

ROMAN·ROADS·RESEARCH·ASSOCIATION



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FLUXGATE GRADIOMETER SURVEY
LAND WEST OF RUDGATE
NEWTON KYME
NORTH YORKSHIRE

MARCH 2021

Geophysical Survey Report No. SMX001



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REPORT & SURVEY DETAILS

Site Description:

Land to west of Rudgate at Newton Kyme
Roman Fort

Parish:

Newton Kyme cum Toulston CP

County:

North Yorkshire

Landowner / Tenant(s):

Mr. & Mrs. Watson (Rudgate),
Mr. McGettigan (Watson's Lane)

HER:

North Yorkshire

Central Grid Reference:

SE 4514 4513 Site 1

Dates of Fieldwork:

December 2018 – May 2019

Fieldwork personnel:

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2nd April 2021

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I. INTRODUCTION

1.1 Summary

A fluxgate magnetometry survey (23 ha) was carried out to the west of the modern road/track known as Rudgate, immediately to the south of the River Wharfe and west of the Roman fort site at Newton Kyme.

No reliable anomalies which can be attributed to the Roman road designated as RR280 (Margary, 1973, p. 417) were found, however, the remnants of two possible temporary camps extending to the west of the Roman fort were discovered. Additionally, a number of what appear to be non-military enclosures were found bordering the flood plain of the River Wharfe at the northern edge of the surveyed area.

1.2 Objectives

The primary aim of the survey was to establish if any traces of RR280 could be found to the west of the modern Rudgate minor road and trackway. This report is the first of a series in which it is hoped to confirm the route of RR280 as it moves from the high ground around the Toulston Lodge / Smaw's Quarry area and descends towards present day St. Helen's Ford where modern Rudgate meets the Wharfe. This stretch of the Roman Road has not yet been detected by aerial photography (with which it is last seen as it enters the southern edge of Toulston Polo Club, a mile to the south of the Roman fort).

The likelihood of two Roman temporary camps extending to the west of Rudgate has been established for some time based on aerial photographic analysis (see 2.4), the survey sought to confirm this and to establish the perimeters of any such camps.

Given the close proximity of the major Roman fort and vicus immediately to the east of the surveyed area, there was also the possibility that domestic activity may have extended on to the west side of Rudgate.

1.3 Site Location and Condition

The magnetometry survey was carried out on two sites north and south of the A659 Tadcaster to Boston Spa road and west of the modern day Rudgate (Figure 1) which is a minor metalled road to the south of the A659 but becomes an unmetalled farm track between the A659 and St. Helen's Ford on the River Wharfe to the north.

Site 1 is immediately to the east of Newton Kyme Roman Fort and vicus. The Roman road is presumed to approximately follow the modern-day farm track on the eastern edge of Site 1, bypassing the Roman fort as it heads northwards. During the survey period the land was initially lying fallow with considerable regrowth of the previous crop, latterly the majority of the site was ploughed and harrowed allowing completion of the survey (although a small

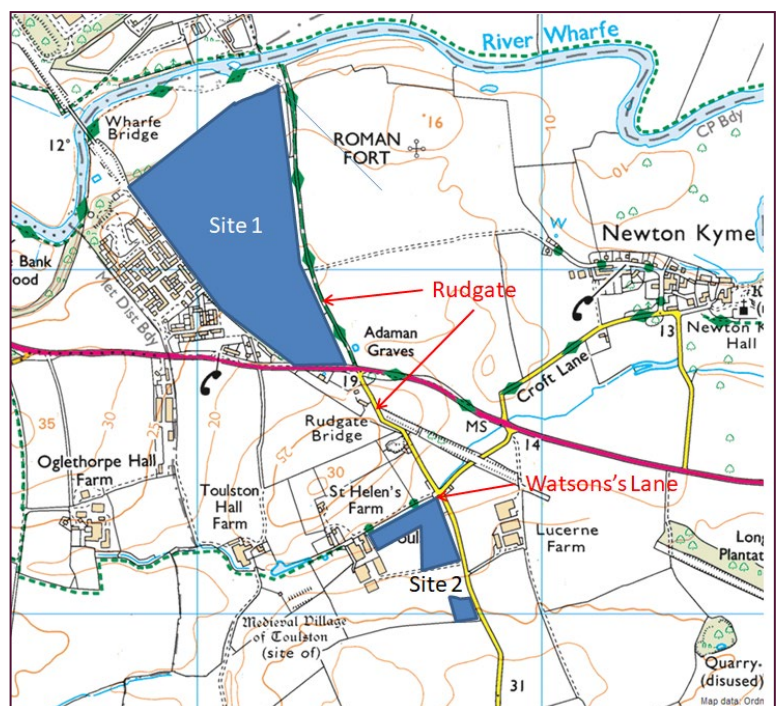


Figure 1. Ordnance Survey 1:25000 map indicating site locations. Contains Ordnance Survey data © Crown copyright and database right 2019

section of the site could not be surveyed due to heavy ploughing). Only the most southerly section of Site 1 was permanent pasture being occupied by a horse paddock.

Site 2 is immediately south of the minor metalled road known locally as Watson’s Lane and west of the minor metalled road known as Rudgate. The northernmost section of the site (adjacent to Watson’s Lane) was permanent pasture, the southern section (adjacent to Rudgate) was recently ploughed and harrowed.

2. ARCHAEOLOGICAL BACKGROUND

2.1 Rudgate RR280

(Warburton, 1720) records the ‘Road Gate’ as branching from the ‘Roman Ridge’ road (RR28B), (Margary, 1973) in the vicinity of Headley Bar and Hazlewood Castle, RR28B was a component of the main overland route to York from Castleford and Doncaster, originating in Lincoln. Rudgate, as it is now known, has the designation RR280 (Margary, 1973, p. 417) and is interpreted as a route northward towards Whixley and Aldborough avoiding the detour via York (Figure 2). A detailed interpretation of current knowledge on Rudgate has been assembled by the Roman Roads Research Association (Haken, 2018).

