The Castle

Castle Eden

Geophysical Survey

PN: TCP-18-CAS

May 2018

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Project reference	**TCP-18-CAS**
On behalf of	**The Castle Partnership**
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1 Contents

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2 Summary

This report presents the results of a geophysical survey undertaken on land adjacent to The Castle, Castle Eden, Co. Durham, on behalf of The Castle Partnership.

The detailed magnetic and earth resistance survey covered approximately half a hectare and identified an irregular square anomaly thought to be comprised of stone that may be of archaeological interest.

The presence of buried utilities, drainage chambers, metallic fencing and possible made ground created strong responses in both the magnetic and earth resistance data that made it difficult to identify any archaeological potential. It is therefore possible that additional archaeological features may be present that could not be identified by the geophysical survey.

Several other irregular anomalies were also detected by the earth resistance survey that could be of interest given their proximity to the square anomaly. The magnetic survey also identified several linear features that could be soil filled features, however their interpretation and context was limited due to the wider magnetic disturbance.

3 Introduction

A geophysical survey was commissioned by The Castle Partnership on land adjacent to The Castle, Castle Eden, Co. Durham (NGR NZ 4270 3875). The purpose of the survey was to determine the presence of any archaeological potential within an area proposed for the development of a biomass plant and access road.

3.1 Location and land use

The survey area measured approximately half a hectare and is within an area of archaeological interest associated with a Scheduled Ancient Monument (*Deserted medieval village, moated site, and early timber building at Castle Eden, 200m south of The* Castle. List number 1015842:UID 28549). The location and survey area are shown in drawing TCP-18-CAS.01. The survey area was found to be relatively level, sloping gently to the north and at a higher elevation than the access road that is present to the west. The field was bounded by a metallic fence in the west and north and by a ha-ha ditch to the east. Modern brick debris was evident within the near surface to the north and northwest boundaries. A suspected sunken concrete soakaway chamber was located in the far northeast of the field, as was a large metallic water trough. The field was used as pasture at the time of the survey.

3.2 Site history

A desktop study was not available at the time of the survey.

The settlement is first recorded as 'Iodene Australem' in relation to a 10th Century land grant but is likely to have been occupied prior to this as an Anglo-Saxon Claw Beaker was unearthed in 1775 during hedgerow clearances near St James' Church. The existing castle and parkland superseded a previous manor, church and village when the land was purchased by Rowland Burdon in 1758. Excavations within the field undertaken by Professor David Austin in 1974 identified significant archaeological deposits associated with a deserted medieval village as well as a substantial ditch and the foundations of a large timber building in the north of the field, possibly linked with a previous moated manor site. The excavations were published in *The Medieval Settlement and Landscape of Castle Eden, Peterlee, Co. Durham: Excavations 1974*.

A topographic and magnetometer survey was previously undertaken by Archaeological Services, University of Durham (ASUD Report 960: February 2003). The topographic survey encompassed the entire field whilst the magnetometer survey was restricted to a 40m strip that followed the path of a previously proposed driveway, commissioned by Mr A. H. Gilman who was a former resident of The Castle. The topographic and magnetometer surveys identified features of probable medieval origin, including former trackways, ridge and furrow cultivation and a moat. (ASUD 960:2003:7).

An additional geophysical survey was commissioned following the submission of a second proposed driveway route by Mr S. Davis that would run along the eastern boundary of the field. The survey comprised a combined magnetic and earth resistance assessment that identified evidence of probable occupation assumed to be of medieval origin, including ridge and furrow cultivation, a moat and a probable stone structure north of the moat. (Quicksurv: TCP: NB/EDEN: 2011).

3.3 Geology and soils

The solid geology of the site is believed to be Magnesian Limestone overlain by glacial drift. (British Geological Survey: online: 2018).

3.4 Dates and additional information

The magnetic survey was undertaken on 10th April 2018, under fine weather conditions. Due to water saturation over some of the field and subsequent adverse weather, the earth resistance survey was delayed until the 8th May 2018. A section 42 licence was granted by Historic England (Case No SL00183190, Monument No. 1015842) to carry out the geophysical survey.

