GSB
PROSPECTION Ltd

GEOPHYSICAL SURVEY REPORT
2008/63

Blythburgh Priory
Suffolk

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Specialising in Shallow and Archaeological Prospection

GSB Survey No. 08/63

Blythburgh Priory, Suffolk

Time Team Series XVI Programme XIII

NGR	TM 452 754		
Location	Blythburgh is approximately 3 miles northwest of Walberswick and 4 miles southeast of Halesworth, Suffolk.		
District	Suffolk Coastal.	**Parish**	Blythburgh.
Topography	Flat grassed areas/rough ground/priory remains.		
Current land-use	Private gardens/set-aside.		
Soils	Newchurch 2 (814c) association consisting of marine alluvium (SSEW 1983).		
Geology	Gravel with micaceous sands (BGS 191).		
Archaeology[#]	Remains of a small Augustian Priory with up-standing parts of the nave walls. The priory was founded in 1125 as a cell of St Osyth's. SAM number SF215.		
Survey Methods	Fluxgate Gradiometer, Resistance and Ground Penetrating Radar (GPR).		

Aims

To try to define the layout of the priory and identify other features of archaeological interest. The work forms part of a wider archaeological research assessment being carried out by Channel 4's **Time Team**.

Summary of Results*

Conditions for survey were not ideal surrounding the ruins and this has impacted on all survey techniques.

Magnetic data were collected to the north of the priory remains; a number of large pit-like responses were located along with a possible former monastic boundary.

Unfortunately, due to the topography and past landscaping of the site, interpretation of the resistance data has proved extremely difficult. However, some high resistance anomalies indicate possible rubble spreads and features which may be associated with the priory nave and cloister.

The GPR data have also proven difficult to interpret; however it has been possible to identify the eastern continuation of the nave and areas of increased response which related directly to the priory buildings.

Project Information

Project Co-ordinator: E Wood BSc MIfA
Project Assistants: J Adcock, Dr J Gater
Date of Fieldwork: 14th – 16th October 2008
Date of Report: 23rd January 2009

***It is essential that this summary is read in conjunction with the detailed results of the survey.**
[#] Taken from *Mower and Scott. 2008*

Survey Specifications

Method

The survey grid was set out and tied in to the Ordnance Survey (OS) grid using a Trimble R8 Real Time Kinematic (RTK) GPS system by **Dr Henry Chapman**.

Technique	Traverse Separation	Reading Interval	Instrument	Survey Size
Magnetometer - Scanning (Appendix 1)	-	-	-	-
Magnetometer – Detailed (Appendix 1)	1m	0.25	Bartington Grad 601-2	0.5ha
Resistance – Twin Probe (Appendix 1)	1m	1m	Geoscan RM15 and MPX15	0.15ha
Ground Penetrating Radar (GPR) – (Appendix 1)	0.5m	0.1m	Sensors and Software Noggin^{Plus} 250MHz	0.11ha

Data Processing

	Magnetic	Resistance	GPR
Tilt Correct	Y	N	N
De-stagger	Y	N	N
Interpolate	Y	Y	Y
Filter	N	High Pass	De-wow/DC-shift, Bandpass, Background Removal

Presentation of Results

Report Figures (Printed & Archive CD):	Location, data plots and interpretation diagram on base map (Figures 1-11).
Reference Figures (Archive CD):	Data plots at 1:500 for reference and analysis. (See List of Figures).
Plot Formats:	See Appendix 1: Technical Information, at end of report.

General Considerations

Smaller scale ferrous anomalies ("iron spikes") are present in the magnetic data, their form best illustrated in the XY trace plots. These responses are characteristic of small pieces of ferrous debris in the topsoil and are commonly assigned a modern origin. While the most prominent of these are highlighted on the interpretation diagram, they are not discussed in the text below unless considered relevant.

Any depths referred to in the interpretation of GPR data *are only ever an approximation*. The conversion from delay time to depth depends upon the propagation velocity of radar waves through the ground; this can vary significantly both laterally and vertically on sites such as this. A velocity of 0.07m/ns has been used after an iterative analysis process of fitting hyperbolic curves to point-source reflections. Where there is a strong electromagnetic contrast, the GPR signal can be inter-reflected or reverberated, producing a delay in the reflection of the signal. This is termed 'ringing' and happens, to some extent, with all reflections resulting in a greater apparent depth than actually exists. As a result, it is often not possible to detect the base of features; only the tops of buried deposits are detected with any kind of certainty (Annan 1996).

Results of Survey

1. Magnetic Survey

1.1 Survey was carried out in the field to the north of the priory only. The data reveal a number of large, strong magnetic anomalies (A) which suggests that they are pits filled with burnt material or rubbish debris and thus potentially of archaeological interest. The majority of these responses lie on a level platform overlooking the estuary to the north and west, adding weight to an archaeological interpretation.

1.2 Bisecting the data is a negative anomaly (B), which could mark the boundary surrounding the priory site; however, the anomalies at least partially coincide with a footpath running through the field and as such the interpretation is tentative.

1.3 An area of magnetic disturbance (C) may suggest a modern dump of materials or be associated with brick rubble spread. Ferrous responses along the limits of the survey area are due to a metal fence.

2. Resistance Survey

Area 2

2.1 A small area was collected in order to ascertain whether the remains of the priory continued to the west. Results indicate that this is the case as a zone of high resistance is on the same alignment as the standing remains. The data also complement the GPR results (See Paragraph 3.2). Unfortunately, due to modern landscaping, the ground falls away immediately to the west of the survey area and so it was not possible to identify the western end of the church.

Area 3

2.2 High resistance anomalies (i) within this area are likely to be associated with the priory, although the responses lie on a different alignment to the upstanding remains. It could be that these relate to a different phase of the priory's history. It must also be noted that a number of trees and other vegetation were present within this area have complicated matters.

Area 4

2.3 An area of high resistance (ii) in the centre of the data appears to form a right angle and is on a similar alignment to the ruins of the priory in the west. An excavation trench was placed within this area in order to locate any walls, and eventually identified cut features backfilled with hardcore material – hence the high resistance response. Dressed stones were found at the bottom of the feature demonstrating that it was clearly a man-made feature; however, at the time of the excavation it was not thought to be a robber trench associated with the eastern end of the church – though this interpretation is still open to debate. This resistance response corresponds to anomaly 12 within the GPR data (see Paragraph 3.5).

Area 5

2.4 High resistance anomalies within this dataset could have an archaeological origin, given the context of the site, but also equally have a topographical/natural or modern origin. A trench uncovered a brick lined drainage system of a modern date.

3. Ground Penetrating Radar Survey

This site proved to be somewhat challenging, both from a geophysical and excavation point of view. Difficulties in interpreting the recorded responses in the GPR data were mirrored by a similar problem once the buried remains were exposed. Determining relative alignments and stratigraphy were far from straightforward and it was clear that, in this instance, the phases of *demolition, robbing, rebuilding and landscaping of materials had produced a complex dataset which did not effectively map all elements of the archaeological resource.*

Area 2

3.1 Survey in this area consisted of two blocks; one (Area 2A) was an attempt to determine whether the west end of the priory extended beyond the previously assumed limit (a sharp drop-off in the topography between the current garden path and a flat lawn area – see paragraph 2.1) as excavation had failed to define any kind of cross wall. Whilst there are strong reflectors identified in the centre of the grid, there is nothing in the distribution to suggest that these reflectors are structural remains and time did not allow for expansion of the survey. However, this area sloped gently up from west to east to meet the garden path and it is possible that there has been some degree of landscaping. In the radargrams, sloping reflectors are quite possibly the original ground surface below imported material (the apparent dip is an artefact of the topographic change along the traverse), whilst the strong reflectors (1) are associated with a change in the near-surface response, potentially suggesting that this is material dug-in at a later date.

3.2 Survey along the garden path (Area 2B) was an attempt to locate the western wall of the Cloister and continuation of the priory nave. The latter was successful with strong anomalies (2) recorded on the correct alignment. Unfortunately, the linear spread of anomalies and trends around (3) which, it was hoped, may be remnants of the cloister perambulatory walk or associated inner wall turned out to be little more than a compacted surface probably related to an earlier path surface. It was unfortunate that the path shared the same alignment and initial depth of detection to priory remains elsewhere on the site, but the theory had to be tested nonetheless. Relatively strong anomalies (4), at depth, related to an earlier structure, unlikely to be related to the priory. Further strong reflectors (5) are visible to the east but are considerably shallower; they may also be archaeological, though this is pure speculation, having no supportive evidence.

