

Tween Bridge Solar Farm

Environmental Statement

Appendix 8.2: Geophysical Survey Report – Part 1

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms
and Procedure) Regulations 2009

APFP Regulation 5(2)(a)

Document Reference: 6.3.8.2

August 2025

Revision 1



**magnitude
surveys**

**Geophysical Survey Report
of
Tween Bridge,
Thorne, Doncaster South Yorkshire
To
Crowle, North Lincolnshire**

**For
Pegasus Planning Group**

Magnitude Surveys Ref: MSSE1548

South Yorkshire HER Event Number: TBC

North Lincolnshire HER Event Number: TBC

OASIS Number: TBC

June 2025



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Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of Tween Bridge Solar Scheme in South Yorkshire/North Lincolnshire. A fluxgate gradiometer survey was successfully completed on a c. 1850 area of land. Anomalies of probable and possible archaeology were identified, including a 19th century tramway relating to peat extraction, possible enclosures of unknown date, former cottages and farm buildings, and several anomalies relating to the bomb storage area of RAF Sandtoft. The historical and modern agricultural use of the landscape is evident throughout the survey area in the form of ploughing trends, mapped and unmapped former field boundaries, drainage regimes and ponds. An area of unknown extraction was identified in the southeastern corner of the survey area. Geological variations have been detected throughout the survey area, this includes anomalies associated with the old course of the River Don, as well as various other superficial deposits. In addition, a number of anomalies have been classified as undetermined, these are of uncertain date and function and have little supporting context. Magnetic Interference from modern sources such as extant fencing, wind turbines, pylons, overhead cables, troughs, agricultural equipment and buried services is visible across the survey area, the effect of this interference is limited but locally significant.

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1. Introduction

- 1.1 Magnitude Surveys Ltd (MS) was commissioned by Pegasus Planning Group to undertake a geophysical survey over a c. 1850ha area of land at Tween Bridge. The survey area is located between the villages of Thorne, South Yorkshire and Crowle, North Lincolnshire (SE 70473 12078 centred).
- 1.2 The survey area consists of two land parcels separated by the Stainforth and Keadby Canal. In the northern parcel, 18 exclusion zones around existing wind turbines have been added.
- 1.3 The geophysical survey comprised both quad-towed and hand-carried GNSS-positioned fluxgate gradiometer survey. Magnetic survey is the standard primary geophysical method for archaeological applications in the UK due to its ability to detect a range of different features. The technique is particularly suited for detecting fired or magnetically enhanced features, such as ditches, pits, kilns, sunken featured buildings (SFBs) and industrial activity (David *et al.*, 2008).
- 1.4 The survey was conducted in line with the current best practice guidelines produced by Historic England (David *et al.*, 2008), the Chartered Institute for Archaeologists (CIfA, 2020) and the European Archaeological Council (Schmidt *et al.*, 2015).
- 1.5 The survey area is located between the boundaries of the South Yorkshire and North Lincolnshire HER. It was agreed by both the South Yorkshire Local Planning Archaeologist (LPA) and North Lincolnshire LPA that a non-intrusive archaeological gradiometer survey was to be undertaken on the site. The survey was therefore conducted in line with both the South Yorkshire Standards for Archaeological Field Evaluation (2022) and the Archaeological Handbook for Lincolnshire (2019) guidance.
- 1.6 It was conducted in line with a WSI produced by MS (Dyulgerski, 2023).
- 1.7 The survey commenced on 5/06/2023 and took 30 weeks to complete, with the last survey week occurring on the week commencing 10/3/2025.

2. Quality Assurance

- 2.1 Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society for Archaeological Prospection).
- 2.2 The directors of MS are involved in cutting edge research and the development of guidance/policy. Specifically, [REDACTED] has a PhD in archaeological geophysics from the University of Bradford, is a Member of CIfA and is the Vice-Chair of the International Society for Archaeological Prospection (ISAP); [REDACTED] has an MSc in archaeological geophysics and is a Fellow of the London Geological Society, as well as a member of GeoSIG (CIfA Geophysics Special Interest Group); [REDACTED] has a PhD in archaeology from the University of Southampton, is a Fellow of the Society of Antiquaries of London and a Member of CIfA, has been a member of the ISAP Management Committee since 2015, and is currently the nominated representative for the EAA Archaeological Prospection Community to the board of the European Archaeological Association.

- 2.3 All MS managers, field and office staff have degree qualifications relevant to archaeology or geophysics and/or field experience.

3. Objectives

- 2.4 The objective of this geophysical survey was to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

- 4.1 The survey area is located between the villages of Thorne, South Yorkshire and Crowle, North Lincolnshire (Figure 1). The survey area, which consists of a total of 1752, is segmented into two land parcels separated by the Stainforth and Keadby Canal measuring 694ha (North) and 1144ha (South) respectively. The survey area is bordered by the villages of Moorends and Thorne to the west, the M180 to the south, the villages of Ealand and Crowle to the east and Thorne Moors to the north.

- 4.2 Gradiometer survey was undertaken across 205 fields predominantly under arable cultivation. The survey area is bounded by Thorne Moors in the north, Crowle Moors to the northeast, the village of Crowle in the east, the M180 in the southeast, agricultural fields to the south of Low Levels Bank, Tudoworth Road in the southwest, Double Bridges Road and the village of Thorne in the west, with Moorends bounding the survey area in the northwest (Figure 2). An area measuring approximately 19ha was unable to be surveyed, this was due to overgrown crops, overgrown vegetation, land access issues, or muddy and waterlogged conditions.

- 4.3 Survey considerations:

Survey Area	Ground Conditions	Further Notes
Survey	Ground Conditions	Further Notes
1	The survey area consisted of a flat cultivated field.	The survey area was bordered to the north and east by hedgerows and trees and to the south by a ditch. The eastern most section of the survey area was unable to be surveyed due to the presence of deep ruts. Overhead cables and telegraph poles were present in the east of the survey area.
2	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north by a ditch and to the east and south by roads. Overhead cables and telegraph poles were present in the east of the survey area.
3	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north by a ditch and to the east and south by roads. Overhead cables and telegraph poles were present in the east of the survey area.
4	The survey area consisted of a flat cultivated field.	The survey area was bordered by a road to the east and west, an earth mound to the

		north and a ditch to the south. The southeast corner was unable to be surveyed due to the presence of a wind turbine.
5	The survey area consisted of a flat arable field with crop stubble.	The survey area was surrounded by water. A series of wind turbines and a road ran along the western border, and a bridge located near to the south-eastern corner.
6	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered in the east and south by ditches and in the west by a road. A road cuts across the survey area in the east. Sections in the north, east and west were unable to be surveyed due to the presence of wind turbines and an earth mound.
7	The survey area consisted of a flat cultivated field.	The survey area was bordered in the north and east by roads and to the south by a ditch. The southwest corner was unable to be surveyed due to the presence of pylons.
8	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north and east by ditches and to the west and south by roads. A section in the east and the south were unable to be surveyed due to the presence of wind turbines and an earth mound.
10	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered in the east and the southwest by a road and to the west and south by ditches. A section in the southwest was unable to be surveyed due to the presence of a wind turbine.
11	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered by hedgerows and a ditch to the southwest, and by hedgerows in all other directions.
13	The survey area consisted of an undulating pasture field.	The survey area was bordered to the north and west by a ditch, and by hedgerows in all other directions. A strip in the centre of the survey area was unable to be surveyed due the presence of debris.
14	The survey area consisted of a flat arable field.	The survey area was bordered to the north by a grass verge and non-surveyable young crop, to the west by a grass verge, and to the south by ditches. A gravel road ran along the central sector, concrete pipes in the south-west, and wind turbines along the northern border.
15	The survey area consisted of a flat arable field.	The survey area comprised a 50m strip of land along a an access road. The north edge of the survey area was bordered by