4 Field Methodology

4.1 Geomatic referencing

The data was collected over 20m x 20m survey grids that were initially drafted in CAD software and overlain onto a basic topographical map. The grid was uploaded to a Trimble R10 GPS system to enable the accurate setting out of the co-ordinates in the field. Non-magnetic surface flags were used to define the corner points of the grid and incremented trapeze ropes for heading and positional markers. Two survey nails were placed in the asphalt road in the west to act as survey control.

4.2 Techniques

4.2.1 Magnetic Survey

A detailed magnetic survey was undertaken to identify the presence and extent of anomalies with an enhanced magnetic susceptibility, such as ditches, pits, field systems and palaeochannels. Fired structures such as hearths, kilns and ovens as well as any buried ferrous metals would also be detected using this technique. The survey was practiced in accordance with Historic England (2008) Guideline No 1, *Geophysical survey in archaeological field evaluation*, and the Charted Institute for Archaeologists (2014), *Standard and guidance for archaeological geophysical survey.*

4.2.1.1 Instrumentation

A Bartington 601-2 Fluxgate Gradiometer was used to undertake the survey.

4.2.1.2 Data Collection

The instrument was balanced in a magnetically stable area located within the castle grounds and was checked and rebalanced using this point throughout the duration of the survey. The data was collected over the pre-determined grid using trapeze ropes, with readings taken at 0.25m increments spaced on 1m traverses in a zig-zag pattern. The instrument sensitivity was set at 0.1nT.

4.2.1.3 Post-processing

The data collected by the instrument was imported into TerraSurveyor software. Processing was kept to a minimum to prevent the creation of artificial artefacts in the data and was restricted to:

- De-stripe - applied to compensate for a slight drift that sometimes occurs between the two sensors (<2nT).
- De-stagger – applied to compensate for heading errors caused when data is collected using zig-zag traverses.

4.2.1.4 Data presentation

The processed greyscale data was clipped at a level deemed appropriate to best show any possible archaeology and presented as a 1:400 greyscale plot in drawing TCP-18-CAS.02 and as a 1:400 X-Y trace plot in drawing TCP-18-CAS.03.

4.2.2 Earth Resistance Survey

Earth resistance surveys are undertaken to locate buried archaeological features such as walls, cists and roads as well as graves and ditches under favourable ground conditions. The survey was practiced in accordance with Historic England (2008) Guideline No 1, *Geophysical survey in archaeological field evaluation*, and the Charted Institute for Archaeologists (2014), *Standard and guidance for archaeological geophysical survey*.

4.2.2.1 Instrumentation

A Geoscan Research RM15 twin array resistance meter was used to undertake the earth resistance survey.

4.2.2.2 Data Collection

The earth resistance data was collected over the pre-determined grid using trapeze ropes and measuring tapes. Readings were taken at 0.5m increments spaced on 1m traverses using a parallel collection method. The electrode separation was 0.5m using a 0.1ohm sensitivity.

4.2.2.3 Post-processing

The data collected by the instrument was imported into TerraSurveyor software. Processing was kept to a minimum to prevent the creation of artificial artefacts in the data and comprised:

- De-spike - applied to reduce high contact readings.
- High Pass Filter – applied to reduce the regional gradient within the data, usually caused by underlying geology or drainage.

4.2.2.4 Data presentation

The processed greyscale data was clipped at a level deemed appropriate to best show any possible archaeology and presented as a 1:400 greyscale plot in drawing TCP-18-CAS.04.

5 Results

The interpretation of both the magnetic and earth resistance data are shown in drawing TCP-18-CAS.05.

5.1 Areas of magnetic disturbance

Dipolar magnetic anomalies are strong positive-negative responses that indicate the presence of surface or near surface ferrous objects or fired materials.