Area 3

3.3 Survey within this area, also consisted of two blocks. Despite the existence of extant but seemingly truncated walls north of the nave (Area 3A), defining their continuation proved somewhat difficult. The terrain was particularly rough with vegetation roots and rubble strewn across the ground. The result has been a series of complex radargrams producing anomalies that are difficult to separate into distinct features (assuming that there are some to be found in this area). Anomalies (6) and (7) may be continuations of adjacent visible structure, with the former potentially showing suggestions of a return to the west. However, this is very tentative as the anomalies and trends vary hugely between successive time-slices, making interpretation very difficult.

3.4 Near-surface, the data south of the nave (Area 3B) are dominated by a band of increased response and high amplitude anomalies running approximately north-south. Whilst the northern segment (8) and the western 'arm' (9) did coincide with a former floor and wall line, respectively, there were still some discrepancies. It was assumed that (9) represented part of the cloister, however this could not be proved by excavation, and it seems that the potential return (10) was just a coincidental anomaly. The anomalies recorded around (11) could possibly be ancillary structures, however without any documentary or excavation evidence to support this, other explanations must be given consideration; there is certainly little definition of individual wall lines, although this has also been true over areas of known archaeology.

Area 4

3.5 The results from the east end are particularly confusing. There appears to be a distinct rectilinear spread of strong reflectors (12) in the shallower time-slices (and responses within the radargrams that look like good candidates for wall footings) that align well with the extant north and south nave walls of the priory. However, excavation revealed nothing more than a strange dump of gravelly material. The material cannot be natural given the stratigraphy and presence of worked stone beneath it; however it was completely devoid of any building fragments or pottery, and quickly became less well-defined, eventually covering a large area. This seems to be reflected in the deeper time-slices where there is little definition to the anomalies; instead the picture is one of a broad spread of reflectors. The origin of linear anomaly (13) is also unclear but, given the gravelly deposits and distance from the main priory, it may not be of major archaeological significance.

3.6 Anomalies adjacent to the sheds (eastern edge of the survey area) are assumed to relate to their construction and former hard-standing, however the lack of a definite position for the Priory's east end leaves the possibility open that it lies nearer the extant remains, perhaps under these sheds. If this is the case, these anomalies would take on a new significance, and perhaps so too would those seen in the southeast corner of the survey area. But to interpret these as anything more than *Uncertain Origin* at this stage would be simply speculative.

Area 5

3.7 This area was surveyed due to its open position between the standing remains of the priory and the burials uncovered at the current property on the site. Unfortunately, the primary source of responses seems to be services, drains and/or possible former paths (for example, 14) identified as strong linear anomalies. Excavation over one of the less linear reflectors (15), in the south of the garden, quickly revealed the top of a brick chamber forming part of the current drainage system. Other, somewhat weaker responses across the garden have been classified as uncertain; it is not clear whether they hold archaeological significance or are a facet of the material used to raise and level this particular lawned area.

4. Conclusions

4.1 Magnetic data have located a number of large pit-like anomalies; these may contain burnt or fired material and are indicative of occupation. A negative feature bisecting the data may relate to the boundary surrounding the priory site; however it may be connected with a modern footpath.

4.2 The resistance data are dominated by amorphous areas of high resistance. Whilst the western survey block has located the continuation of the nave, elsewhere it has proved extremely difficult to relate the results to the priory remains.

4.3 The GPR survey also produced a complex set of responses that proved difficult to interpret prior to excavation. That said, even after some of the remains had been uncovered there was still difficulty in attributing the now extant features to the GPR data. It appears that landscaping and the remodelling, robbing and re-use of materials have badly affected the integrity of geophysical responses attainable over the site. At its worst, chance alignments of features, seemingly unrelated to the priory, complicated the interpretation further. It was possible to identify the eastern continuation (but not the exact dimensions) of the nave, and areas of increased response that related directly to zones of priory structure; however, identification of individual architectural features and the precise layout, in this instance, remained elusive.

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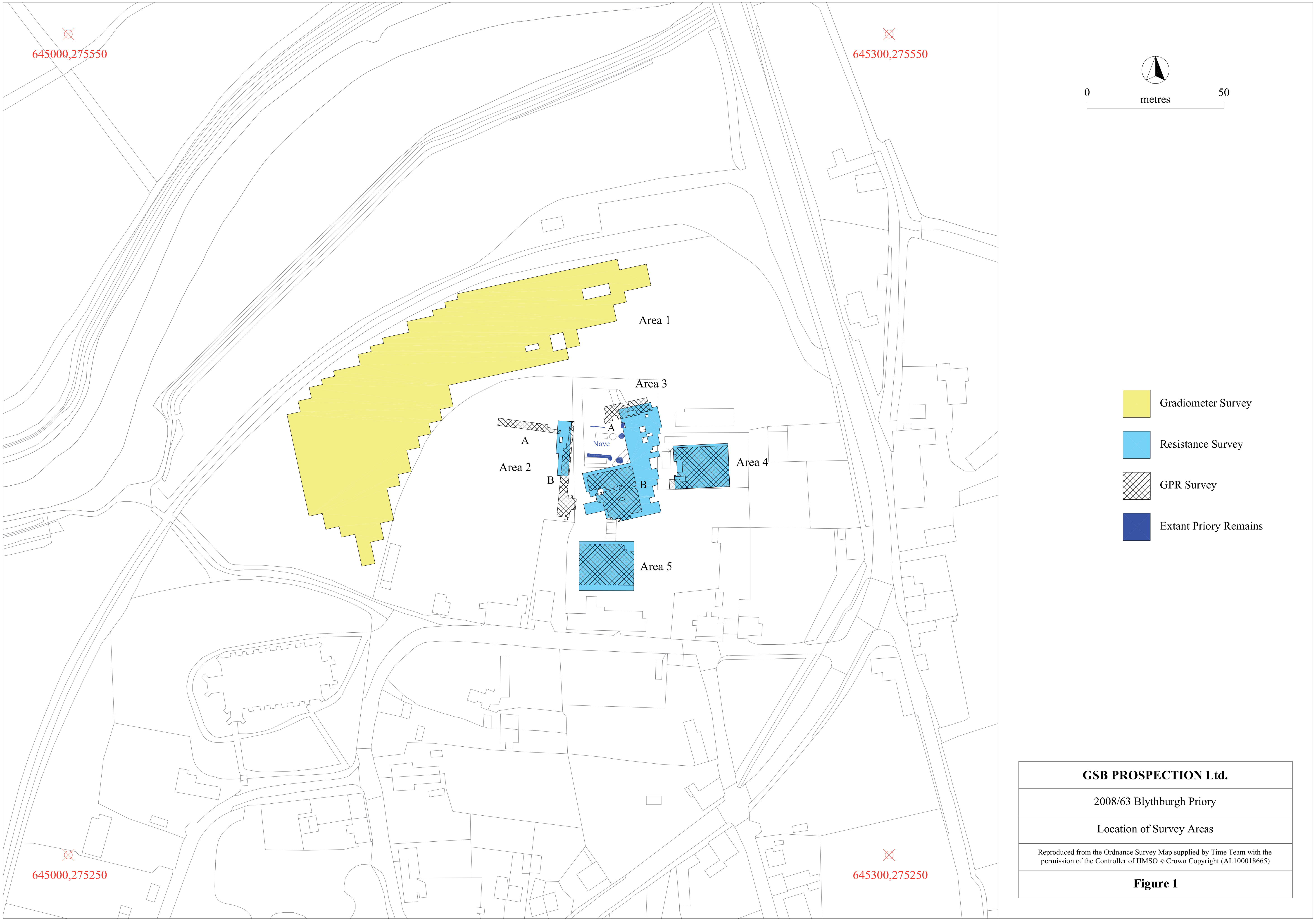

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Location of Survey Areas

Figure 1

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Summary Gradiometer Greyscale