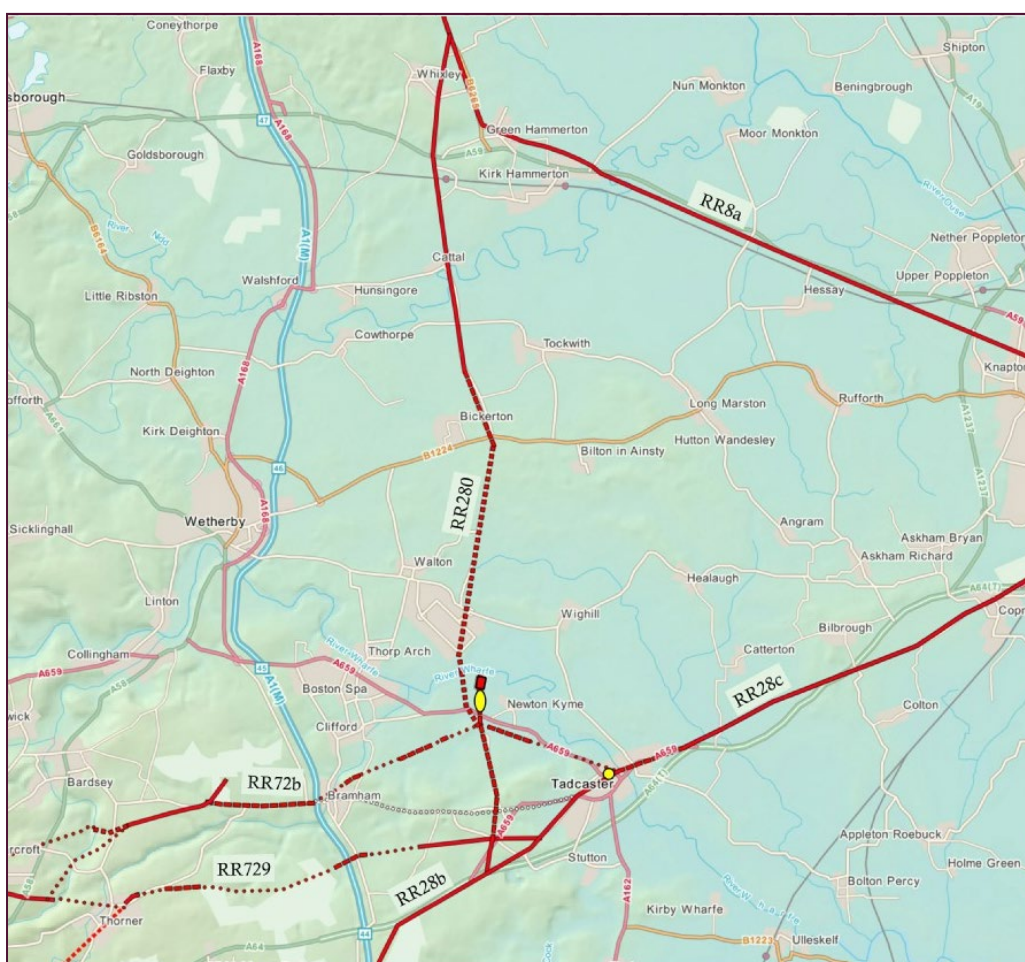


Figure 2. Plan of known and projected Roman Roads West of Tadcaster (Haken, 2018).

RR280 can be located by aerial photography at its junction with RR729 immediately to the south of the modern day Toulston Polo Club (formerly the grounds of Toulston Park) as shown in figure 3. However, it has not been identified north of this point as it approaches the River Wharfe.

2.2 Previous Archaeological Investigations

No record of archaeological investigation, either geophysical or archaeological excavation, of the area within the limits of the current survey, can be found.

However, there have been a number of investigations of the adjacent fort complex and of the supposed course of Rudgate around the area of Toulston Polo Club. In 1908 and 1909 F.G. Simpson carried out an excavation across the fort ramparts, his diaries of the dig being summarised by Grace Simpson, (1981). Simpson reported finding the foundations of a Roman fort with robbed out walls apart from a small area where 2 courses of the inner wall remained. A small amount of pottery (1st to 4th Century), animal bone, an iron signet ring and a coin dated 350-360 CE were recovered. An excavation of



Figure 3. Aerial photography around Toulston Polo Club showing the line of RR280 heading north towards Newton Kyme Roman Fort and RR729 heading east towards Tadcaster and York. Map data © Google 2018.

the fort by H.G. Ramm reported a 10ft wide wall on a foundation of clay and stone with a gravel bank on the inner face and two ditches on the outer face (Wright, 1957).

Dymond (RCHME) carried out an excavation in the area south of Toulston Polo Club over the soil marks of RR280 as shown in figure 3. He found evidence of ditches and a degraded road surface, 25ft wide, comprising clay and limestone chippings on a levelled surface with ditches 4ft wide and 2.5ft deep (Wright, 1961).

(Ramm, 1976) excavated within the grounds of Toulston Polo Club (Toulston Park) in 1962 and found evidence of ditches but no road agger. Ramm also reports that a further investigation in the same area by L. Taylor in 1966 had similar inconclusive results.

2.3 1978 Geophysical survey and Excavation at Newton Kyme Fort

Archaeological investigations by the Department of Archaeological Sciences, University of Bradford were carried out in 1978 in advance of the construction of a gas pipeline through the area west of the Newton Kyme fort in 1979.

(Bolton & Heathcoat, 1978) carried out a geophysical survey along the proposed path of the gas pipeline; the survey was a 10m wide strip with additional strips where archaeological anomalies were indicated. Figure 4 shows the estimated location of this survey geo-referenced on the satellite image of the Newton Kyme site.

The inset in figure 4 shows a linear anomaly interpreted as a potential ditch by the original surveyors. In addition to this potential ditch, the surveyors also identified a double ring ditch feature immediately south of the linear ditch. Based on the above results and subsequent interpretation of aerial photographic data, it was proposed that an unrecorded temporary camp may have existed at the site. A small excavation was carried out over the ditch and circular features to verify the geophysics.

Monaghan (1991) published the results of this excavation which confirmed the existence of the ditch and ring ditch features. Furthermore, the results were interpreted as showing a clavicular entrance to the temporary camp at this point.

The build-up of silt in the ditch below a 'humic' layer was interpreted as indicating the ditch may have been open for some time before being backfilled. The ring ditch feature was interpreted as an iron age structure representative of a type seen in lowland Yorkshire.