Magnetic disturbance can be seen to dominate the gradiometer data. Two distinct bipolar linear features are evident running through the survey area in a north to south direction with a possible third to the far east of the field. Such responses are likely to be from buried utilities. Strong disturbance is also evident along the western boundary, which is probably associated with the metallic fencing that is in place. Additional magnetic disturbance is also concentrated in the far northeast of the survey area and is probably the response from a metallic water trough and presumed reinforced concrete soakaway.

Anomaly A is small area of disturbance in the far southeast corner of the survey area. This anomaly is isolated from the main responses, although it cannot be determined if the response is archaeological or from buried tipped material. The disturbed response to the east of anomaly A is likely to be from a metallic footbridge that spans the ha-ha ditch.

Additional isolated dipolar spikes were identified within the survey area using the X-Y trace plots. They are likely to correspond to surface or near-surface ferrous materials and have high magnetic values. Only the larger spikes have been shown on the interpretation drawing. It is possible that the iron spikes could correspond to buried material culture when located adjacent to known archaeological features.

5.2 Positive magnetic anomalies

Positive magnetic anomalies are indicative of an enhanced magnetic field gradient and can be associated with archaeological soil filled features such as cut ditches or pits.

Several linear anomalies were identified from the gradiometer data. They vary in strength from 2nT to 6nT and could be of archaeological interest, although the magnetic disturbance limits their wider context and interpretation within the survey area.

Elsewhere, additional isolated magnetic enhancements were detected within the areas unaffected by the magnetic disturbance. Most are individual responses identified using the raw X-Y trace plots and have low, broad magnetic values. They could be considered to be archaeological when associated with features of known human agency however, it is also possible that they represent variations within the underlying geology or deeply buried ferrous metal / burnt materials.

5.3 High earth resistance anomalies

High resistance anomalies are often interpreted as buried features which have a low conductivity or moisture content, such as stone walls, concentrations of rubble or compacted trackways.

Anomaly B is roughly square in shape and located in the southeast of the survey area. The shape and isolated nature of the response could be indicative of a former structure or floor that may be of archaeological interest.

Anomalies C and D also have high resistance values but can be attributed to drainage features, as C correlates to a manhole and D the concrete soakaway. Similarly, it is likely that the anomalies present in the far northeast corner of the survey area are probably responses from modern buried debris associated with the construction of the nearby garages.

Additional areas of enhanced resistance were identified within the data as well as several weak linear anomalies. Most are associated within a broad, weak response (**Anomaly E**), that could be due to a change in the underlying topography, geology or drainage. However, given the association with anomaly A, it may be possible that they could also be of archaeological interest.

Anomaly F is composed of very high resistance values and is located along most of the western boundary. It is possible that the response is from made ground given the presence of modern brick material within the near surface.

5.4 Low earth resistance anomalies

Low earth resistance anomalies are usually associated with buried features with an enhanced moisture level such as cut ditches, graves and pits.

Three long linear anomalies of low earth resistance were identified within the data and correspond well with the dipolar magnetic linear features that are likely to be associated with buried utilities.

Anomaly G is an additional linear feature running in an east to west direction. The response is very weak and it is not corroborated by the magnetic data which may eliminate it as a cut feature of archaeological interest.

6 Conclusions

A well-defined anomaly (B) was identified in the far southeast of the survey area that could be the remnants of a stone structure and of possible archaeological interest. Several adjacent irregular anomalies (E) were also identified by the earth resistance survey that are much weaker but may be of interest given their proximity to anomaly B. Similarly, a small isolated area of magnetic disturbance (A) is also present adjacent to anomaly B. The response could be from buried ferrous or fired debris, however the context of the disturbance in relation to anomaly B may infer that it could also be of interest.

Several magnetically enhanced linear anomalies were detected within the survey area that could represent soil filled features, however their context within the field is limited due to the presence of metallic disturbance within the data caused by several presumed buried utilities and metallic fencing. The presence of made ground was also suggested by high earth resistance readings along the majority of the western boundary and the occurrence of modern bricks at the near surface.