Figure 2

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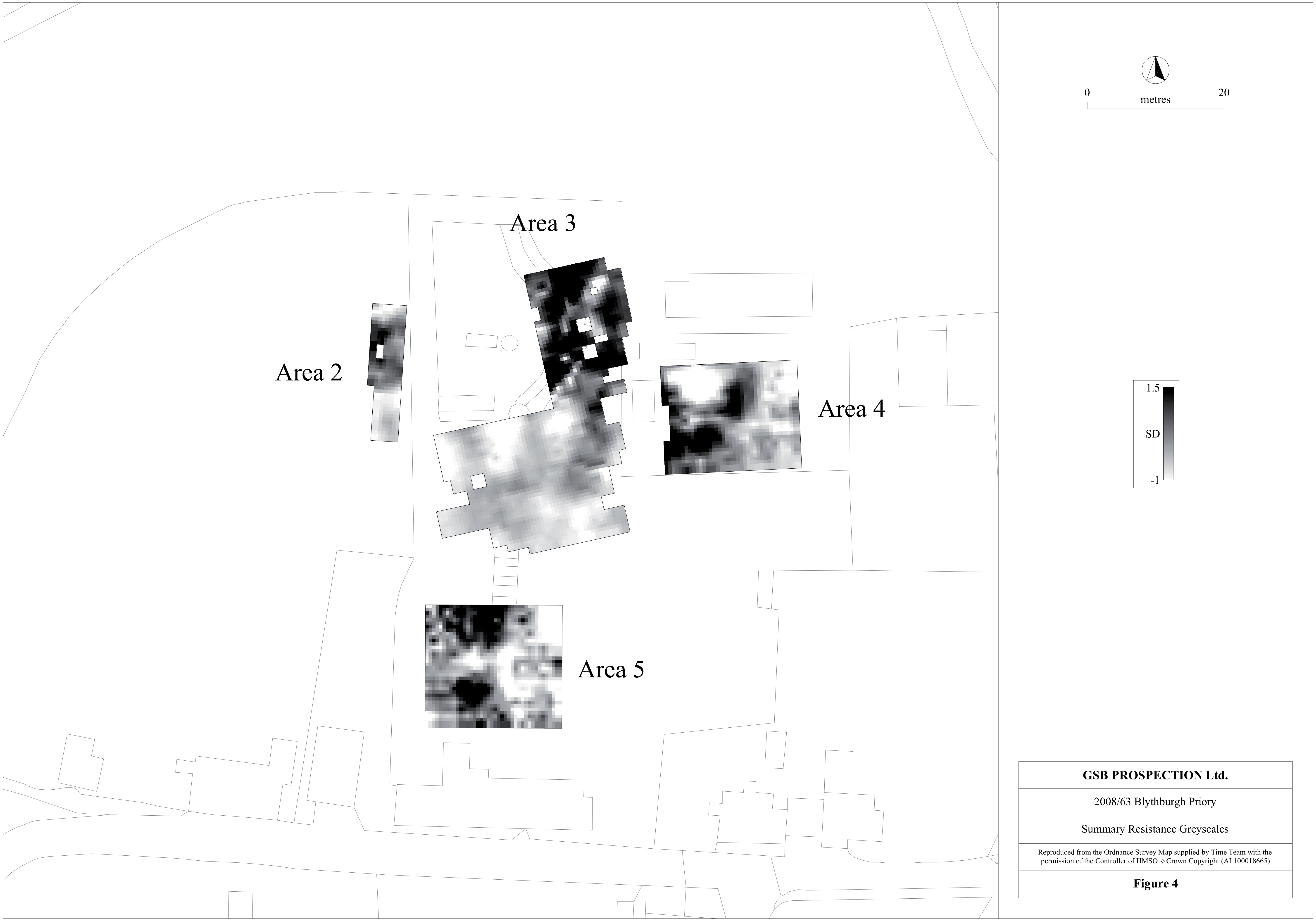
Summary Gradiometer Interpretation

Figure 3



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Summary Resistance Greyscales

Figure 4

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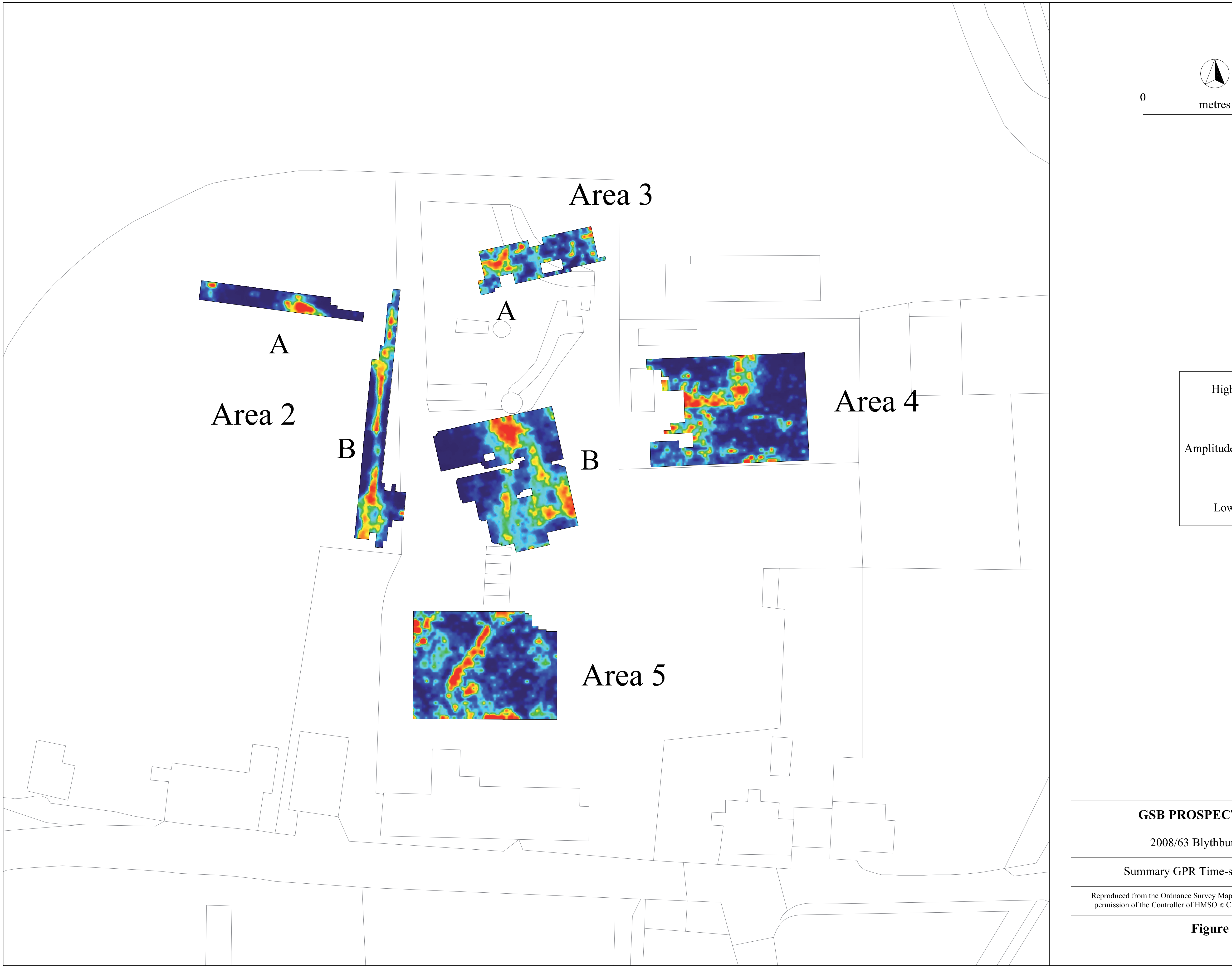
Summary Resistance Interpretations

