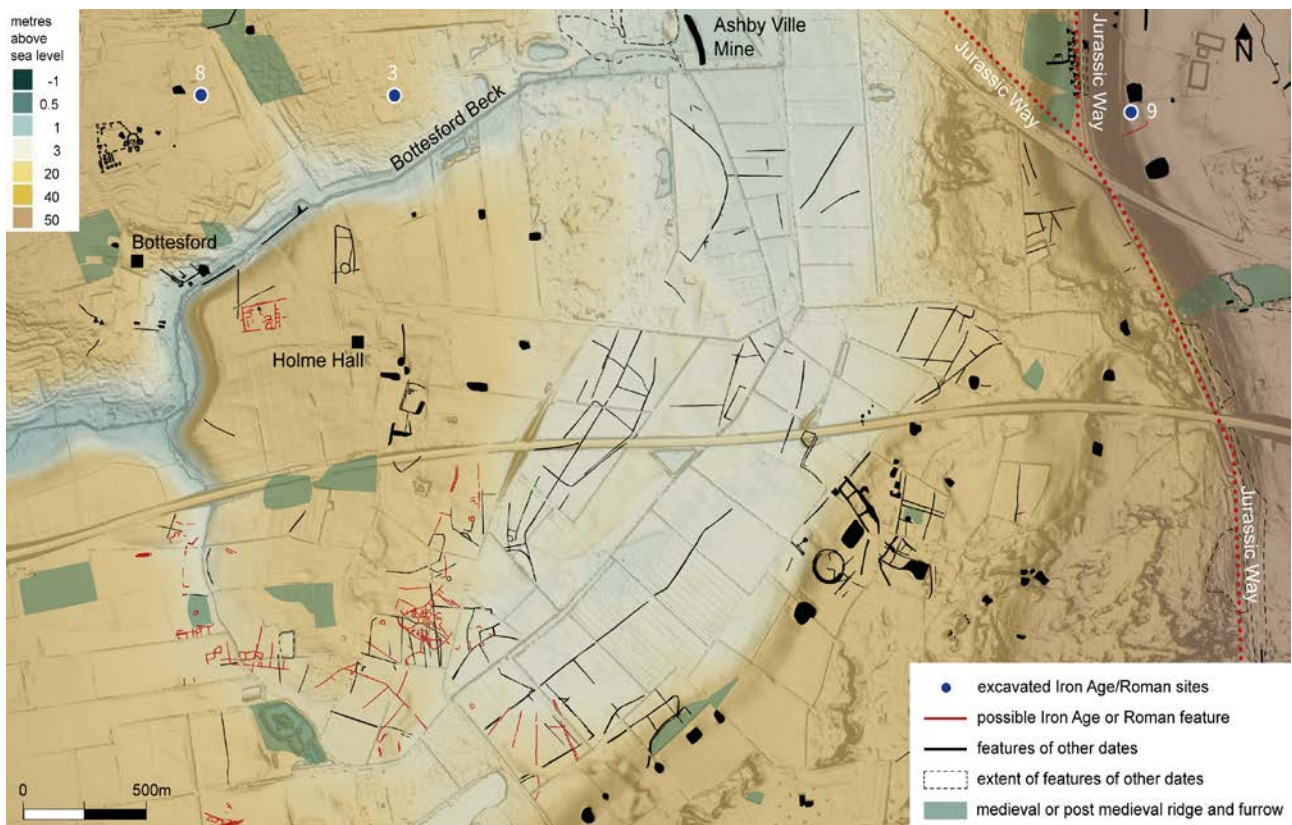


Figure 6: Iron Age and Roman features recorded in the area around Holme Hall. The excavated sites are: 3 Timberland, 8 Frederick Gough School 9 Ravensthorpe. (Background generated from lidar DTM 2018 © Historic England; source Environment Agency, also includes North Lincolnshire HER data).

South of Bottesford Beck there have been far fewer archaeological interventions so here interpretation of the visible features is reliant on morphology, historical cartography and surface finds. As noted in the previous section there are three potential monuments of possible Neolithic or Bronze Age date though none has been identified with confidence.

At the southern edge of the shallow basin, east of Holme Plantation, there is an arrangement of pit alignments (MLS1849). Four alignments converge towards the basin from slightly higher ground to the south, three are single rows of pits, one is a double with a consistent c. 5m gap between each row. A single short linear feature, possibly also defined by pits, runs perpendicular to the double pit alignment. A similar and probably contiguous arrangement was recorded to the immediate south-west of Holme Plantation by the Lincolnshire NMP Project (MLS2187). These pit alignments were investigated during the course of sand extraction in the late 1970s. Although much damage had already been done to this group the excavations confirmed the regularity and rectangular shape observed in the cropmarks east of Holme Plantation. No dating evidence was retrieved but comparison with similar arrangements in Northamptonshire

indicates that a Late Bronze Age to Iron Age data is conceivable (Deegan 2007, 122-123). Environmental evidence collected from the site indicated the presence of rush plants and burning of woodland nearby at the time the pits were open (MLS2187).

There are several significant settlement foci in this area that may be of Iron Age or Roman date: west of Holme Plantation, the south-eastern margins of the Holme island, the banks of the un-named tributary and overlooking Bottesford Beck. However, it is clear from the fragmentary nature of the cropmarks and the number of fields that have not produced any cropmarks that this is an incomplete picture. This is despite fairly intensive coverage: there are already several hundred aerial photographs that have specifically targeted the cropmarks in this area. However, there is dearth of recent, high-quality, colour coverage and several years of repeated and well-timed aerial reconnaissance is required to gain a fuller picture of this landscape.

The features to the west of Holme Plantation are at the very edge of this project's area. The rather indistinct cropmarks suggest a tight arrangement of rectilinear enclosures, seemingly cut or cutting a short section of triple ditch boundary (MLS10813).

There are cropmarks along the south-east flanks of the Holme island (MLS1848). These strongly suggest a large centralised settlement in the fields to the west of Clarks Farm (now Willow Farm). It comprises a number of rectilinear enclosures within and around which are several hut circles, all seemingly confined within a large irregular area loosely defined by ditches. These features are very similar in scale and layout to the settlements at Hungerhills and Wattlesyke in West Yorkshire. The latter was excavated and dated to the Iron Age and Roman periods (Martin et al 2013). At Holme, field boundaries and other enclosures extend out from this settlement along the south-east edge of the island.

Along the banks of the un-named tributary there are very fragmented and disjointed cropmarks that together suggest several linear arrangements of small enclosures. It is tempting to see similarities between these features and the Late Iron Age phase 3 enclosures uncovered at Timberlands but realistically the cropmark evidence is too ambiguous (Richardson 2009, Fig. 5).

A large rectilinear enclosure occupies a prominent position overlooking Bottesford Beck to the north and the Holme island and shallow basin to the south. It was probably inter-visible with the site of the settlements at Timberland and possibly, depending on the ground cover, the large rectilinear enclosure Raventhorpe, on the Lincoln Edge. This enclosure bears comparison to the Timberland Phase 4 enclosure, which was preserved in situ rather than excavated. Measuring 130m by 90m the enclosure is slightly larger than the Timberlands example, which is 100m by 65m, though the proportions are similar. They both have internal enclosures or subdivisions and both appear to have been built along existing boundary ditches. Both examples bear comparison to Winton's Roman settlements with possible villas from the area to the immediate south (Winton 1997, Fig. 4.1-3). A hoard of 1st to 3rd-century coins (MLS19473) was found in the adjacent field.

Further to the west there are two small rectilinear enclosures overlooking the flood plain and Bottesford Beck. Below these, on the wind-blown sands at the far outer edge of the flood plain there are cropmarks that indicate a series of field boundaries and one or more possible enclosures, amongst recent field drains. Most of the ditches and banks that appear as cropmarks on the flood plain are demonstrably linked to the practice of warping but here the closest warp deposits are nearly a kilometre further to the west. An area to the south of the putative enclosure was excavated in 2007 but only a single undated post hole was found (MLS20223).

These varied settlements would have had access to a variety of landscapes and resources. Bottesford Beck offered a route across the flood plain to the River Trent as well as valley-side grazing. On the higher ground the soil were free draining and fertile for cultivation. Limestone for building could be sourced from the Lincoln Edge and Lower Lincolnshire Limestone. The shallow basin and the flood plain could have provided reeds and rushes, waterfowl, fish and eel, although only the excavations at Burringham Road at Dragonby have produced any evidence that fish and eel were part of the Iron Age or Roman diet, and then in very small quantities (Palaeoecology Research Services 2009, 64; Jones 1996, 164).

There is evidence that peat was burnt as fuel from Timberlands and heather, possibly from living plants or from peat, at Burringham Road (Richardson 2009, 38; Boyer et al 2009, 32). Both of which would have been available from flood plain and the shallow basin.

Dudley noted the availability of bog iron in the shallow basin, as well as the ore in the outcropping of Pecten Ironstone. At Timberlands small quantities of smelting slag was recovered from Iron Age contexts and block slag found at Phoenix Parkway is also considered to be of Late Iron Age date, though neither are considered conclusive proof of iron smelting on these sites. (Cowgill, 2009a, 35; Cowgill 2009b, 73-74). Small quantities of possible smelting slags were found in Late Iron Age to later Roman-British contexts at Dragonby. Dudley notes that substantial quantities of iron slag were present in fields around Top Farm, and the putative villa site (MLS2394). Whilst this evidence is thin it does demonstrate that iron was being made in the area in these periods.

Many of the earthwork, cropmark or soilmark features recorded in this area are likely to be of later date. There are possible medieval settlement remains running south from Holme Hall and perhaps later features at Twigmoor Hall (MLS1850, MLS26908 & MLS26909). However, many of the long linear ditches, particularly those in the shallow basin, pertain to 19th-century drainage schemes and correlate close with features depicted on various 19th-century maps. They are likely to be the remains of a late post medieval strategy to drain the lower lying land into Bottesford Beck.

Conclusion

The cropmark evidence for Iron Age and Roman settlement is largely concentrated in the area around Holme in the south and at Dragonby in the north of the project area. However, the evidence of archaeological excavations and chance finds strongly suggests that the area of Frodingham Ironstone Member between the two, which is now almost completely built over, would have supported numerous communities, farming and other activities.

Outside the areas of former mining and modern development this method of prospection is impeded by unyielding land cover: alluvium, warrens and woods. Disappointingly, the lidar data has contributed little for these periods in the large tracts of woodland. The presence of medieval or post medieval earthwork ridge and furrow in some woods perhaps indicates that the earlier sites had already been levelled by ploughing.

Sites and landscapes of known or possible medieval or post medieval origin

There have been several significant archaeological excavations within the project area. Finds made by Derrick Riley in 1933 led to the discovery of a middle to late Anglo-Saxon cemetery and settlement at Flixborough when decades later, the site was threatened by sand extraction (Lovelock et al 2007, 4). The outer court at Thornholme Priory, whose impressive ruins had stood on the edge of the Ancholme Valley for centuries, was excavated by Glyn Coppack in the 1970s (MLS78). The moated site at North Conesby was depicted on the late 19th century Ordnance Survey maps, but soon after was buried beneath slag from the nearby iron and steel works. In the early 2000s the slag was removed, giving the opportunity for archaeological excavation of the moat and its interior platform. This yielded evidence for a sequence of buildings and a bridge across the moat ditch (Leahy and Steedman 2008).

This section will briefly review the aerial evidence for some of the known medieval sites and settlements and focus in on the landscape around Thornholme Priory (Fig. 7). It will also highlight a particular monument type: the retting pit, most examples of which are likely to be of post medieval date.

Medieval settlements

Sawcliffe, High Risby and Low Risby

Four medieval villages lie close to Risby Road, which traverses the Lower Lincolnshire Limestone. Sawcliffe, High Risby and Low Risby were depopulated in the medieval period but Appleby, which sits at the intersection of Risby Road and Ermine Street, thrived.

Today, Sawcliffe Farm stands in the north-east corner of a rectangular field containing the earthwork remains of the village of Sawcliffe (MLS1996). The earthworks within this field are scheduled monuments (NHLE1017554). Aerial photographs taken in 1947 show that the fields to the north, south and west were under cultivation at that time and any settlement remains that had extended into these fields had been ploughed to ground level. The field to the east, however, was still under pasture and it appears that the settlement did extend a little further in this direction.

The earthworks south-west of the farm fall into two groups – an arrangement of large earthwork ponds to the north and a hollow way flanked by buildings to the south. Some of the building remains are sharply defined on the lidar imagery and produce parchmarks in dry summers, which suggest low stone walls may survive below the grass and topsoil.

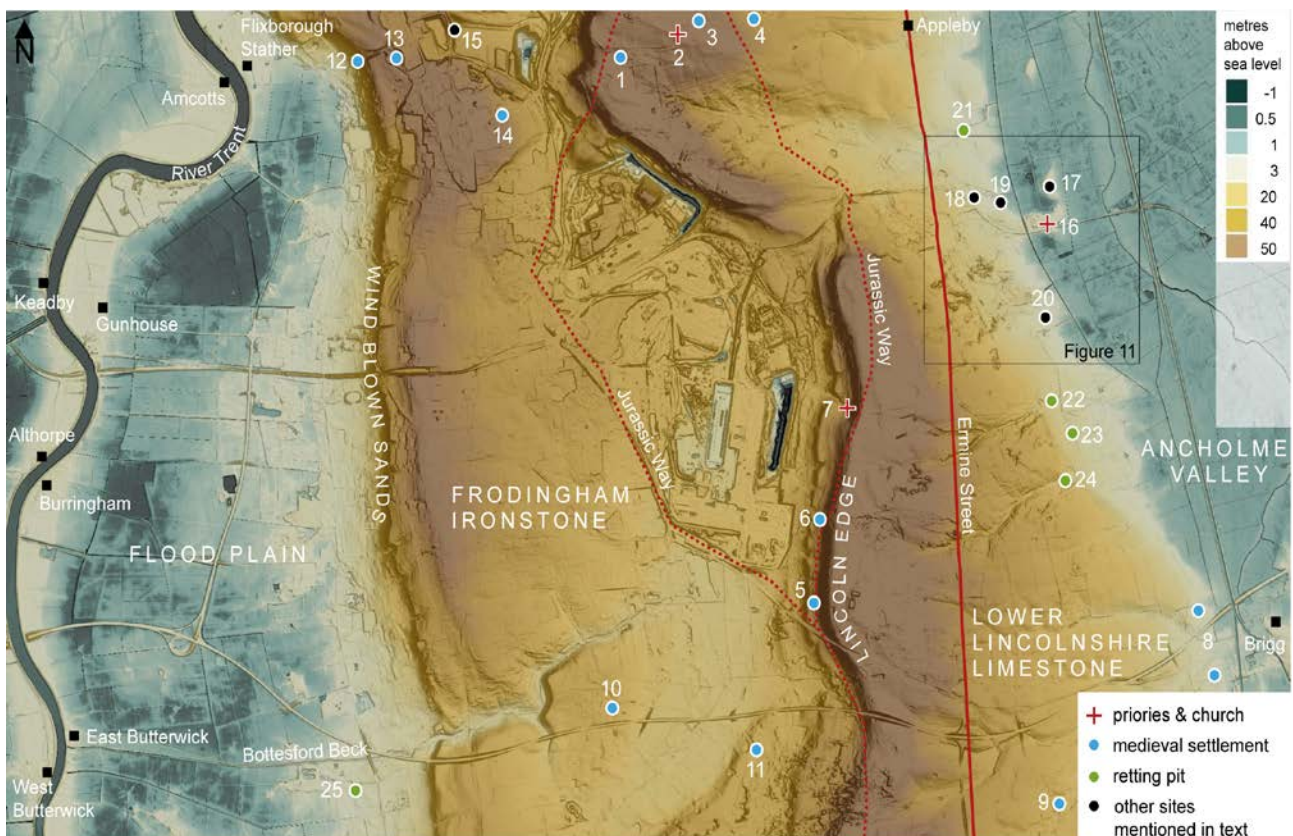


Figure 7: Distribution map of medieval settlements and other medieval and post medieval sites mentioned in the text. (1 Sawcliffe MLS1996, 2 the church of St Bartholomew MLS19667, 3 High Risby MLS1989, 4 Low Risby MLS1988, 5 Ravensthorpe MLS1828, 6 Manby MLS26899, 7 Gokewell Priory MLS1805, 8 Castlethorpe MLS726 & MLS1791, 9 Sawby MLS26932, 10 Holme MLS1850, 11 Twigmoor Hall MLS26908 & MLS26909, 12 Flixborough Anglo-Saxon settlement MLS5018, 13 North Conesby moat MLS2213, 15 MLS1972, 16 Thornholme Augustinian Priory MLS78, 17 MLS22703, 18 MLS26821, 19 MLS24694, 20 MLS10742, 21 retting pits MLS22609, 22 retting pits MLS26865, 23 retting pits MLS26876, 24 retting pits MLS26873, 25 retting pits MLS26938). (Background generated from lidar DTM 2018 © Historic England; source Environment Agency, also includes North Lincolnshire HER data).

A short distance to the north-east of Sawcliffe lie the remains of the church of St Bartholomew (MLS19667). These comprise the low, grassed-over walls of the church building within a D-shaped enclosure. The church earthworks are Scheduled (NHLE1016931). The church had a long history, the Domesday Book of 1087 lists a church at Risby, it passed into the possession of Thornholme Priory in the 12th century and was still in use in the early 17th century (NHLE1016931). The medieval settlement at High Risby lay to the north-east of the church and is likely to be partly obscured by High Risby Farm. The historical aerial photographs show expansive, if rather indistinct earthworks covering across the two fields east of the farm (MLS1989). These earthworks include enclosures and buildings flanking an east to west aligned trackway which runs parallel to Risby Road. Both fields have now been ploughed, except for a narrow strip of ground, left for unknown reasons, in which a small proportion of the earthworks still survive.

A few fields eastward and downslope are the remains of Low Risby (MLS1988). The earthworks that were visible in 1947 suggest a single row settlement along a continuation of the trackway observed at High Risby. Most of these earthworks had been ploughed to ground level by 1953. A large square mound survives at the east end of the village but this appears to be associated with a post medieval building (MLS26058).

The church of St Bartholomew stands close to the meeting of three roads or trackways: Risby Road, the trackway that ran through the Risbys and a route that is aligned north-west to south-east. The latter is visible as a soilmark to the south-east of the church and was preserved in field boundaries to the north-west (MLS22401). Given the church's links with Thornholme Priory this may have been part of a direct route between the two sites.

Ravensthorpe, Manby and Gokewell Priory

The medieval settlements of Ravensthorpe and Manby and Gokewell Priory lie along the Lincoln Edge. Ravensthorpe is a well-preserved linear settlement that runs along a narrow shelf of Whitby Mudstone Formation (MLS1828). The land falls away to the west and, to the east, rises up onto the Lower Lincolnshire Limestone and the site of putative Roman villa (MLS26072). The visible settlement remains flank the eastern side of a hollow way and include the outlines of at least 15 buildings. They are truncated to the east by a modern farm track. Aerial photographs taken in 1956, when there was a light cover of snow on the ground, suggest that there may have been disturbed earthworks east of the modern trackway, but these have now been levelled. At odds with this linear arrangement is the rectangular building on a slight mound that is situated at the edge of the low escarpment, west of the village. This is thought to be the church.

There are hints that the medieval trackway continued northwards towards what is now Manby Hall. The hall is likely to be on the site of the medieval village of Manby (MLS1806). Two hollow ways converge in the woods and fields north-west of the hall, one descending from the Lincoln Edge in a south-westerly direction, the other heading northward and gradually descending towards the foot of the escarpment. The former is so deeply incised that at some point an earthen causeway has been built across it. The fields to the immediate west of Manby Hall have been taken by ironstone mining but the historical aerial photographs show that there was medieval or post medieval ridge and furrow here.

Further north along the escarpment is the site of Gokewell Priory, a small Cistercian nunnery established in the 12th century and dissolved in 1536 (MLS1805). The priory was built at the source of a spring, which rose in the escarpment and flowed westward. Earthworks on this site are now largely confined to the narrow strip of woodland that

hugs the banks of the spring and contains the ruins of a later farmhouse and courtyard farm. The surrounding fields were ploughed in late 20th century, which removed all of the earthworks that had survived into the 1940s and 1950s (see Fig. 8).

Ordnance Survey archaeologists had surveyed the site in 1962 (HE RR63805). The historical aerial photographs show further details. They show a near-square precinct laid out around the spring and beck, which were dammed to form one or more ponds. An L-shaped embankment in the south-west corner of the precinct, may be the remains of another enclosure with a slightly different layout. Outside of the precinct there was large near-square enclosure, which contained possible building remains, a pond and a dam. The enclosed areas were surrounded by ridge and furrow. There are numerous other shallow hollows within and outside the enclosures, some of which are likely to be post medieval dewponds or extraction pits.

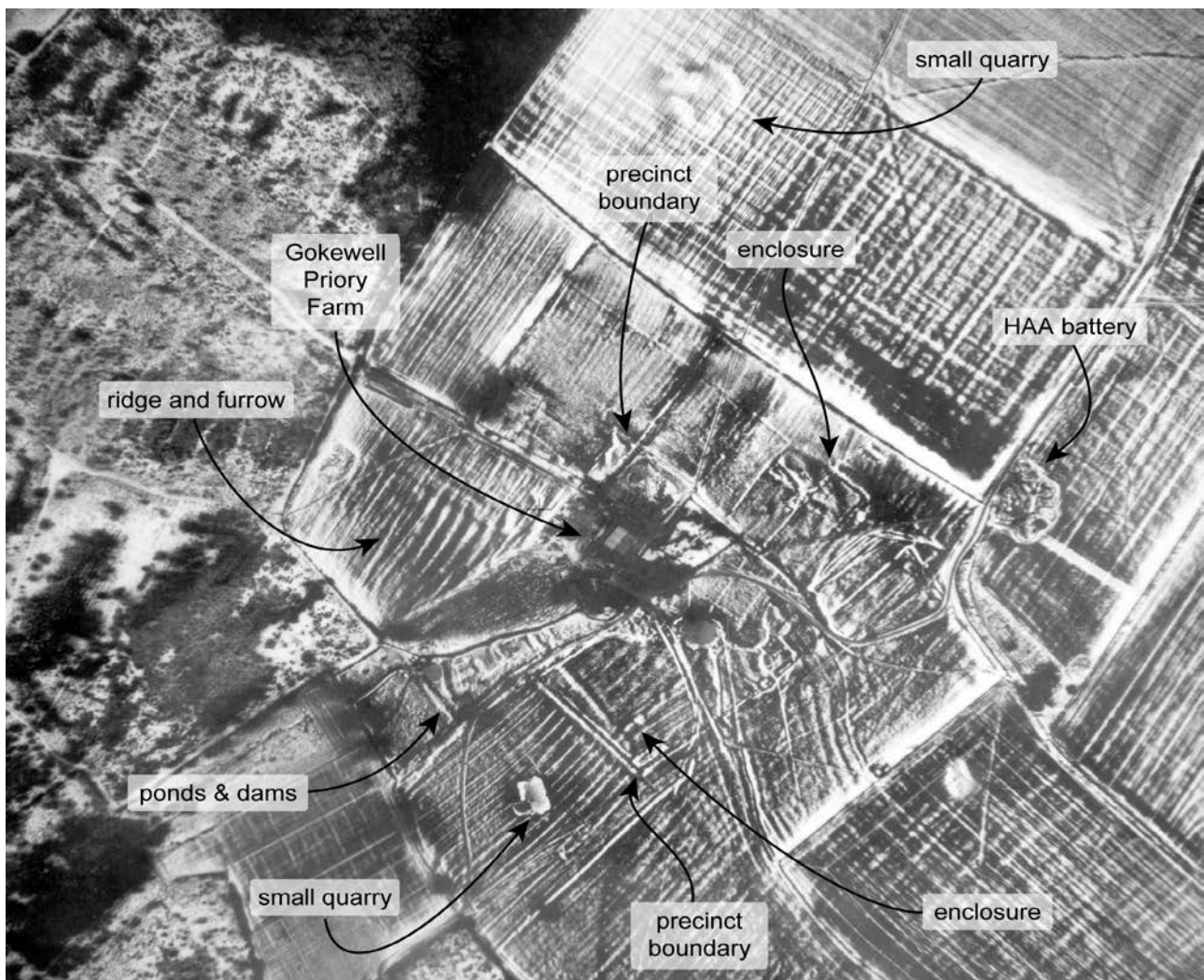


Figure 8: A vertical aerial photograph of Gokewell Priory taken in 1956 (part of RAF/58/1934/V/133 12 January 1956 Historic England Archive (RAF Photography)).