The failure of the geophysical survey to find a southern ditch to the proposed temporary camp was attributed to the presence of limestone bedrock close to the surface at the southern end of the survey. It was proposed that a turf rampart was more likely for a temporary camp rather than excavation of a ditch into the limestone. This may have relevance for our own survey results.

A complete adult human skeleton was recovered during the excavation and the condition and nature of the interment suggested a possibly violent death. The pottery found was not dated and a jet bead was also recovered.

The author concluded that a temporary camp in this location would indicate an early date in the Roman era and might possibly be associated with the initial expansion of the Roman Army into this area.

2.4 Aerial Photographic Interpretation

A detailed interpretation of aerial photographic data from the Newton Kyme site was carried out by the RCHME (Boutwood, 1996). Figure 5 shows the results of this study and indicates key features of the interpretation. In particular Boutwood proposes two potential temporary camps (denoted A and B in the diagram), where A is the camp described by Monaghan (1991) and B is a large previously unrecognised camp proposed on the basis of the nature of the feature observed in the aerial photographic data. In both cases only portions of the eastern sides of the proposed camps are evident from the interpretation. It is probable that both camps would extend to the west of Rudgate into the area covered by the current survey.



Figure 4. 1978 Geophysical survey of gas pipeline path. Inset: Possible archaeological feature targeted for investigation by excavation. (After Bolton & Heathcoat, 1978). (Map data ©Google 2018).



Figure 5. Plan of fort and vicus at Newton Kyme, transcribed from aerial photographs. After Boutwood (1996).

A further synthesis of aerial photographic data, excavation and geophysical evidence from the Magnesian Limestone Belt is available as part of the National Mapping Programme (Roberts, et al., 2010). This plot (Figure 6) shows some features extending across Rudgate in to the area of the current survey. The plot also shows the potential temporary camp ditches (i.e. Boutwood A & B) in a darker line shade.

2.6 Lidar Imagery of Newton Kyme Fort

Lidar imagery is available for the area of the current geophysical survey (Fig. 8). The image clearly shows the Roman Fort and Neolithic Henge features to the east of Rudgate, but there is little to see in the fields to the west other than a roughly north/south ridge toward the western edge of the image.



Figure 8. . Lidar image covering Site 1 and Newton Kyme Roman Fort. ©RRRA 2019, derived from Environment Agency lidar data (50cm resolution for SE44NE) and reproduced under Open Government Licence v.3.0

3. GEOLOGICAL BACKGROUND

3.1 Site Geology and Condition

The British Geological Survey (<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>) shows the area of the current survey lies on an outcrop of the Brotherton Formation of dolomitic limestone formed in the Permian period.

The Cranfield Soil and Agriculture Institute Soilscape Map (<http://www.landis.org.uk/soilscales/>) shows the survey area to comprise 'freely draining loamy floodplain soils' in areas immediately adjacent to the River Wharfe with the majority of the surveyed area comprising 'freely draining slightly acid loamy soils' and 'freely draining lime-rich loamy soils'.

4. METHODOLOGY

4.1 Equipment

The area was surveyed using a Sensys Magneto MXPDA 5 fluxgate gradiometer 5-probe array. The cart is equipped with a Trimble R8s GNSS GPS system, operated in a base and rover configuration. This machine is capable of high-resolution data collection, and takes readings every 10cm along the traverse

axis and every 50cm along the grid axis (thus achieving 18000 readings per 30m square). The machine collects data within a 0.2 nanoTesla (nT) sensitivity range. Because the cart uses a real time kinematic GPS to position itself, each data point of the survey has an in-built sub 2cm accuracy.

Drone photography was carried out using a DJI Phantom 4 drone with a standard 12MP 20mm f2.8 lens.

4.2 Data Treatment

The data from the magnetometer has been processed and presented using G-Sys (an in-house developed Geographic Database Management program which can also display, process and present digitised plans and images). This report was produced using Microsoft Word 2016, QGIS 3.4.12 and GIMP 2.10.10 for further image manipulation. All maps and figures have north pointing vertically to the top of the page and Google Earth Pro (7.3.2.5776) images are used for background map location for some of the figures.

The orthomosaic of drone photographic data was processed using Maps Made Easy (www.mapsmaddeasy.com).

4.3 Standards and Guidelines

Project management, survey, data processing, report production and archiving were conducted and prepared to standards exceeding the current best practice guidelines (Chartered Institute for Archaeologists, 2014); (David, et al., 2008); (Schmidt & Ernenwein, 2013); (Schmidt, et al., 2015).

5. GRADIOMETER RESULTS

5.1 Gradiometry Site 1

Site 1 covered 19.44 hectares and was surveyed over a number of days in late 2018 and early 2019.



Figure 9. Site 1: Gradiometer survey of land west of Rudgate & south of R. Wharfe. (Map data © Google 2018).

5.2 Gradiometry Site 2

Site 2 covered 2.57 hectares and was surveyed on a single day in early 2019.



Figure 10. Site 2: Gradiometer survey of land west of Rudgate & south of Watson's Lane. (Map data © Google 2018).

6. INTERPRETATION

6.1 Site 1



Figure 11. Interpretation of geophysical anomalies. (Map data © Google 2018).

Site 1 (Fig. 1) shows a number of anomalies which might suggest an archaeological origin. These can broadly be sub-divided as domestic/agricultural, military/Roman, pits and unattributed in nature. Figure 11 represents an interpretation of the gradiometer results based on the form of the anomalies observed.

Much of the area surveyed shows evidence of medieval and post-medieval agricultural use as evidenced by the heavy rig and furrow responses in the west and north of the plot. There is also evidence of either quarrying or geological disturbance in the central area.

The very strong magnetic responses in the south eastern section are due to the gas pipeline installed in the 1970s which continues northwards on the eastern side of the Rudgate and which initiated the archaeological investigation described in section 2.3 above. The pipeline will almost certainly have destroyed any archaeology which might have existed along its course.

6.1.1 Site 1: Northern and Western Section

The northern and western segments of the gradiometer plot show a number of tracks/ditches and enclosures of a domestic nature, possibly relating to animal husbandry (Fig. 12 indicated in 'blue'). These features border the flood plain of the River Wharfe and confirm and extend the interpretation of the aerial photographic evidence by Roberts et al. (2010) shown in figure 6 above. These may be contemporary with the palisaded double ring ditch described by Monaghan (1991) which he tentatively dated to immediately before the Roman occupation of the area.