Figure 5



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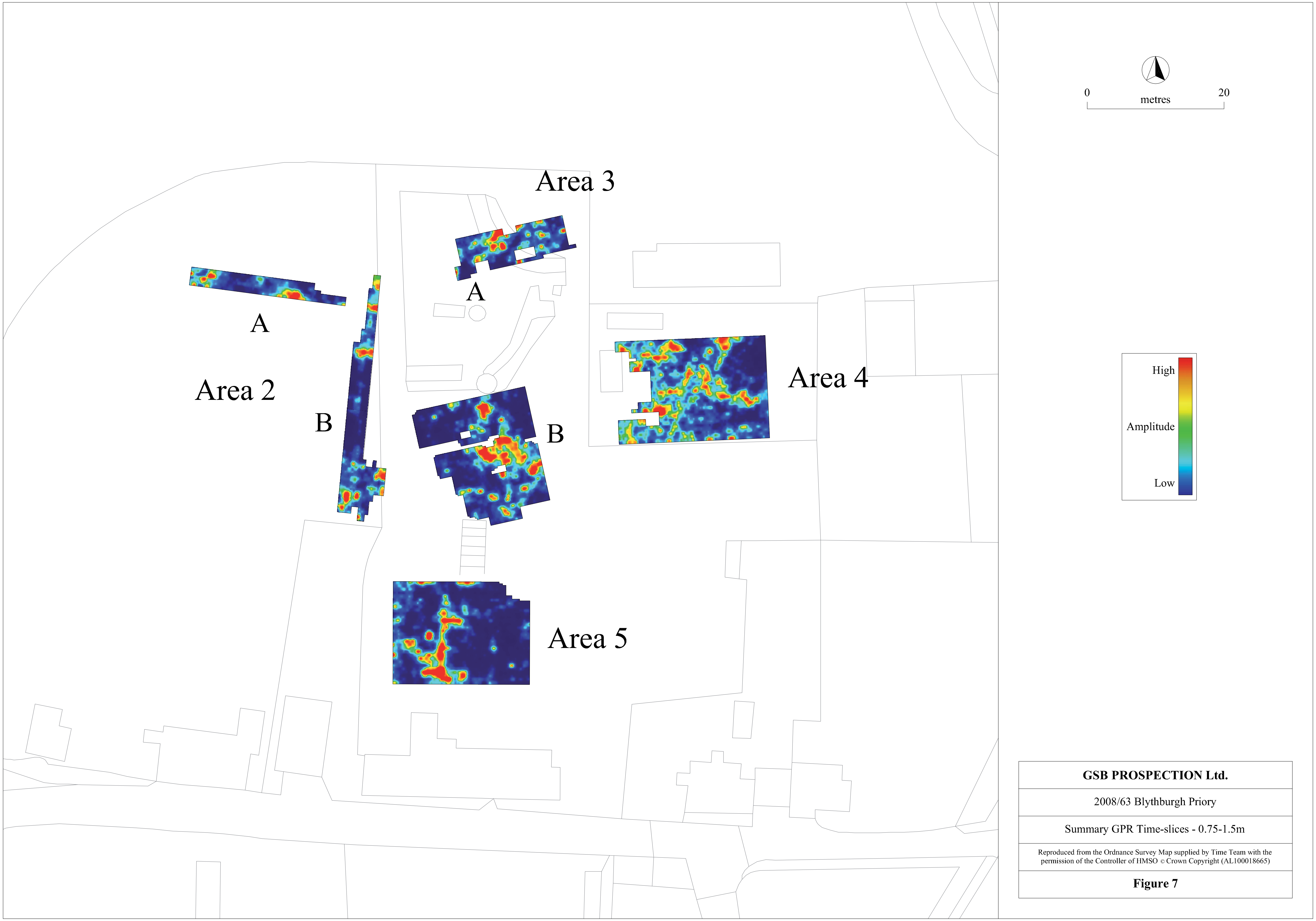
Summary GPR Time-slices - 0-0.75m

Figure 6



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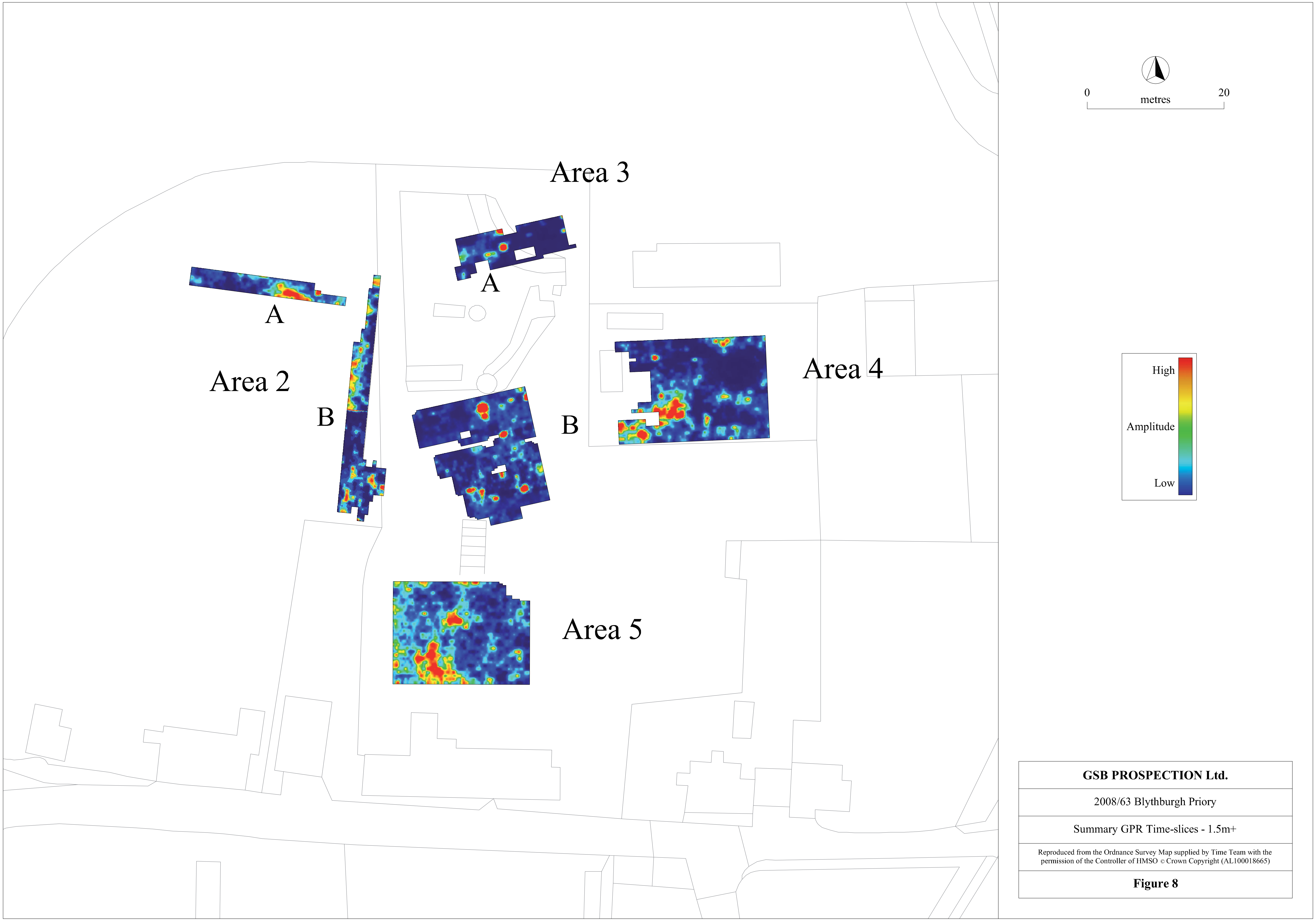
Summary GPR Time-slices - 0.75-1.5m

Figure 7



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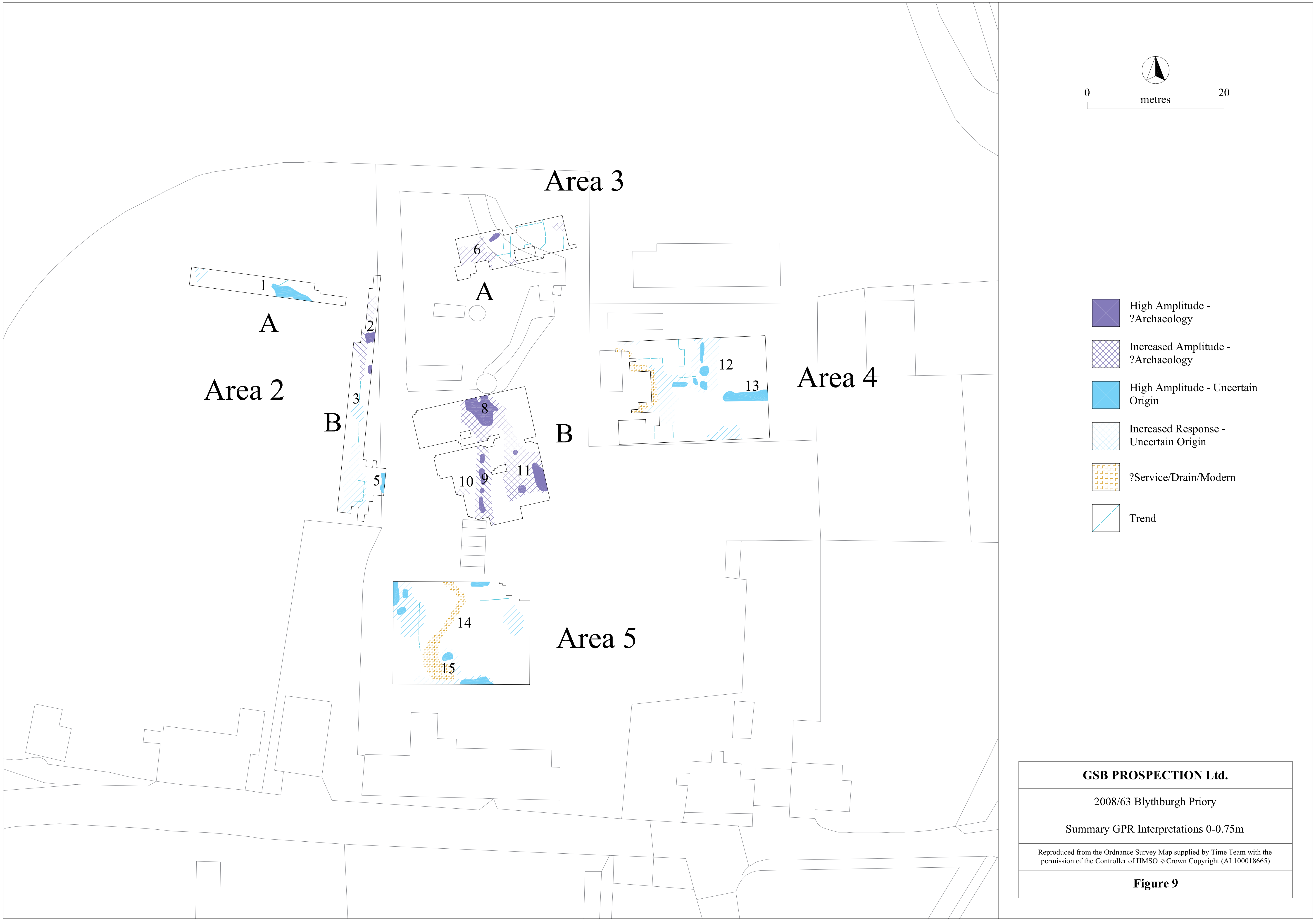
Summary GPR Time-slices - 1.5m+