Castlethorpe

In the late 19th century Castlethorpe was represented by diverse properties strung along Brigg Road: Castlethorpe House, Castlethorpe Mills, Tan Yard, Malthouse and Castlethorpe Hall. These stood on the lower slopes of the Lower Lincolnshire Limestone, on the western edge of the Ancholme Valley. Nearby Brigg held a strategic crossing point on the River Ancholme, taking advantage of a narrowing of the river valley at this point and was at the southerly limits of the river's tidal reach.

Amongst this dispersed post medieval Castlethorpe there are two distinct areas of earthworks that may be the remains of medieval and/or early post medieval settlement.

The southernmost group lies close to Scawby Road, which leads to the river crossing at Brigg (MLS726). This group comprises a moat flanked by enclosures, possible building platforms, ridge and furrow and field boundaries. There is also evidence that shallow sand or gravel extraction has removed some features. The moat and its immediate environs are scheduled (NHLE1016429)

The second group is close to the 18th-century Castlethorpe Hall or Manor House (see Fig. 9). Here the land falls gently to the south and east towards an un-named beck and the edge of the Ancholme Valley. The beck rises west of Ermine Street, flows eastward to Brigg Road and then southeast towards the river.

The most substantial earthworks stood in a rectangular area east of the hall. Here, the junction of two substantial ditches, has been interpreted by some as the north-east corner of a large moated enclosure, the other parts being masked or destroyed by the hall complex. The ground between the ditches and the hall, the interior of the putative moat, is divided by grassed-over walls and two large walled-enclosures.

East of the large ditches an unusual circular feature sits at the centre of one of two enclosures. It is approximately 13m in diameter and maybe the robber trench of a substantial circular building. East of this are broad ditches and banks that appear to be the remains of fishponds intercut with plough ridges.

A hollow way runs from the south-east corner of the Castlethorpe Hall complex down to the beck. Small walled enclosures and buildings flanked either side. There are more fragmentary settlement remains west of the hall.

Most of the earthworks in this area were levelled by ploughing in the second half of the 20th century and some elements were probably destroyed when the M180 was constructed. Cropmarks and soilmarks relating to the levelled earthworks have continued to appear in the last decade, which indicates that some features do still survive below ground level.

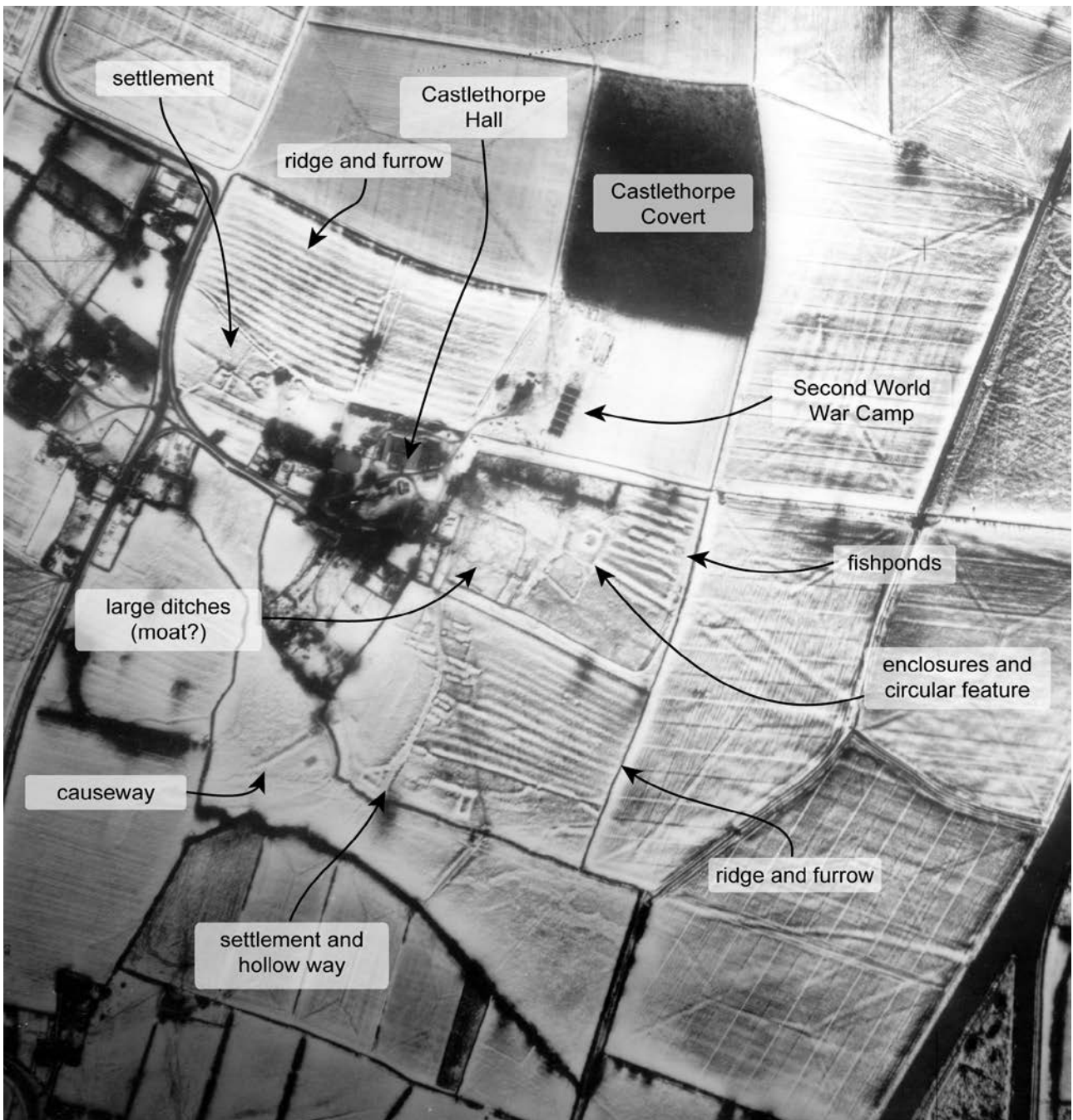


Figure 9: A vertical aerial photograph of Castlethorpe taken in 1956 (part of RAF/58/1934/V/87 12 January 1956 Historic England Archive (RAF Photography)).

Flixborough & Conesby

As the introduction to this section alluded, aerial photography played no part in the discovery of the Anglo-Saxon settlement and cemetery at Flixborough nor the moat at North Conesby. However, the appearance of cropmarks on the east side of Conesby Farm did prompt investigations that would reveal extensive Roman and medieval settlements, with the latter likely to be the remains Great Conesby (MLS1854).

A little to the north North Conesby Moat and the Great Conesby settlement historical aerial photographs have revealed a small group of earthworks. These have previously been overlooked, probably because they were destroyed by ironstone mining in 1960s. They appear to have comprised the low, grassed over remains of a rectangular building, a T-shaped mound, two oval mounds, seemingly cut by ditches or trenches and a section of hollow way running north to south. They were located in a small field on the east side of Normanby Road, that sloped gently southward towards an unnamed beck. The remains of a small quarry are visible in the south-west corner of the field. The significance of these remains is that they appear to coincide with observations made by R H Arrand in 1949 'In the field at the other side of the road at the top of the hill, I found two sites of burnt sand with scraps of medieval pottery and various bits of rubbish including a piece of sheet lead, which may or may not be anything' (quoted in MLS1972). Furthermore, in the early 1960s an Anglo-Saxon urn was recovered in this field during ironstone mining along with a quantity of medieval pottery.

Holme Hall and Twigmoor Hall

Loughlin and Miller identified the area around Holme Hall as the likely location of the Holme medieval settlement (1979, 200). Collectively the aerial photographs and lidar imagery have revealed a disjointed arrangement of features (MLS1850). A possible trackway runs near north to south, possibly flanked by fields or paddocks. There are several oblong hollows that have the appearance of medieval fishponds but may instead be post medieval extractive pits. There is no clear evidence of low building remains such as those visible at nearby Ravensthorpe (see above).

Twigmoor Hall lies on the opposite side of the shallow basin to the Holme. Fields on all sides contain low earthworks or cropmarks (MLS26908 & MLS26909). Most of these appear to be related to late post medieval drainage and some are small quarry pits but amongst these may be features of earlier date. It would be useful to monitor this area, particularly in times of drought, when the ditched features and any buried building remains may be revealed in more detail. However, an alternative remote sensing technique, such as resistivity survey may be applied more successfully here.

Thornholme Priory & its environs

Thornholme Priory was founded in c. 1150 and dissolved in 1536. The priory was sited on the western edge of Ancholme Valley. More specifically, the surviving earthworks are concentrated along a narrow strip of ground where the Jurassic limestone rises very slightly above the flood plain and reaches eastward towards the river. The land to the north, east and south is low lying and prior to drainage was 'a former tidal wetland consisting of saltmarshes, reedswaps and alder carrs...' (Neumann 1998, 76).

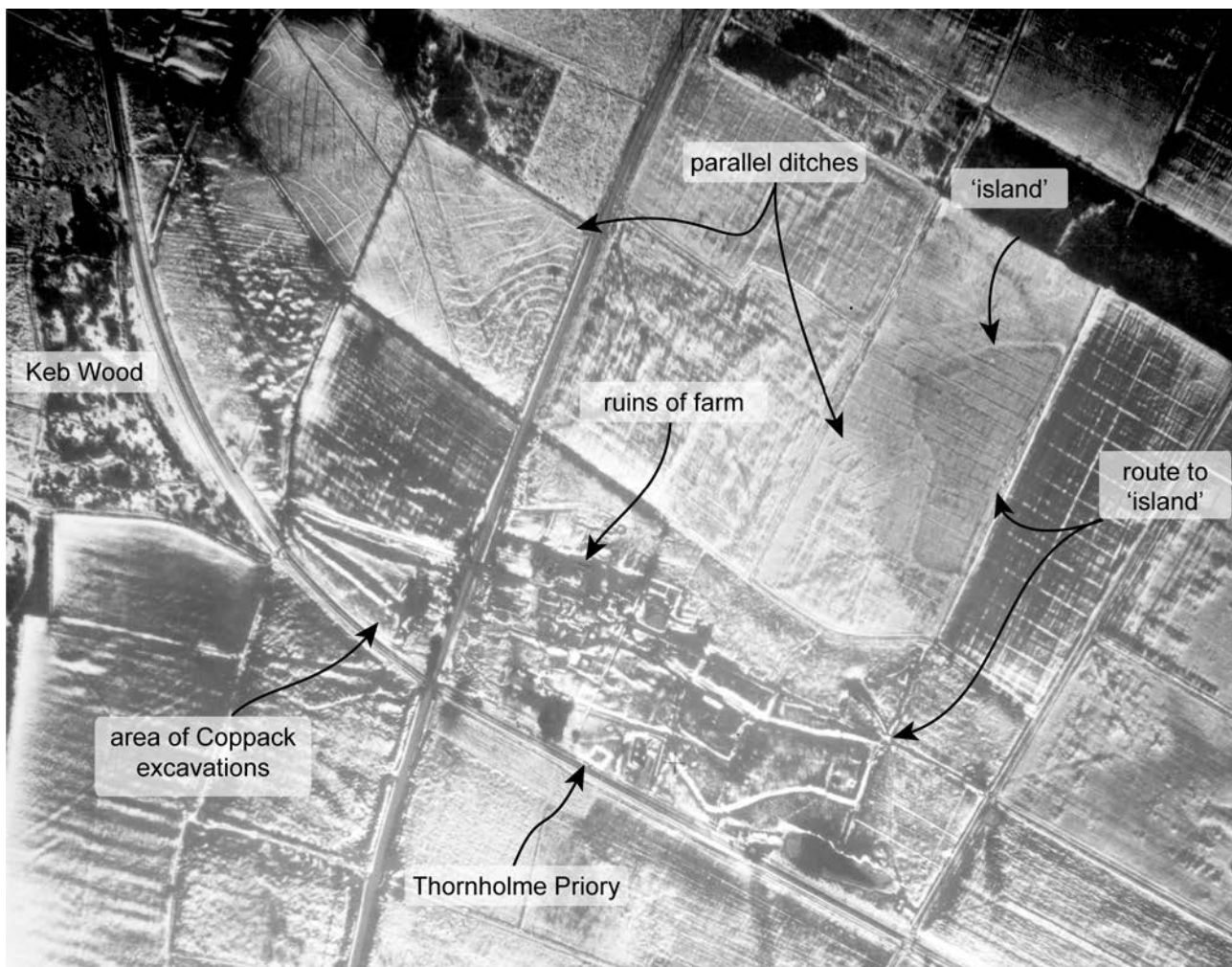


Figure 10: A vertical aerial photograph of Thornholme Priory taken in 1956 (part of RAF/58/1934/V/137 12 January 1956 Historic England Archive (RAF Photography)).

Prior to the 20th century the priory earthworks had been disturbed by the construction of Priory Farm, which sits on top of some of the priory earthworks and is now in ruins; the cutting of West Drain, which runs along the outer edge of the flood plain; and the construction of the Trent, Ancholme & Grimsby railway line, which truncates the southern edge of the priory complex. Excavations in the 19th and 20th centuries have revealed complex sequences and layers of buildings. Clearly the earthworks and grassed-over stonework that are visible on the aerial photographs and the lidar imagery are only the uppermost palimpsest of the deeply stratified remains.

The aerial photographs and lidar imagery have, however, identified several intriguing features in the vicinity of the priory (Figs 10 and 11). These are, so far, undated but may be relevant to the priory's economy.

North-east of the priory another small island of limestone rises above the flood plain. It is roughly D-shaped in plan, is approximately 265m long and 125m wide and, like the location of the priory, covered in wind-blown sands. Historical aerial photographs show the western edge of this island was marked by a low scarp slope, which may have been artificially enhanced to prevent flooding. Until the middle of the 20th century a field boundary ran along the eastern edge of the island, and this in turn may have followed the remains of a route leading up onto the island from the far eastern end of the priory complex.

The presence of ridge and furrow indicates that at some time the island was ploughed. There are also several other discrete features: mounds and small enclosures, which may be the remains of other activities.

Mid-way between the priory and Ermine Street the historical aerial photographs show earthworks extending across several fields. Many of those to the north of Sand House are likely to relate to post medieval drainage and field boundaries. However, amongst these there are possible building remains and ditches that suggest a small medieval settlement; unfortunately truncated and bisected by the railway line.

North-east of Sand House there is an unusual and extensive arrangement of parallel ditches or gullies covering an area of approximately 8ha. A similar arrangement, covering approximately 14ha lies nearly 1.4km to the south and a smaller and somewhat simpler group has been identified west of the island.

The two larger arrangements comprise bundles of narrow trenches or gullies in various orientations. Some are straight, others sinuous and they appear to follow the very subtle changes in topography. They fan out from, or converge into, broader ditches, which are generally quite straight and run across the contours. Both arrangements are located on the edge of the flood plain and between areas of slightly higher ground.

These ditches survived as earthworks into the 1950s and were most clearly defined on photographs taken in 1956, when there was a light dusting of snow (see Fig. 10). They were ploughed level in the second half of the 20th century. However, the presence of cropmarks on more recent aerial photographs demonstrates that some do survive below ground level.

The purpose of these arrangements is unclear. The complex configuration of parallel ditches is similar to that required for wetting water meadows. Water meadows were designed to 'float' a shallow film of moving water across grassland, either to elevate the ground temperature in winter and/or to increase fresh water supply in the summer. The former would protect grass from frost and lengthen the growing season, the latter would encourage a larger, richer hay crop (Historic England 2018, 1).

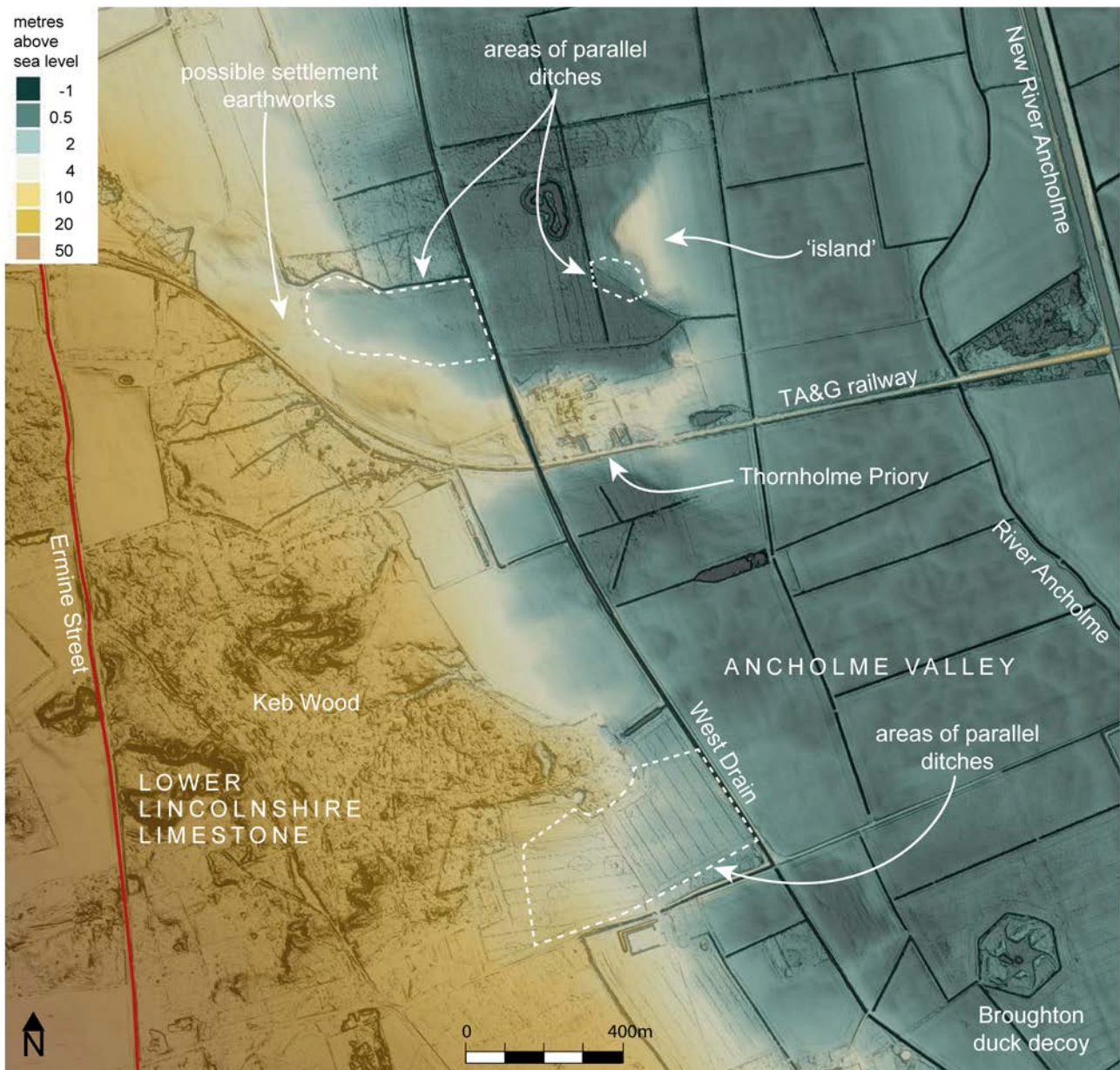


Figure 11: The topographic setting of Thornholme Priory. (Background generated from lidar DTM 2018 © Historic England; source Environment Agency).

Catchwater schemes distributed water via field gutters that ran near-parallel to the contours on hillslopes and valley sides (Historic England 2018, 5). Bedwork systems were more complex and developed for level terrains, such as floodplains. Carefully controlled water was channelled along the crests of low ridges so that it would spill down their shallow slopes to create an even and constant film of flowing water. No such ridges are visible on the historical aerial photographs on these sites and it is unlikely that these could have been removed by ploughing or other actions without also disturbing or backfilling the narrow ditches. In short the arrangements observed near Thornholme Priory, resemble catchwater systems applied in an environment where bedwork water meadows would perhaps have been more effective.

These irrigation techniques are often considered to be 16th-century progressions from an older practice holding a shallow body of still water over the ground (Historic England 2018, 2). Cook et al have argued that the catchwater system may have earlier origins and noted ‘the well-established interest of monasteries in water management schemes, and their expertise in hydraulic engineering, may suggest that meadow irrigation was a particular feature of monastic land management’ (2003, 162). However, it must be questioned whether water meadows would have had useful purpose in these locations before the major drainage schemes were initiated.

Alternative interpretations are equally unsatisfactory. These arrangements bear some similarities to the herringbone arrangement used in modern field drainage. However, most of the narrow ditches run with rather than across the contours and the sinuous nature of some suggests this is not their purpose. Patterns of similar layout and scale are seen in forestry plantations. Although the two valley edge examples are both adjacent to Keb Wood, there is no evidence for trees on these sites on Bryant’s 1828 map or the 19th-century and early 20th-century Ordnance Survey maps.

The HER monument record for the priory includes a quote from Read’s History of the Isle of Axholme concerning its environs ‘A considerable quantity of the land has been enhanced in value, and been made more productive, having recently undergone the process of warping.’ (MLS78). Read was writing in 1858, when there was still considerable warping activity along the lower Trent Valley. However, the uppermost deposit at the valley edge sites is wind-blown sand and the island examples are on a small exposure of the Jurassic limestone.

In conclusion the function and date of these features is uncertain, but a possible role in the economy of Thornholme Priory should not be discounted and these features warrant further documentary research and ground investigation.

Retting pits

This project has identified groups of features that are tentatively identified as retting pits or ponds. Retting is an important stage in the process of transforming a hemp or flax crop into textiles and ropes. The harvested crop is de-seeded then soaked in water to release the long fibres from the more woody components. The retted matter is then dried and the woody components physically removed by breaking and scutching. Hackling, liking combing fleece, aligns the fibres, which are then laid out in the sunlight to bleach before spinning and weaving.