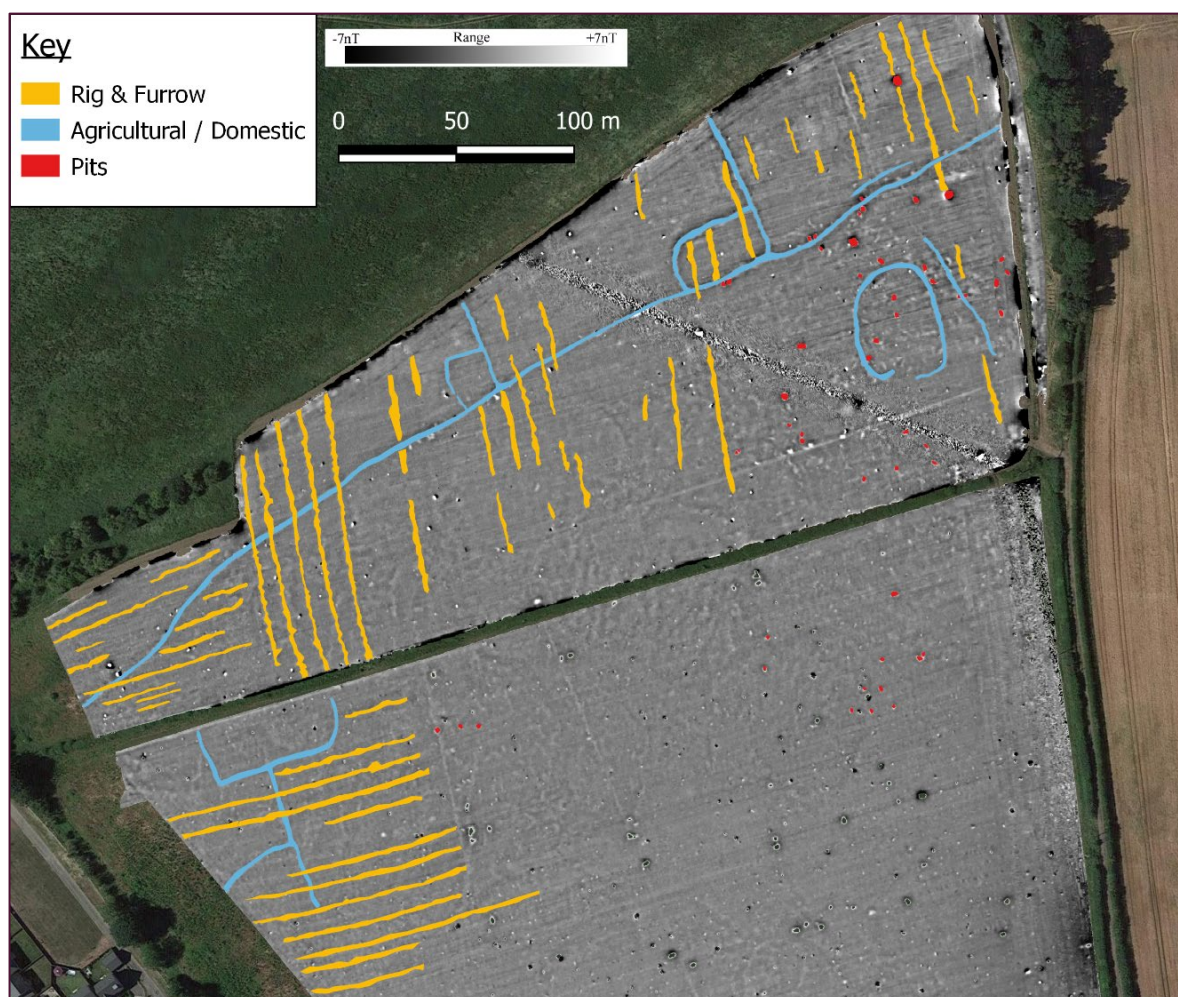


Figure 12. Interpretation of Site 1, North and West section anomalies. (Map data ©Google 2018).

Figure 13 also shows the anomalies attributed to rig and furrow agricultural features (shown in 'yellow'). There are two directions of the rig and furrow, roughly north/south and east/west which can be explained when the features are superimposed on the Ordnance Survey 1849 map (Fig. 13).