The earth resistance survey also confirmed the presence of buried utilities that correlated with those detected by the magnetic survey. An additional linear feature of low resistance (G) was identified running in an east to west direction. The response is very weak, and it is not corroborated by the magnetic data which may eliminate it as a cut feature of archaeological interest.

Much of the magnetic and earth resistance data in the far northeast of the survey yielded very little due to the presence of a metallic water trough and concrete soakaway.

Numerous additional isolated magnetic enhancements as well as isolated dipolar spikes were identified using the raw X-Y trace plots. The magnetic enhancements could be archaeological when associated with known anthropogenic features; however they could also be from variations of the underlying geology or deeply buried ferrous metal / burnt material. The dipolar spikes have high magnetic values and are likely to correspond to surface or near-surface ferrous materials.

7 References

Historic England (English Heritage 2008) Geophysical Survey in Archaeological Field Evaluation. Research and Professional Services Guideline #1.

Institute of Field Archaeologists (2002) IFA Paper No 6, The use of geophysical techniques in archaeological evaluations.

Charted Institute of Archaeologists (2014) Standard and Guidance for Archaeological Geophysical Survey.

Austin D (1974): The Medieval Settlement and Landscape of Castle Eden, Peterlee, Co. Durham:

ASUD Report 960 (2003) Land at The Castle, Castle Eden, County Durham.

Quicksurv (2011) Report TCP/NB/EDEN: The Castle, Castle Eden, Geophysical Survey.

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NZ 40 41 42 43

SITE LOCATION

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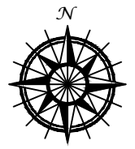

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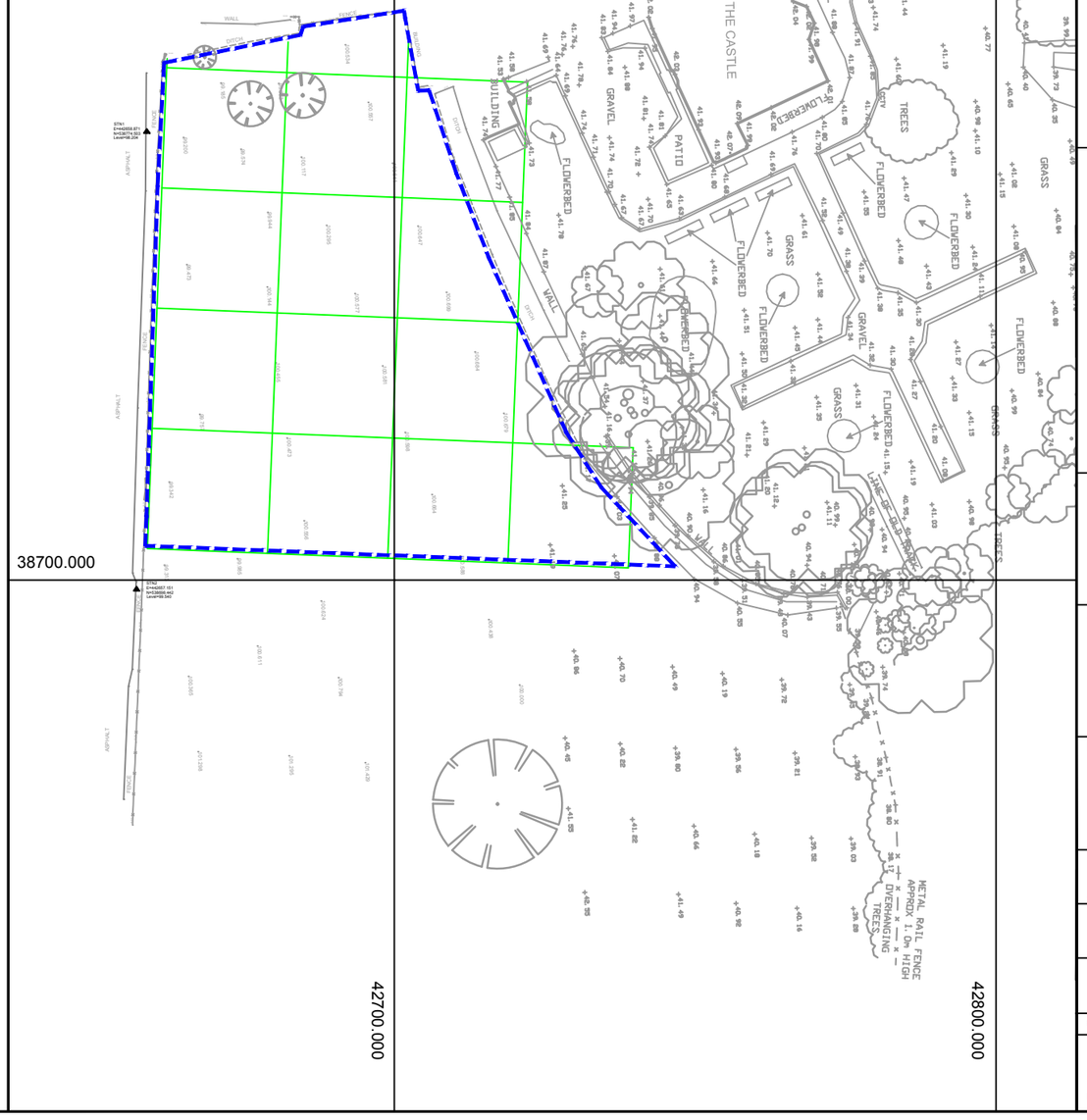