South of this project area Everson et al identified a large group of earthwork retting pits in wood and scrub to the south of Scotter (see Fig. 12.A; MLI51280). Possible examples were recorded as cropmarks by the Lincolnshire NMP project near Scotterthorpe and near Holme Planation (HE RR1057084 & HE RR1058182).

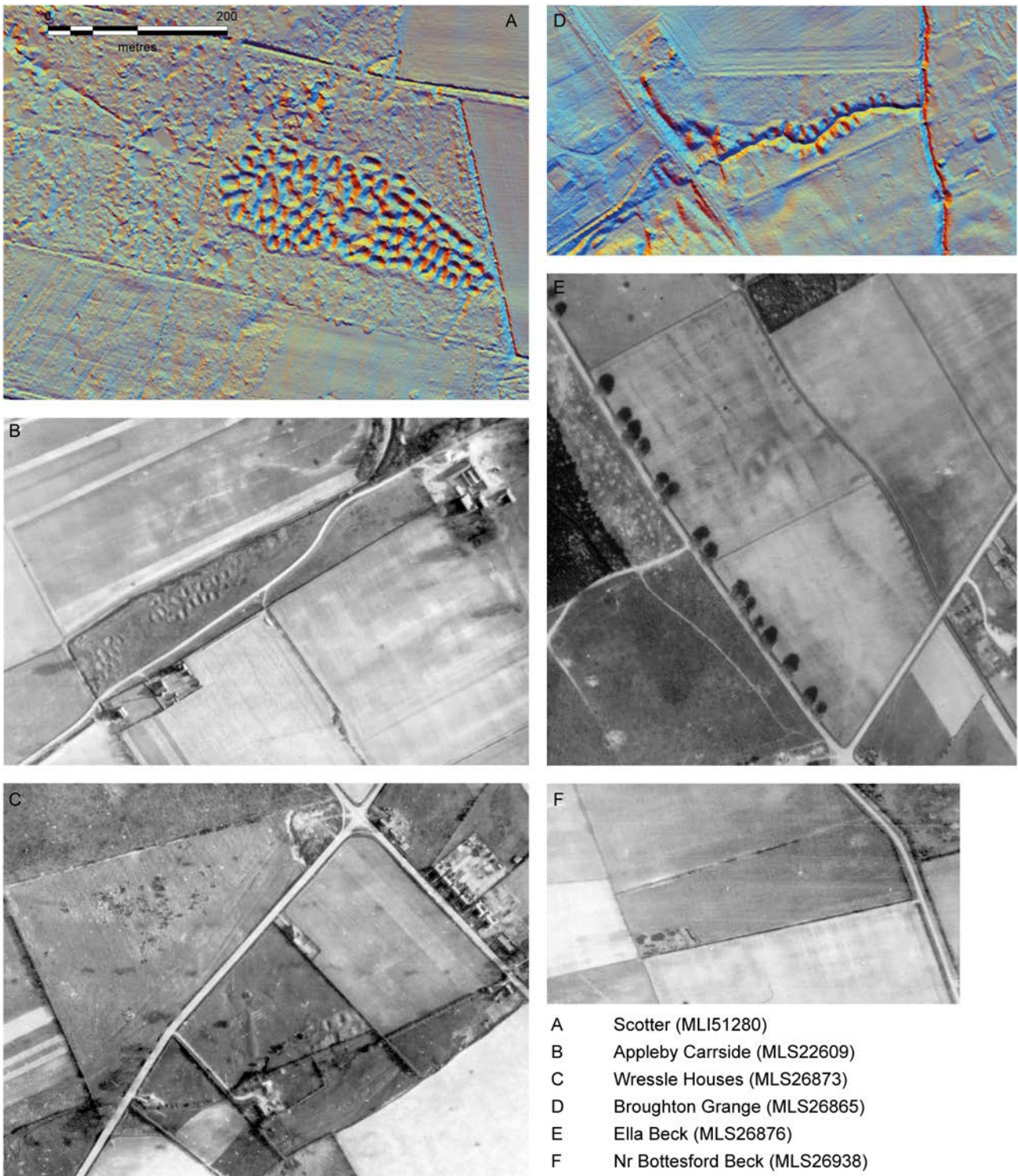


Figure 12: Examples of retting pits. (A & D lidar DTM 2018 © Historic England; source Environment Agency; B part of RAF/CPE/UK/2042/FP/1009 29 April 1947; C part of RAF/CPE/UK/2042/FS/2084 29 April 1947; E part of RAF/3G/TUD/UK/203/V/5210 12 May 1946 and F part of RAF/CPE/UK/2042/FP/1096 29 April 1947 all Historic England Archive (RAF Photography)).

Most of the possible retting pits identified by this project are located low on the dip slope of the Lower Lincolnshire Limestone, close to the western edge of the Ancholme Valley.

Near Appleby Carrside there is a group of more than 20 pits, which are circular to oval in plan with upcast banks (Fig. 12. B; MLS22609). The smaller examples are approximately 6m in diameter and the largest are up to 12m long. They are arranged in a slightly meandering drift next to a straight section of Appleby Beck. This sinuosity may indicate that they predate the straightening of the beck. A similar scenario is observed near Waddingham, Lincolnshire where an S-shaped line of oval pits run close to Sallowrow Drain. This drain is a straightened watercourse but it's previous sinuous character is shown on Bryant's map of 1828 (HE RR1056631) The Appleby Carr examples survived as earthworks in 1947 but have now been levelled.

Moving southward, a series of oblong pits flank the banks of a small meandering stream near its confluence with Ella Beck (MLS26865). These 15 or more pits, and upcast spoil between them survive as earthworks, having been in woodland since the late 19th century (Fig. 12.D). Cropmark examples of a similar arrangement are visible to the south on a straightened section of Ella Beck these had been levelled before 1946 (Fig. 12.E, MLS26876).

Further upstream on Ella Beck there is a small group of retting pits near Wressle Houses (MLS26873). The OS One Inch map of 1824 depicts a 'Bleaching House' on banks of the beck close to these pits. This would be where fibres and textiles were laid out to be bleached by sunlight (Fig. 12.C).

Across the watershed, in the lower Trent Valley, there is a small cluster of pits in the corner of a field between Bottesford Beck and West Common Lane (MLS26938). Although sand or clay is extracted in the vicinity the small size of each individual pit suggests that these particular features were not for extraction. It may be a coincidence that these pits lie a few fields away from the 'bleach yard' near Messingham water mill. Intriguingly, to the north of the bleach yard, on the banks of Bottesford Beck there is an arrangement of five or more narrow and parallel ditches and a cross ditch. The distance between the narrow ditches is 11m to 14m and the similarity to the putative watermeadows near Thornholme Priory cannot be ignored (see above).

Retting pits have a long history of use. The recently completed 'From Flaxen Locks and Retting Pits' project looked at the documentary, archaeological and palaeobotanical evidence for flax and hemp growing and processing on the Isle of Axholme. It found evidence for Roman hemp processing in retting pits that appear as cropmarks at Bracken Farm, Haxey, which lies 3km west of the River Trent (Richer 2021, 19). As noted above the Sallowrow Drain retting pits appear to respect a watercourse that was still meandering in the early 19th century. Furthermore, if the connection between the retting pits and the bleacheries is valid, then it suggests that both were in use in the early 19th century, though this does not preclude earlier origins.

Discussion

This project has recorded earthworks and some cropmarks at each of the following scheduled monuments: Thornholme Augustinian Priory (NHLE1017821), Sawcliffe medieval village and moated site (NHLE10175540), Earthwork remains of St Bartholomew's Church (NHLE1016931) Ravensthorpe medieval settlement (NHLE106426) and the moated site east of Castlethorpe House (NHLE1016429). This work has not identified significant cause to suggest a change or alteration to the defined boundaries of these monuments.

The aerial photographs and lidar imagery yielded little information for the area of Flixborough nunnery and site of All Saints medieval church and burial ground (NHLE1009382). The lidar data does suggest the presence of a large, low platform within the burial ground area (MLS26985). However, there is no mention of this feature in previous descriptions of the burial ground, including the official list entry so this earthwork may of natural origin.

The historical aerial photographs have provided a record of the extensive earthworks that were present at the medieval settlements of High Risby, Low Risby and Castlethorpe and at Gokewell Priory. All four sites have been significantly impacted by ploughing in the 20th century so that very few if any of the former earthworks are still standing above ground level. However, it is likely that archaeological deposits associated with these settlements do survive below ground level.

This project has identified two types of site that recur at several locations and may reward further research. The retting pits are undated but likely to be of post medieval origin. Some of the approaches developed by the 'From Flaxen Locks and Retting Pits' project in the Isle Axholme could be usefully applied to these examples.

It is noted that there are no examples of these forms of clustered, earth-cut retting ponds, that have scheduled monument protection, in any part of the country. Whilst it is not suggested that the examples identified in this project area meet the criteria required for consideration, a re-assessment of this monument class may be useful. Flax and hemp processing were an important element of the textile and ropemaking industries in the medieval and post medieval periods. It is likely that this monument type is under-recorded, the Lincolnshire NMP may have recorded examples as 'extractive pits'. Furthermore that project did not have access to lidar data so that pits obscured by trees, such as the example at Scotter, were not identified at all.

Concerning the putative water meadows if there is a relationship between these and Thornholme Priory, then this may be elucidated by documentary research. If however, as is likely, these ditch arrangements are the remains of later activity then, a better understanding may come from other, as yet unidentified, examples elsewhere along the margins of the Ancholme Valley.

Warping in the Lower Trent Valley

Introduction

This project covers part of the Lower Trent valley, an area where an unusual method of agricultural improvement was practised from the late 18th century, namely warping. Warping is the process of covering land with alluvium by artificial means, rather than natural deposition. Although without parallel elsewhere in England a similar technique was employed in the Val di Chiana, Italy (Herapath 1860, 94).

The first application of the technique is credited to a Mr Barker at Rawcliffe (now in the East Riding) in the 1730s (Gaunt 2020, 226). Writing in 1843, Pusey describes two methods: wet warping and cart warping. In the former alluvium was carried in suspension to the designated fields via artificial watercourses, in the latter existing alluvial deposits, such as those in a relict river channel, were quarried and moved to designated fields by cart or wagon. Cart-warping was far less widely practised but it was used intensely on Hatfield Chase some 15km to the west of this project (Pusey 1843, 296). However, it is Ralph Creyke's report of his experiments in warping on land in the Lower Ouse Valley that furnish the details of the process (1824; 1845).

Geological and topographical background

The River Trent meanders south to north through this project's area and towards the Humber Estuary, having started its journey c. 290km to the south-west in Staffordshire. In the estuary it adds to the silt-laden waters brought down by the Yorkshire rivers and, possibly, suspended clay eroded from the Holderness coast (Gaunt 2020, 227) (Fig. 13).

The Lower Trent warplands extend as far south as Gainsborough and peter out at Flixborough. This project covers a relatively small proportion of the eastern flood plain: the stretch between East Butterwick and Flixborough. Very little of the western flood plain is covered by this project so this discussion will focus on the land to the east.

Figure 14 shows the River Trent flanked by natural levees, which are marginally higher than the surrounding flood plain and approximately 750-900m wide. In its present course the river meanders through the levees so they are often wide and present on one bank but near absent on the opposite bank. Settlements along this stretch of the river are arranged in pairs: the East and West Butterwicks, Althorpe and Burringham, Keadby and Gunness, Amcotts and Flixborough Stather, each with access to land on the adjacent stretch of elevated levee.

At East Butterwick the floodplain behind the levee is approximately 5km wide but it gradually narrows to approximately 1km at Flixborough Stather. The eastern edge of the flood plain is marked by an abrupt rise up on to the Frodingham Ironstone but wind-blown sands soften the foot of the escarpment.

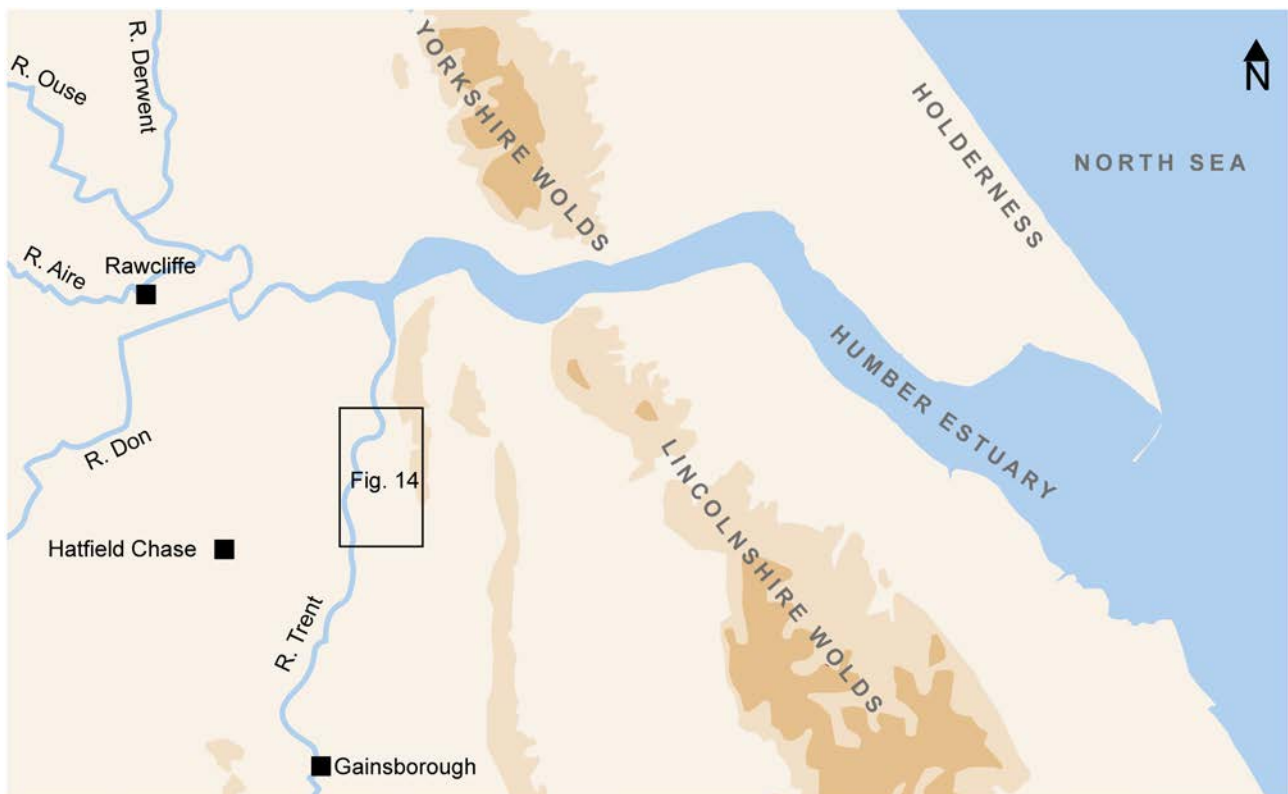


Figure 13: The Humber Estuary and its tributaries.

Before warping the flood plain was a very low lying mix of peaty ground, wind-blown sands and some natural alluvium. This land was difficult to farm and agriculturally unproductive.

Overview of wet warping process.

The simple aim of warping was to improve soil quality and thus agricultural productivity. The objectives were to

- deposit rich and fertile silts and fine gravels across the land
- cover the acid peats and sands with more neutral deposits
- generate a soil with a better structure and
- improve drainage by raising the ground level with accumulated warp deposits

Behind this seemingly simple aim there was a complex and lengthy process that required considerable engineering.

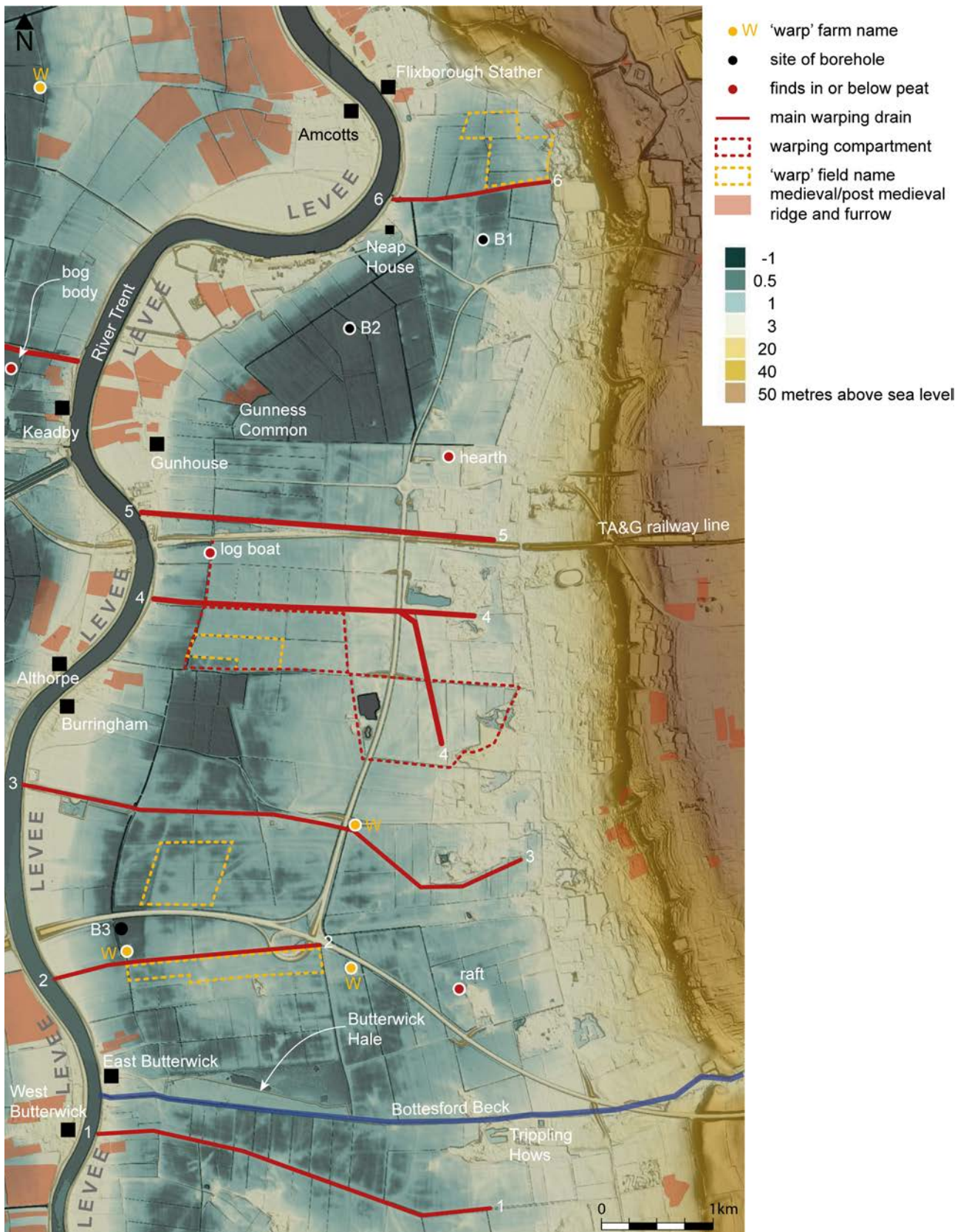


Figure 14: The main warping drains, villages, key sites and features discussed in the text. (Warping drains: 1 West Common North Drain, 2 Peacock & Hall's Drain, 3 Healey's Drain, 4 Earl Beauchamp's Warping Drain, 5 un-named warping drain, 6 Lysaght's Drain. Boreholes: B1- SE869131.01 (Van de Noort et al 1998), B2- SE80NW41 & B2- SE81SE34 (BGS GeoIndex Onshore). (Background generated from lidar DTM 2018 © Historic England; source Environment Agency, also includes North Lincolnshire HER data).

In preparation for warping a broad and deep channel between raised embankments was cut from the river bank out towards the edge of the flood plain. These main warping drains would supply several simultaneous and successive warping operations. Areas to be warped would be enclosed by a substantial bank and, where needed, more ditches or inlets would be cut to link the main warping drains to each warping compartment. Sluice gates were positioned to control the ingress and exit of water at several points in the system.

The key to this process was the tidal backwash from the Humber Estuary. This would force silt-rich waters from the estuary back up the river. The high spring tides provided the required conditions. The sluice gates would be opened to allow the silty waters to divert from the river into the main warping drains and then into the warping compartments. The aim was to produce a near level surface so lower areas within a compartment would require more warp and higher areas less. This was achieved by channelling the water around the compartment with smaller ditches and banks.

Before the tide turned the sluice gates would be closed and the silt was allowed to settle out of the standing water. On the retreating tide the sluice gates would be opened to allow the 'clean' water to flow out. The force of the exiting water would scour out any lingering silt in the main warping drain, keeping it clear for the next high tide.

This process was repeated during the spring tides and across several seasons until it was judged that the depth of warp was sufficient. The warp could accumulate at approximately 2mm per tide, and 300mm per season. Some areas were treated over several years and some warp deposits are 1,500mm deep (Gaunt 2020, 226).

Once warping in a compartment was judged to be complete the enclosing banks and internal banks and ditches were deliberately levelled and filled in to return the maximum amount of land to agriculture. The main warping drains were retained to service other compartments. Newly warped ground was left to settle and dry and then planted first with clover and oats, and could be used as pasture. Once settled the ground proved suitable for rotations of potatoes, wheat and oats (Gaunt 2020, 226).

The distribution of warping deposits in the lower Trent valley has been established by the British Geological Survey, their [large-scale maps](#) created in the 1970s are particularly informative in this regard. In his time with the BGS, Gaunt undertook

extensive geological and historical research into the process and established criteria for the identification of warp deposits: a light, well-drained sandy soil, clear evidence of laminations below the ploughsoil, a buried soil horizon and differences in field levels (Limbert 2020, ix).

The first three are clearly observations to be made in the field but lidar imagery can reveal variations in ground level. The strength of aerial imagery; conventional photographs and lidar imagery, is in the identification of the physical remains warping infrastructure over large areas. This project has recorded extensive arrangements of warping ditches and associated banks, as extant and truncated earthworks and buried remains as cropmarks and soilmarks.

Warping infrastructure

Main warping drains

Four known main warping drains run from the banks of the River Trent eastwards towards the outer edge of the flood plain: West Common North Drain (MLS27034), Peacock & Hall's Drain (MLS26992), Healey's Drain (MLS24681 & MLS26991) and Earl Beauchamp's Warping Drain (MLS24682) (see Fig. 14). West Common North Drain and Peacock & Hall's Drain are depicted and named on Bryant's map of 1828, Healey's Drain on the Burringham tithe map of 1841 and Earl Beauchamp's Warping Drain is labelled 'Warping Drain' on the OS Six Inch map of 1886.

A broad ditch running inland from Gunness is absent from Bryant's map, but present with a sluice on a plan of the land in 1834 (Russell 1981, Fig 6). Smith identifies this ditch as a warping drain and notes the warping process was completed by 1847 (2012, Plate 39, 236). When the railway linking the Frodingham iron ore mines and the River Trent was built in the 1860s some sections, and the Gunhouse Branch in particular, ran so close to the southern edge of this drain that it is possible that the tracks ran along the drain's southern embankment (Henthorn 1981, fig. 9). By 1886, this drain's exit into the river had silted up behind the new Ironstone Wharfe and the ditch is depicted as a long marshy, water-filled channel (OS Six Inch map of 1886). Despite the intrusions of the railway lines and subsequent modifications some sections of this drain are still visible on aerial photographs and lidar imagery (MLS26990).