		an access road. No physical bordered was present to the east west or south.
16	The survey area consisted of a flat arable field.	The survey area was bordered to the north and east by drainage ditches and to the west by a farm track. There was no physical boundary to the south of the survey area. A section in the east was unable to be surveyed due to the presence of overgrown vegetation.
17	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered in the north by hedgerows, northeast by a ditch and in the west and south by roads. Overhead cables and pylons were present across the eastern part of the survey area. A section in the east of the survey area was unable to be surveyed due to a mound of earth.
18	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered by hedge to the north and east. No physical border was present to the south or west. An access track was present along the west of the survey area.
21	The survey area comprised flat arable crop.	The survey area was bounded by road and access tracks to the east and west. A ditch was present along the south border. No physical border was present to the north. A wind turbine was present along the south west of the west border.
22	The survey area consisted of a flat cultivated arable field.	The survey area was bordered to the north by a ditch and access roads in all other directions. A section in the south was unable to be surveyed due to the presence of a wind turbine.
23	The survey area consisted of a flat arable field with young crop.	The survey area was bordered by ditches to the north south and east. A road was present along the west of the survey area.
24	The survey area consisted of a flat arable.	The survey area was bordered to the north and east by ditches, to the south by hedgerows and to the west by a trackway.
25	The survey area consisted of a flat arable.	The survey area was bordered to the east, south and west by ditches and to the north by a road. A section in the north was unable to be surveyed due to the presence of a wind turbine.
26	The survey area consisted of a flat arable field.	The survey area was bordered to west by a farm track and by drainage ditches in all other directions Overhead cables and pylons were present in the east and running NE-SE across the survey area.

27	The survey area consisted of a flat arable field with young crop.	The survey area was bordered to the east by a grass verge, and by ditches in all other directions.
28	The survey are comprised flat arable crop.	The survey area was bordered by hedge and drainage ditches to the south east and north. No physical boundary was present to the west. A large hardstanding platform and wind turbine were present along the west of the survey area.
29	The survey are comprised flat arable crop.	The survey area was bordered by forest to the south and east. Drainage ditches were present to the north and west.
30	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered by hedgerows and trees to the north, south and west, and to the east a ditch. Pylons and overhead cables were present across the survey area. A section in the west was unable to be surveyed due to the presence of crop.
31	The survey area comprised flat arable crop.	The survey area far bordered to the north by forest. A hedge and drainage ditch were present along the west border. A road and farm track ran along the south and east of the survey area.
32	The survey area comprised flat arable crop.	the survey area bordered a forest and farmhouse to the east of the survey area. A ditch and hedge ran along the north and south of the survey area. No physical boundary was present to the west.
33	the survey area comprised flat pasture	A ditch and tree line were present to the north and west of the survey area. A farm track rand along the east border. No physical boundary was present to the south of the survey area.
35	The survey area comprised flat arable crop.	the survey area was bordered by hedges and trees to the northwest, west, and south. No physical boundary was present ot the north of the survey area.
36	The survey area comprised flat arable land	The survey area was was bordered by a farm track and hand to the south east and north. There was noy physical boundary to the west.
37	The survey area comprised flat arable land	The survey area was was bordered by a farm track and hand to the south east and north. There was noy physical boundary to the west.
38	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north by ditches, to the east by a grass verge, and to the west and south by

		hedgerows. Telegraph poles, wire and a road also ran along the southern border.
39	The survey area consisted of flat arable with a young crop.	The survey area was bounded by drainage ditches to the north and south. No boundary was present to the west. A wind turbine and access road were present to the east of the survey area.
40	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north by hedgerows, to the east by a road and to the south by a ditch. Overhead cables and pylons were present across the southern part of the survey area.
41	The survey area comprised flat arable crop.	the survey area was bordered to the north and south by hedges. A farm track ran along the north edge of the survey area. No physical boundary was present to the east of west of the survey area.
42	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north and south by ditches and in the east by a path and the west by a grass verge. Rutting was present in the centre of the survey area.
43	The survey area comprised flat arable crop.	the survey area was bordered to the north and south by hedges. A farm track ran along the north edge of the survey area. No physical boundary was present to the east of west of the survey area.
44	The survey area consisted of a flat arable field with wheat crop.	The survey area was bordered to the northwest and south by drainage ditches and to the east and northeast by a grass verge. There was no physical boundary to the west of the survey area.
46	The survey area consisted of a flat arable field with wheat crop.	The survey area was bordered on all sides by ditches with some hedges. An access road ran along the north west of the survey area. A large hard standing platform and wind turbine were present in the centre of the survey area
47	The survey area consisted of a flat arable field with wheat crop.	The survey area was bordered on all sides by ditches with some hedges. An access road ran along the north west of the survey area. A large hard standing platform and wind turbine were present on the western border of the survey area
49	The survey area comprised flat arable crop.	The survey area was bordered to the east and west by a farm track and a rail road. The south was bordered by a ditch and hedge. There was no physical boundary to the north of the survey area.

50	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north, east and south by hedgerows and trees.
52	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered by hedge and a ditch to the north and south and east. An access road was present to the west of the survey area
53	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north, east, south, and west by trees. Overhead cables and pylons were present in the south and east of the survey area.
56	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north, east and west by ditches and to the south by a road. Overhead cables and pylons are present in the east of the survey area.
57	The survey area consisted of a flat arable field.	The survey area was bordered to the east and south by roads and to the north and west by ditches. Telegraph poles and overhead cables were present in the north of the survey area.
58	The survey area consisted of a flat arable field.	The survey area was bordered to the north and west by an electric fence and there was no physical boundary to the east and south. Sections in the south were unable to be surveyed due to the presence of wind turbines.
59	The survey area consisted of a flat arable field with crop stubble.	The survey was bordered on the east, south and west by a ditch, to the north by metal fencing, hedgerows, and a railway track.
61	The survey area consisted of an undulating arable field with crop stubble.	The survey area was bordered on the north, east and south by roads and the west by a ditch. A road cut across the survey area in the west. Sections on the southern and west of the survey area were unable to be surveyed due to the presence of wind turbines.
62	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north and south by a road and to the west by a ditch.
63	The survey area consisted of an undulating arable field.	The survey area was bordered to the north, east and west by agricultural fields, and to the south by trees and ditches. A gravel track ran along the north border and overhead cables ran long the centre and southern sectors of the area (aligned E-W).

76	The survey area consisted of a flat arable field with young crop.	The survey area was bordered to the north-west and south-east by water-filled ditches. Other agricultural fields were located in the west and east.
80	The survey area consisted of a flat arable field with crop stubble and hay bales.	The survey area was bordered to the north, east south and west by ditches. Overhead cables and telegraph poles were present on the northern bordered. An area to the southwest was unable to be surveyed due to overgrown vegetation.
81	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north and west by ditches, to the east by a grass verge and to the south by a road and ditch. Overhead cables and pylons are present in the south of the survey area.
87	The survey area consisted of a flat, but uneven arable field with crop stubble.	The survey area was bordered in all directions by water-filled ditches. A pylon was located in the north-eastern sector and its overhead cables ran west across the area.
88	The survey area consisted of a flat arable field with young crop.	The survey area was bordered to the north-east by a ditch, to the north-west by a road, to the south-west by tall grass and hedges, and to the south-west by agricultural fields. Telegraph poles and overhead cables were located along the north-eastern border.
92	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the north and east by ditches and to the south by overgrown vegetation and a road, and to the west by overgrown vegetation.
93	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered to the south by a road, the east by overgrown vegetation and to the north and west by ditches.
94	The survey area consisted of flat arable field with young crop	The survey area was bordered to the south by a road, the east by overgrown vegetation and to the north and west by ditches.
95	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered in the north and west by hedgerows, to the east by hedgerow and a ditch and to the south by a ditch. Overhead cables and telegraph poles were present on the northern border. In the survey area a significant number of haybales were present.
104	The survey area consisted of a flat arable field.	The survey area was surrounded by fences and bushes. Survey could not take place in the north-west due to haystacks and agricultural machinery.