SITE LOCATION

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Client Name

The Castle Partnership

Job Title

The Castle
Castle Eden

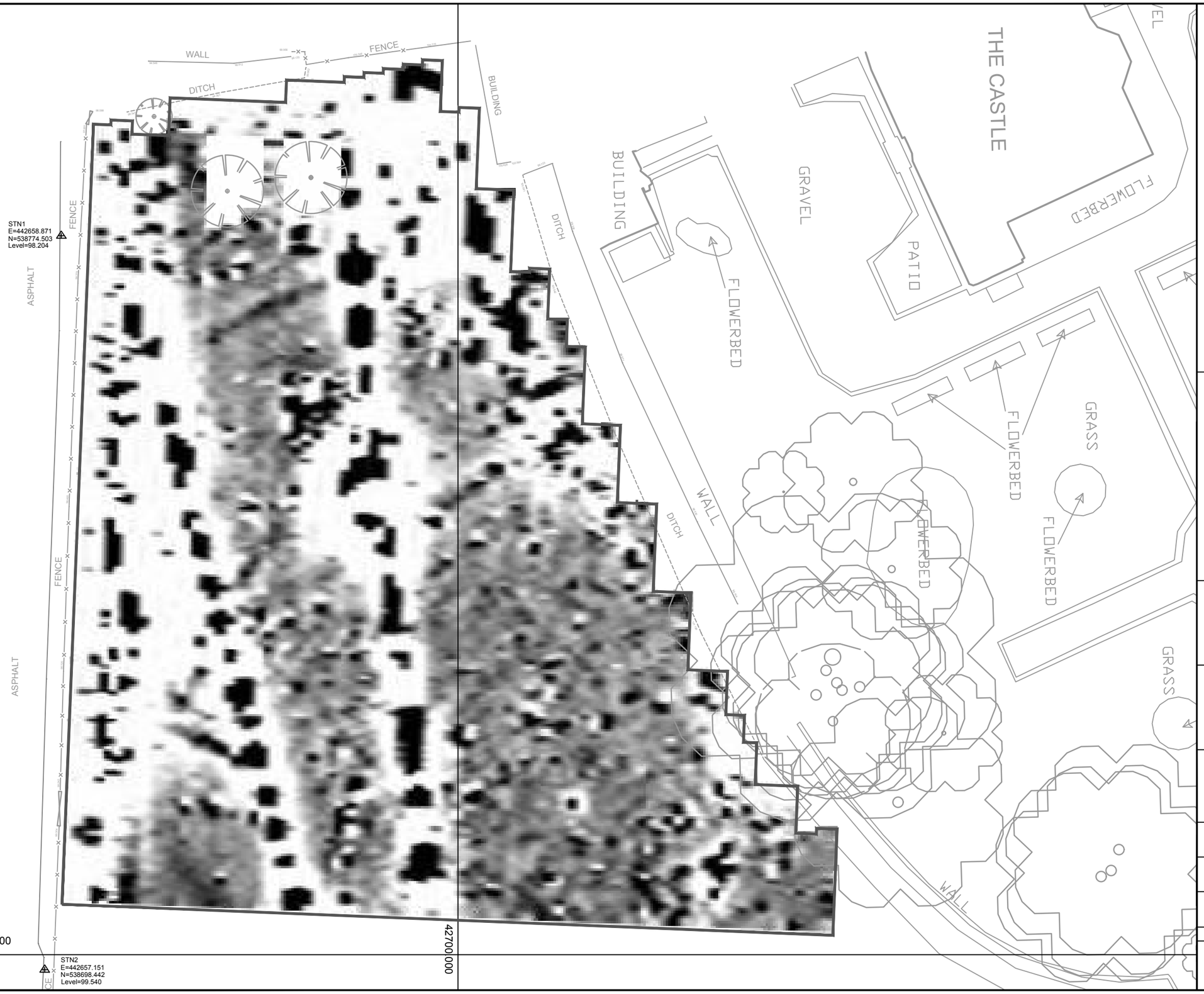
Drawing Title

Site Location & Survey Extents

Scale	Drawn
As Shown	NB
Date	Approved
09/05/18	AP

Revision	Amendments		By	Checked

Project Number	Drawing No.	Revision	Status
TCP-18-CAS	01	-	Final



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Client Name

The Castle Partnership

Job Title

The Castle
Castle Eden

Drawing Title

Processed Greyscale Gradiometer Data

Scale	Drawn
1:400 @ A3	NB
Date	**Approved**