A sixth ditch, Lysaght's Drain, runs across the narrow flood plain from a point near Neap House (see Fig. 14). This ditch is depicted on Bryant's map of 1828, and follows the township boundary between Flixborough and Crosby. The name is a more recent reference to Lysaght's iron works, which were built a little to the east in 1912. There is some ambiguity as to the purpose of this ditch; the British Geological Survey records only natural alluvium in the fields to the north and south (<https://largeimages.bgs.ac.uk/>

iip/mapsportal.html?id=13459667). However, a borehole sunk 370m south of this drain encountered warp deposits 40cm to 74cm below the surface and below that peat (Lillie 119, table 7.8). Furthermore, the Flixborough tithe map of 1840 names fields on the north side of this ditch as 'Warp Land' and 'Warp Close' (see Fig. 14). Smith notes a discussion concerning the use of an existing drainage sluice named 'Neap Clough' in lieu of constructing of a new warping drain (2012, 238). 'Neap Clough' and 'Lysaght's Drain' may be one and the same feature.

The current condition of the main warping drains is variable. Modern drainage ditches still run along West Common North Drain, Lysaght's Drain and along Healey's Drain as far the M181. Some sections of the Earl Beauchamp's Warping Drain and Peacock & Hall's Drain survive as drains between fields. In many places the original banks have been reduced or levelled to reclaim the land for cultivation. The ditches have undoubtedly been dredged many times and are likely to have been re-cut.



Figure 15: Cropmarks showing the levelled remains of a section of Earl Beauchamp's Warping Drain (Google Earth™ aerial imagery 2015).

Where Healey's Drain and Earl Beauchamp's Warping Drain have been levelled in the fields to the east of the M181 they produce bold and distinctive cropmarks and soilmarks, particularly on more recent imagery. Figure 15 shows a section of Earl Beauchamp's Warping Drain on either side of the M181 and suggests a complex arrangement of ditches and banks, particular around the site of the footbridge that is marked on the OS Six Inch map of 1886.

Warping compartments

Little survives of the banks that were built around warping compartments; they were usually removed once the process was completed. However, traces of warping compartment bank are depicted on the OS Six Inch map of 1886, either side of Earl Beauchamp's Warping Drain, on Brumby Common West. From this it is possible to reconstruct the circuits of two compartments, one c. 60ha the other 70ha (see Fig. 14). Some of the banks (MLS27012) are visible on the historical aerial photographs and the lidar imagery indicates that short sections of compartment bank may survive as earthworks on the remains of Brumby Common (MLS27026). Survival in this instance may be attributable to the relatively late date of the warping, which was instigated in the 1860s (Smith 2012, 179).

Secondary and lesser ditches

There is prolific evidence on the aerial photographs for the secondary features that ran from the main warping drains to the compartments and those more transitory features that spread the water around the compartments. These ditches were often flanked by banks that contained the flow and directed the water around the compartments. The lidar imagery indicates that some of the features survive as low and shallow earthworks but many more are visible as cropmarks and soilmarks. The distribution of this evidence is not even, there are extensive and complex cropmarks and soilmarks of warping infrastructure on either side of West Common North Drain but far fewer are visible in the fields flanking Earl Beauchamp's Warping Drain.

The West Common North Drain system lies near the southern edge of this project. The area beyond was mapped for the Lincolnshire NMP project in the late 1990s and this shows extensive warping ditches in the fields down to the River Eau.

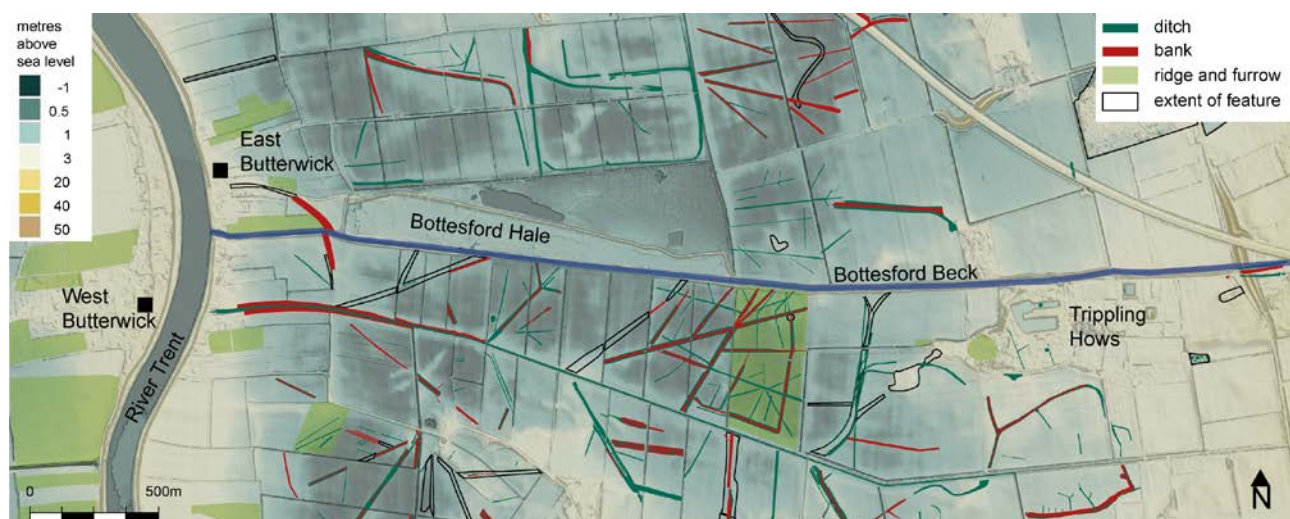


Figure 16: Warping drains between West Butterwick and Tripling Howes. (Background generated from lidar DTM 2018 © Historic England; source Environment Agency).

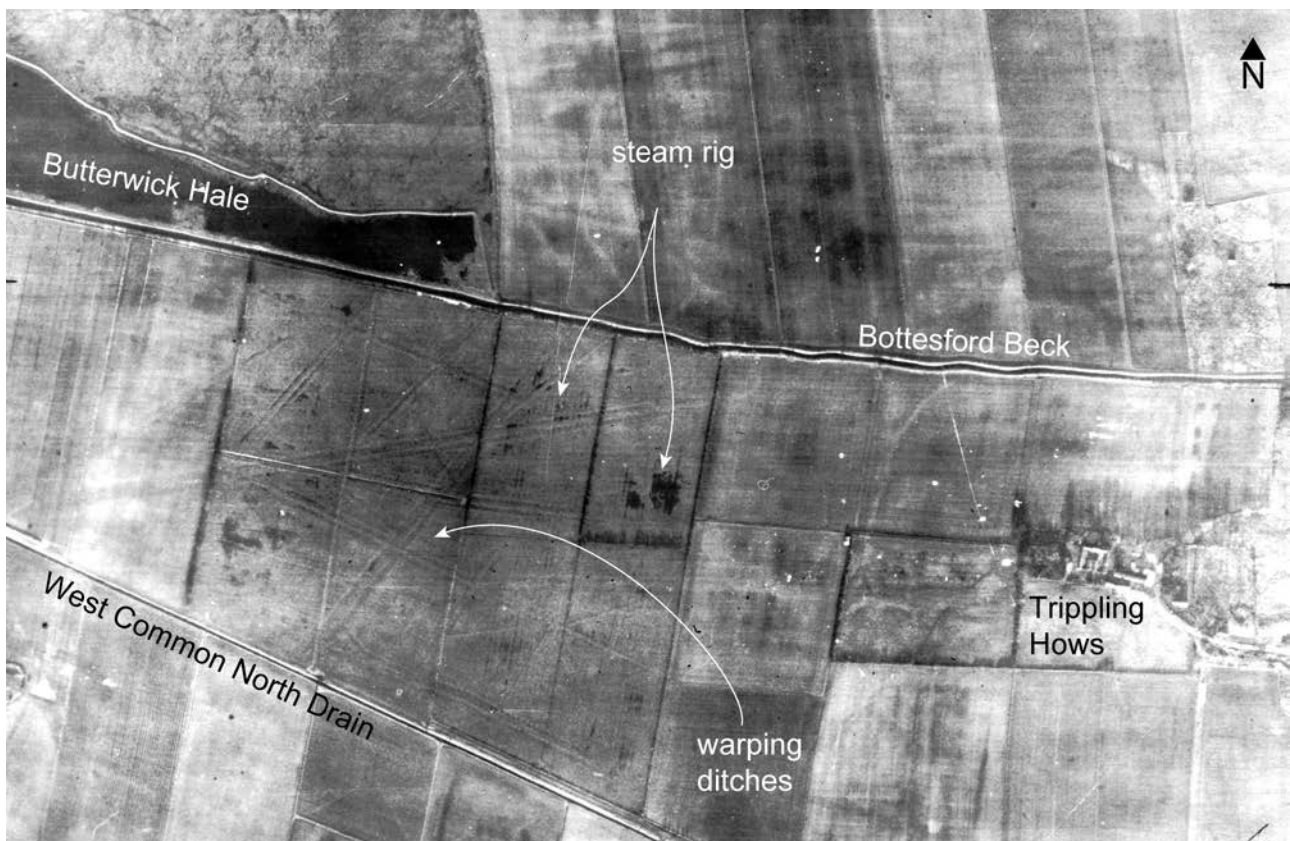


Figure 17: Earthwork drains and rig in fields between Bottesford Beck and West Common North Drain (part of RAF/CPE/UK/1880/5155 6 December 1946 Historic England Archive (RAF Photography)).

The West Common North Drain lies a short distance south of and near parallel to Bottesford Beck, which is much straightened in its passage across the flood plain (Fig. 16). Together they define a narrow strip of land, 730m at it widest, that runs across the flood plain from the levee to the windblown sands at Tripling Hows. Secondary ditches spur north-eastward from the main drain towards the beck and these in turn fan out across the fields. This arrangement is closely mirrored by the drains that served the fields south of West Common North Drain. Towards the east end of the main drain the secondary ditches seek out the lower lying ground between the dunes.

In certain fields the ditches and banks are particularly complex (see Fig. 17). These may reflect superimposed arrangements from several warping seasons. These remains are perhaps the oldest examples of warping infrastructure in the project area. The West Common North Drain was created for general land improvement when the land was enclosed in 1804 but warping began in 1811 (Smith 2012, 221-222).

On Figure 16 the lidar data shows that the area between Bottesford Beck and West Common North Drain is relatively low compared to other warped ground. This may be because insufficient warp was laid down or that the underlying peat has shrunk, or both. The accumulated weight of the warp deposits squeezed water out of the underlying peat

causing it to shrink and thus the ground level to sink. Intriguingly though, some of the ditches between the drain and beck survived as earthworks into the late 1940s. They appear to have been cut by steam rig. This suggests a scenario where early attempts to plough and cultivate this warped ground were unsuccessful and it was returned to pasture until the middle of the 20th century.

Absence of warping

It was not necessary, or possible, to lay warp on the river levees because the soils here were relatively light and freely draining as well as standing slightly higher than the flood plain. The absence of warp on the levees is demonstrated by the visibility of medieval and early medieval ridge and furrow. Had these areas been warped then these cultivation remains would be deeply buried and unlikely to produce cropmarks or soilmarks (see Fig. 14).

The warp deposits do not encroach on the higher dunes of wind-blown sand along the eastern margins of the flood plain, although the warping drains did reach into low ground between them. Neither are the dunes restricted to the outer fringe; there are many little 'islands' of sand that protrude above the warp deposits in the middle of the flood plain. In the right growing and ripening conditions the contrast between warp deposits and wind-blown sand is sharply delineated in the colour of the crop (see Fig. 15).

The lidar imagery reveals several areas on the east side of the river that are slightly lower than the surrounding ground.

The fields to the north of Gunness Common are low lying. There is an abrupt, albeit small, change in level between these fields and the ground to the immediate south. These fields lay in a detached portion of the more northerly township of West Halton. This appears to correlate with the 'triangular area of dark grey-brown soft peaty clay' described by Gaunt (2020, 239). He attributes this lack of warping to the landowner refusing to contribute to the costs of the process. A borehole in this area recorded peat below the topsoil (BGS SE81SE34).

Gaunt identified similar peaty clay at the surface in fields to the east of Burringham (2020, 239). These too are noticeably lower than the land to the north, east and west.

A small rectangular area at Burrington South Grange is lower than land to the north, east and south, though the north of the area has now been cut by the M180 (MLS24684). The soil in this small area is darker than the light reddish soils on the adjacent ground. A borehole sunk in the north-west corner of this area encountered peat immediately below the top-soil (BGS SE80NW41). It is likely that this small area was not warped, though interesting to note that it abuts Peacock and Hall's Drain and that Burrington South Grange was named as Warping Close Farm on Bryant's map of 1828.

Gaunt also observed that Butterwick Hale had not been warped (2020, 239). Confusingly, the lidar imagery shows that some of this unwarped ground is marginally higher than the warped land to the north and south. Again, this is likely to be due to the compression of the peat under the layers of warp. In the middle of the 19th century Herapath observed that ‘Peat-moss, nevertheless, is found to settle a great deal under treatment, and the level of the land thus warped is often found to become considerably lower than it was before the operation.’ (1850, 98).

Discussion

The warping process is of historical and regional significance, particularly as the practice was geographically limited to the tidal reaches of the Humber tributaries. The application of this process has dramatically shaped the landscape of the Lower Trent Valley. The warping ditches and banks survive both as integral elements of the modern landscape and as archaeological features. The purpose and nature of the warping infrastructure means that the ditches are not rich repositories of cultural material like big prehistoric or medieval ditches in settlement contexts. However, the environmental conditions and relative recency has allowed for the survival of organic structural elements. For example, in 2020 archaeological excavations at Keadby Windfarms uncovered a remarkably well-preserved wood-lined sluice (Scholma-Mason et al 2018, fig. 9).

Some studies have placed warping in a historical context, in relationship to land ownership, agricultural schemes and enclosure (Smith 2012). An archaeological approach has already shown the potential to reveal more about the landscape immediately before warping (Lille 1998).

The mapping generated by this project will help distinguished areas where warp is absent, where warp is present and the land that was disturbed by warping infrastructure. From the latter it may be possible to infer where built structures such as sluices may be present.

Warp deposits are also significant because they have effectively sealed and buried older land surfaces and environments. In some places the warp layer may be protecting environmental and cultural material in and beneath waterlogged peat deposits. In the late 18th and 19th centuries the floodplain and similar environments were considered marginal land of little use: Creyke’s land was a ‘barren and uncultivated morass’; Pusey’s described Hatfield Chase as a ‘worthless, deep, quaking bog’ (1845b, 400; 1843, 296). But now it is understood these environments were rich in resources and exploited accordingly (Historic England 2021). Whilst it is unlikely that the flood plain was permanently occupied, the remains of transitory activity associated with resource gathering and movement may survive. Certainly wooden craft have survived on the warplands, viz the possible Bronze Age examples recovered at Yaddlethorpe Grange (MLS1042), Burringham (MLS25970) and just to the south of this area at Scotter

(MLI50080). A hearth and gullies, undated but beneath peat deposits and warp layers, were discovered on the edge of the flood plain (MLS22698). Features such as fish and eel traps and trackways might be expected. Peat cutting west of the River Trent at Keady led to the discovery of a well-preserved body of possible late Roman date (MLS71). Peat is also an important repository of palaeoenvironmental material stored during the period of accumulation.

Furthermore, peat deposits, particularly those that are sealed and undisturbed, are recognised as important carbon stores and have a role in mitigating climate change.

Warping had also buried some of the lower-lying wind-blown sands. The higher sands still stand out in the flood plain and are the foci for varied activities: the farms at Tripping Hows and Yaddlethorpe Grange, the duck decoy at Ashby and the site of the Second World War battery east of Neap House (MLS21394). The sandy ridges may have offered more passable routes through the flood plain and across to the River Trent. Those that are now buried beneath the warp deposits may hold information.

The iron and steel industries at Scunthorpe

Introduction

Today, the town of Scunthorpe is central to the United Kingdom's steel industry and is home to the last integrated steel works operating in England. Integrated steelworks are those that take in the raw ores, fuels and alloys to produce molten iron, then molten steel and from that, steel products.

Scunthorpe was a late entrant to industrial-scale iron and steelworking in England. The historical assets typically associated with the early stages of development and industrialisation of these processes e.g. cementation furnace at the 18th-century steel works at Derwentcote, Co. Durham (NHLE1015522), the early 19th-century works with crucible furnace at Abbeydale, Sheffield (NHLE1246418) and the early 18th-century cementation furnaces excavated at Coalbrookdale (Nevell 2022, 331), are absent.

Scunthorpe's late efflorescence and indeed its subsequent importance was a direct consequence of the local geology. This area had substantial reserves of iron ore, both at the surface and buried, but the low quality of that ore meant that its potential could not be fully realised until significant technological developments in the iron and steelmaking processes had been made elsewhere.

Geology

Within this project's area the main ore-bearing rock, the Frodingham Ironstone lies at or near the surface between the upper edge of the Trent Valley and the foot of the Lincoln Edge (see Fig. 18). The ore bed peters out to the west and gently dips to the east and consequently the depth of overburden gradually increases. There is an abrupt change at the escarpment from where the gently dipping Frodingham Ironstone is buried beneath some 30 metres or more of younger rocks. These strata are exposed as narrow bands in the escarpment slope and include three further iron-bearing beds: Pecten Ironstone, Marlstone Rock Formation and, less consistently, Northamptonshire Sand Formation.

Daglish and Howse wrote an account of the ironstone beds and their relative economic values in 1875, a time of exploration and discovery and before Geological Survey of the United Kingdom (now the British Geological Survey) had reached this area. They identify the Frodingham Ironstone as bed No. 5 and describe it as heterogenous, with iron content ranging from 12% and 40%. Fossils were abundant in No.5: ammonites, gryphea, lima and pecten, so much so that the gryphea – often known as 'devil's toenails' was later incorporated into the Borough of Scunthorpe's Coat of Arms, granted in 1936.

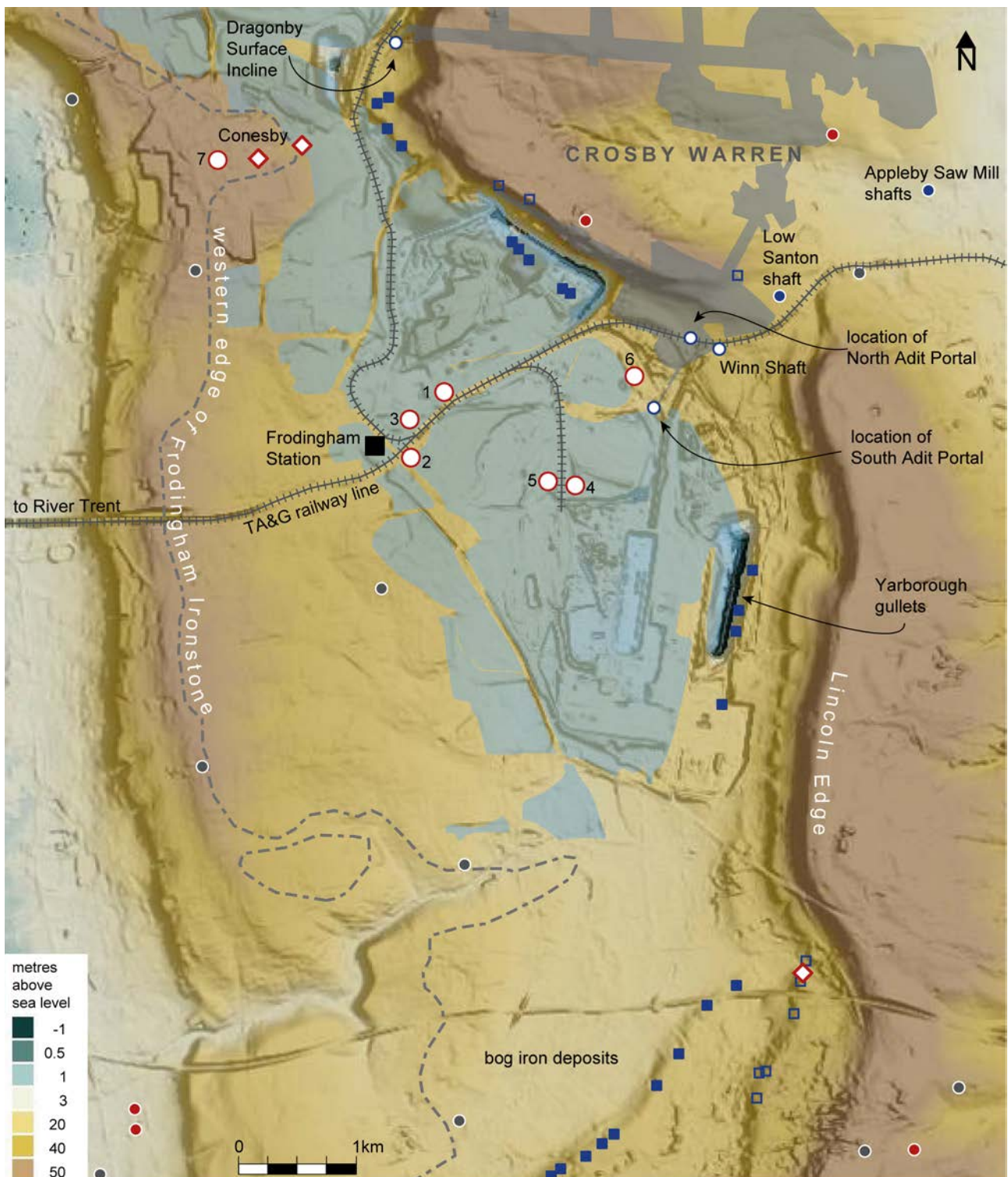












Figure 18: Distribution map of archaeological and historical evidence for iron ore mining, iron smelting and the locations of the late 19th- and early 20th-century iron works: 1 Trent Iron Works, 2 Frodingham Ironworks, 3 Lindsey Ironworks, 4 Redbourn Ironworks, 5 North Lincolnshire Iron Works and 6 Appleby Iron Works and 7 Lysaght's (Normanby) Iron Works. (Background generated from BGS Geology Viewer and lidar DTM 2018 © Historic England; source Environment Agency, also includes North Lincolnshire HER data).

-  pre-19th-century smelting sites
-  site of late 19th- & early 20th-century iron works
-  bloomery slag
-  slag
-  pit on or close to Pecten Ironstone outcrop
-  pit on or close to Northampton Sandstone outcrop
-  site of late 19th-century mine shaft
-  site of 20th-century adit or mine entrance
-  approximate extent of opencast mining
-  approximate extent of underground mining

The Pecten Ironstone is No.4 bed and described as thin, highly fossiliferous and ‘not considered of workable value’. It is named after the Pecten, a scallop species that is prolific in this bed. Daghish and Howse’s No. 3 and No. 2 beds equate to the Marlstone Rock Formation and ores in the Northamptonshire Sand Formation. Where they occurred in this area neither were considered viable for smelting, although they were heavily exploited near Grantham and Northampton, respectively.

The outcropping Frodingham Ironstone was partly covered with deposits of wind-blown sands, which were of little impediment even to the earliest quarrying enterprises.

Iron smelting, working and ore extraction before the late 19th century.