109	The survey area consisted of a sloping arable field with crop stubble.	The survey area was surrounded by hedges. Telegraph poles and wires ran E-W near to the southern border and a piece of metal was located near to the northern border. An area near to the western border could not be surveyable.
110	The survey area consisted of a flat arable field.	The survey area was bordered to the north, east and west by ditches and to the south by trees and hedgerow. Overhead cables were present across the southern section of the survey area.
114	The survey area consisted of a flat arable field with linseed crop.	The survey area was bordered by hedgerows in all directions.
115	The survey area consisted of a flat arable field with linseed crop.	The survey area was bordered by hedgerows to the north and east, and by overgrown vegetation to the south and west.
116	The survey area consisted of a flat arable field with linseed crop.	The survey area was bordered by a track to the north and east, and by hedgerows to the south and west.
117	The survey area consisted of a flat arable field with harvested crop stubble.	The survey area was bordered to the west and south by hedges with reinforced concrete posts and wire. The north-east was bordered by wooden fences and hedges, as well as the M180. A water-logged area in the centre could not be surveyed.
118	The survey area consisted of a flat cultivated arable field.	The survey area was bordered to the south and east by roads and to the north and west by hedgerows and trees.
119	The survey area consisted of a flat cultivated arable field.	The survey area was bordered to the north by the M180, a copse of trees to the east and further agricultural field to the south and west.
120	The survey area consisted of a flat cultivated arable field.	The survey area was bordered to the north and east by ditches and to the south and west by hedgerows and roads.
121	The survey area consisted of a flat arable field.	The survey area was bordered to the east by hedgerows and a ditch and was bordered by ditches in all other directions. Overhead cables and telegraph poles were present along the southern boundary.
125	The survey area consisted of a flat, but slightly uneven arable field.	The survey area was bordered to the north, west and south by water-filled ditches, and to the east by hedges, trees and tall vegetation. Sectors in the centre and south-east could not be surveyed due to this vegetation. A wooden fence and a

		metal gate were located along the southern perimeter.
135	The survey area consisted of a gently sloping arable field.	The survey area was surrounded by trees and bushes. A track ran along the western and northern borders, and a metal mast was located in the south-west.
136	The survey area consisted of a flat arable field with hay bales.	The survey area was bordered to the north and east by water-filled ditches, and to the west and south by hedges and trees. Telegraph poles, overhead cables, and a wooden fence ran along the southern border.
138	The survey area consisted of a flat arable field with young crop.	The survey area was bordered to the north and south by hedgerows and trees and to the east and west by ditches.
140	The survey area consisted of a flat arable field.	The survey area was bordered to the north and south by hedgerows and trees and to the east and west by ditches.
141	The survey area consisted of a flat arable field with maize crop.	The survey area was bordered by ditches to the north and west, and by hedgerows to the south and east. An area in the southeast was unable to be surveyed due to tall crops.
142	The survey area consisted of a flat arable field with maize crop.	The survey area was bordered by a track to the south, hedgerows to the southeast, and by ditches in all other directions. Two storage tanks were present to the south.
144	The survey area consisted of a flat arable field.	The survey area was bordered to the south and west by trees and hedgerows, to the north by a ditch and to the east by an electric fence and trees.
145	The survey area consisted of a flat arable field.	The survey area had no physical boundary to the south and was bordered by a ditch to the west and hedgerows to the north and east.
146	The survey area consisted of a flat arable field.	The survey area was bordered by hedgerows in all directions.
147	The survey area consisted of a flat arable field.	The survey area had no physical boundary to the north and was bordered by a ditch and hedgerows to the west and hedgerows to the south and east.
148	The survey area consisted of a flat arable field with maize crop.	The survey area was bordered to the west by a track, and by hedgerows in all other directions. Areas in the northeast and northwest were unable to be surveyed due to tall crops.
149	The survey area consisted of a flat arable field with wheat crop.	The survey area was bordered by overgrown vegetation in all directions. A drainage ditch was present in the northern boundary.

150	The survey area consisted of a flat arable field.	The survey area had no physical boundary to the north and was bordered by a ditch and hedgerows to the south, hedgerows to the north and east.
151	The survey area consisted of a flat arable field.	The survey area was bordered on all sides by hedgerows. A track was present along the northern boundary.
152	The survey area consisted of a flat arable field with maize crop.	The survey area was bordered on all sides by hedgerows. A track was present oriented along the northern boundary. A portion of the survey area to the northwest was unable to be surveyed due to tall crops.
153	The survey area consisted of a flat arable field.	The survey area was by a track to the north and west, hedgerows to the south and a ditch to the east.
154	The survey area consisted of a flat arable field with maize crop	The survey area was bordered on all sides by overgrown vegetation. Drainage ditches were present in the north and east boundaries. A portion of the survey area to the northwest was unable to be surveyed due to deep ruts.
155	The survey area consisted of a flat arable field with maize crop	The survey area had no physical boundary to the south and was bordered by a ditch to the west and hedgerows to the north and east.
159	The survey area consisted of a flat pasture field.	The survey area was surrounded by electric fences.
160	The survey area consisted of a flat arable field with bean crop.	The survey area was bordered to the north and east by metal electric fences, to the west and south by ditches and to the south-west by trees.
161	The survey area consisted of a flat pasture field.	The survey area was bordered to the north, east and west by metal electric fences, and to the south by ditches. A road ran along the eastern border.
162	The survey area consisted of a flat pasture field.	The survey area was surrounded by metal electric fences. A road ran along the western border.
163	The survey area consisted of a flat pasture field.	The survey area was surrounded by metal electric fences. A road ran along the western border.
164	The survey area consisted of a flat pasture field.	The survey area was bordered to the west, north and east by electric fences, and to the south-west by hedges. Two electric fences ran E-W along the centre of the area. Two sectors in the centre could not be surveyed due to bio-waste.

165	The survey area consisted of a flat arable field.	The survey area was bordered to the north, east and west by hedgerows and to the south by a ditch.
166	The survey area consisted of a flat arable field with crop stubble.	The survey area was surrounded by hedges. Two strips in the centre of the survey area could not be surveyed due to a hedgerow and a ditch, an area on the eastern border due to standing water, and an area in the south-east due to tall grass. Telephone poles and wires ran E-W across the southern sector.
169	The area consisted of flat arable with young crop	The survey area was bordered by a farm track to the north. A farm house was present in the centre of the north border of the field .No physical boundary was present to the south or east . A drainage ditch and road were present to the west of the survey area.
170	The survey area consisted of a flat arable field.	The survey area was bordered by trees and hedges to the west and by overgrown vegetation in all other directions.
172	The survey area consisted of a flat arable field with potato crop.	The survey area was bordered by trees and hedges to the west and drainage ditches to the east and north. The physical boundary was present to the north
173	The survey area consisted of a flat pasture field to the north and potato crop to the south.	The survey area was bordered by a drainage ditch to the north and by trees and hedges in all other directions. An area in the north was unable to be surveyed due to overgrown vegetation.
174	The survey area consisted of a flat arable field.	The survey area was bordered by hedges to the north and east and by ditches to the south and west.
175	The survey area consisted of a flat arable field.	The survey area was bordered by ditches to the north west and east. A farm track was present along the south of the survey area.
176	The survey area consisted of a flat arable field with wheat crop.	The survey area was bordered to the north and west by drainage ditches. A farm track was present along the east of the survey area. A hedge ran along the south of the survey area.
177	The survey area consisted of a flat arable field.	The survey area was bordered by drainage ditches to the north and east. A farm track was present along the west of the survey area. No boundary was present along the south of the survey area.
178	The survey area consisted of a flat arable field.	The east and west of the survey area was bordered by hedges. A farm track ran along the west and south of a the survey