Figure 8



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Summary GPR Interpretations 0-0.75m

Figure 9

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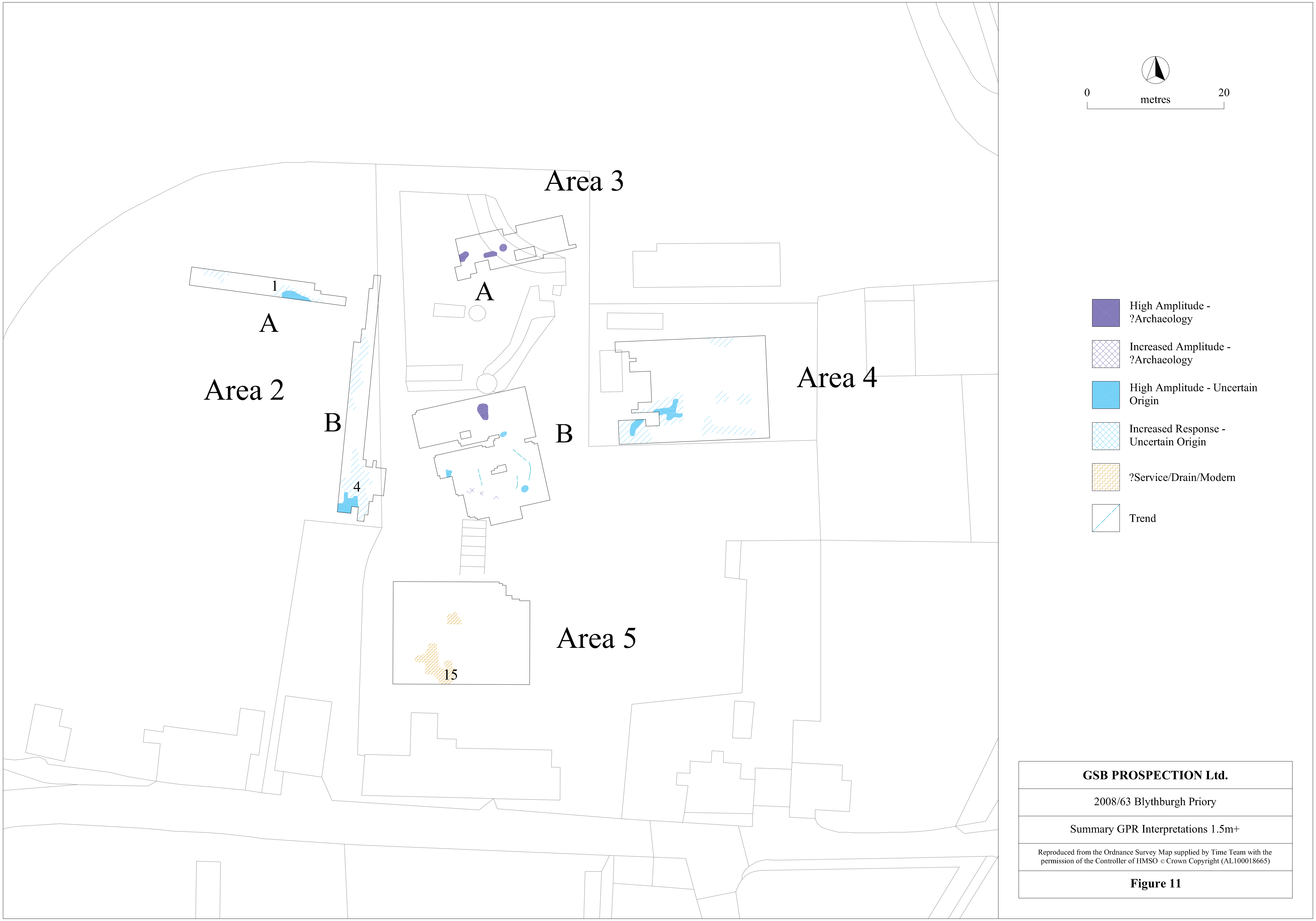
Summary GPR Interpretations 0.75-1.5m

Figure 10



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Summary GPR Interpretations 1.5m+

Figure 11

Appendix 1: Technical Information

Instrumentation

Fluxgate Gradiometer: Geoscan FM36/256 and Bartington *Grad*601-2

Both the Geoscan and Bartington instruments comprise two fluxgate sensors mounted vertically apart; the distance between the sensors on the former is 500mm, on the latter 1000mm. The gradiometers are carried by hand, with the bottom sensor approximately 100-300mm from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. The fluxgate gradiometer suppresses any diurnal or regional effects. Generally, features up to 1m deep may be detected by this method. Having two gradiometer units mounted laterally with a separation of 1000mm, the Bartington instrument can collect two lines of data per traverse.

Resistance Meter: Geoscan RM15

This instrument measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity. The most common arrangement is the Twin Probe configuration which involves two pairs of electrodes (one current and one potential): one pair remain in a fixed position, whilst the other measures the resistance variations across a grid. The resistance is measured in ohms and, when calculated, resistivity is in ohm-metres. The resistance method as used for standard area survey employs a probe separation of 0.5m, which samples to a depth of approximately 0.75m. The nature of the overburden and underlying geology will cause variations in this depth.

GPR: Sensors & Software Noggin Smartcart

The Noggin system includes an onboard digital video logger (DVL III), 250 MHz or 500MHz antenna, an odometer wheel and battery. It is, therefore, a fully integrated system. The built-in software uses the integrated odometer to provide an accurate distance measurement to the response. The data are recorded in digital format and can be processed to produce depth slice maps, 2D sections or 3D cubes.

Display Options

XY Trace

This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. The advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the individual anomalies. The display may also be changed by altering the horizontal viewing angle and the angle above the plane. The output may be either colour or black and white.

Greyscale

This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

Relief Plot

This is a method of display that creates a three dimensional effect by directing an imaginary light source on a given data set. Particular elements of the results are highlighted depending on the angle of strike of the light source. This display method is particularly useful when applied to resistance data to highlight subtle changes in resistance that might otherwise be obscured.

3D Surface Plot

This is similar to the XY trace, but in 3 dimensions. Each data point of a survey is represented in its relative position on the x and y axes and the data value is represented in the z axis. This gives a digital terrain, or topographic effect.

Radargram

Radar data comprise a record of reflection intensity against the time taken for the emitted energy to travel from the transmitter down to the reflector and back to the receiver. The resultant plot is effectively a vertical section through the ground along the line of the traverse, with time (depth) on the vertical axis, displacement on the horizontal axis and reflection intensity as a grey or colour scale.

Time Slice

If a number of radargrams are collected over a grid, or in conjunction with GPS data, it is possible to reconstruct the entire dataset into a 3D volume. This can then be resampled to compile ‘plan’ maps of response strength at increasing time (or depth) offsets, thus simplifying the visualisation of how anomalies vary beneath the surface across a survey area.