Direct evidence for pre-industrial era iron smelting activity in the project area is concentrated around Conesby Farm, which lies to the immediate east of the site of Lysaghts (Normanby) Steel Works. Possible furnace lining material and iron smelting slag were found alongside Roman pottery in an excavation trench dug to the east of the farm (MLS26092) and excavations to the east of the farm found evidence of furnace structures and smelting slags in several contexts that collectively spanned the 9th to the mid-16th centuries (MLS1854).

An undated ‘old iron smelting kiln’ is marked on a BGS map 200m north of Twigmoor Top Farm, near the southern edge of this project. Just north of this project area a Roman bowl-hearth was recovered at Thealby in the early 20th century (MLS1110).

Possible bloomery slag has been recovered at numerous sites in Iron Age, Roman, medieval and undated contexts (MLS20223, MLS21180, MLS22615, MLS2009, MLS21211 & MLS17297). There is a wider distribution of iron slag, a scrap iron hoard and currency bars that point to iron working in the Iron Age and Roman period, but not necessarily iron smelting.

Early smelters would have had access to the expanses of exposed Frodingham Ironstone and the narrow Pecten Ironstone outcrop. Metal may also have been smelted from ‘the ‘rafts’ of rich bog iron ore (containing up to 50 and 60 per cent. of iron)’ that could be found in the low-lying area south of Sweeting Thorns (Dudley 1949, 143). Bog iron forms in still pools and bogs where the ferruginous content of ores has migrated through percolating water.

This project recorded a number of small, rectangular quarries dug into the shallow foot of the Lincoln Edge at the interface between the Charmouth Mudstone and the narrow outcropping of Pecten Ironstone. One is identified as 'Old Clay Pit' on the OS Six Inch map of 1885 but others are not labelled. There are similar lines of pits higher up the escarpment; these coincide with the outcropping of the Northamptonshire Sandstone. These quarries may indicate exploitation of the ore beds in the later post medieval period. It would be very difficult to detect and distinguish early ore extraction from the aerial evidence alone, and furthermore, the widespread mining carried out in late 19th and 20th centuries would have destroyed any evidence of early exploitation of the Frodingham Ironstone.

Iron ore mining

Historically, the country's iron industry had relied on ironstones in the Coal Measures, haematite from the north west of England and ores from the south west of England (Nevell 2022, 323). Only in the mid-19th century did attention turn to the Jurassic ore-fields in Cleveland and Northamptonshire, which, until then, had been considered unsuitable for industrial scale smelting (Pocock 1964, 105). By the end of 1850s the potential of the Frodingham Ironstone had been recognised and heavily promoted by the landowner Rowland Winn. William Henry and George Dawes, whose blast furnaces were a long and bumpy cart-ride away at Elsecar, South Yorkshire took on the first mining lease in this area (Pocock 1964, 107).

Surface or open mining

Pocock's paper on the development of ore mining provides a useful context for the evolution of the landscape, particularly since until the late 1940s almost all ore came from open or surface mines rather than the deeply-buried ore beds east of the escarpment (1964).

The earliest aerial photographs of the Scunthorpe area were taken in the 1920s and 1930s but these are mostly low oblique views and reveal little of the overall manner and extent of mining in these decades. Vertical photographs taken by the RAF in the late 1940s provide extensive and blanket coverage and good detail but they show the landscape a full 90 years after mining had begun. However, some of the early mining history is still legible in that landscape (Fig. 19).

In the late 1850s sections of narrow-gauge railway linked the Frodingham ore bed to the River Trent and this was upgraded again in the 1860 with the construction of the Trent Ancholme & Grimsby railway line (TA&G Line, but later named the Barnsley to Barnetby Railway). Now ore could be easily transported away from the mines but more significantly it was feasible to build blast furnaces on the ore field. The other components in the iron making process: coal and coke, could be brought in and the resulting pig

iron could be taken out for further processing elsewhere. The actual construction of the railway line had helped to establish the extents and depths of the ore beds and gave the mining operations a known point to work from (Pocock 1964, 107). The Dawes took this opportunity and built their Trent Iron Works on land to the east of Frodingham Station. Their first furnace was blown-in in 1864 and quickly followed by the Frodingham Iron Company just south of the station. Both companies also took leases to extract ore on adjacent land. These were followed by others and by 1875 there were five iron works with 13 blast furnaces in operation between them and a further six furnaces under construction (Daglish and Howse 1875, 6). Not every iron works had its own mines; some were obliged to buy their ore from Winn's own mines.

These surface mines were opened by cutting a deep and narrow trench or gullet to expose the ore and give access to labourers, their tools and wagons. Having exposed a working face, usually on the east side of the trench, the ore was removed and the face gradually advanced eastward. Overburden and waste would be tipped against the opposing face, partly backfilling the void (see Fig. 19).

Once established the expansion of mining was rapid; between 1873 to 1874 annual ore production doubled (Pocock 1964, 108). With this in mind, it is unsurprising that the first of the large-scale Ordnance Survey maps, which were surveyed in 1885-1886, offer little clue as to the location and scale of the first explorations. Many of the initial mines had already been subsumed by that date but the body of water shown on the north side of the Trent Iron Works may be the Dawes' exhausted workings.

In the last decades of the 19th century, mining extended out of the Frodingham and Scunthorpe townships and Winn's land and onto land owned by the Sheffield family. Crosby Warren was parcelled into a series of leases which were granted between 1877 and 1899 (Pocock 1964, 108). The orientation of these long strips took account of the gentle dip in the Frodingham Ironstone so that each lease would bear an equal share of the overburden. This pattern was still legible in the late 1940s (Fig. 19).

In the early decades of mining only the weathered and oxidised uppermost ores were sought, these were known as 'gingerbread' (Pocock 1964, 110). Ore in the bottom beds was left in situ or tipped as waste. Such discrimination was possible because stripping the ore and loading the carts was still a manual process with very little mechanical assistance or automation.

By the early 20th century the more accessible ores had been exploited and a number of obstacles impeded expansion. To the west the ore bed petered out and to the south the declining quality of the ore encountered in the Ashby Ville mine led to its closure (Pocock 1964, 110). At that time, pushing the surface mines eastward against the increasing depth of overburden was unfeasible. Instead, new ground was opened to the north of Crosby Warren, facilitated by the completion of the North Lindsey Light Railway in 1906. John Lysaght established iron and steelmaking operations here in the early 1900s.

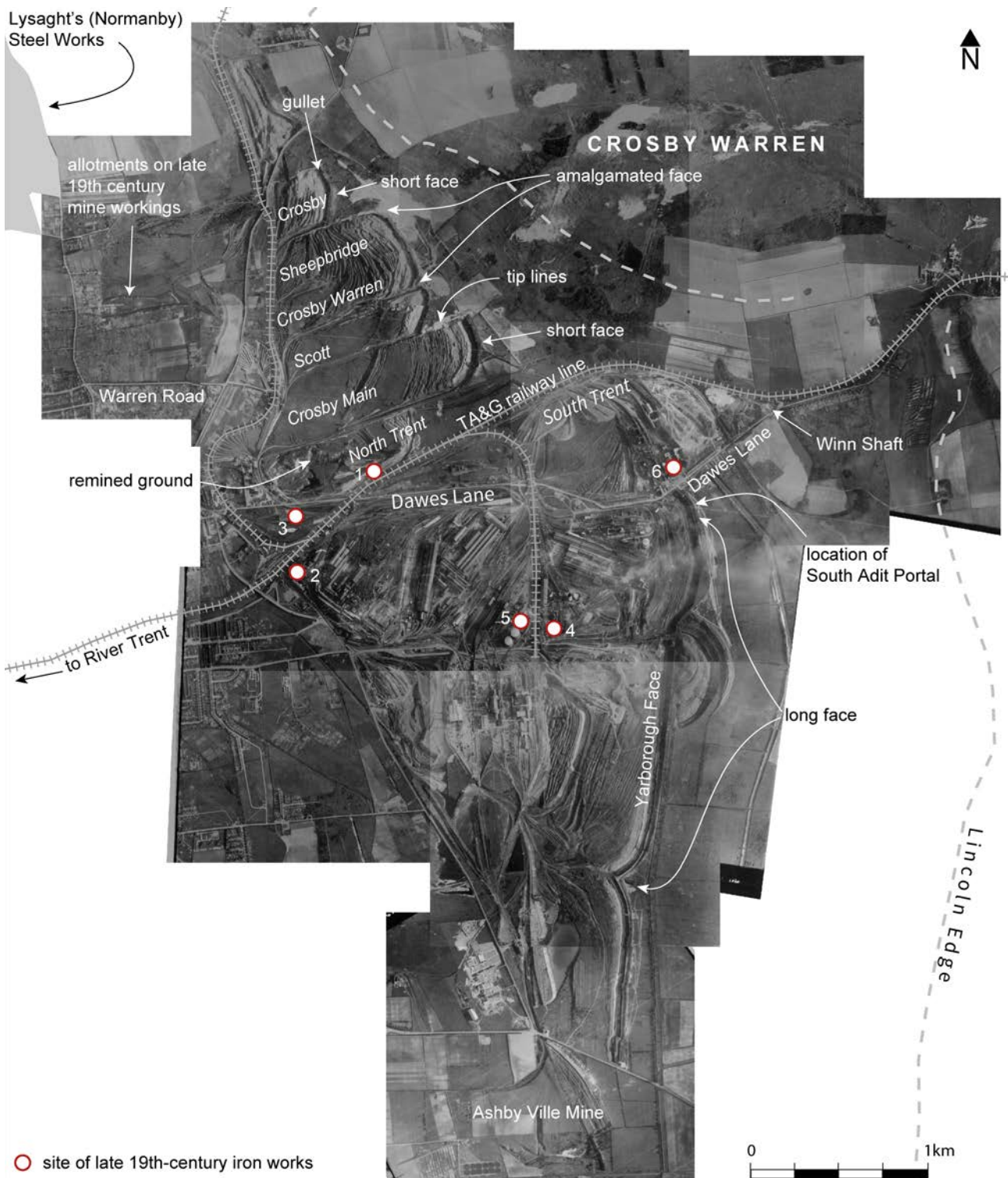


Figure 19: A mosaic of RAF vertical aerial photographs showing the position of the six 19th-century iron works and the extents of surface mining in the late 1940s. The iron works are numbered: 1 Trent Iron Works, 2 Frodingham Iron Works, 3 Lindsey Iron Works, 4 Redbourn Iron Works, 5 North Lincolnshire Iron Works and 6 Appleby Iron Works. (Contains parts of RAF/CPE/UK/2042 FP/1015, 1017, 1019, 2091, 4057, 4087 and 4089 29 April 1947 Historic England Archive (RAF Photography)).

However, technological developments in steelmaking meant that the poor local ores could now be efficiently utilised, particularly when combined with silica-rich ores imported from further south (Pocock 1964, 112). This encouraged the practice of 'remining'.

The surface mines worked in the previous decades were re-opened to extract the bottom beds that had been left in situ and waste tips were re-sorted. Pocock notes that remining continued until at least 1949 south of the railway and was nearly complete in the Crosby area in the early 1960s (1964, 114). This practice of remining explains why the area to the north of Trent Iron Works showing abandoned and water-filled pits on the OS map of 1885 was the site of considerable digging activity on the 1947 aerial photographs (see Fig. 19). Similarly, why the area north of Warren Lane is marked as 'quarry' on the OS map of 1885, subsequently used for allotments but cut by a new gullet and workings on aerial photographs taken in 1953.

In the interwar years the more widespread adoption of mechanical stripping, removal and transportation helped to increase ore production but it was still constrained by the short working faces that had arisen from the original narrow leases. This was somewhat relieved when these workings were amalgamated and ore could be cut more efficiently from longer faces (see Fig. 19). However, the increasing depth of overburden forced exploration of deep mining options.

Underground Mining

Deep mining had been on Winn's agenda from the outset. In an effort to encourage deep mining he had leased his land from two portions: the Scunthorpe East Common portion, where the ore outcropped and the Appleby portion, which lay to the east of the Lincoln Edge where the reserves were deeply buried. The leases were granted in pairs, one from each portion. Whilst the outcropping ore was still abundant and easy to retrieve there was little imperative to explore the potentials of deep mining, with all its additional costs, complex practicalities and uncertainties. Nevertheless, several exploratory boreholes were sunk near Appleby Saw Mill and Low Santon and evidence of these is visible on historical aerial photographs.

At Appleby Saw Mill the OS map of 1886 depicts two separate shafts each with buildings and small spoil heaps. One is labelled 'Ironstone Pit (Disused)' and the other simply 'Shaft'. Both shafts and the saw mill itself are linked by single-track wagonways to the TA&G Line near Appleby Station. Some 50 years later the buildings at the more northerly shaft were still standing, including a free standing chimney, the other is obscured by trees. All structures have now been demolished and the land returned to grass or arable crops but some elements and the shafts themselves may survive below ground level (MLS9456). A short section of wagonway embankment survives as an earthwork. A borehole record for the more northerly shaft indicates that the top of the ironstone was nearly 90m below ground level at this location (BGS borehole SE91SW13).

The 1885 OS Six Inch map shows a similar arrangement of features south-west of Low Santon Farm: a small cluster of buildings linked by wagonway to the TA&G Line. These remains were certainly abandoned and overgrown by the late 1940s and now the ground on which they stood has been returned to agriculture (MLS26795). The Frodingham Ironstone lies at a depth of 70m at this location (BGS boreholes SE91SW212 & 215).

Decades later, with increasing depths of overburden, underground mining was re-explored. In the 1930s an adit was cut into the ironstone face in a gullet to the south of Dawes Lane. Ground photographs taken in 1939 show a simple façade around the adit portal, which was replaced by a three-tier brickwork design by 1945 (s06026; s06029). Its purpose was to prevent weathering of the exposed ore bed around the portal. The portal is visible on historical aerial photographs but by 1973 this gullet had been partly re-landscaped and flooded (MLS27111).

In the late 1930s an adit referred to as the ‘Winn Shaft’ or ‘Santon Mine Shaft’ was dug a little further east and closer to the foot of the escarpment. The headgear and winder house are visible on historical aerial photographs (MLS27108). The latter is still standing and identifiable by its exposed steel framework. Here the top of the Frodingham Ironstone is only 9m below ground level but the purpose of the adit was to give lateral access to the reserves north-east of the escarpment (BGS Borehole SE91SW356). The mine closed during the war, due to labour shortage, but it reopened in 1948.

After the war a second adit was sunk some distance to the north at Dragonby. It was entered via a large, landscaped concavity that makes for a striking feature on the contemporary aerial photographs (MLS27112). The mine closed in the early 1980s and this large earthwork is now partly obscured by trees but visible on the lidar imagery.

The North Adit, built in the late 1950s was probably opened to replace the Whin Shaft access, which stood just 260m to the south-east. The entrance was marked by a wide, wing-shaped façade. This is still standing and has been incorporated into the walling around a small enclosure or compound (MLS27110).

An undated plan held by the BGS demonstrates the relationship between these adits and the underground workings in the Santon Mine, which extend between Dawes Lane and Dragonby and east to Appleby (see Fig. 18).

The end of ore extraction at Scunthorpe

In 1967 the surviving steel works: Appleby-Frodingham, Redbourn and Normanby Park (formerly known as Lysaght’s) were nationalised under the British Steel Corporation. With nationalisation came the Anchor project, a modernisation scheme that brought continuous casting facilities, new mills, and dedicated coke and ore preparation plants (<https://britishsteel.co.uk/who-we-are/where-weve-come-from/>). The local ores were supplanted with higher quality imports from Sweden, Canada and the USA and new iron ore terminal was constructed at the Port of Immingham.

Deep mining on the Frodingham Ironstone ended in 1981 and the last of the open mines, Yarborough, ceased production in the late 1980s (North Lincolnshire Local Plan - Adopted Plan May 2003, 191).

Since the late 19th century when former ironstone workings were reinstated as allotments, restitution has been a part of the mining process. Large areas of former surface mining were reinstated and redeveloped in the latter half of the 20th century; the Anchor Project works, which included the 'mile-long Bloom and Billet Mill' required many hectares of this land. Some former workings were earmarked for waste tipping, but others were left to flood and/or naturally regenerate and these now support important habitats and a range of activities. These relict faces and tips heaps at these workings are an important representation of an industry that dominated the Scunthorpe area for over 120 years, but because of the nature of the activity these surviving earthworks are not in themselves of significant age.

The first iron works at Scunthorpe.

The first of the iron works: Trent Iron Works and the Frodingham Iron Works, were built next to the TA&G railway line, close to Frodingham Station (see Fig. 18). Their blast furnaces were blown-in, that is to say the firing process was initiated, in 1864. These were followed by the Lindsey Iron Works to the north of the station 1873.

Meanwhile, a second focus had developed a little further to the south-east with the construction of the North Lincolnshire Iron Works, started in 1968 and then the Redbourn Hill Works blast furnaces, which were blown-in in 1875. These works stood nearly a kilometre south of the TA&G railway line so a wagonway was constructed to link them to the main line.

The last of the 19th-century iron works to be built in the area was the Appleby Iron Works, which was operating by the end of 1876. Until the last decade of the 19th century these works were producing pig-iron solely for export and further processing elsewhere (Pocock 1964, 110). From the 1890s onwards developments in steel-making technology, and in particular a process more suited to the phosphorous-rich ores from the area, encouraged the evolution of the steelmaking at Scunthorpe.

General description of the first iron works

The late 19th-century iron works were built in an area that had already experienced disruption from open mining but was otherwise rural in character. The nearest settlements: Scunthorpe, Frodingham and Crosby were no more than small villages. The erection of the blast furnaces on Scunthorpe, Frodingham and Brumby Warren must have been an astonishing sight.

The layout and structure of these early works can be gleaned from the historical Ordnance Survey maps, contemporary ground photographs held by the North Lincolnshire Museum Service Image Archive and a small number of aerial photographs taken in the 1920s and 1930s. By the late 1940s, when blanket aerial coverage first becomes available, most of the original blast furnaces had been removed and replaced.

The first of the blast furnaces, built at the Trent Iron Works, were 12m high but later examples were nearly twice as tall and up to 6m in diameter (Daff 1981, 33-37). The blast furnaces stood in pairs or rows of three or more. Contemporary ground photographs suggest that in several cases the blast furnaces were built on low, rectangular platforms or furnace pads surrounded by stone wall revetments (see for example s01435, s01301). These bases were no doubt a necessity when building on the light, friable sands that covered the warrens.

The early blast furnaces were heated with hot gases generated in adjacent stoves, and charged with a mix of iron ore and fuel (coal and coke). By the 1880s most of the works at Scunthorpe had a brick or iron hoist tower that lifted the ore and fuel mix to the top of the furnaces which were then accessed by gantries. This mix was still manually loaded into the hot furnace (see s01079).

The molten iron was tapped from the bottom of the furnace into a series of moulds prepared in beds of sand, known as pig beds (see s01430). The pig beds were set out across the furnace pads. Slag, being lighter than the molten metal was tapped at a higher level and, at this time, was taken away in carts and wagons to the slag heaps. The movement of ore and fuel to the blast furnaces and pig iron and waste away necessitated complex networks of wagonways. Photographs taken in the 1890s show wagons pulled by horses (see s05670).

As well as the stove houses or free-standing stoves the blast furnaces were accompanied by other structures such as chimneys, wooden cooling towers, office buildings, and smithing and engineering workshops. A small number of houses were built near each of the iron works for workers.

A detailed examination of the historical maps and aerial photographs and recent imagery indicates that no element of any of the 19th-century iron works is still standing. A situation that is not unexpected given the rapid and extensive development of the steel manufacturing at Scunthorpe in the 20th and early 21st century. However, there has been considerable variation in how each of the original iron works sites were used and developed through the 20th century and into the 21st century. It is possible that some elements at some sites may survive below current ground level.

Trent Iron Works

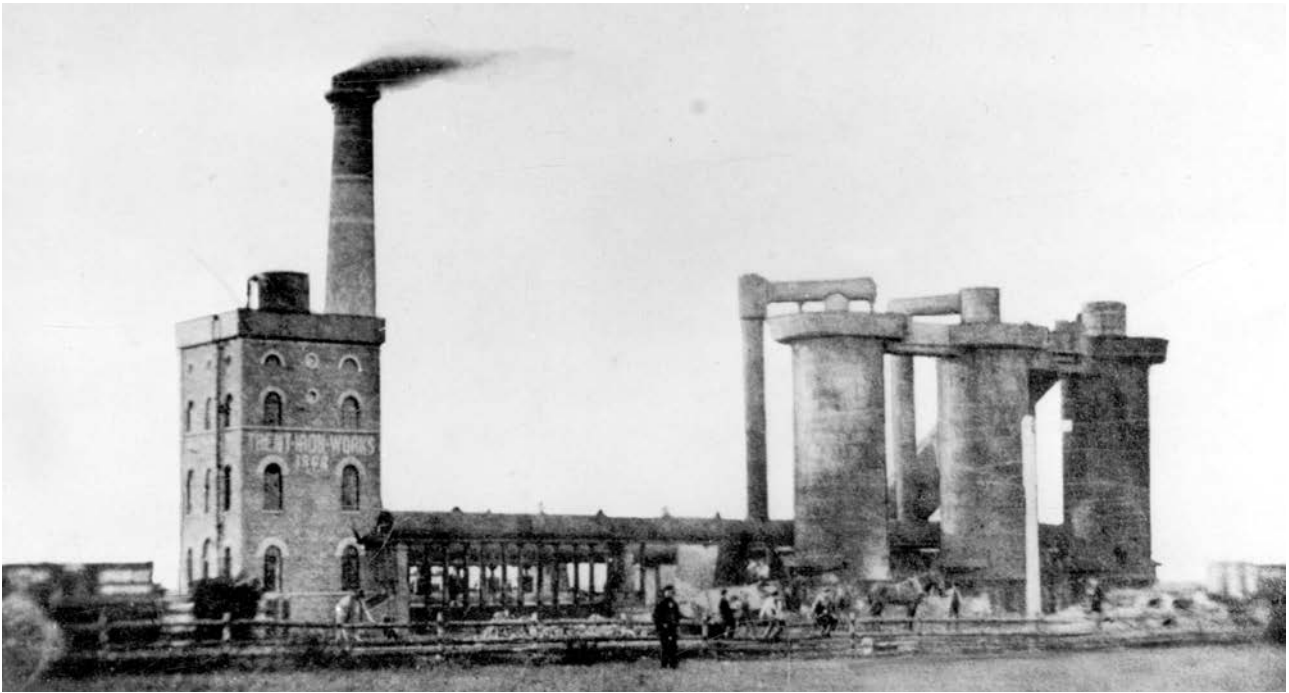


Figure 20: Trent Iron Works in the 1870s, looking north from the Dawes Lane area (s01297 reproduced with kind permission of North Lincolnshire Museum).

Early ground shots of these works show their configuration in the 1870s (Fig. 20). There were three blast furnaces at this time. The OS 25 inch map of 1887 (surveyed in 1885) shows Trent Iron Works then had six blast furnaces that stood in a row alongside the TA&G Line. A range of buildings stood to the rear and the blast furnaces were book-ended by larger buildings (MLS27098). A short terrace row of worker's houses stood to the west. To the immediate north of the works was a body of water, probably a flooded ore mine. This works closed in the late 1880s but the blast furnaces, hoist tower and main buildings were still standing on aerial photographs taken in 1926 (Daff 1981, 38). By 1936 the furnaces had been demolished and the ground on which they stood had been cleared (see Fig. 21). The possible stove house and other buildings were roofless and lift tower and chimney were still standing. There was, at this time, activity to the immediate north of the works, probably reminding of the areas that were first excavated in the 1860s.