		area. Two large cisterns were present to the south of the survey area. No physical boundary was present to the north
179	The survey area consisted of a flat arable field with young crop to the west and crop stubble to the east.	The survey area was bordered to the north and south and southeast by ditches, and by overgrown vegetation to the east. There was no physical boundary to the west of the survey area.
180	The survey area consisted of a flat arable field with crop stubble.	The survey area was bordered in all directions by trees and hedges. A drainage ditch was present in the northern boundary. Overhead cables and telegraph poles were present in the east and ran NE-SW across the survey area. A portion of the survey area to the west was unable to be surveyed due to a large muck heap.
181	The survey area comprised flat arable land	the survey area was bordered by drainage ditches on all sides. A road ran along the south and east of the survey area. Overhead cables ran east to west along the north of the survey area.
183	The survey area comprised flat arable land	The survey area was bordered by drainage ditches and an electric fence on all sides. A large muddy puddle was present in the south east of the survey area.
185	The survey area comprised flat arable crop with young crop	The survey area was bordered by hedges to the south, east, and west. Rubble was present along the north boundary of the survey area.
187	The survey area comprised a flat field with young crop	the survey area was bordered to the south and west by forest. The north and east were bordered by hedges and drainage ditches
188	The survey area consisted of a flat arable field with young crop.	The survey area was bordered by hedges to the north west and east. The south of the survey area was present to the south.
193	The survey area comprised flat arable	The survey area was bordered by trees and hedges to the west south and east. No boundary was present to the north
194	The survey area comprised flat arable	the survey area was bordered by ditches to the north and east. A hedge and barbed wire fence were present to the south and west of the survey area. A telephone line was present along the north of the survey area running east to west.
202	The area consisted of flat arable with young crop A large area of mud and standing water was present	The survey area was bordered by ditches to the north and south. No boundary was present to the east. The west of the survey area bordered a caravan lot.

	in the east of the survey area	
203	The area consisted of flat arable with young crop	The survey area was bordered by ditches to the north and south. No boundary was present to the east or west.
204	The area consisted of flat arable with young crop	The survey area was bordered by ditches to the north and south. No boundary was present to the east or west.

- 4.4 The underlying geology comprises Mercia Mudstone Group Mudstone to the east of the survey area, and Chester Formation Sandstone to the west. The superficial deposits comprise of Sutton Sand Formation to the southeast, east, and smaller sections of the north, Peat in the east and north, alluvium (clay, silt, and gravel) across the centre and south of the survey area, Hemingbrough Glaciolacustrine Formation clay and silt to the northwest, warp clay and silt to the northeast, and Glaciofluvial deposits, Devensian sand and gravel to the west. (British Geological Survey, 2025).
- 4.5 The soils consist of slowly permeable seasonably wet slightly acid but base-rich loamy and clayey soils to the south and west, loamy and clayey soils of coastal flats with naturally high groundwater in the centre of the survey area, loamy and clayey floodplain soils with naturally high groundwater in the centre and east, raised bog peat soils to the north, naturally wet very acid sandy and loamy soils to the east and south, and loamy and sandy soils with naturally high groundwater and a peaty surface to the southeast. (Soilscapes, 2025).

5. Archaeological Background

- 5.1 The archaeological background is compiled from data obtained from the South Yorkshire Historic Environment Record (SYHER, 2022) and the North Lincolnshire Historic Environment Record (NLHER, 2022).
- 5.2 The survey area is situated on the northern boundary of the Isle of Axholme, an area which, prior to being drained in the 17th century, was an area characterised by marshland which was navigable by small craft, with settlements being located on areas of high ground. The Isle was bounded by the River Don in the north and west, the River Idle in the west and the River Trent in the south. There is a considerable archaeological record surrounding the survey area, from the pre-historic to the modern period.
- 5.3 Peat deposits have been recorded in several boreholes to the west of Medge Hall, c. 10 m south of the survey area. These deposits lay between at 0.30 m – 0.70 m and sat above an old and relatively undisturbed land surface. Radiocarbon dating from the base of the peat layers suggested that the paleo-land surface beneath dated to the mid-late Neolithic (NLHER, 2022).
- 5.4 A Bronze Age trackway was recorded during the excavation of a drain c. 87 m south of the survey area, to the west of Warpings Farm. This consisted of several large split timbers forming a 3m wide trackway (NLHER, 2022).

- 5.5 Within the survey area, to the north of Poultry Farm, a large area of linear and curvilinear cropmarks have been recorded via aerial photography. These were investigated in 1975, with the excavations revealing several ditches, pits, and possible roundhouses which overlaid earlier field systems. Pottery and coin finds confirmed that these features formed part of a Romano-British settlement, one that is suggested to relate to other surrounding cropmarks, in an area that stretches at least c. 500 m south and c. 850 m northeast of the survey area (NLHER, 2022).
- 5.6 Further linear, curvilinear and rectilinear were observed on aerial photography within the survey area, to the southeast of Belton Grange, to the northwest of Marsh Road and to the northeast of the Thorne Waste Drain Road. Although these cropmarks have not been excavated, an Iron Age or Romano-British origin is the most probable based on similar investigated features in the local vicinity (NLHER, SYHER, 2022).
- 5.7 Linear, curvilinear and rectilinear cropmarks in the form of enclosures and field systems are located c. 400 m southeast of the survey area at Briar Hill Farm, and c. 750 m southeast of the survey area at Swans Grove Farm (SYHER, 2022).
- 5.8 Early Medieval activity within the study area is limited to Crowle, c. 980 m to the east of the survey area. This includes an 10th century Anglo-Scandinavian cross fragment, incorporated into St Oswald's Church. Although St Oswald's is 12th century in date, the cross fragment suggests that an earlier religious structure stood nearby. Two early medieval pits were also discovered during a redevelopment of Crowle Market, both of which contained pottery, animal bone and spelt and wheat grains (NLHER, 2022).
- 5.9 A Medieval moated enclosure sits c. 400 m east of the survey area at Hirst Priory. This was the site of an Augustinian cell of Nostell Priory which was founded in the early 12th century, and dissolved in c.1540 (NLHER, 2022).
- 5.10 It is postulated that Tudworth deserted Medieval village lies c.180 m south of the survey area, to the south of Sandtoft Road. This village was named in the Domesday Book as comprising of twenty eel ponds. It was depopulated in the 17th century (SYHER, 2022).
- 5.11 In the Post-Medieval period, the marshland of North Lincolnshire was extensively drained to accommodate more farmland. The result of this was a network of large drains that run throughout Lincolnshire and across/around the survey area.
- 5.12 Within the survey area, to the northwest of Marsh Road, there is a World War Two aircraft crash site. A Lancaster Bomber crashed on the 5th of April 1945, with the loss of all seven airmen, two of whom were not recovered along with the aircraft and are presumably still buried at the crash site (NLHER, 2022).
- 5.13 Located c. 800 m south of the survey area, Sandtoft Airfield was constructed during the Second World War and opened for use by Bomber Command in 1943. Decoys were placed in the surrounding area to mislead German bombing raids, one of these is situated within the survey area to the south of the A18, whilst another lies c. 130 m south of the survey area, to the north of the M180. The bomb stores of the airfield were located in the southern limits of the survey area.

6. Methodology

6.1. Data Collection

6.1.1 Magnetometer surveys are generally the most cost effective and suitable geophysical technique for the detection of archaeology in England. Therefore, a magnetometer survey should be the preferred geophysical technique unless its use is precluded by any specific survey objectives or the site environment. For this site, no factors precluded the recommendation of a standard magnetometer survey. Geophysical survey therefore comprised the magnetic method as described in the following section.