Data Processing

Zero Mean Traverse	This process which sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set. It is usually only applied to gradiometer data.
Step Correction	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors
Interpolation	When geophysical data are presented as a greyscale, each data point is represented as a small square. The resulting plot can sometimes have a 'blocky' appearance. The interpolation process calculates and inserts additional values between existing data points. The process can be carried out with points *along* a traverse (the *x* axis) and/or *between* traverses (the *y* axis) and results in a smoother greyscale image.
Despike	In resistance survey, spurious readings can occasionally occur, usually due to a poor contact of the probes with the surface. This process removes the spurious readings, replacing them with values calculated by taking the mean and standard deviation of surrounding data points. It is not usually applied to gradiometer data.
High Pass Filter	Carried out over the whole a resistance data-set, the filter removes low frequency, large scale spatial detail, such as that produced by broad geological changes. The result is to enhance the visibility of the smaller scale archaeological anomalies that are otherwise hidden within the broad 'background' change in resistance. It is not usually applied to gradiometer data.
GPR Filters	There are a wide range of GPR filters available and their application will vary from project to project. The most commonly used are: Dewow (removes low frequency, down-trace instrument noise); DC-Shift (re-establishes oscillation of the radar pulse around the zero point); Bandpass Filtering (suppresses frequencies outside of the antenna's peak bandwidth thus reducing noise); Background Removal (can remove ringing, instrument noise and minimize the near-surface 'coupling' effect); Migration (collapses hyperbolic tails back towards the reflection source).

Tie-in Techniques and Information

Tapes

A number of points on each survey grid are recorded by triangulating to at least two fixed points on the base map. If there is a lack of 'hard detail' in the mapping, some form of survey marker will be left *in-situ* for reference.

NOTE: When re-establishing the grid (for excavation or other post-survey work) only data from the supplied tie-in diagram should be used and NOT the report figures.

Electronic Distance Measurers (EDM) / Total Stations (TST)

This type of instrument measures the distance and angle to features with reference to a fixed point. Where possible the EDM will be set up over a point that can be re-established with relative ease, e.g. over map detail, a survey marker or at a point measureable by tapes. Distances and angles to permanent points of reference and/or map detail are recorded as well as at least two points per survey grid.

NOTE: When re-establishing the grid (for excavation or other post-survey work) only data from the supplied tie-in diagram should be used and NOT the report figures.

Global Positioning Systems (GPS)

Using a roving receiver unit, these systems record the longitude, latitude and altitude of a given point by triangulating between a network of satellites. For survey-grade measurements, the accuracy is refined by integrating data from a fixed base station or local reference network. In addition to grid points, elements of map detail are collected to assess the existing base-map accuracy and, in worst-case scenarios, use the data on a non-georeferenced map. If the supplied mapping is found to be inaccurate, it is sometimes necessary to shift the position of GPS points (keeping their relative positions fixed) within the site plan to correlate cartographic features with the 'real-world' co-ordinates; this should be considered when using GPS to re-establish an existing survey grid (see note below). It should be noted that the accuracy of any GPS-positioned point is dependent upon both the system and the satellite geometry at the time of survey. On projects where multiple contractors have used GPS, the possibility of compound errors between original survey grid creation, tie-in information and grid re-establishment should be borne in mind when positioning trenches over recorded anomalies.

NOTE: If re-establishing the grid with a GPS (for excavation or other post-survey work), use only the co-ordinates recorded on the tie-in diagram or, if supplied, the GPS data file included on the Archive CD; relative positions in the report diagrams may be correct but absolute co-ordinates can vary if discrepancies in the base mapping have been encountered.

Terms Commonly used in the Interpretation of Results

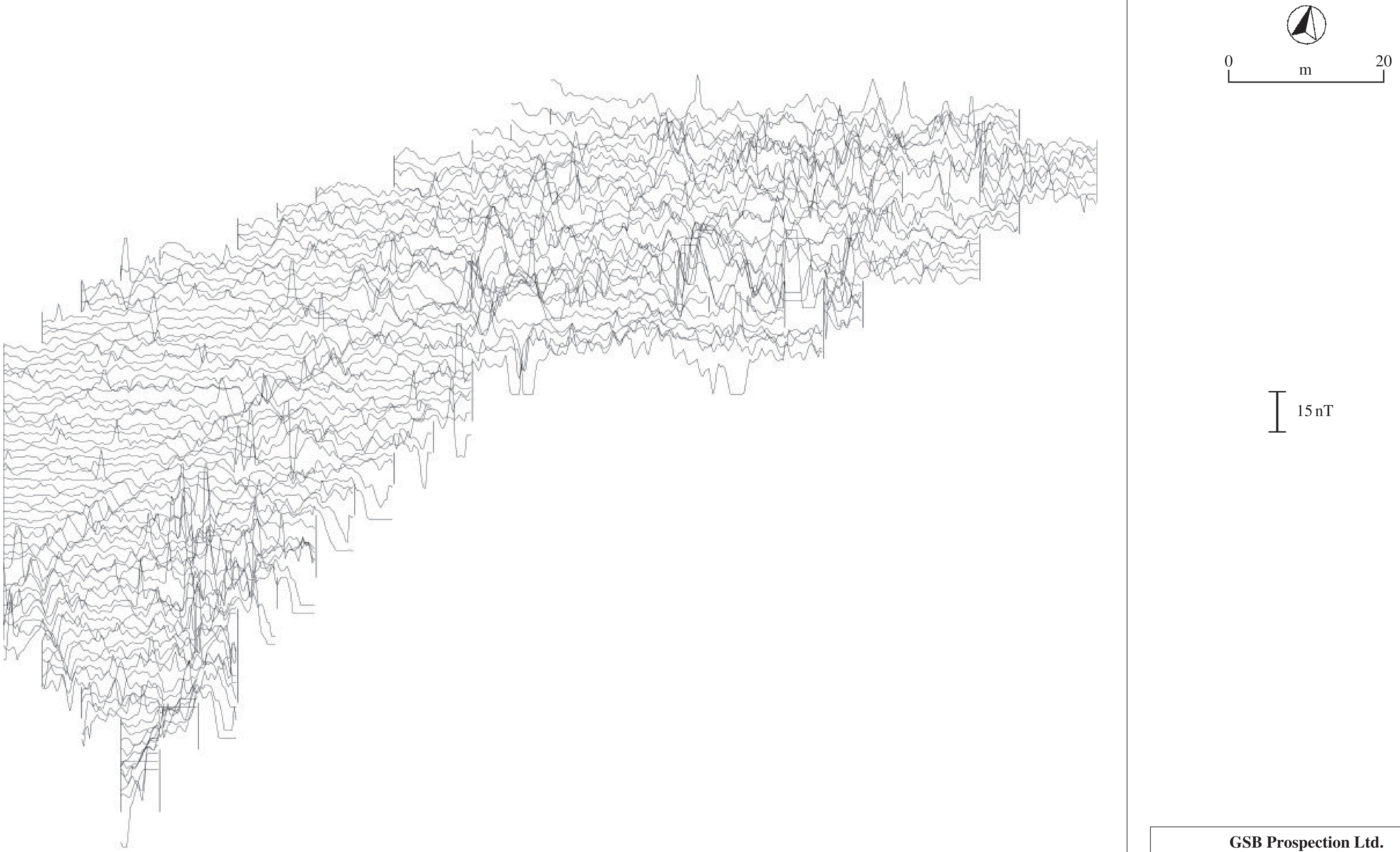
Magnetic

Archaeology	This term is used when the form, nature and pattern of the response are clearly or very probably archaeological These anomalies, whilst considered anthropogenic, could be of any age.
? Archaeology	The interpretation of such anomalies is often tentative, with the anomalies exhibiting either weak signal strength or forming incomplete archaeological patterns. They may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Areas of Increased Magnetic Response	These responses show no visual indications on the ground surface and are considered to have some archaeological potential.
Industrial	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions e.g. palaeochannels or magnetic gravels.
? Natural	These are anomalies that are likely to be natural in origin i.e. geological or pedological.
Ridge and Furrow	These are regular and broad linear anomalies that are presumed to be the result of ancient cultivation. In some cases the response may be the result of modern activity.
Ploughing Trend	These are isolated or grouped linear responses. They are normally narrow and are presumed modern when aligned to current field boundaries or following present ploughing.
Uncertain Origin	Often, anomalies (both positive and negative) will be recorded which stand out from the background magnetic variation yet show little to suggest an exact origin. This may be because the characteristics and distribution of the responses straddle the categories of "*?Archaeology*" and "*?Natural*" or that they are simply of an unusual form.
Trend	This is usually an ill-defined, weak, isolated or obscured linear anomaly of unknown cause or date.
Areas of Magnetic Disturbance	These responses are commonly found in places where modern ferrous or fired materials are present e.g. brick rubble. They are presumed to be modern.
Ferrous Response	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.