These remimed areas had been backfilled by 1947, with spoil, waste or slag. The narrow strip of ground, measuring approximately 225m by 45m, where the original iron works had stood appears to be intact at this time and contains small structures, although these do not appear to be relicts from the old iron works. The BGS does classify this ground as 'backfilled open workings and quarries' and it possible that the strip had been mined and reinstated in the period between the 1936 and 1947 aerial photographs. However, it may

be the case that the backfill identified here by the BGS resulted from the earliest phase of mining and therefore predates the first blast furnaces. If this area did escape remining then it is possible that some elements survived below ground level in 1947. Subsequent activity on this ground does not preclude continued survival of any buried remains.

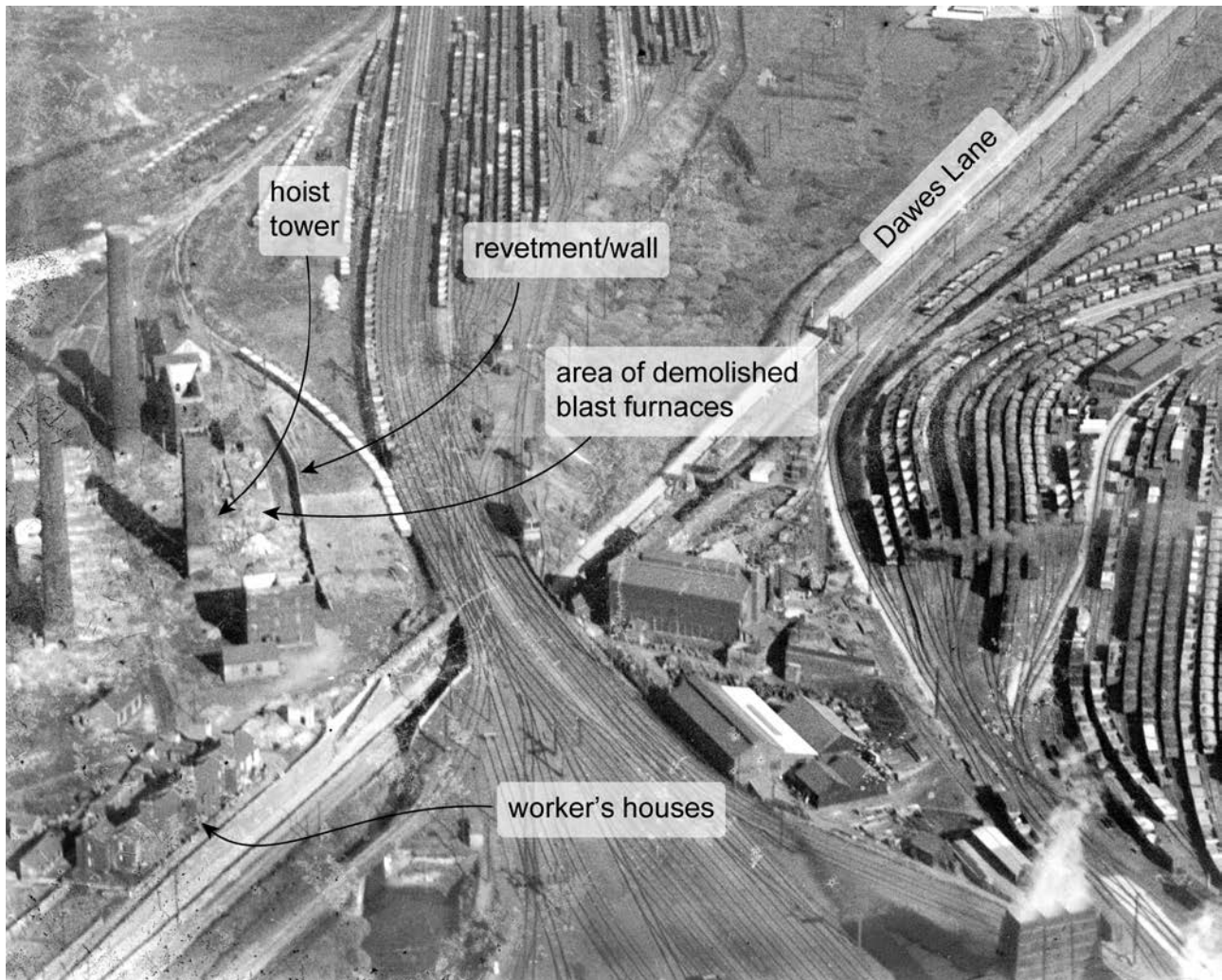


Figure 21: Ruined buildings and structures at the Trent Iron Works in 1936 (part of EPW052035 1 October 1936 © Historic England Archive. Aerofilms Collection).

Frodingham Iron Works

By the 1890s the Frodingham Iron Works comprised four furnaces that were oriented south-west to north-east with a hoist tower between them, a row of stoves behind and other buildings to the east and west (Fig. 22).

Early 20th-century photographs show that the southern most of the blast furnaces had been re-built, not only bigger but with a skip car and bridge so that it could be mechanically-charged with ore and coke (see s01077).



Figure 22: The Frodingham Iron Works in c. 1890 (s05670 reproduced with kind permission of North Lincolnshire Museum).

Aerial photographs taken in 1936, 1948 and 1953 show the same general layout at the core of the works as the 1887 map, but the blast furnaces had been rebuilt and the stoves replaced (see Fig. 23). However, by 1958 the blast furnaces and stoves had been demolished. The ground on which they had stood had been cleared, levelled and laid with rail tracks. The blast furnaces had stood at what is now the junction between Old Ironside Road and Castella Drive (see Fig. 24). There does not appear to have been any significant ground disturbance since they were demolished in the late 1950s, in particular there is no evidence of ore mining, so if any remains were left below ground level at the time then these may survive.

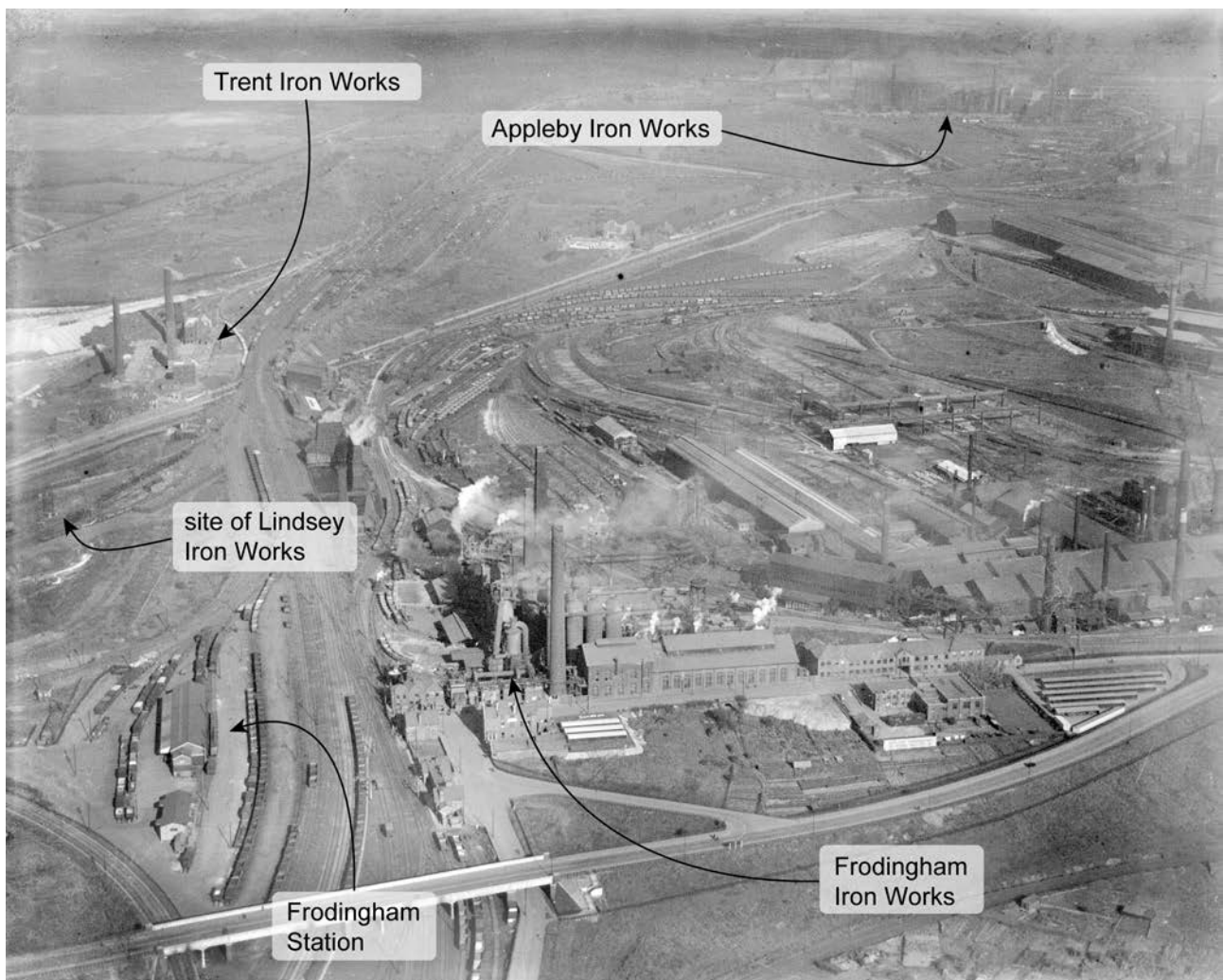


Figure 23: The Frodingham Iron Works in 1936 (EPW052033 1 October 1936 © Historic England Archive. Aerofilms Collection).

Two buildings that had stood east of the blast furnaces still survive today (centred SE9057 1119 and SE9061 1125). They appear to have been present in 1948 but their location is obscured by the stoves and smoke on the aerial photographs taken in 1936. These structures are partly brick-built but their historical and architectural significance is not clear. A section of the more westerly building (actually several different abutting structures) has distinctive chamfered corners and a sloping roof that truncates an upper window (see Fig. 24). It coincides with a small building of similar footprint that is depicted on the OS 25 inch map of 1907. If this building has stood since the early years of the 20th century and overlaps with the earliest blast furnaces, then it is reasonable to deduce that this area has not been mined since. It possible that features associated with the earlier iron works are preserved beneath these buildings and the adjacent ground.

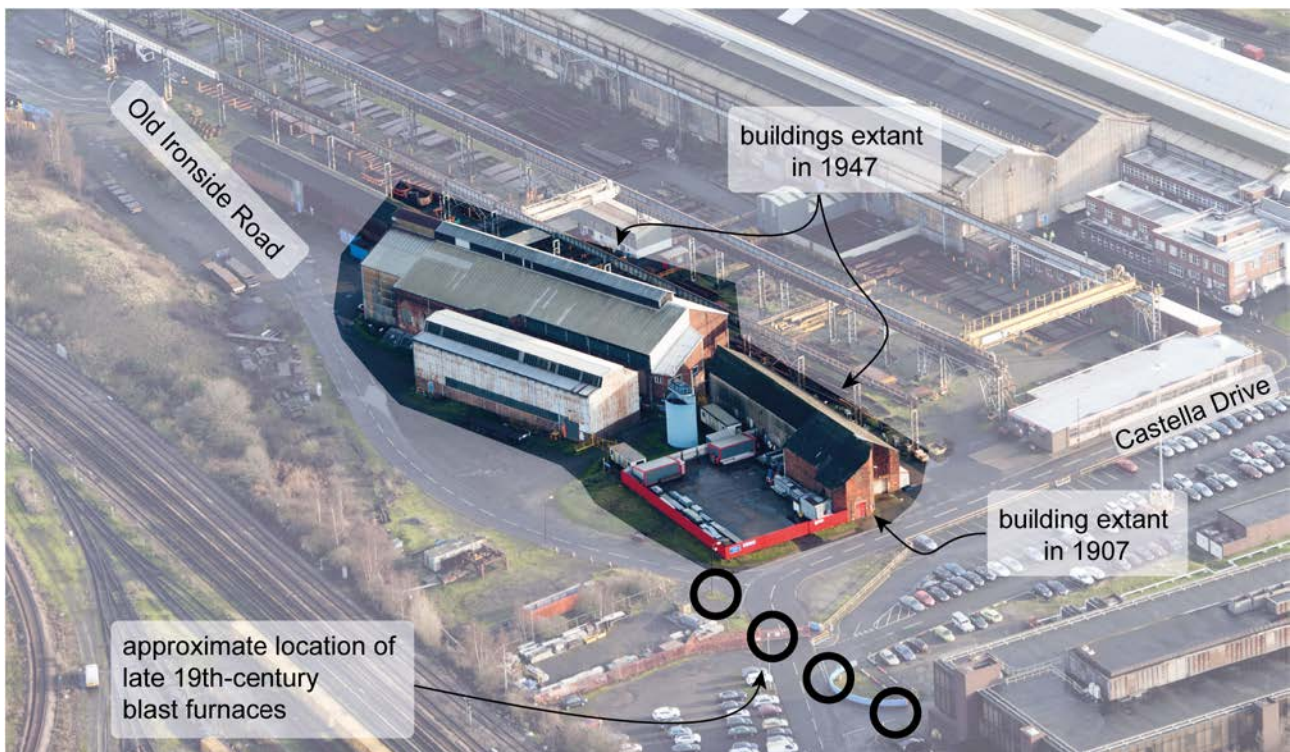


Figure 24: The site of the Frodingham Iron Works in 2016 (HEA 28843_003 13 January 2016 © Historic England Archive).

Lindsey Iron Works

The Lindsey Iron Works opened with two furnaces in 1873 and had closed by the end of the century (Fig. 25). Photographs of these works that were taken during demolition give some insight into the structure of the blast furnaces. The outer shell of the furnaces was supported on a ring of iron columns, each 6-10m high. These were left askew amongst the piles of rubble when the structures were blown up (see s01085). The ground on which the furnaces had stood is not visible on aerial photographs taken in 1926, but there is mining activity to the immediate east. Coverage from 1936 is too oblique to be informative but it does show that a large engine shed had been built on the ground to the immediate west of the blast furnace site. By 1947 the crescent-shaped area between Dawes Lane and Station Road was used for engine and wagon marshalling and maintenance, as evidenced by the large concrete engine shed and turntable. Rail tracks ran across the area where the blast furnaces had stood. Similar activity persisted until recently and there does not appear to have been any deep disturbance on this site since the late 1940s.

The British Geological Survey 1:10,560 map of 1979 classifies most of the area between Dawes Lane and Station Road as 'backfilled opencast workings and quarries'. However, a narrow lens-shaped area is identified as 'blown sand' and this may include all or part of the site of the late 19th-century blast furnaces and associated structures.



Figure 25: The Lindsey Iron Works in the 1890s (s01301 reproduced with kind permission of North Lincolnshire Museum).

If a layer of wind-blown sand survived in this area then so might any archaeological remains, including the below-surface remains of the late 19th-century iron works. One intriguing possibility is that the sand recorded here by the BGS, rather than being of natural origin was instead the dispersed remains of pig-iron casting beds.

Redbourn Hill Works

The Redbourn Hill Iron and Coal Co. Ltd's first blast furnace was blown-in in 1875. The Ordnance Survey 25 Inch scale map of 1887 and contemporary photographs show two blast furnaces, a hoist tower between them, a row of stoves to the rear and other buildings to the immediate north (Fig. 26). By the time of the 1907 edition these works had expanded and a long ironstone gullet had been cut on the open ground to the east. Aerial photographs taken in 1926 and 1936 indicate that the two original blast furnaces had been demolished and there were now three on the site: two to the south of the original stacks and a third in the approximate area of the 19th-century hoist tower. Raised pig-iron casting beds swept north-westward from the bases of the blast furnaces. Although they were rebuilt again in the mid-20th century the location of the three blast furnaces remained unchanged until they were demolished in 1980.

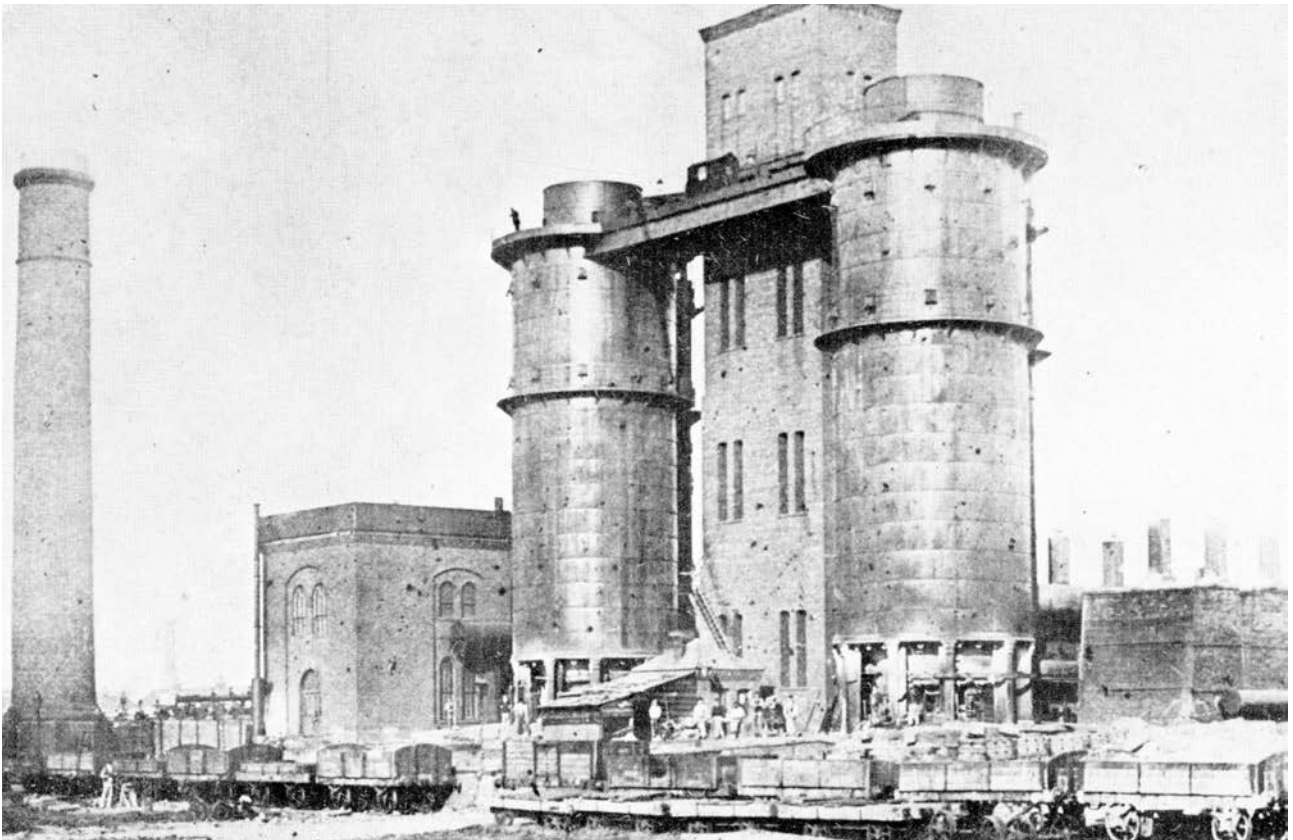


Figure 26: The Redbourn Hill Iron Works in the 1880s (s01303 reproduced with kind permission of North Lincolnshire Museum).

By 1993 most structures on the vast Redbourn site had been demolished. Large areas of the site had been cleared and levelled for the storage of steel products. Between and around these yards there was overgrown vegetation and rubble tipping. Here aerial photographs taken in the 1990s indicate the survival of low and partly buried structural and earthwork remains that appear to pertain to various phases of activity (see Fig. 27). These include an irregular island that stands higher than the surrounding ground level. A circular earthwork on this island, approximately 7m in diameter coincides with the location of the more southerly of the three mid-20th century blast furnaces but the island itself extends to the approximate position of one of the original blast furnaces.

The BGS 1:10,560 map of 1979 indicates that the ground on which the late 19th-century Redbourn Hill blast furnaces had stood has at some point been mined and backfilled. There is a gap in the map and photographic coverage between 1910 and 1926 when this might have occurred, but this would have left the company without furnaces for the period of demolition, mining then rebuilding at the same location, and no such hiatus is reported. A more plausible scenario is that the area was mined and backfilled before the first iron works were built. Alternatively, the BGS data may simply extrapolate across those areas that could not be inspected on the ground in the 1970s, when these steel works were still standing. The site of these earthworks has been disturbed further since the early 1990s but this may not preclude the survival of the mid-20th century features and these in turn may overlies earlier elements.

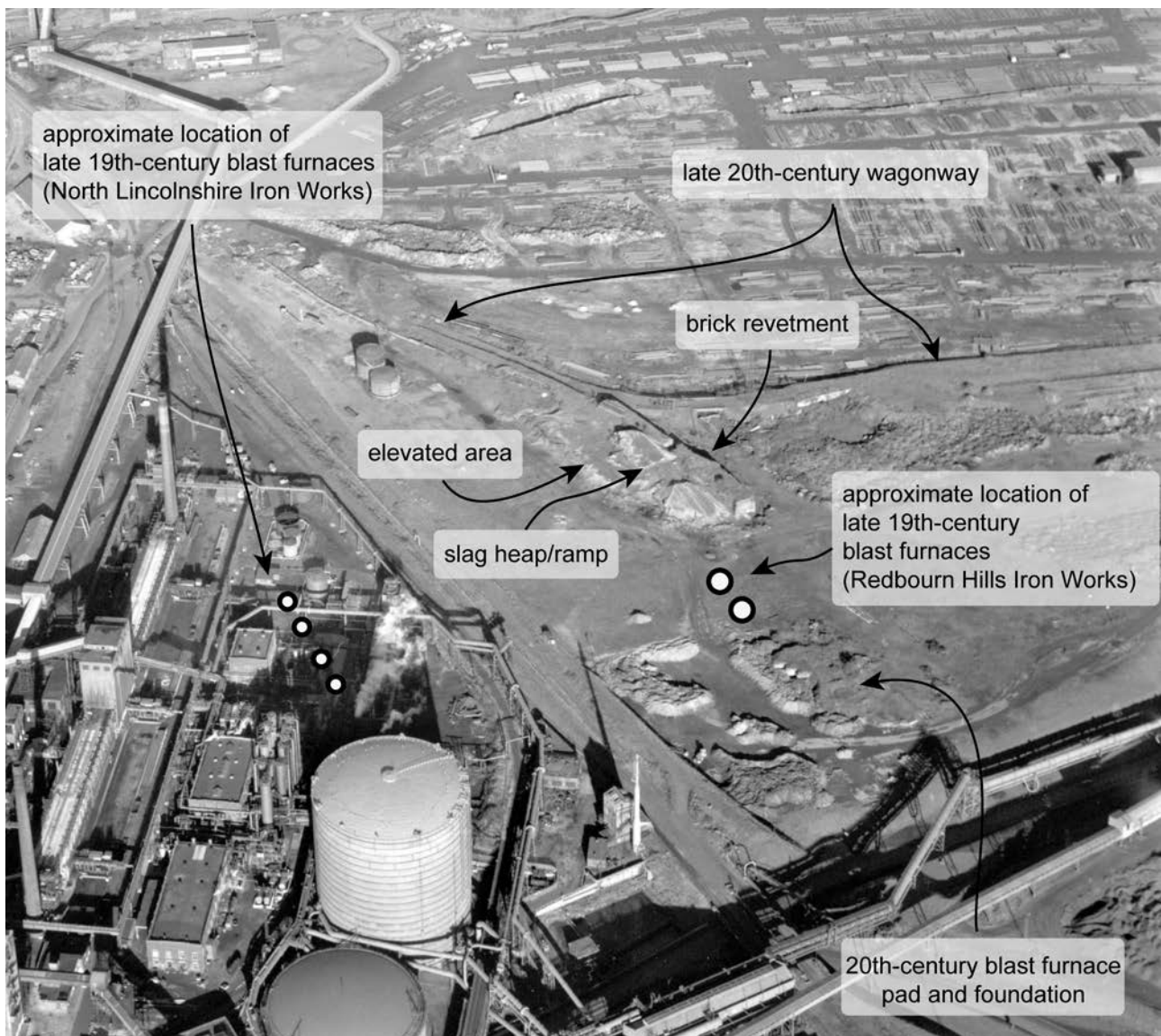


Figure 27: Earthworks and the low structural remains on the site of the former Redbourn Hill Iron Works (NMR 19396/06 02 November 1999 © Historic England Archive).