6.1.2 Geophysical prospection comprised the magnetic method as described in the following table.

6.1.3 Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1m	200Hz reprojected to 0.125m

6.1.4 The magnetic data were collected using MS' bespoke quad-towed cart system and hand-carried GNSS-positioned system.

6.1.4.1 MS' hand carried and quad towed system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.4.2 Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing, and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.4.3 A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.2. Data Processing

6.2.1 Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to the EAC and Historic England guidelines for 'minimally enhanced data' (see Section 3.8 in Schmidt *et al.*, 2015: 33 and Section IV.2 in David *et al.*, 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen *et al.* (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3.Data Visualisation and Interpretation

- 6.3.1 This report presents the gradient of the sensors' total field data as greyscale images, as well as the total field data from the upper and/or lower sensors. The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high contrast material. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images of the gradient and total field at different plotting ranges have been used for data interpretation.
- 6.3.2 Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historical maps, LiDAR data, and soil and geology maps. Google Earth (2025) was also consulted, to compare the results with recent land use.
- 6.3.3 Geodetic position of results – All vector and raster data have been projected into OSGB36 (ESPG27700) and can be provided upon request in ESRI Shapefile (.SHP) and Geotiff (.TIF) respectively. Figures are provided with raster and vector data projected against OS vector mapping provided by the client.

7. Results

7.1.Qualification

- 7.1.1 Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible, an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports, as well as reports from further work, in order to constantly improve our knowledge and service.

7.2.Discussion

- 7.2.1 The geophysical results are presented in combination with satellite imagery and historical maps (Figures 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58, 62, 66, 70, 74, 78, 82, 86,

90, 94, 98, 102, 106, 110, 114, 118, 122, 126, 130, 134, 138, 142, 146, 150, 154, 158, 162, 166, 170, 174, 178, 182).

- 7.2.2 A fluxgate gradiometer survey was successfully completed across c. 1850ha. The survey generally responded well to the environment of the survey area, however, some areas were affected by green waste in the far south and wind turbines in the northwest which may have obscured weaker anomalies in these areas, if present. Area 61 was particularly affected by wind turbines, causing artefacts in a section of the data.
- 7.2.3 Anomalies of probable or possible archaeological origin, though limited in number, were identified within the survey area. The scarcity of anomalies interpreted as archaeological may be due to several factors. Firstly, in the past the survey area is known to have consisted predominantly of fenland which, before the draining of the fenland and rerouting of the River Don in the 17th century, would have been unsuitable for settlement and agriculture. Secondly, the local geology may have masked more ephemeral archaeological anomalies in several areas. This includes areas where archaeology has been identified in the past, such as a Romano British settlement in Areas 133, 166, 167 and 135, and cropmarks to the southeast of Belton Grange. These areas have detected strong responses relating to a change in superficial deposits, bedrock or topography. This could mask deeper or more ephemeral archaeological features in these areas, should they be present.
- 7.2.4 Several strong anomalies have been identified in Areas 137 and 138 (Figures 147 - 162). This includes eight anomalies which may represent former structures in area 137 and a larger potential structure in Area 138. These anomalies are located in an area where a former World War Two ammunition dump for Sandtoft Airfield is recorded on the North Lincolnshire HER (see 5.14). RAF Sandtoft was a WW2 base for long range bombers, and, as no structures appear on any historic mapping for the area, it is likely these anomalies relate to activity taking place at the airfield during this period.
- 7.2.5 Several weak linear and curvilinear anomalies have been detected in Areas 77, 133, 134, 165, 166. The signal and form of these anomalies are suggestive of ditches and are located in the vicinity of Poultry Farm, an area known for Romano-British settlement through cropmarks and archaeological investigations. It should be noted that these anomalies are weak and the strength of the local geology in this area may obscure further anomalies.
- 7.2.6 Geological variations have been detected across the survey area (Figures 55 – 70 & 87 – 182). This includes strong positive anomalies relating to the old course of the River Don, its tributaries and associated alluvial plain, the course of which was altered in the 17th century. Superficial deposits relating to the old river course has been detected in the southwest through to the northeast corner of the survey area. These anomalies would correspond with the pre-17th century landscape of North Lincolnshire which consisted predominantly of fenland surrounding the River Don. These geological anomalies have the potential to obscure archaeological features due to their strength, they areas may also indicate areas where there is increased potential to preserve prehistoric remains under superficial alluvial deposits.

- 7.2.7 Anomalies of significant strength and coverage have been identified which reflect the diverse range of superficial deposits present within the survey area. This includes glacial and glaciofluvial deposits to the west (Figures 87 – 90), peat deposits in the south and southeast (Figures 143 – 162), aeolian sand deposits in the south and southeast (Figures 143 – 162), and alluvial deposits in the southwest, south southeast and northeast (Figures 55 – 70 & 87 – 182). These deposits have the potential to mask ephemeral archaeological anomalies, however, in the case of the glaciofluvial, alluvial and peat deposits, these superficial deposits have been known to hold well preserved prehistoric remains.
- 7.2.8 A number of areas comprising of strong magnetic noise alongside spreads of ferrous material have been detected across the survey area (Figures 3 – 26, 31 – 34 & 75 – 82). These correspond with farms, ponds, water engines and cottages that are visible on 19th century mapping that are no longer extant. This would be consistent with the historical landscape character of the survey area, which is known to have been predominantly used for agriculture in the post-medieval – modern period.
- 7.2.9 The survey area is extensively covered by a series of linear anomalies which represent drainage regimes (Figures 3 – 182). This is consistent with field drainage found elsewhere in Lincolnshire where the low-lying ground, high groundwater and seasonally wet nature of the land requires extensive drainage networks. As some of these drains appear to respect defunct 19th century field boundaries, it is likely that at least some of these date from this period.
- 7.2.10 Numerous linear and curvilinear anomalies have been detected across the survey area which correspond with mapped former field boundaries, many on 19th century historic mapping, with several being coupled with areas of strong magnetic noise (Figures 3 - 182).
- 7.2.11 Two modern/industrial anomalies were detected within the survey area. This includes a potential area of quarrying in Area 137 (Figures 150 – 153, 159 - 162), and an early 20th century tramway relating to peat extraction in Area 63 (Figures 51 - 54). This would correspond with the increased use of the area's natural resources in the 20th century, with large scale peat extraction occurring in the area from the 19th century and well into the 20th century.
- 7.2.12 Several anomalies have been classified as 'undetermined' due to lack of context, or any clear pattern or morphology which would enable a confident interpretation. Nevertheless, an archaeological origin for these anomalies cannot be excluded.

7.3. Interpretation

7.3.1. General Statements

- 7.3.1.1 Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.
- 7.3.1.2 **Data Artefact** – Data artefacts usually occur in conjunction with anomalies with strong magnetic signals due to the way in which the sensors respond to very

strong point sources. They are usually visible as minor 'streaking' following the line of data collection. While these artefacts can be reduced in post-processing through data filtering, this would risk removing 'real' anomalies. These artefacts are therefore indicated as necessary in order to preserve the data as 'minimally processed'.

- 7.3.1.3 **Ferrous (Spike)** – Discrete dipolar anomalies are likely to be the result of isolated pieces of modern ferrous debris on or near the ground surface.
- 7.3.1.4 **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentration of multiple discrete, dipolar anomalies usually resulting from highly magnetic material such as rubble containing ceramic building materials and ferrous rubbish.
- 7.3.1.5 **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures, typically including fencing, pylons, vehicles and service pipes, have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure weaker anomalies relating to nearby features, should they be present, often over a greater footprint than the structure causing them.
- 7.3.1.6 **Undetermined** – Anomalies are classified as Undetermined when the origin of the geophysical anomaly is ambiguous and there is no supporting contextual evidence to justify a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally distinct from those caused by ferrous sources.