Resistance

Archaeology	High or low res responses are clearly or very probably archaeological These anomalies, whilst considered anthropogenic, could be of any age.
? Archaeology	The interpretation of such anomalies is often tentative, with the anomalies exhibiting either weak signal strength or forming incomplete archaeological patterns. They may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions e.g. palaeochannels or magnetic gravels.
? Natural	These are anomalies that are likely to be natural in origin i.e. geological or pedological.
? Landscaping / topography	These are regular and broad linear anomalies that are presumed to be the result of ancient cultivation. In some cases the response may be the result of modern activity.
Vegetation	These are isolated or grouped linear responses. They are normally narrow and are presumed modern when aligned to current field boundaries or following present ploughing.
Trend	This is usually an ill-defined, weak, isolated or obscured linear anomaly of unknown cause or date.

GPR	
Wall /Foundation/ /Vault /Culvert etc.	High amplitude anomaly definitions used when other evidence is available that supports a clear archaeological interpretation.
Archaeology	Anomalies whose form, nature and pattern indicate archaeology but where little or no supporting evidence exists. If a more precise archaeological interpretation is possible, for example the responses appear to respect known local archaeology, then this will be indicated in the accompanying text. As low amplitude responses are less obvious features it is unlikely that they would have a definitive categorisation.
? Archaeology	When the anomaly could be archaeologically significant, given its discrete nature, but where the distribution of the responses is not clearly archaeological. Interpretation of such anomalies is often tentative, exhibiting either little contrast or forming incomplete archaeological patterns.
Historic	Responses showing clear correlation with earlier map evidence.
?Historic	Responses relating to features not directly recorded on earlier maps but which appear to respect features that are. May form patterns suggestive of formal gardens, landscaping or footpaths.
Area of Anomalous Response	An area in which the response levels are very slightly elevated or diminshed with respect to the 'background'. Where no obvious surface features or documentary evidence can explain this spread of altered reflectivity it is assumed to denote some kind of disturbance, though the origins could be of any age and either anthropogenic or natural. Possible explanations are changes in subsurface composition and groundwater ‘ponding’.
Natural	Anomalies relating to natural sub-surface features as indicated by documentary sources, local knowledge or evidence on the surface.
?Natural	Responses forming patterns akin to subsoil/geological variations either attenuating or reflecting greater amounts of energy. An archaeological origin such as rubble spreads or robbed out remains cannot be dismissed.
Trend	An ill defined, weak or isolated linear anomaly of unknown cause or date.
Modern	Reflections that indicate features such as services, rebar or modern cellars correlating with available evidence (maps, communications with the client, alignment of drain covers etc.).
?Modern	Reflections appearing to indicate buried services but where there is no supporting evidence. Also applies to responses which form patterns, or are at a depth which suggests a modern origin. An archaeological source cannot be completely dismissed.
Surface	Responses clearly due to surface discontinuities, the effects of which may be seen to 'ring' down through radargrams and so incorrectly appearing in the deeper time-slices.



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Magnetic Data - Area 1

Figure A1

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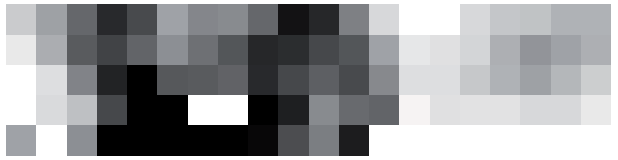
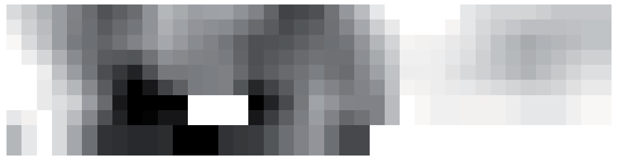
Magnetic Data - Area 1
Figure A2

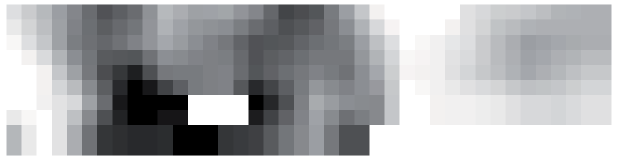
Raw Data



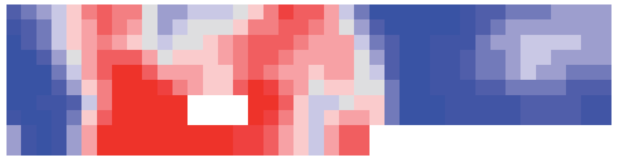
Interpolated Data

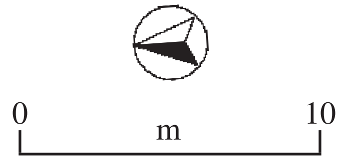


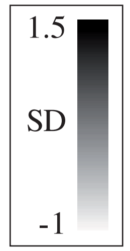
High Pass Filtered Data

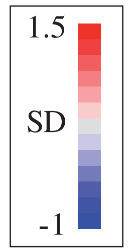


Interpolated Data









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Resistance Data - Area 2

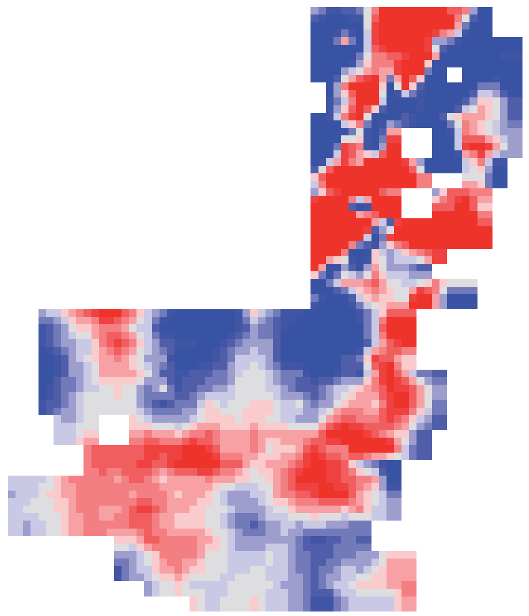
Figure A3

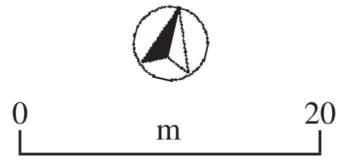
Raw Data

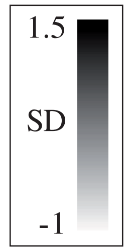
Interpolated Data

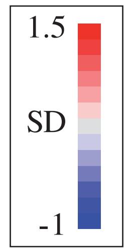
High Pass Filtered Data

Interpolated Data









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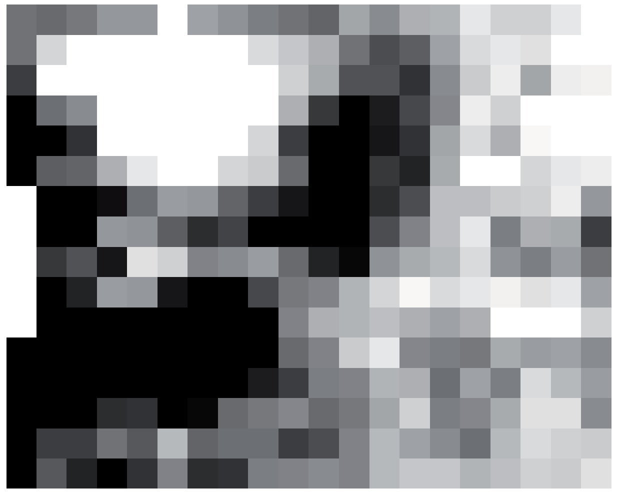
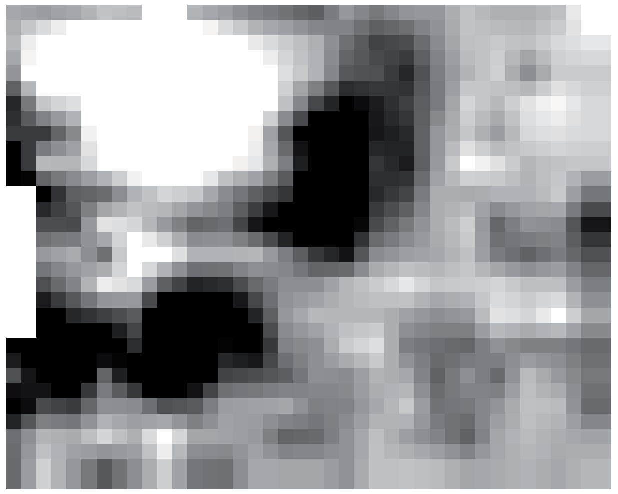
Resistance Data - Area 3
Figure A4