North Lincolnshire Iron Works

Early but undated ground photographs show three blast furnaces with stoves to the rear and pig-iron casting beds to the fore (Fig. 28). At this works the ore and fuel were lifted by ramped wagonways before the final ascent to the top of the blast furnaces by hoist. Aerial photographs taken in 1936 show the dismantling of these works: the blast furnace and stoves had already been demolished and cleared, other buildings had been reduced to the rubble and low walling. The old ramped wagonways, probably constructed from waste and slag, were still in situ at this time but an ironstone gullet had been opened and partly backfilled to the immediate west of the demolished blast furnaces. By 1947 the area of the North Lincolnshire Iron Works had been completely re-developed as a coke oven plant and oil refinery, both of which are still in place. There is a strong possibility

that the whole site, including the ground on which the blast furnaces had stood on, was mined or re-mined prior to redevelopment. It is unlikely that any elements of the late 19th and early 20th century North Lincolnshire Iron Works survive in situ.

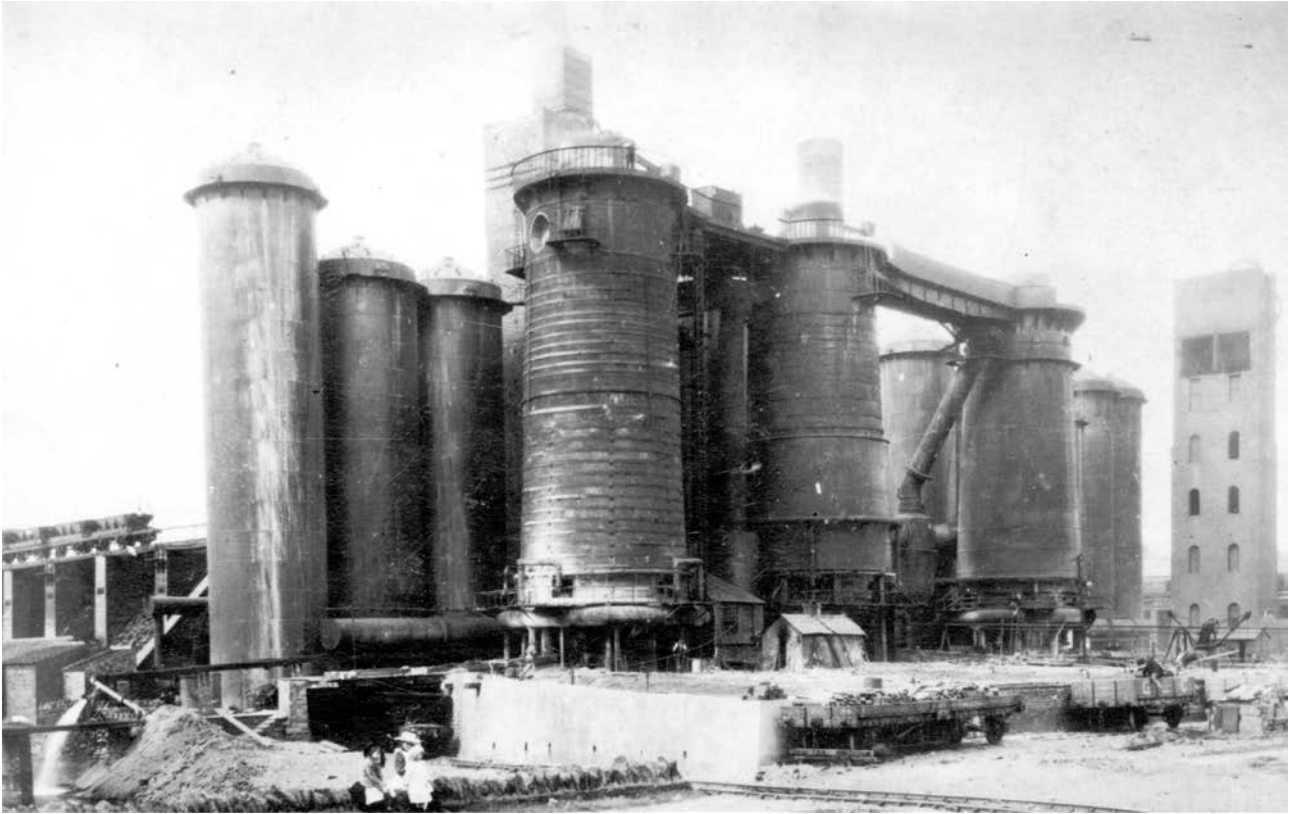


Figure 28: The North Lincolnshire Iron Works in the late 19th or early 20th centuries (s01435 reproduced with kind permission of North Lincolnshire Museum).

Appleby Iron Works

In 1874 the Appleby Iron Co. Ltd was granted a site of 15 acres in Appleby parish on which to build two blast furnaces, by 1884 a third had been started and would be followed by a fourth. The company was taken over by the Frodingham Iron Company in 1912 and the two amalgamated to become the Appleby-Frodingham Steel Company in 1918.

There are ground photographs of the Appleby Iron Works taken towards the end of the 19th century and beginning of the 20th century (eg s01094 and s01448). They show two pairs of straight-sided blast furnaces. The more southerly pair were served by a distinctive Y-shaped arrangement of ducts and an iron-work hoist tower that stood between them.

Aerial photographs taken in 1936 appear to show the southerly pair but the pair to the north have been replaced by blast furnaces that are bellied in shape with an external ribbed structure (Fig. 29). This accords with accounts that the company was to rebuild the two new furnaces by April 1913, work that ultimately started in 1917 (Wells 2012).



Figure 29: Looking east across the Appleby Iron Works (part of EPW052042 1 October 1936 © Historic England Archive. Aerofilms Collection).

By 1947, this works had developed and expanded. The earliest blast furnaces had been demolished and there were new buildings (not blast furnaces) in their place. The two, newer blast furnaces were still present as were the adjacent pig-iron casting beds.

The steel works on the Appleby site were still active in 1951 but by 1964 the blast furnaces and other structures had been demolished. The ground where the two late 19th-century blast furnaces had stood was levelled, though this does not preclude the survival of some elements below ground level. There were above ground remains visible as the locations of the two early 20th-century blast furnaces (see Fig. 30). These comprise two low, flat, polygon platforms. These are grassed over but their edges are sharply defined, suggesting they have a low walled revetment. They coincide closely with the shape and location of the pig-iron casting beds that were present in the late 1940s. Two circular grass-covered features, one on each platform, coincide with the approximate position of the two more northerly blast furnaces and may be the remains of the under hearths or foundations. The other features surviving above ground in this area that do not appear to relate directly to the late 19th-century iron works but they do indicate some potential for survival.

The British Geological Survey 1:10,560 map of 1979 indicates that the location of the former Appleby Iron Works is 'made ground' rather than backfilled open cast mining. Continuity on the site between the late 1870 and 1951 suggests that there has been not opportunity to exploit the ironstone deposits beneath the works footprint and so there is the potential for survival of industrial remains originating from the mid-20th century and earlier.



Figure 30: Earthworks and the low remains of structures on the site of the Appleby Iron Works (11 April 2022 © Bluesky International/ Getmapping PLC)

Lysaghts (Normanby Park) Steel Works



Figure 31: Looking south-east across Lysaght's Steel Works (EPW048520 1 July 1935 © Historic England Archive. Aerofilms Collection).

In 1912 John Lysaght opened his steelworks on a large site nearly 3km to the north-west of the earlier iron works. The original footprint of the site lay to the west of Normanby Road and north of Old Park Farm. There is no indication on the historical OS maps that this area was mined for ore before the works were built. However, the works themselves are not depicted on the 1947 edition (revised in 1938), bar a few marginal buildings, so these maps are clearly not a reliable record of change in this particular area. It is known that the area to the immediate north-west of the works was not been mined because in the early 2000s the medieval moat at North Conesby, that been buried by a large slag heap was re-exposed, archaeologically excavated and reinstated (MLS2213).

Aerofilms Ltd visited Lysaght's Steel Works on many occasions between 1926 and 1951. The result is over 300 aerial photographs of the works from a variety of directions and angles, from a distance and close-up. These show the overall layout of this integrated steelworks and its settings and are also an excellent visual record of key components such as the blast furnaces and the rolling mills (see Fig. 31). The Aerofilms images, along with vertical photographs taken by the RAF in the 1940s and 1950s and later the Ordnance Survey and Meridian Airmaps also chart changes and expansions at the works. A selection of aerial photographs taken in the mid-20th century has been collated and annotated to provide a visual guide to the operation of this steelworks at that time ([see below](#)).

From the late 1920s there were five blast furnaces with Cowper stoves to their rear. Ore, coke and other minerals was prepared in stockyards in the north of the complex and brought to the bottom of the furnaces by wagon. The skip bridge, a metal framework with tipper trucks on rails, carried the ore and coke up to the top of the furnaces to charge them from above. The molten iron was tapped at the foot of the furnaces transported in insulated wagons to the melt shops to the south. The slag was initially carted to the huge slag heap on the north-west side of the works but later it was processed for fertiliser and aggregate (Pocock 1981, 53). In the late 1940s and early 1950s the blast furnaces were modified to re-use the hot dirty gas generated by the smelting process. The characteristic uptake pipework on top of the furnace carried the gas to nearby cleaning tanks and then to the stoves.

By 1968 only three furnaces remained. This plant closed in 1981 and by 1986 most of the furnaces, stoves and cooling towers and rail infrastructure had been demolished, though the long rolling mill buildings were still standing. By 1995 much of the site had been relandscaped and redeveloped, retaining a few of the late 20th-century rolling mill buildings.

Two red-brick buildings at Normanby Park Workshops, which were built next to the steelworks between 1935 and 1947, appear to be the only buildings still standing from this period. The original function of these buildings is not known but they were probably associated with the works. The lidar imagery indicates that the site has been landscaped into a series of large flat terraces to accommodate large warehouse-type structures. In some areas this may have been achieved by raising the ground level, in which case remnants of features dating from the early to mid-20th century may survive below ground level. In other areas the ground level may have been reduced, in which case the potential for survival is very low.

Conclusion

The aerial photographs and earlier ground photographs together form a comprehensive record of the built environment for the Lysaght's Steel Works and a sparser but still informative record of the other iron and steel works. The aerial imagery does of course have its limitations, it does not show the activity within those vast buildings where the molten iron was reprocessed into steel and then into steel products.

It was beyond the remit of this project to attempt to map and record the later components of these very dynamic industrial landscapes. By the start of the Second World War the original iron and steel works had consolidated into three integrated steelworks: Lysaght's, Redbourn and Appleby-Frodingham. Each had increased their furnace capacity and two new furnaces were erected on what would become known as the South Ironworks site in 1939. These developments were accompanied by new ore preparation and sinter plants, coke ovens, melting shops and rolling mills, all large-scale facilities that required many hectares of land. Two further blast furnaces were built at the South Ironworks site in 1954. In the second half of the 20th century a number of initiatives were implemented to increase production, prompting further re-organisation of the landscape.

Instead this project has attempted to establish the footprints of the original 19th-century iron works and then identify their potential for survival in any form given the subsequent and current land use. It has also sought to record those later elements that survive in the modern landscape which might otherwise be overlooked. The results of this work are tabulated in [Appendix 2](#).

20th-century military remains

Introduction

This area contains a number of 20th-century military sites. Most of the features and installations recorded by this project pertain to the Second World War, but there are a small number of sites that may be of First World War origin.

Possible First World War sites

Aerial photographs taken in 1947 show an unusual group of earthworks on what had been Brumby Common (see Fig. 33). They include a system of zig-zig trenches, a short section of crenelated trench form, a row of three possible foxholes or weapons pits and a series of mounds flanking short straight ditches or trenches (MLS26962). These earthworks appear to be well-grassed over on aerial photographs taken in 1944 and 1947 but this alone would not necessarily indicate that they are of First rather than Second World War origin.

These features were located to the east of Rowmills Plantation on Brumby Common. A large part of the common had been removed by ironstone mining in the late 19th and early 20th century. The HER has records of opencast mining that suggest these earthworks stood on ground that was removed between 1908 and 1936. Clearly, if this mining was in the later decades of this timeframe then these earthworks are not of First World War origin. Certainly, land to the east of these features had been mined and reinstated and a partly overgrown ironstone gullet runs beside them. The British Geological Survey classifies the ground west of this gullet as 'ironstone' rather than 'backfilled open works'. However, even east of the gullet some of the ground has the gently undulating appearance that is characteristic of the warrens and commons, suggesting the origin land surface was intact at that time.

The purpose of these earthworks is similarly uncertain. They lie close to the steelworks, which were of considerable importance in the First World War, but these earthworks are by no means defensive in scale or position. Neither are they close to any established training facility. It is more likely that they are the result of fieldwork training or familiarisation for local recruits or volunteers. These features have now been levelled and built over.

Several other practice trenches are visible on the aerial photographs, many are close to Second World War installations and so likely to be of similar date. However, two short zig-zag rows at Woodland View on the edge of the Trent flood plain and a more complex arrangement on Primrose Hill Wood have no immediate associations and so a First World War origin cannot be discounted (MLS26964 & MLS21651).



Figure 32: Possible First World War earthworks near Rowmills Plantation (part of RAF/CPE/UK/2042/FS/2058 29 April 1947 Historic England Archive (RAF Photography)).

The Woodland View trenches have now been built over. The trenches on Primrose Hill Wood, although fragmentary, do suggest a layout that replicated the multiple lines of defences that would be encountered at the front. Some of these features were truncated by the cutting created for the M180 but those to the north survive as low earthworks in a small opening in the woods.

Second World War Sites and Installations.

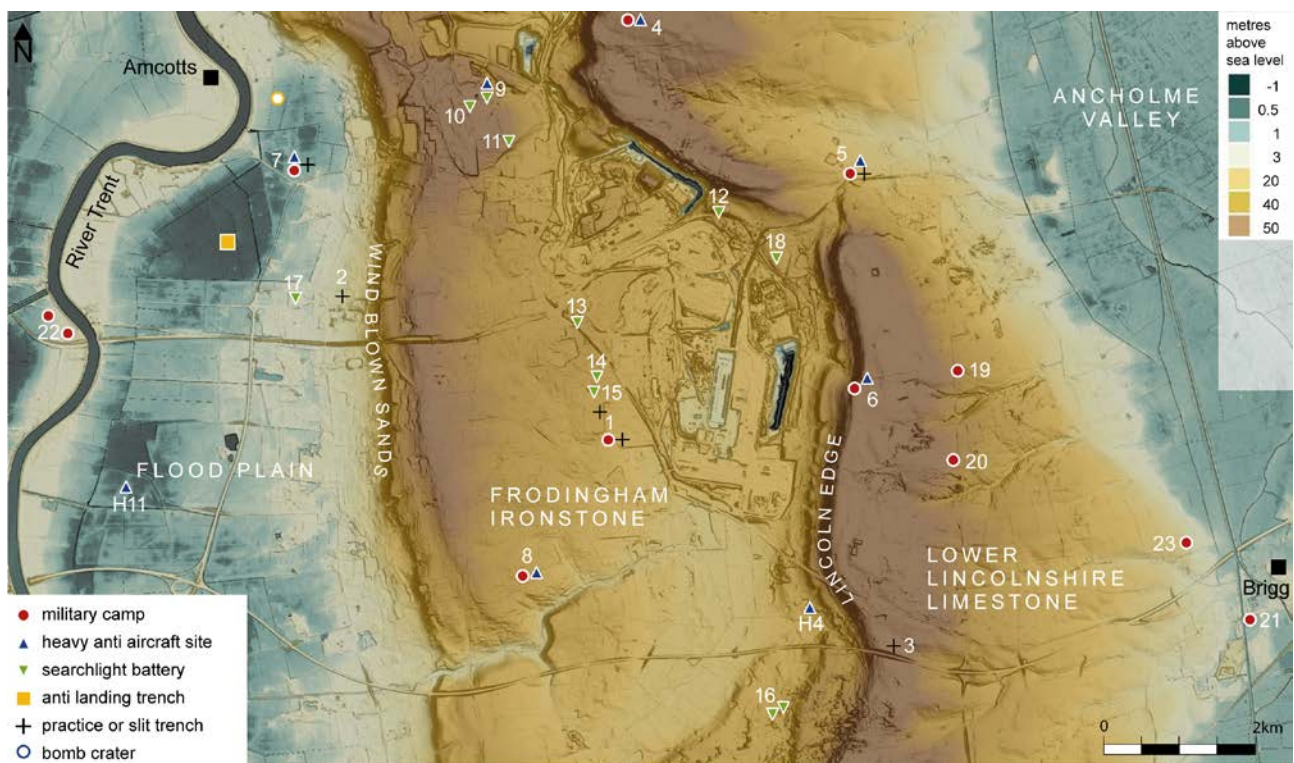


Figure 33: Distribution of 20th-century military sites and installations (see Table 1 for details). (Background generated from BGS Geology Viewer and lidar DTM 2018 © Historic England; source Environment Agency).

Three main types of Second World sites were recorded by this project: gun batteries, searchlight batteries and camps and depots for various activities (see Table 1).

Gun batteries

During the Second World War Scunthorpe was a gun defended area with 12 heavy anti aircraft sites, reflecting its importance as a centre of industry. Of the 12 sites, Scunthorpe H1, H7-H8, H12 are outside of this project area and H9 does not appear to have been allocated. Neither H4 or H11 are visible at the given locations on the post-war aerial photographs, they are reported as unarmed in 1942 and may have been completely dismantled by 1947.

A further three sites: Santon Hill (MLS20844), Gokewell (MLS21408), East of Neap House Farm (MLS21394) are also recorded as unarmed in 1942. The emplacements at these sites were in a ruinous state by 1947 and the examples at Santon Hill may have been made of sandbags rather than built with concrete.

The two heavy anti-aircraft batteries at Sawcliffe and Bottesford had substantial concrete emplacements and they remained standing long after the end of the war.

Most of the heavy anti-aircraft batteries had small camps nearby. These provided offices, barracks, stores and other facilities for the operators and their support teams.

Searchlight emplacements

Small earthworks thought to be searchlight emplacements have been identified in the project area. These comprise either small single mounds, or more often, trios of mounds. Like the gun sites, these were concentrated around Scunthorpe and the steel works, but there are outliers on the flood plain and on Twigmoor Warren.

Camps and Depots

A depot camp stood on the east side of Ermine Street concealed by the trees of Broughton Wood. This was RAF Broughton, a supply depot for local air bases and it was built late in the war (MLS22696). The lidar imagery indicates that the bases of the stores, offices and barracks are still present. There is was a smaller accommodation camp a kilometre south along Ermine Street in Manby Wood. It has been suggested that this housed the WAAFs (Women's Auxiliary Air Force) working at the depot (MLS22710). Ground investigations at the Manby Wood camp found that blast furnace slag from the nearby steel works had been used as hardcore in the hut bases (MLS22710).

There were two small camps on the west bank of the River Trent at Keadby, one at Castlethorpe and another at Brigg. The Castlethorpe example was a German Working Camp known as Camp 148 (MLS21364, Thomas 2003, 32). The huts were arranged in lines along the southern and western edges of Castlethorpe Covert, in the south-west corner of the wood and on the cleared ground between the wood and Castlethorpe Hall. The lidar imagery indicates that some hut bases and other small earthworks survive under the tree cover.

The two Keadby camps were located on either side of Station Road (MLS21369 & MLS27046). One is reported to have been a prisoner of war camp, though it is not listed in English Heritage's nationwide survey of these sites (Thomas 2003). These camps were located to the immediate north of Keadby Bridge, which was a strategic rail and road crossing point on the River Trent. Similarly, the small camp at Brigg is located next to the New River Ancholme Bridge and within 1km of other strategic rail and road crossing on the old and new rivers (MLS26935).

Subsequent use and current condition

Many of the camps were re-used after the war. The small camp at Santon Hill for example is reported to have been a PoW camp in 1946 (MLS21366). The camps at Sawcliffe and Bottesford were informally occupied after the war, reflecting the overall shortage of housing in Scunthorpe at this time.

The Sawcliffe heavy anti-aircraft emplacements are one of the better preserved Second World War sites in the project area. This site was assessed for the Monuments Protection Programme and no further scheduling action was taken. The similar site at Bottesford was demolished and built over by 1973. At Gokewell the individual gun emplacements and some hut bases are visible as very low earthworks but there are no above ground remains at the sites near Neap House and Santon Hill.

The possible gun emplacement north-east of Conesby Farm was destroyed by ironstone mining but the small structure reported to be the ammunition store is still standing on the edge of the mine (MLS26110).

The lidar imagery indicates that elements of the RAF Broughton supply depot and the nearby camp and the PoW camp in Castlethorpe Covert may survive as low earthworks within the woods. The camps at Keadby and Brigg have been demolished, levelled and in two cases built over, the third is now a play park. Most of the putative searchlight battery sites have been levelled or destroyed, only the example on Twigmoor Warren survives as low earthworks.