09/05/18	AP

Revision	Amendments		By	Checked

Project Number	Drawing No.	Revision	Status
TCP-18-CAS	02	-	Final

30nT

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SCALE 1:400 @ A3

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Client Name

The Castle Partnership

Job Title

The Castle
Castle Eden

Drawing Title

Gradiometer X-Y Trace Plot

Scale	Drawn
1:400 @ A3	NB
Date	**Approved**
09/05/18	AP

Revision	Amendments		By	Checked

Project Number	Drawing No.	Revision	Status
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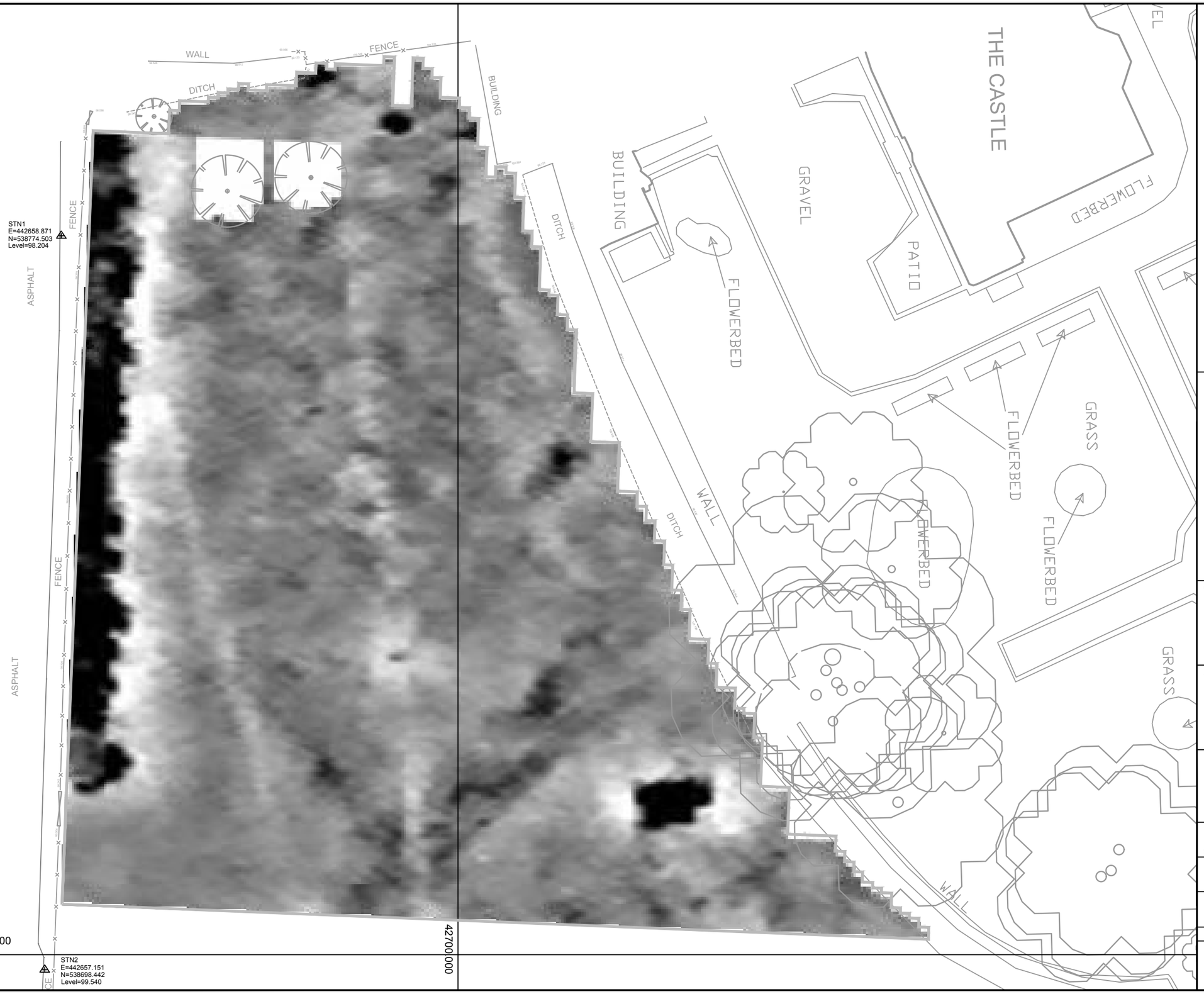