7.3.2. Magnetic Results - Specific Anomalies

- 7.3.2.1 **Archaeology Probable** – A strong positive linear anomaly has been identified in Area 63 (**63a**) (Figures 51 - 54). This measures c. 245m in length and correlates with a tramway which first appears on the OS Map of 1900, running from the Medge Hall Peat Works which is located c. 900m to the northeast, and terminating in the centre of the Area 63. This anomaly is likely caused by a packed surface, used to hold the tracks of the tramway.
- 7.3.2.2 **Archaeology Probable** – Within Area 138 a rectangular spread of enhanced magnetic material has been detected (**138a**). It measures c. 30m in length and c.12m wide. The anomaly corresponds with records of a former munitions building related to RAF Sandtoft and appears as on an aerial photograph photo (RAF_CPE_UK_1880_V_5048), held by Historic England and available to view online. Within Area 137 to the west, similar anomalies (**137a**) have been discovered together with possible access tracks that also probably relate to RAF infrastructure (Figures 159 - 162).
- 7.3.2.3 **Archaeology Possible** – In the northern part of Area 77 a rectilinear anomaly (**77a**) has been discovered. It measures c.25m each side and seems to form a

partial enclosure, possibly a fold yard due to its proximity to Clay Bank Farm, which is visible on 19th/early 20th century mapping (Figures 75 - 78).

- 7.3.2.4 **Archaeology Possible** – In the centre of Area 133, two weak linear anomalies (**133a**) have been identified. The larger of these is orientated north-south and measures 170m in length, whilst the second shorter linear appears to be attached to the former forming a right angle, running eastwards towards what was Plains Cottage in historic mapping. Due to the alignment of these anomalies being similar to modern agricultural field boundaries, a more recent origin could be postulated. However, due to the fact these anomalies do not correspond with any boundaries on historic mapping, and the known presence of a Romano-British settlement in this area, a possible archaeology interpretation has been made due to the possibility these are field system ditches (Figures 135 – 138).
- 7.3.2.5 **Archaeology Possible** – Four weak linear anomalies have been identified in the northwestern corner of Area 165 (**165a**), these appear to form a roughly square enclosure which encloses an area of 0.1ha. This likely represents the ditches of a former enclosure and may relate to the Romano-British settlement activity which is known at Poultry Farm, 1km to the west (Figures 151 - 154).
- 7.3.2.6 **Archaeology Possible** – A number of strong linear and curvilinear anomalies have been identified in the south of Area 181 (Figure 141). These anomalies, which are located within the former channel of the River Donn, do not correspond to any anomalies recorded on the OS mapping or satellite imagery. These anomalies have been interpreted to be of possible archaeological origin, however an agricultural activity cannot be discounted.
- 7.3.2.7 **Archaeology Possible** – In the northern half of Area 166 and the southeastern corner of Area 134, a number of linear and curvilinear anomalies (**166a**) have been identified which would suggest these anomalies are ditches. The main linear anomaly runs in a northeast direction from the southeast corner of Area 134, through a field boundary into Area 166, before turning east-south-east. This main linear measures 104m in length and forms a roughly 130 degree bend in the centre, where a curvilinear appears to be located on the southern side. Although these anomalies are located close to agricultural features, an archaeological origin is possible due to the fact they do not appear to respect modern and historical field boundaries and the known presence of Romano-British settlement 600m south at Poultry Farm (Figures 139 – 142).
- 7.3.2.8 **Archaeology (Spread)** – An amorphous anomaly has been identified in the southwestern corner of Area 137 (Figures 151 – 154). The size and morphology of this anomaly suggests that this is an area of extraction, the weak positive magnetic signal is likely caused by the enhanced material used to infill this possible quarry.
- 7.3.2.9 **Agricultural (Strong, Weak, Spread)** – Across the survey area a multitude of strong and weak linear anomalies and linear spreads of ferrous material have

been identified (Figures 3 - 182). The majority of these roughly correspond with field boundaries recorded on 2nd Edition Ordnance Survey (OS) mapping, whilst other have been interpreted as being unmapped field boundaries due to their similarities in magnetic signal and alignment to mapped field boundaries.

- 7.3.2.10 **Agricultural (Strong)** – In the eastern part of Area 145 a strong anomaly has been identified. It is in the form of 'D' and measures c. 25m across (Figures 163 - 166, 171 - 174). This is the site of a former pond and whilst anthropogenic in origin is of little archaeological significance.
- 7.3.2.11 **Agricultural (Spread)** – Several areas of enhanced magnetic signal and ferrous material have been identified throughout the survey area. These discrete but numerous dipolar anomalies appear to correlate with various agricultural buildings, cottages or structures which are no longer extant. This includes former farm buildings in Areas 2, 25, 73 & 77 (Figures 3 - 13, 55 - 58 & 75 - 82), former canals in Areas 170 – 174 (Figures 52 - 58) water engines in Areas 8, 47, 131 & 156 (Figures 23 - 26, 43 - 46, 115-122 & 107 - 114), former cottages in Areas 2, 125 & 167 (Figure 3 - 13, 107 - 114 & 135 - 138) and former ponds in Areas 61, 63, 122 & 142 (Figures 35 - 42 & 163 - 166). All of these features are visible on 19th century mapping, however no further information is known about them. The strong dipolar magnetic signal is likely caused by the spread of refuse material left from the demolition of these features. This type of signal has the potential to obscure weaker anomalies should they be present.
- 7.3.2.12 **Paleochannel (Strong, Weak, Spread)** – From the southwestern corner to the northeast corner of the survey area, numerous large-scale sinuous anomalies and spreads have been identified. These anomalies follow the mapped former course of the River Don that is known to have traversed the survey area prior to its rerouting in the 17th century. The old course of the Don has been detected in Areas 78, 81, 82, 83, 102, 103, 133, 134, 166, 178, 179, 182, & 183 (Figures 63 – 70, 84-87, & 143 - 163), whilst associated palaeochannels, tributaries and alluvial deposits have been detected in areas 75, 76, 78, 80, 81, 82, 83, 87, 88, 97, 105, 106, 107, 108, 109, 110, 111, 163, 164, 166, 167, 175, 176, & 177 (Figures 55 – 70, 79 - 82, & 87 – 170). These anomalies would correspond with the pre-17th century landscape of North Lincolnshire which consisted predominantly of fenland, formed around the River Don. The anomalies associated with the old course of the river have the potential to obscure archaeological features due to their strength and breadth. However, within the river channel a few anomalies of anthropological origin are expected to be present.
- 7.3.2.13 **Natural (Strong, Weak, Spread)** – Across the survey area, a number of amorphous anomalies have been identified which are most likely related to the underlying geology of the survey area, including changes in superficial deposits or bedrock geology. This includes alluvial deposits of clay and silt which have been detected in Areas 67, 69, 71 & 75 (Figures 55 – 70), sedimentary peat deposits in Areas 99, 100, 126, 129, 131, 139, 141, 142, 143, 155, 170, 171, 172,

173, & 174 (Figures 107 – 122, 84-88 & 160-164), aeolian sand deposits in Areas 100, 135, 136, 138, 146, 148, (Figures 84-88 & 147 – 164), glaciofluvial deposits of sand and gravel in Areas 104 & 117 (Figures 84 - 90 & 95 - 102), glacial deposits of clay and silt in Areas 4 & 7 (Figures 11 - 22), and alluvial deposits of clay, silt sand and gravel in Areas 73-78, 80-88, 94, 96-98, 100-103, 106 - 112, 116, 118, 120, 133, 134, 157 - 164, 166, 167, 172-183, 193, & 194 (Figures 83 – 174). As these anomalies demonstrate considerable strength and coverage, it is possible that they may mask ephemeral archaeological responses.