Table 1: Second World War Military sites

No. Fig. 32	Types	Name/Location (HER monument No.)
4	heavy anti aircraft battery & camp	Scunthorpe H2, Sawcliffe (MLS19666)
5	heavy anti aircraft battery & camp	Scunthorpe H3, Santon Hill (MLS21366 & MLS20844)
6	heavy anti aircraft battery & camp	Scunthorpe H10 /Gokewell (MLS21408)
7	heavy anti aircraft battery & camp	Scunthorpe H6 or E, east of Neap House Farm (MLS21394)
8	heavy anti aircraft battery & camp	Scunthorpe H5, Bottesford (MLS21386)
9	gun emplacement & searchlight battery	north-east of Conesby Farm (MLS26110)
10	searchlight battery	north-west of Conesby Farm (MLS26970)
11	searchlight battery	south of Conesby Farm (MLS26968)
12	searchlight battery	Soke Nook Plantation (MLS26806)
13	searchlight battery	New Frodingham (MLS27177)
14	searchlight battery	Midland Road (MLS27169)
15	searchlight battery	East Common Lane (MLS271170)
16	searchlight battery	Twigmoor Warren (MLS26928)
17	searchlight battery	Doncaster Road (MLS21395)
18	searchlight battery	South-west of Santon (MLS26806)
19	depot	RAF Broughton/Brigg Supply Depot in (MLS22696)
20	accommodation camp	associated with RAF Broughton/Brigg Supply Depot (MLS22710)
21	camp	Brigg (MLS26935)
22	camp	two camps at Keadby (MLS21369 & MLS27046)
23	camp (prisoner of war)	Castlethorpe Covert (MLS21364)

Current condition and landscape context
HAA – structural elements still present but overgrown camp – all huts removed but some hardstandings still present
HAA - partly demolished by 1947, now completely levelled and returned to cultivation camp - still standing in 1947, now all elements removed, most ground returned to cultivation
HAA – partly demolished by 1947, now low, overgrown earthworks camp – most huts removed by 1947, now low earthworks, partly rough grass, partly under trees.
HAA – partly demolished in 1947, now levelled and returned to cultivation camp – some huts still standing in 1947, now levelled and returned to cultivation
HAA – still extant in 1947, now built over camp – still extant in 1947, now built over
gun emplacement – destroyed by surface mining ammunition store – extant searchlight battery – levelled earthwork
now levelled and under cultivation
now levelled and under cultivation
now levelled and under cultivation and rough grassland
built over
built over
land is now a park the earthworks are levelled or destroyed
survive as low and disturbed earthworks
demolished by 1947, now built over
partly demolished by 1947, now levelled and returned to cultivation
earthworks
some low earthworks
built over
MLS21369 –all structures demolished MLS27046 – now all structures demolished and a small park
low earthworks in woods, ground to south cleared of any structures

Project products and outcomes

Project products

The work of this project has generated a spatial dataset, monument records and several ancillary resources for various audiences. It is recorded in [OASIS](#) under the identifier alisonde1-508469.

Spatial dataset (the project map)

This project has produced accurate, detailed and consistent mapping from aerial photographs and lidar imagery. Every map feature is tagged with summary information including the monument period and type, the source imagery and is linked by a unique identifier to the relevant monument record.

This spatial dataset will be shared with North Lincolnshire Historic Environment team and embedded within the GIS environment that they use for planning and development. It will be available online via the Historic England [Aerial Archaeology Mapping Explorer](#). The mapping will also be available to download or to access via API from the Historic England [Open Data Hub](#).

Monument records

The project has enhanced 155 existing North Lincolnshire HER monument records and created 313 new monument records. North Lincolnshire HER records are available to search and read via the Heritage Gateway.

The Heritage Schools Programme

This project produced tailored resources for seven individual schools. These are an adjunct to the map and aerial photograph packs that are produced by Heritage Schools Programme team. The tailored packs included georeferenced aerial photograph regressions, highlighted key earthwork or cropmark sites in the vicinity of each school and suggested simple observation and surveying activities on local and accessible sites.

To acknowledge the importance of the steel industry in this area a resource focusing on steel production was compiled from historical aerial photographs. This uses images of the key buildings and structures to provide a simple overview of the process of steelmaking at an integrated steelworks.

In addition, this project created a resource that explains the warping process and its impact on the modern landscape.

Iron and Steel Works map and photograph regressions.

Wayne Cocroft, Historic England Senior Archaeological Investigator (Military/Industrial Archaeology) identified a need to understand what might survive on the site of each of the late 19th-century steelworks at Scunthorpe. To meet this requirement a sequence of images was generated from historical Ordnance Survey maps, late 19th- and early 20th-century ground photographs and aerial photographs taken from the 1920s onwards. From this sequence the location of the original blast furnaces was identified, the date of demolition ascertained, the likely impact of mining and re-mining activity at those locations assessed and the subsequent and current land use established.

This analysis has established that no structural remains of the original 19th-century ironworks survive above current ground level. The low remains of early 20th-century blast furnaces do appear to survive as earthworks or grassed-over stonework at Appleby and Redbourn. This analysis has also assessed the potential for survival of any elements of the original iron works structures below current ground level. This information is summarised in Appendix 1.

Other outputs

The OASIS event record for this project has been updated to signpost the completion of the project and the availability of its data and this report (alisonde1-508469). The topics in the East Midlands Regional Research Frameworks to which this work may contribute have been flagged.

A presentation on the work of this project was delivered to international aerial survey colleagues at this discipline's annual conference, Aerial Archaeology Research Group Zagreb 2023. It focused on the unique warping landscapes of the lower Trent Valley and Scunthorpe's industrial heritage.

Project outcomes

National Heritage List for England

As discussed in preceding chapters, this project did not identify any cause to suggest changes or amendment to the boundaries and descriptions of the scheduled monuments in this area. However, it is noted that Money Field Roman site, Dragonby (NHLE1055224) is an 'Old County Number' that did not undergo Monument Projection Programme review. It is anticipated that the aerial mapping of this site may contribute to any future review.

The National Heritage List and the iron and steel industry at Scunthorpe



Figure 34: The four blast furnaces at Scunthorpe (NMR 20320_008 28 June 2005 © Historic England Archive).

At present, no heritage asset linked to Scunthorpe's iron and steel industry has scheduled monument or listed building protection, despite Scunthorpe's unique position as the last of the integrated steelworks in England. The near-future will bring significant changes to steelmaking in the country, primarily with a shift to low-carbon production methods. Williams observes that redundant structures and sites are rapidly demolished and cleared (2019, 21).

The steel works are dynamic landscapes with hardworking infrastructure that is frequently replaced or updated. The list below includes surviving early to mid-20th century structures, possible buried and low earthwork remains of early 20th-century blast furnaces, and late 20th-century features with significant impact on the surrounding landscape.

This list is intended only to highlight the presence of these assets, no attempt has been made to evaluate them against the formal designation criteria.

- Four queens blast furnaces. Commissioned in 1939 and 1954, producing molten iron for the steelmaking process. Distinctive structure and iconic landmarks with high visibility in Scunthorpe and its environs. (Fig. 34)
- Dragonby Surface Incline. Large landscaped concavity at entrance to underground iron ore mine. Now disused. See [EAW028986](#)(MLS27112)
- Low remains of two early 20th-century blast furnaces at Appleby Site. Grassed over earthworks, possible pig casting bays, furnace pad and foundation. Elements of the earlier iron works may lie under these remains. (see Fig. 23) (MLS27102)
- Low remains of a 20th-century blast furnaces and other features, at Redbourn Hills. Grassed over earthworks and some exposed brickwork, possible pig casting bays, furnace pad and foundation. Elements of the earlier iron works may lie under these remains. (see Fig. 22) (MLS27104)
- Workshops east of Normanby Road next to the former Lysaght's Normanby steel works. Red brick workshops built between 1935 and 1947. No buildings survive on the Lysaght's site. (MLS27089)
- Group of buildings that had stood east of the Frodingham Steel Works blast furnaces survive. One may be depicted on the OS 25 inch map of 1907. This potential for this building to stand on the remains of features associated with earlier phases of iron working at Frodingham. (see Fig. 21) (MLS27106)

- Winder house, Dawes Lane. Identifiable by its exposed steel framework. Built in 1939. (MLS27108)
- North Adit. Wide, winged façade entrance to the underground iron ore mine. Built 1957. (MLS27110)

Under-represented monument types

Two monument types or themes are under-represented in National Heritage List for England: retting pits and warping infrastructure.

This project has identified one example of a group of retting pits that survive as earthworks, those near Broughton Grange (MLS26865). However, a systematic review of known and potential examples in the county of Lincolnshire may yield better candidates for consideration.

There are three listed or scheduled assets that are directly associated with the practice of warping in the lower Trent Valley: Keadby Lock (NHLE1342735), the Sluice at Derrythorpe Road (NHLE1076974) and the Sluice at Snow Sewer (NHLE1083227). However, none of these extend to the associated warping drains or embankments. In the absence of any precedent for this particular monument type it unclear what criteria candidates should be judged against. The mapping generated for this project and the discussion in this report may provide a starting point for a discussion, but it is possible that better candidates lie further to the south or west of this project area.

Appendix 1 Structure of the spatial data

The features mapped by this project have the following attribute or object data.

Field Name	Description	Sample data
LAYER	the form of the archaeological feature	BANK or DITCH
PERIOD	date of feature	NEOLITHIC or MEDIEVAL/ POST MEDIEVAL
NARROWTYPE	monument type	TOFT
BROAD_TYPE	broader monument type to enable grouping of individual features	SETTLEMENT
EVIDENCE_1	form of remains as seen on SOURCE_1	EARTHWORK
SOURCE_1	source feature was mapped from i.e. details of aerial photograph or lidar	HISTORIC ENGLAND ARCHIVE OS/67307 V 0065 20-AUG-1967
EVIDENCE_2	form of remains as seen on SOURCE_2, usually the latest observed condition	LEVELLED EARTHWORK
SOURCE_2	latest available informative source aerial photograph or lidar	LIDAR English Heritage Trust DSM 03 & 14-MAR-2016
HE_UID	Historic England Research Record number (if available)	23092
HER_NO	Historic Environment Record number	MLS12354

The monument polygons generated by this project (which outline features covered by a single monument record) have following attribute or object data.

HE_UID	Historic England Research Record number (if available)	23092
HER_NO	Historic Environment Record number	MLS12354

Appendix 2 Survival potential on the sites of the 19th-century iron works

NORTH LINCOLNSHIRE IRON WORKS (MLS27105)

NGR: SE917 109

Established: 1865

Early layout: Up to four blast furnaces, stoves to the west, pig iron casting beds to the east
Brief site history: 1926 four blast furnaces standing. 1936 blast furnaces demolished and demolition of other structures underway. 1936 – 1940s possible/likely iron ore extraction. By 1947 site had been re-developed.

Current site use: coke oven plant and oil refinery

BGS classification for original site area (from 1970s large scale maps): backfilled opencast workings and quarry

Potential for survival of features dating the late 19th and early 20th century: VERY LOW - although the aerial photographs do not directly record ironstone mining at the location of the furnaces, it is likely that ore was removed before the site was re-developed.

TRENT IRON WORKS (MLS27098)

NGR: SE908 116

Established: 1864

Early layout: Up to five blast furnaces (OS 25 inch map of 1887 shows six)

Brief site history: 1926 some blast furnaces still standing. 1936 all blast furnaces had been demolished but some other structures still standing. 1947 ironstone open mining on adjacent ground but possible that the narrow strip on which blast furnaces had stood escaped this. 1947 onwards buildings on the site.

Current site use: Casting workshops and other works

BGS classification for original site area (from 1970s large scale maps): backfilled opencast workings and quarry

Potential for survival of features dating the late 19th and early 20th century: LOW but If the ground on which the furnaces stood was not mined in the mid-20th century, then it is possible that some elements may survive below ground level.

LINDSEY IRON WORKS (MLS27101)

NGR: SE9052 1147

Established: 1873

Early layout: Two blast furnaces

Brief site history: 1907 furnaces demolished, followed by ironstone open mining around and possibly on the blast furnace site. 1940s onwards this has been an engine/wagon maintenance yard.

Current site use: Rail maintenance yard

BGS classification for original site area (from 1970s large scale maps): General area: backfilled opencast workings and quarries but area of furnaces: wind blown sand.

Potential for survival of features dating the late 19th and early 20th century: LOW TO MEDIUM
There are no above ground remains but the BGS data suggests the site of the furnaces escaped ironstone mining so below ground remains are possible. Could the 'wind blown sands' actually be remnants of pig iron casting beds?

FRODINGHAM IRON WORKS (MLS27106)

NGR: SE904 111

Established: 1865

Early layout: Up to four blast furnaces, stoves to the south-east, pig iron casting beds to the north-west

Brief site history: 1953 blast furnaces on same site (but not original BFs). 1953-1958 furnaces demolished, site then levelled, except for two building which still stand.

Current site use: road & parking tarmac surfaces

BGS classification for original site area (from 1970s large scale maps): backfilled opencast workings and quarry (if correct this must have happened before 1865)

Potential for survival of features dating the late 19th and early 20th century: LOW TO MEDIUM
A) early 20th-century and late 19th-century peripheral elements of the iron works may survive beneath the footprint of the two surviving buildings B) if any parts of the blast furnaces or associated structures were left below ground level when the site was demolished in the mid-1950s then there it is possible that those elements still survive below ground level.

APPLEBY IRON WORKS (MLS27102)

NGR: SE924 118

Established: 1876

Early layout: Up to four furnaces in early years, then two demolished and two new built further to the north in the early 20th century

Brief site history: 1951 blast furnaces still active 1964 blast furnaces demolished, site relandscaped but not totally cleared and not yet redeveloped

Current site use: Mix of levelled and rough open ground

BGS classification for original site area (from 1970s large scale maps): made ground

Potential for survival of features dating the late 19th and early 20th century: MEDIUM TO HIGH earthworks and structural remains that may pertain to the two early 20th century blast furnaces and associated structures are visible. Although the site of the late 19th-century furnaces has been levelled elements may survive beneath current ground level and peripheral elements beneath the other earthworks.

REDBOURN HILL IRON WORKS (MLS27104)

NGR: SE919 109

Established: 1875

Early layout: two furnaces in late 19th-century replaced by one on same site and two further south in early 20th century

Brief site history: until 1980 three blast furnaces (probably rebuilt several times) on site. 1980 large scale clearance of all structure and buildings, then used for open storage

Current site use: Mix of levelled and rough open ground

BGS classification for original site area (from 1970s large scale maps): backfilled opencast workings and quarry (if correct it is likely that this happened before 1875)

Potential for survival of features dating the late 19th and early 20th century: MEDIUM TO HIGH earthworks and structural remains pertaining to one of the 20th century blast furnaces and associated structures are visible. Potential for earlier remains to survive below ground level and in areas where the current ground is elevated.

References

- Jones, A K G (1996) 'Fishes', in *Dragonby. Report on excavations at an Iron Age and Romano-British settlement in North Lincolnshire*. Oxbow Books.
- Allen Archaeology Limited (2010) *Archaeological scheme of works final report: land off Phoenix Parkway, Scunthorpe, North Lincolnshire*. 2010004.
- ARS Ltd (2021) Archaeological Evaluation on Land off Oak Avenue, Scawby, North Lincolnshire. 2021/150/73.
- Boyer, P, Proctor, J, and Taylor-Wilson, R (2009) *On the Boundaries of Occupation. Excavations at Scunthorpe and Bottesford, North Lincolnshire*. Pre-Construct Archaeology Limited (PCA Monograph 9).
- Creyke, R (1824) 'Warping Peat Moss', *Transactions of the Society, Instituted at London, for the Encouragement of Arts, Manufactures, and Commerce*, 43, pp. 3–11.
- Creyke, R (1845a) 'On Warping', *Journal of the Royal Agricultural Society of England*, 5, pp. 399–405.
- Creyke, R (1845b) 'Some Account of the Process of Warping', *British Farmer's Magazine* [Preprint], (9). Available at: https://books.google.co.uk/books?id=8tkEAAAQAAJ&dq=Some+account+of+the+process+of+warping&source=gbs_navlinks_s.
- Cook, H, Stearne, K and Williamson, T (2003) 'The origins of water meadows in England', *The Agricultural History Review*, 51(2), pp. 155–162.
- Cowgill, J (2009b) 'Archaeometallurgical Debris Report' included in Allen Archaeology 2010.
- Cowgill, J (2009a) 'Industrial Residues', in *Iron Age and Roman Settlement Activity at Timberland, Scunthorpe, North Lincolnshire*. Archaeological Services WYAS (Archaeological Services WYAS publications, 11).
- Daff, T (1981) 'The establishment of ironmaking at Scunthorpe', in *An Industrial Island: A History of Scunthorpe*. Scunthorpe Borough Museum and Art Gallery.
- Daglish, J and Howse, R (1875) 'Some Remarks On The Beds Of Ironstone Occurring In Lincolnshire.', *Transactions of North of England Institute of Mining and Mechanical Engineers* [Preprint].

Deegan, A (2007) 'Late Bronze Age, Iron Age and Roman settlements and Landscapes', in *Mapping Ancient Landscapes in Northamptonshire*. English Heritage, pp. 81–123.

Dudley, H (1949) *Early Days in North-West Lincolnshire. A Regional Archaeology*. Scunthorpe: W. H. & C. H. Caldicott.

Everson, L, Taylor, C C and Dunn, C J (1991) *Change and Continuity: Rural Settlement in North-West Lincolnshire*. HMSO.

Gaunt, G (2020) *The Quaternary geology of the southern part of the Vale of York*. The Thorne & Hatfield Moors Conservation Forum.

Coppack, G and Hayfield, C (1998) 'Thornholme Priory: the archaeology of a small Augustinian house'.

Henthorn, F (1981) 'The Coming of the Railway', in *An Industrial Island: A History of Scunthorpe*. Scunthorpe Borough Museum and Art Gallery, pp. 39–45.

Herapath, T J (1850) 'The improvement of land by warping, chemically considered.', *Journal of the Royal Agricultural Society of England*, 11, pp. 93–113.

Historic England (2018) *Historic England – Water Meadows – Introductions to Heritage Assets*. Swindon: Historic England.

Historic England (2021) *Peatlands and the Historic Environment: An Introduction to their Cultural and Heritage Value*. HEAG300a (version 1.1). Portsmouth: Historic England. Available at: [HistoricEngland.org.uk/advice/technical-advice/peatlands/](https://historicengland.org.uk/advice/technical-advice/peatlands/).

Historic England (2023) *Heritage at Risk. East of England Register 2023*. Historic England.

Jones, D (1998) 'Long Barrows and Neolithic Elongated Enclosures in Lincolnshire: An Analysis of the Air Photographic Evidence', *Proceedings of the Prehistoric Society*, 64, pp. 93–114.

Knight, D, Vyner, B and Allen, C (2012) *East Midlands heritage: an updated research agenda and strategy for the historic environment of the East Midlands*. Nottingham, York: University of Nottingham ; York Archaeological Trust for Excavation and Research.

Leahy, K and Steedman, K (2008) 'Lost and found - the tale of the Conesby Moat at Scunthorpe, North Lincolnshire', *Current Archaeology*, (221), pp. 26–31.

Loveluck, C and Atkinson, D (2019) *The Early Medieval Settlement Remains from Flixborough, Lincolnshire: The Occupation Sequence, c. AD 600-1000*. Oxbow Books. Available at: <https://doi.org/10.2307/j.ctv2p7j5zq>.

Lillie, M (1998) 'Alluvium and warping in the lower Trent valley', in *Wetland heritage of the Ancholme and Lower Trent Valleys: An Archaeological Survey*, pp. 102–122.

Limbirt, M (2020) 'Dr. G. D. Gaunt: A Bio-Bibliography', in *The Quaternary geology of the southern part of the Vale of York*. The Thorne & Hatfield Moors Conservation Forum, pp. viii–x.

Loughlin, N and Miller, K R (1979) *A survey of archaeological sites in Humberside carried out for the Humberside Joint Archaeological Committee*.

Martin, L, Richardson, R and Roberts, I (2013) *Iron Age and Roman settlements at Wattle Syke: archaeological investigations during the A1 Bramham to Wetherby upgrading scheme*. Archaeological Services WYAS (Yorkshire Archaeology, 11).

May, J (1996) *Dragonby. Report on excavations at an Iron Age and Romano-British settlement in North Lincolnshire*. Oxbow Books.

Neumann, H (1998) 'The palaeoenvironment survey of the Ancholme Valley', in *Wetland heritage of the Ancholme and Lower Trent Valleys: An Archaeological Survey*, pp. 74–101.

Nevell, M (2022) 'The Archaeology of the Iron and Steel Industries in Britain' in *The Oxford Handbook of Industrial Archaeology*. Edited by E. C. Casella, M. Nevell, and H. Steyne. Oxford University Press, pp. 322–340. Available at: <https://doi.org/10.1093/oxfordhb/9780199693962.013.7>.

Pocock, D C D (1964) 'Stages in the Development of the Frodingham Ironstone Field', *Transactions and Papers (Institute of British Geographers)*, (35), p. 105. Available at: <https://doi.org/10.2307/621103>.

Pocock, D C D (1981) 'The industrial base, 1875-1919', in *An industrial Island: A History of Scunthorpe*. Scunthorpe Borough Museum and Art Gallery.

Pusey, P (1843) 'On the agricultural improvements of Lincolnshire.', *Journal of the Royal Agricultural Society of England*, 4, pp. 287–315.

Palaeoecology Research Services (2009) 'Fish', in *On the boundaries of occupation. Excavations at Burringham Road, Scunthorpe and Baldwin Avenue, Bottesford, North Lincolnshire*. Pre-Construct Archaeology Limited.

Pre-Construct Archaeology Ltd (2010) *Archaeological Evaluation at the Former Riddings Allotment Gardens, Burringham Road, Scunthorpe, North Lincolnshire*. Unpublished report

Richardson, J (2009) *Iron Age and Roman Settlement Activity at Timberland, Scunthorpe, North Lincolnshire*. Archaeological Services WYAS (Archaeological Services WYAS publications).

Richer, S (2021) 'Archaeological evidence of flax and hemp around the Isle of Axholme and Hatfield Chase, North Lincolnshire'. Available at: <https://ioahc.net/from-flaxen-locks-to-retting-pits-final-report/> (Accessed: 23 February 2024).

Riley, D N (1978) 'Risby Warren, an occupation site dating from the Mesolithic to the Early Bronze Age.', *Lincolnshire History and Archaeology*, 13.

Russell, R C (1981) 'The enclosures of Ashby, Crosby, Scunthorpe & Frodingham, Brumby Common and Brumby Moors', in *An Industrial Island: A History of Scunthorpe*. Scunthorpe Borough Museum and Art Gallery, pp. 14–23.

Scholma-Mason, O, Bailey, L and Dalland, M (2017) 'The Archaeology of a Dynamic Landscape - Archaeological Works at Keadby Windfarm', *Lincolnshire History and Archaeology*, 52.

Smith, T M (2023) 'Warping and parliamentary enclosure: the example of north-west Lindsey, Lincolnshire'. *Agricultural History Review* 62, 1 pp 83-97

Smith, T M (no date a) 'ENCLOSURE & AGRICULTURAL IMPROVEMENT IN NORTH-WEST LINCOLNSHIRE FROM CIRCA 1600 TO 1850.'

Thomas, R J C (2003) *Prisoner of War Camps (1939 – 1948)*. English Heritage.

Van de Noort, R and Ellis, S (eds) (1998) *Wetland heritage of the Ancholme and Lower Trent Valleys: An Archaeological Survey*. Humber Wetlands Project, University of Hull.

Wells, L (no date) 'Industrial History of Scunthorpe: Appleby Iron Company'. Available at: <https://industrialhistoryofscunthorpe.wordpress.com/places/appleby-iron-company-1876/> (Accessed: 14 February 2024).

Williams, M (2019) *The Steel Industry in England: An Historical Overview*. 065–2019. Historic England.

Winton, H (1998) 'The cropmark evidence for prehistoric and Roman settlement in West Lincolnshire.', in *Lincolnshire's Archaeology from the Air*. (Lincolnshire History & Archaeology, 11).

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