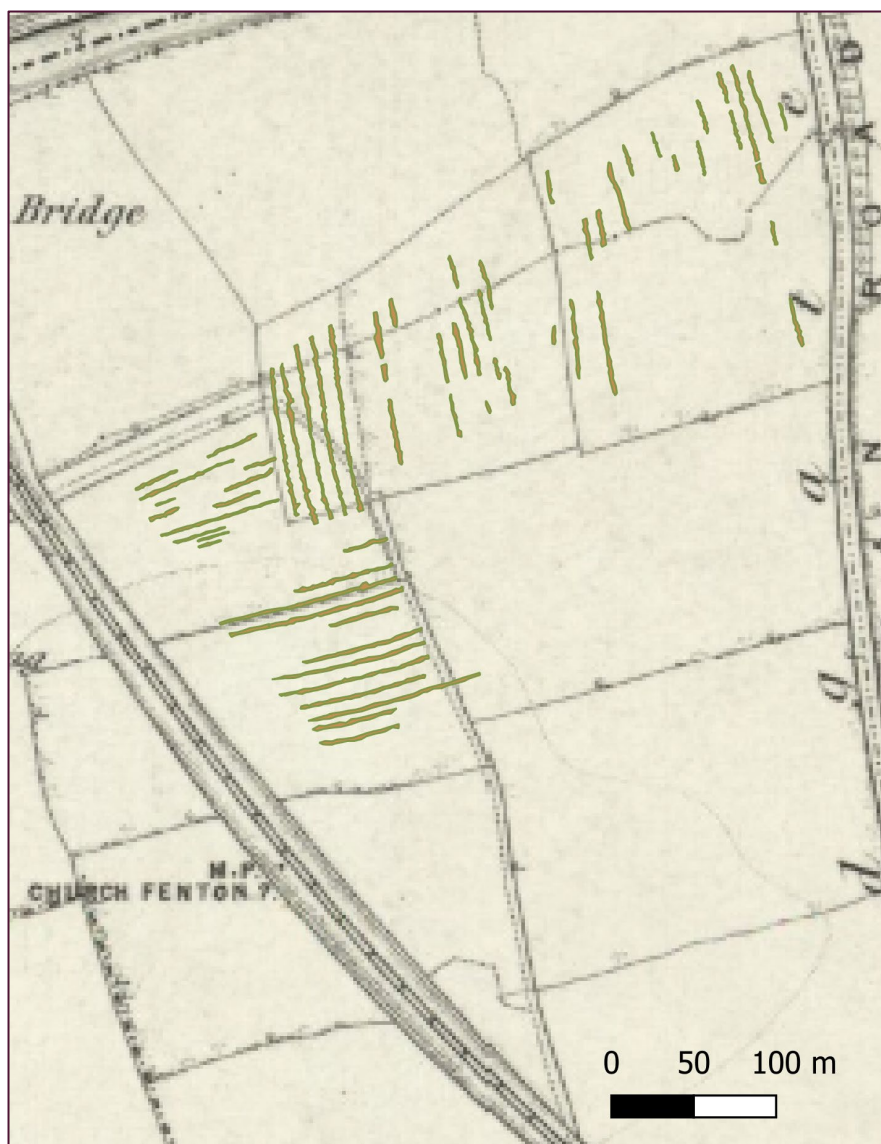


Figure 13. Rig & furrow features overlaying the 1849 OS map. (Reproduced with the permission of the National Library of Scotland under (CC-BY) licence).

Figure 13 shows that the rig and furrow features closely respect field boundaries shown in the 1849 OS map (Ordnance Survey, 1849), most of which have now disappeared. The same field boundaries are known to have existed almost a century before this date as they appear in the 1760 Fairfax Estate map and it is possible that they may have been in existence long before that date.

There are a high number of anomalies in the northern section of the site 1 survey which may represent pits (Fig. 12 shown in 'red'). Given the evidence for agricultural features in the same area it is possible that at least some of these pits may well be contemporary with this activity.

6.1.2 Site 1: Roman/Military Anomalies

Although relatively faint and absent in some places where they might be expected, it is possible to distinguish two distinct anomalies which have the typical form of Roman military ditches associated

with temporary camps (Fig. 11 indicated 'A' & 'B'). No trace was found of the curved feature identified on the NMP as a possible NW corner (see figure 6).

The large feature (marked 'B', Fig. 11) is on a slightly different alignment to ditch A and would appear to be on a larger scale. The northern east/west aligned linear feature is interpreted as a temporary camp ditch which is 'shared' between features A and B for a significant distance before feature A extends past the corner angle of feature B. This would imply that the second of the two camps constructed reused/recut a section of the previous camp ditch. The position of these northern boundary ditches is on slightly higher ground above the flood plain of the River Wharfe and it would be efficient to reuse a defensive line already existing in this area.

The absence of linear anomalies attributable to either feature A or B, where they might be expected to represent the southern ditches of temporary camps, may well be due to the proximity of the limestone bedrock to the surface, alluded to by Monaghan (1991) when endeavouring to explain the same lack of evidence for a southern ditch in the geophysical survey of the late 1970s to the east of Rudgate. Equally this could be due to subsequent agricultural activity removing any evidence of such features.

As already outlined, the existence of temporary camps at Newton Kyme has been in three previous studies. The first as a result of a geophysical survey and excavation in the late 1970s (Monaghan, 1991) the second by a detailed study of aerial photographic data by Boutwood (1996) for the RCHME, and a further synthesis of aerial photographic evidence for the national mapping programme (Roberts, et al., 2010). Boutwood not only confirms the veracity of the earlier interpretation (denoted Boutwood A hereafter), but also proposes a second temporary camp (Boutwood B) the eastern ditch of which lies to the east of Boutwood A and much of which is obscured by the, presumably later, Roman fort(s) and vicus complex.

Figure 14 is a composite diagram showing the results of the current gradiometer survey aligned with the aerial photographic interpretation by Boutwood (1996) georeferenced using GIS software.



Figure 14. . Composite diagram combining current gradiometer survey and Boutwood (1996) aerial photographic interpretation, superimposed on satellite imagery using QGIS software. (Map data ©Google 2018).



Figure 15. 2019 drone data showing cropmark (box) possibly representing the south east corner of Boutwood A (1996).
 ©Mike Haken, 2019, processed using Maps Made Easy (www.mapsmadeeasy.com)

Figures 14 and 15 show a possible interpretation of the geophysical and aerial photographic data to estimate the extent of the two Roman temporary camps at Newton Kyme. The two camps differ considerably in size but their general orientation is similar. The southeast corner of Boutwood A is not shown on the Boutwood (1996) plan, however, recent drone photography (denoted '2019 Drone Data' in figs. 14 & 15), taken by the current surveying team, showed what could be a faint cropmark interpreted as a possible south east corner of the Boutwood A eastern ditch. The dotted lines in figures 14 & 15 are conjectural ditch alignments based on the projection of the temporary camp ditches proposed by Boutwood (1996) and the current survey and drone data that have not been detected by aerial photography or gradiometer survey.

In common with many temporary camps, neither camp is laid out with precision (see figure 14) making the estimation of intended dimensions seem at first sight tricky. If, however, we assume that the camps were laid out along their central axes, the dimensions between the ditches are as follows:

Boutwood A, east/west 363m, north/south 274m.
 Boutwood B, east/west 540m, north/south 435m.