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Client Name

The Castle Partnership

Job Title

The Castle
Castle Eden

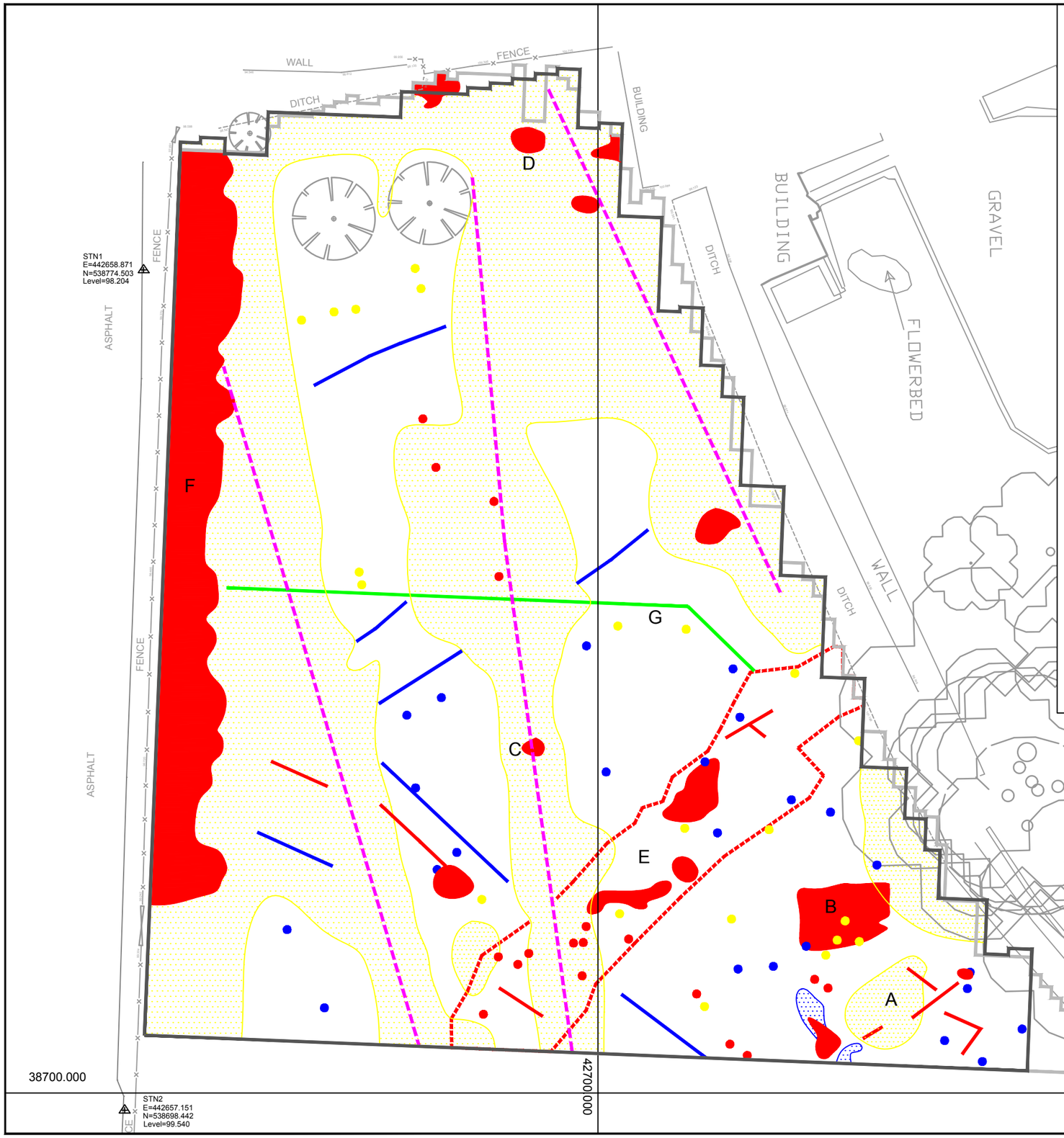
Drawing Title

Filtered Earth Resistance Data

Scale	Drawn
1:400 @ A3	NB
Date	Approved
09/05/18	AP

Revision	Amendments		By	Checked

Project Number	Drawing No.	Revision	Status
TCP-18-CAS	04	-	Final



Key

- Magnetic enhancement. Associated with soil filled features of possible archaeological interest.
- Isolated magnetic enhancement. Possibly associated with deeply buried ferrous material or small soil filled archaeological feature.
- Area of dipolar magnetic disturbance. Probably associated with ferrous metal, tipped debris or fired material.
- Isolated dipolar spike. Probably associated with ferrous or fired material.
- High earth resistance anomalies. Probably associated with buried stone features or materials with low moisture content.
- Area of broad earth resistance response. Possibly of interest when associated with known archaeological features. Probably associated with a change in underlying topography, geology or drainage.
- Low earth resistance anomalies. Associated with ditches or conductive materials with enhanced moisture content.
- Composite linear anomaly. Probably associated with buried services, detected by both magnetic and earth resistance surveys.
- Extent of magnetic data.
- Extent of earth resistance data.

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SCALE 1:400 @ A3

0 25m

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Job Title

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Castle Eden

Drawing Title

Interpretation Drawing

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Date	**Approved**
09/05/18	AP

Revision	Amendments		By	Checked

Project Number	Drawing No.	Revision	Status
TCP-18-CAS	05	-	Final