- 7.3.2.14 **Undetermined (Strong, Weak)** – Multiple linear, curvilinear, and discrete anomalies have been identified across the survey area (Figures 3 – 70 & 87 – 114). These anomalies do not have any supporting contextual evidence and may be partially obscured by the spreads of anomalies resulting from geological variation across the area. These anomalies are themselves likely to be the result of geological or agricultural processes, but in these cases an archaeological origin cannot be entirely ruled out. A sub-square anomaly **[175a]** and an amorphous anomaly with a clear edge **[174b]** were identified in Areas 175 and 174 respectively (Figures 155-158). While these do not correspond to anything visible on historical mapping, their morphology and the presence of mapped sand pits in the immediate surroundings of the survey area suggests these could represent possible unmapped sand pits.
- 7.3.2.15 **Ferrous Spread** – Spreads of strongly enhanced magnetic material have been detected across the survey area. Much of this is related to modern agricultural practices such as the spreading of green waste in Areas 127-132, and 184-188 (Figures 111 – 122) and former field boundaries in Areas 2-21 (Figures 3 – 42).
- 7.3.2.16 **Drainage (Trend)** – A multitude of linear anomalies, on multiple alignments throughout the survey area have been detected (Figures 3 - 182). Three types of magnetic responses have been recorded. The first type of response consists of strong, positive, linear signals. The second kind of anomaly consist of weak positive linear signals. The third type of anomalies have a weak, dipolar signal indicative of modern ceramic drains. The drainage features are arranged on a variety of alignments, ranging from the typical closely spaced herringbone pattern to wide rectilinear organisation terminating at the field edges. Many of these drainage regimes appear to respect defunct 19th century field boundaries (Figures 3 - 58), it is therefore likely that many of these drainage networks originate from this period.
- 7.3.2.17 **Services** – Buried services have been detected throughout the survey area (Figures 3 - 6, 15 – 18, 27 - 30, 39 - 46, 51 – 54, 71 – 78, 91 – 110, 123 – 129, 139 – 142 & 167 - 174). These linear anomalies, comprising repeating strong dipolar anomalies, are characteristic of buried services; their strength and spread has contributed to the obscuring of weaker anomalies if present.
- 7.3.2.18 **Wind Turbines** - Across Areas 4 - 8, 10, 14, 17, 21, 25, 46, 47, 61 & 63 magnetic disturbance has been detected, caused by the presence of wind turbines in these

locations (Figures 3 – 54). This type of dipolar response is typical for large magnetic structures. This type of magnetic interference may mask more ephemeral anomalies of archaeological origin if present.

7.3.2.19 **Overhead Cables** – Magnetic disturbance relating to overhead power cables and associated masts have been detected in Areas 1, 2, 7, 17, 23, 24, 30, 31, 38, 73, 81 & 87. This type of specked dipolar background is most evident in the Total Field Data (Figures 3, 7, 15, 31, 35, 47, 51, 55, & 67). This type of magnetic interference may mask ephemeral anomalies of anthropogenic origin if present.

8. Conclusions

- 8.1 A fluxgate gradiometer survey was successfully completed across the majority of the survey area. The survey generally responded well to the environment of the survey area; however, some areas were affected by magnetic disturbance caused by green waste, wind turbines, overhead and underground cables, pylons and telegraph poles, agricultural equipment, and extant structures. Extensive natural deposits were also identified throughout the survey area, some of which display a strong magnetic enhancement and could conceal ephemeral archaeological anomalies in these areas.
- 8.2 Few anomalies of probable or possible archaeological origin were identified within the survey area and mostly reflect the agricultural use of the landscape. This may be due to several factors. Before the drainage of North Lincolnshire in the 17th century, the survey area consisted predominantly of fenland which would have been unsuitable for settlement and agriculture. The quantity and strength of the signals relating to the former course of the River Don and its tributaries, paleochannels, bedrock and other superficial deposits should be noted, as these may have masked more ephemeral archaeological anomalies in large swathes of the survey area. The archaeological features may not hold sufficient magnetic material that differs from the background magnetism of the survey area for them to be visible.
- 8.3 In the southeastern section of the survey area, the survey has detected several amorphous anomalies which appear to form at least nine structures. These are located to the north of the former World War Two airfield of RAF Sandtoft, and within an area identified in the North Lincolnshire HER as the bomb storage area for the airfield. Identifiable linear anomalies may indicate former access supply tracks. It is probable that these anomalies are associated with WW2 activity at RAF Sandtoft.
- 8.4 Several weak anomalies have been identified in the central-southern section of the survey area, these are located in the vicinity of Poultry Farm, an area known for Romano-British settlement through cropmarks and archaeological investigations. It should be noted that these anomalies are weak and the strength of the local geology in this area may obscure further anomalies.
- 8.5 Strong and broad anomalies have been identified in the survey area which are associated with the old course of the River Don, its tributaries and alluvial plain. The strength and coverage of these strong anomalies have a high potential to obscure weaker archaeological responses, should they be present.

- 8.6 Natural variation in the geology and superficial deposits has been detected throughout the survey area. The presence of alluvial, glacial and glaciofluvial deposits are of particular importance, both due to prehistoric settlements occurring in these areas, as well as the quality of prehistoric material that can be found within them.
- 8.7 The survey has detected anomalies associated with the agricultural character of the survey area, this includes former mapped and unmapped field boundaries, former farm buildings, cottages, drainage regimes, water engines, ponds and ploughing trends.
- 8.8 Two modern/industrial anomalies have been detected, a tramway relating to peat extraction in the north of the survey area, and an area of unknown extraction in the southeastern corner of the survey area.
- 8.9 Several anomalies have been classified as 'undetermined' due to lack of context, or any clear pattern or morphology which would enable a confident interpretation. Nevertheless, an archaeological origin for these anomalies cannot be excluded.

9. Archiving

- 9.1 MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.
- 9.2 MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to any dictated time embargoes.

10. Copyright

- 10.1 Copyright and intellectual property pertaining to all reports, figures and datasets produced by Magnitude Services Ltd is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