Given the Roman preference for measurements in multiples of twelve, it would seem reasonable to allow 12 Roman feet (ie 3.6m) on the inner side of the ditch to accommodate a small berm and rampart, meaning that we must deduct 7.2m from each dimension to obtain internal dimensions:

Boutwood A: 355.8m x 266.8m = 1202 pedes x 901.4 pedes = 10 actus x 7.5 actus; x/y ratio 4:3
 Boutwood B: 532.8m x 427.8m = 1800 pedes x 1446 pedes = 15 actus x 12 actus; x/y ratio 5:4

It has long been recognised that temporary camps were frequently set out using round number ratios of the actus, ie 120 Roman feet, one Roman foot (*pes*, plural *pedes*) = 0.971 ft (Jones 2012, ch.5). The small margins of error apparent in these measurements, the worst being 0.42% out and

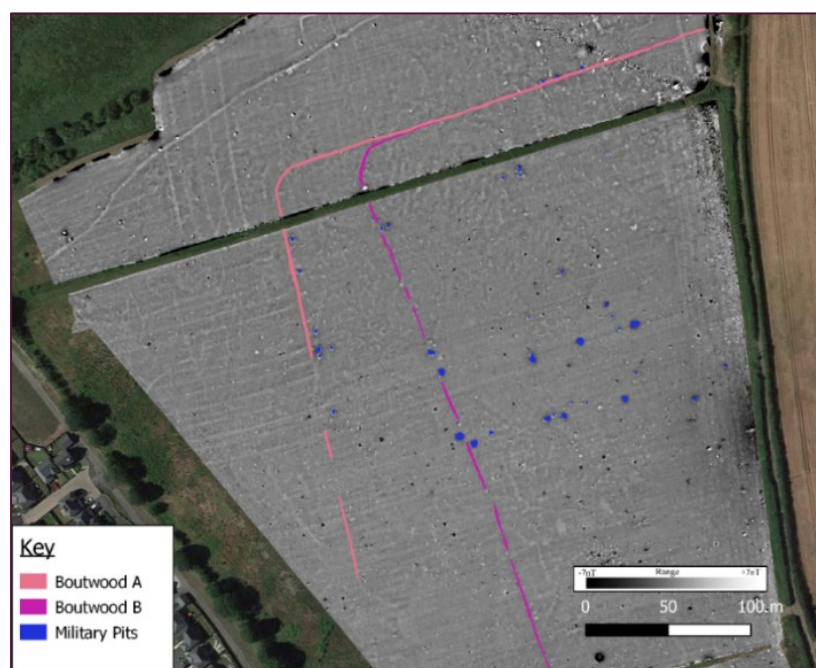
the best spot on, leaves very little doubt that the interpretation of the camps is correct, and that both camps were set out along their axes to determine the position of the rampart (see figure 19). When taking into account truncation of the ditches by ploughing, it becomes almost certain that the ditches of both camps were set 12 *pedes* further out (Haken, in prep.).

The internal area of Boutwood A is 94,927 m², (9.5 Ha) and the internal area of Boutwood B is 22,846 m² (22.85 Ha). Jones (2012) gives an extensive review of the research on holding capacity of Roman temporary camps, and suggests a possible occupancy range of between 480 men/Ha and 670 men/Ha. Such estimates could, however, be very much on the low side, since the only detailed contemporary account of camp layout, usually ascribed to Hyginus, accommodates as many as 1,150 men/Ha (Jones 2012, 50). Boutwood A would therefore have accommodated anything 4,560 and 10,925 men. The similar sized camp at Rey Cross is generally thought to have held at least legion plus so on an estimate based on 690 men/Ha Boutwood A would hold approximately 6,500 men. Boutwood B, on the other hand, is a very large camp and is almost exactly the same in area as the previously largest known in England, at Brampton Bryan in Herefordshire (Welfare & Swan 1995, 61-3) although it is easily surpassed by some of the extremely large camps found in Scotland (Jones, 2012). Based on the occupancy range proposed by Jones (2012, p.58), Boutwood B would hold between 10,968 and 15,776 men, or as many as 26,277 if Hyginus' figures were to be applied.

The date of Camp A cannot be determined, however analysis of aerial photography shows that the north eastern ditch of camp B predated the permanent structures at the site, and since recent analysis by Mike Haken has confirmed a 'Parrot Beak' entrance to one of the forts, this demonstrates that the earliest fort must be of early Flavian date at the very latest (Haken, in prep.), it follows that Boutwood B must be Flavian or possibly even earlier.

The dimensions of Boutwood B suggest a camp capable of holding several legions with auxiliary units. Its size suggests it was built for a campaign strength army where it was necessary to gather large numbers of troops for movement as a single body. This makes sense, since the position of Newton Kyme is likely to have been of strategic importance for advances into the north as it guarded a major crossing point of the River Wharfe. This would later be the route of the major Roman road (RR280) towards Aldborough, Stanwick and further north. The possible existence of at least two forts at Newton Kyme attests to this important location.

6.1.3 Site 1: Possible Military Pits



Several strong anomalies within the central portion of the proposed temporary camps appear to be along linear alignments, roughly parallel to the northern ditch and perpendicular to the western ditch of the larger (Boutwood B) proposed camp. These anomalies may represent fire pits or rubbish pits, both of which are known to have been placed alongside rows of tents. Other pits are situated along the edges of the western

Figure 16. . Possible pit anomalies associated with the temporary camps.
(Map data ©Google 2018).

ditches of both camps A and B, but interestingly there are none along the northern ditch. The pits would need to be confirmed by excavation.

6.1.4 Site 1: Unattributed Anomalies and Quarry Features

Site 1 contained some linear anomalies which could not be interpreted as belonging to any specific period of activity (Fig. 17 indicated in 'green') or could not be confidently identified as being the result of human activity. Similarly, some areas of disturbance are interpreted as representing 'quarrying' activities (Fig. 17 'dotted' polygons).



Figure 17. Unattributed and quarrying/geological features. (Map data ©Google 2018).

The linear features in the north eastern section of Site 1 (1, 2 & 3, Fig. 17), although appearing to be archaeological, do not appear to belong to the agricultural/domestic features described in 6.1.1 and, most likely, represent a different period of activity.

Several anomalies in the central section of Site 1 (4, 5, 6 & 7, Fig. 17) do not appear to relate to features previously described and may be geological in nature. The central, roughly circular, feature (8) has a diameter of approximately 22m and requires further investigation to determine if archaeological or geological.

The curved anomaly (9) is in the area proposed for the south western corner of the temporary camp Boutwood A (Fig. 14), however, it is broader and more disperse than the ditch anomalies identified as Boutwood A and cannot be confidently identified as the corner ditch of that possible camp. Feature 10 (Fig. 17) is a linear feature which approximately aligns with the western ditch of Boutwood A and may be a continuation of that feature. If so, this would indicate that Boutwood A is substantially larger than proposed in the above discussion (6.1.2). Further investigation is necessary to elucidate the actual extent of both proposed temporary camps along their southern edges.

Feature 11 (Fig. 17) is a linear anomaly which appears archaeological in nature, it does not share an alignment with any other identified features and extends into the area of quarrying/geological disturbance. It does not correspond with any features in the 1849 OS map (Fig. 13) and is, therefore, likely to precede the field layout present by the 18th/19th century.

Several areas of disturbance are identified on figure 17. These are interpreted as either the result of quarrying activities or geological features. They may, in part, explain the absence of a southern ditch feature especially in relation to the proposed Boutwood B temporary camp.

6.1.5 Site 1: Modern Features



Figure 18 shows the strong gradiometer signal caused by the modern gas pipeline installed in 1979 described in section 2.3 above. The pipeline crosses the survey area of Site 1 in the south eastern section and continues along the eastern side of modern Rudgate. It completely masks any possible features which may be of an archaeological nature.

To a lesser extent, overhead powerlines in the south eastern section, along the eastern section and crossing the north eastern section, cause a disturbance in the gradiometer survey. However, these do not substantially interfere with the interpretation of the survey results.

Figure 18. Anomalies caused by modern features. (Map data ©Google 2018).

6.2 Site 2

The opportunity arose to survey an area to the south of the A659 in the angle of Watson's Lane and Rudgate (Figure 1). Figure 10 shows the results of this survey. No anomalies which could be attributed to an archaeological origin were identified. The absence of any evidence of a road structure along the eastern edge of Site 2 indicates that the course of RR280 is likely to lay either under the modern Rudgate road or further to the east of the surveyed area.

7. CONCLUSIONS

By Richard Gibson & Mike Haken

Other than agricultural activity and the introduction of field boundaries some time prior to 1760, there appears to have been very little disturbance to either Site 1 or Site 2 between the Roman period and the installation of the modern features described in 6.1.5.

Geophysical survey further south along the line of RR280, conducted by RRA shortly after this current survey (Gibson 2021), has demonstrated that RR280 was a major road, flanked by ditches spaced approximately 60 Roman feet apart (i.e. in excess of 17.5m) with substantial lines of quarry pits further out on both sides. It would have been expected, therefore, that if RR280 lay beneath modern Rudgate west of the Newton Kyme complex (as is the traditional view), the current survey would have shown indications of a ditch or quarry pits immediately west of the modern track; yet no such anomaly on the eastern edge of the survey area was found, in either Site 1 or Site 2. Furthermore, taken with the absence of any evidence of a major road between the fort complex and modern Rudgate in the aerial photographic interpretation (Boutwood, 1996) or in the 1970s geophysical survey immediately to the east of modern Rudgate (Monaghan, 1991), it seems highly unlikely (although not entirely impossible) that the Roman road could be directly beneath the modern Rudgate farm track at this point. Therefore, it seems most likely that RR280 is in fact the road identified from the aerial photographic evidence (Boutwood, 1996) leaving the south gate of the fort and passing through the extra-mural settlement. If this is correct, then RR280 must have been set out after Camp B was constructed, since the road cuts its south eastern corner. Since the road has clearly been diverted to pass through the gate of Flavian period fort (Haken in prep), it must have been constructed at some time between the abandoning of Boutwood B and the construction of the Flavian fort.

Further geophysical investigations to the east of Rudgate and to the south of the current survey area towards Toulston Polo Club would be required to determine the course of this important road with certainty.

Based on our gradiometer survey, previous aerial photographic interpretations (Boutwood (1996) and Roberts et al. (2010)) and the geophysical and excavation evidence to the east of Rudgate described by Monaghan (1991), we can confirm that the agricultural/domestic enclosures and features extend along the slope leading down to the southern bank of the Wharfe in the northern section of Site 1.

Furthermore, linear anomalies have been identified which appear to have been created by the ditches of the western sections of the two Roman temporary camps, as identified in the aerial interpretations of Boutwood (1996) and Roberts *et al* (2010) to the east of Rudgate. The curving west end to the northern ditch of camp Boutwood A proposed on the NMP interpretation (figure 6; Roberts, et al. 2010, fig. 48) was not observed, indeed the northern ditch can be seen clearly on the Site 1 survey continuing as a single straight feature significantly further on to the west, and as a reverse cropmark on Google Earth imagery from July 2017 continuing eastwards as far the fort defences. This evidence, coupled with the evidence of the survey of two north west curved corners, led to the inevitable conclusion that the northern ditches of both Boutwood A & B shared the same alignment. It seems probable that the north

west defences of Camp A were still apparent in places in the late medieval or post-medieval periods, since the limits of rig and furrow respect them in places, passing slightly over the ditch in others (figure 11). The location of a trackway marked on the 1849 Ordnance Survey map (figure 13) may also have been partly influenced by the position of the defences of Boutwood A, although this is less clear.

Combining all the available data enabled the reconstruction of the outlines of the two camps. If the reconstruction is correct, the camp entrance protected by a clavicular as suggested by Monaghan (1991) would be almost exactly half way along the north defences of Boutwood B. There is, however, no surviving indication of a clavicular at the west gate of Boutwood B. Given Monaghan's conclusion that the ditch of the return was shallower, it must be possible that the western gate defence has been entirely ploughed out, although given the small scale of the excavation, it is similarly possible that Monaghan's interpretation was incorrect. There seems to have been no hard and fast rule about the location of gates along the long sides of Roman temporary camps, since they are sometimes halfway, sometimes a third of the way, sometimes two fifths of the way along, and occasionally seemingly random (see Welfare & Swan 1995, 12-13). Of the probable total of eight gateways in the camps, only two have been identified and it is impossible to predict with certainty where the other six might reasonably be, although it is certainly normal to have gates at or close to the centres of the shorter sides.