11. References

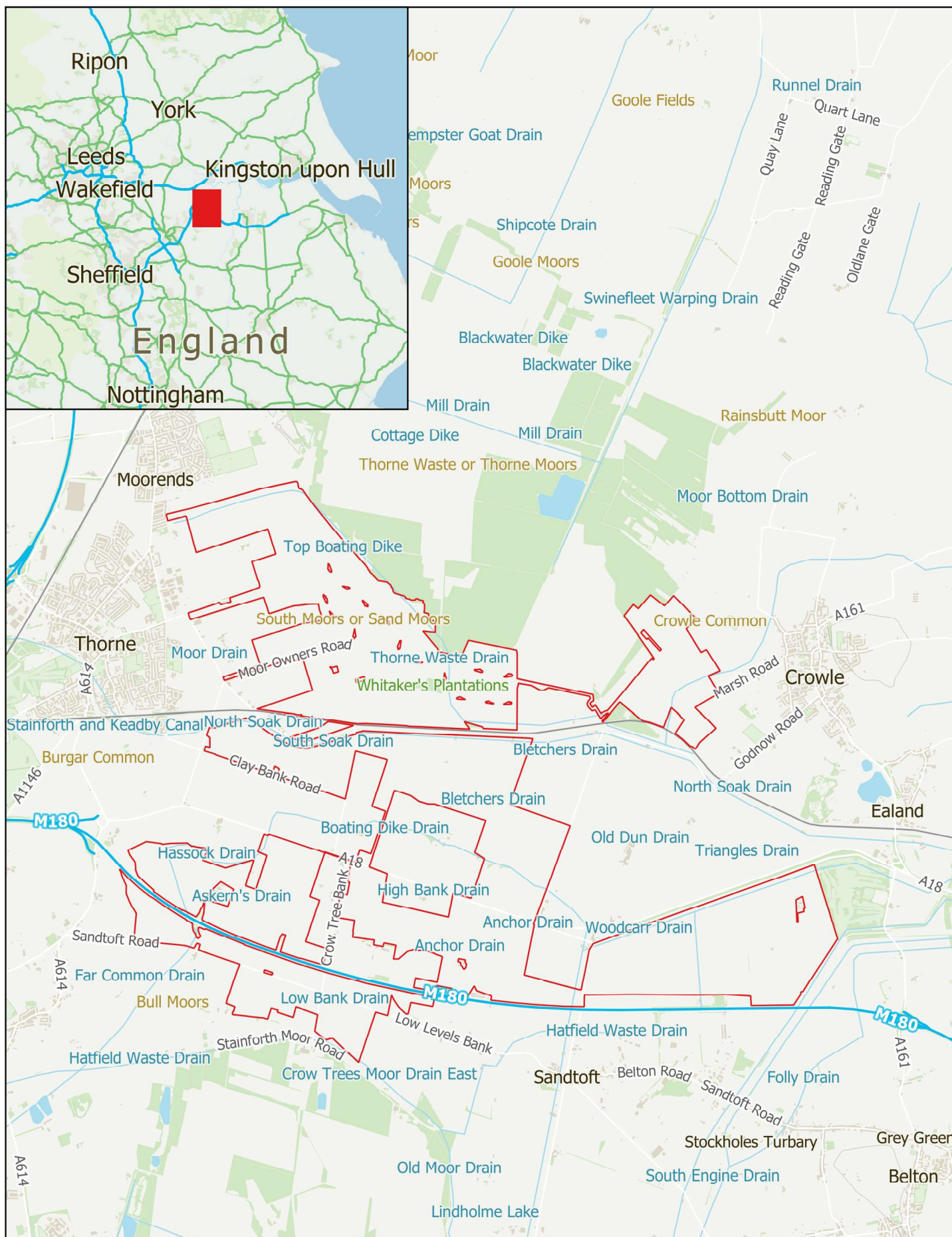
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12. Project Metadata

MS Job Code	MSSE1548
Project Name	Tween Bridge - Thorne, Doncaster, South Yorkshire to Crowle, North Lincolnshire
Client	Pegasus Planning Group
Grid Reference	SE 70473 12078
Survey Techniques	Magnetometry
Survey Size (ha)	1850ha (Magnetometry)
Survey Dates	2023-06-05 to 2023-12-20
Project Lead	[REDACTED] BSc (Hons) MSc FGS
Project Officer	[REDACTED] BA MRes
HER Event No	TBC
OASIS No	TBC
S42 Licence No	N/A
Report Version	1.0

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Lead to Review	SOC	KD	21 December 2023
0.2	Addressing Project Lead comments	SOC	FPC	12 January 2024
0.3	Addressing Director comments	SOC	FPC	15 January 2024
0.4	Addressing Client Comments	DPT	SOC	19 February 2024
0.5	Addressing Project Lead comments	IT, HR	IC, FPC	12 July 2024
0.6	Amended Report for Director Sign Off	KD, MM	FPC	13 June 2024
1.0	Report Issued As Final	KD	KD	20 June 2025



MSSE1548: Tween Bridge - Thorne, Doncaster, South Yorkshire to Crowle, North Lincolnshire

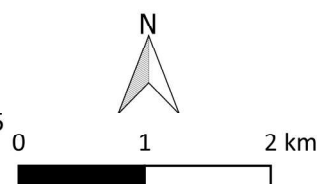
Figure 1 - Site Location

1:60,000 @ A4

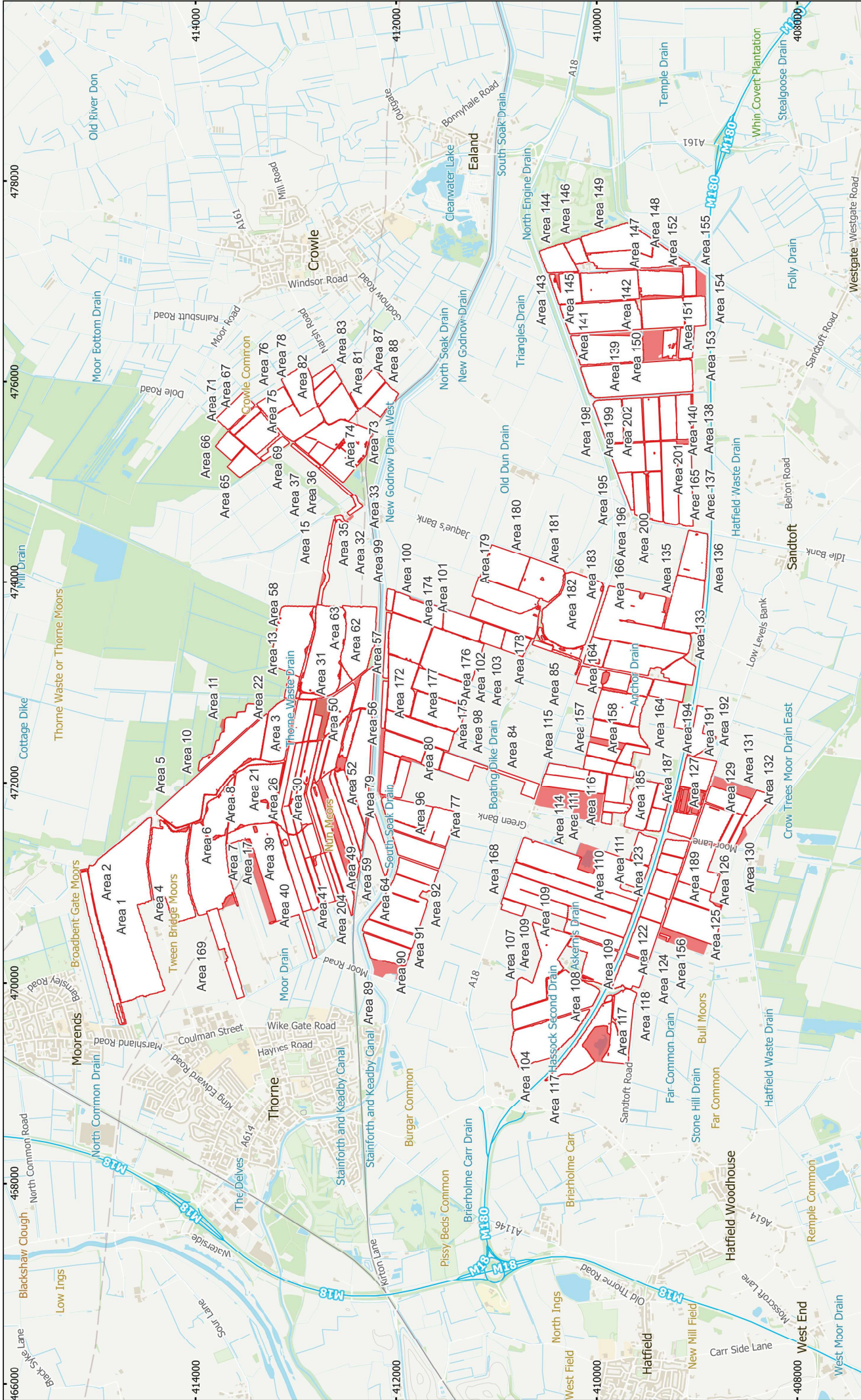
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 Site Boundary



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s u r v e y s





0 500 1,000 1,500 m



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SURVEYS

MSSE1548: Tween Bridge - Thorne, Doncaster, South Yorkshire to Crowle,
North Lincolnshire
Figure 2 - Location of Survey Areas
1:35,000 @ A3
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