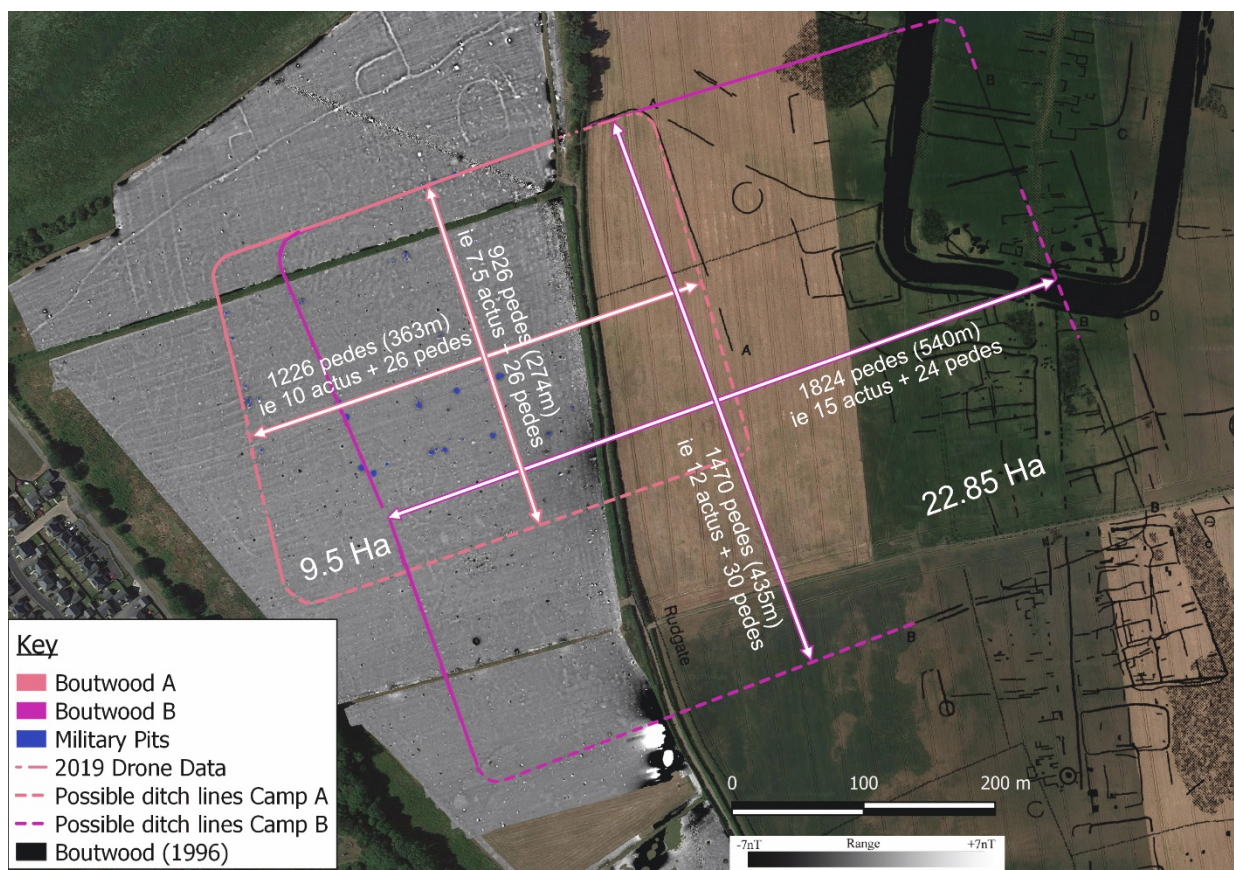


Figure 19. Illustration of the proposed camp outlines, showing the dimensions along the main axes in modern and Roman units

As detailed in 6.1.2, the camps appear to have both been set out by measuring along their central axes using the *actus* (ie 120 *pedes*) as a standard unit of measurement and to precise ratios; Boutwood A in the ratio 4:3 (10 x 7.5 *actus*) and Boutwood B in the ratio 5:4 (15 x 12 *actus*). It is assumed that the initial measurement determined either the centreline or the inner edge of the rampart, although since no rampart survives this is impossible to determine with absolute certainty. The inner edges of the ditches were then apparently set a further 12 *pedes* out. As can be seen clearly from the camp outlines (figure 19), the process of setting out the camp defences from these cardinal points was far less precise.

It is currently not possible to date Boutwood A, although excavation of the pits along its western ditch may provide dating evidence. Its size however (9.5 Ha), is very similar to other camps which are assumed to have accommodated a single legion plus auxiliaries, a total of 6,500 men using Jones's higher occupancy estimate.

The 'permanent' military installations at Newton Kyme were all placed across the north east corner of Boutwood B, and the road through the vicus (which is being proposed as the course of RR280) cuts across the camp's south eastern corner. Therefore, it seems that the camp is earlier than the earliest fort. Since the east gate of one fort is of the 'Parrot Beak' type, the camp must be of Flavian date at the very latest. Given its size (23 Ha), the camp was capable of holding anything between 11,000 and 26,000 men, depending on which assumed occupancy rate is applied (see p.16). At the very minimum, this will have been two legions plus auxiliaries and potentially more. This raises an important question which it is beyond the scope of this report to answer – when and why would an army of such a size have been assembled at Newton Kyme?

If nothing else, Boutwood B demonstrates the use of Newton Kyme as an important crossing point of the R. Wharfe before the construction of RR280, and is potentially an indicator of the existence of a well established late Iron Age north – south routeway. Further geophysical survey to the east of Rudgate, including the site of the Roman fort and vicus, would not only aid in confirming the extent of the temporary camps but may also give further clues as to the presence (or not) of an earlier trackway, and help to determine the course of RR280 and its crossing point of the Wharfe.

8. ARCHIVING

8.1 Reports

Whenever possible, the RRRRA has a policy of making all reports available online on its website, as well as providing the appropriate Historic Environment Record(s) with digital copies in PDF-A format, and contributes all reports to the ADS Library via OASIS (also in PDF-A format). Availability may potentially be subject to a time embargo dictated by the landowner, or by the RRRRA itself when a site is considered particularly sensitive or potentially at risk.

8.2 Data

Whenever possible, the RRRRA has a policy of making the survey data publicly available, to ensure that future researchers are able to reprocess and manipulate the data in the most up to date and appropriate manner. Availability may potentially be subject to a time embargo dictated by the landowner, or by the RRRRA itself when a site is considered particularly sensitive or potentially at risk. Since file sizes can be very large, and the costs of lodging data with repositories such as the Archaeology Data Service can be substantial, RRRRA can only supply data on request, which should be made in the first instance to info@romanroads.org.

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