Raw Data

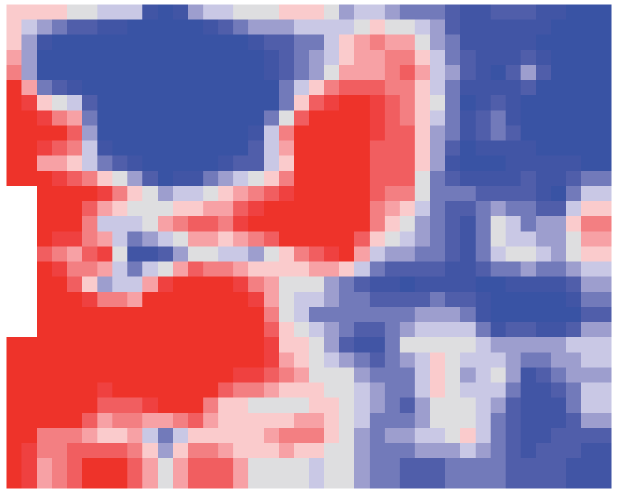


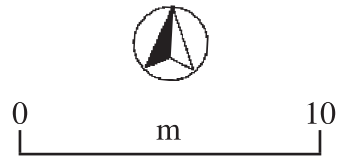
Interpolated Data

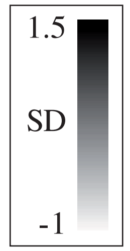
High Pass Filtered Data

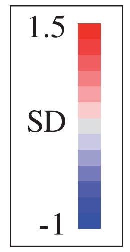


Interpolated Data









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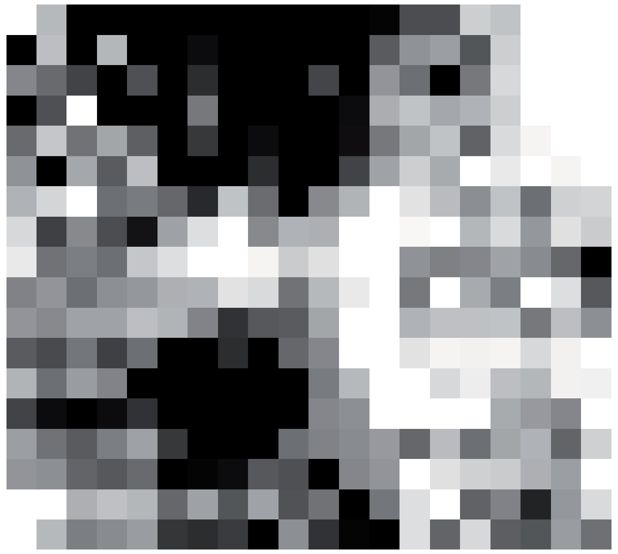
Resistance Data - Area 4
Figure A5

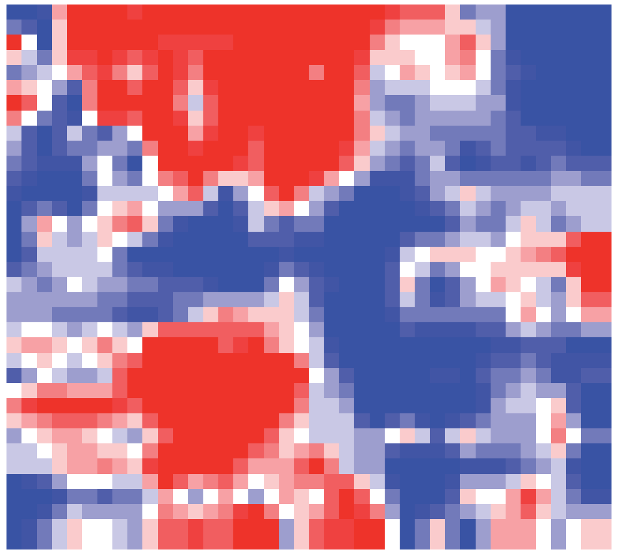
Raw Data

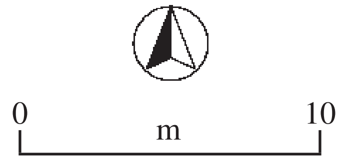


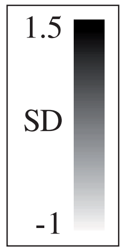
Interpolated Data

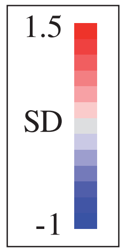
High Pass Filtered Data

Interpolated Data









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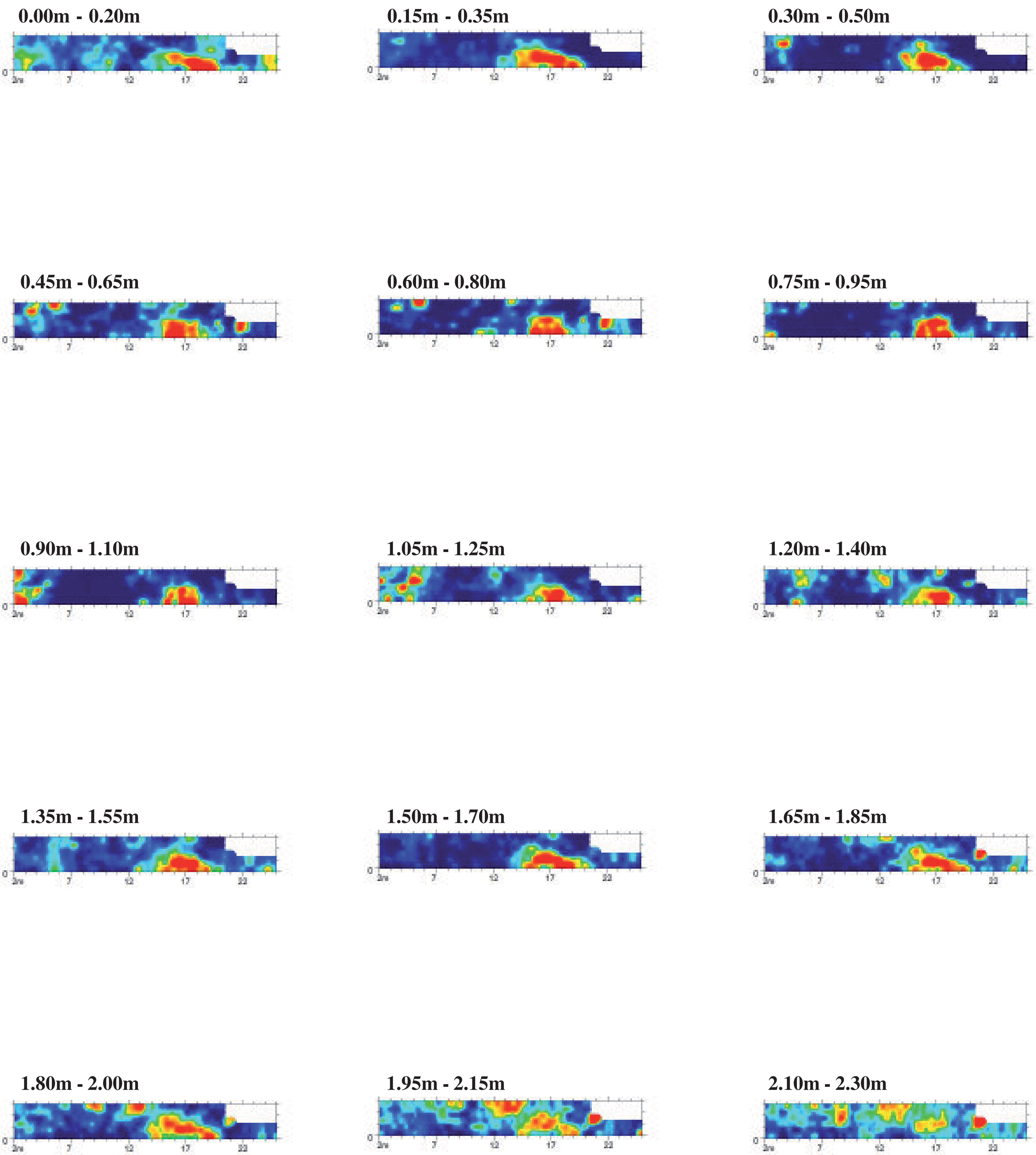
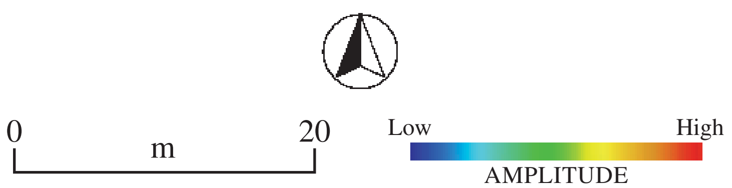
Resistance Data - Area 5
Figure A6





Data processing:
De-wow/DC-shift, Bandpass filter, Background removal .

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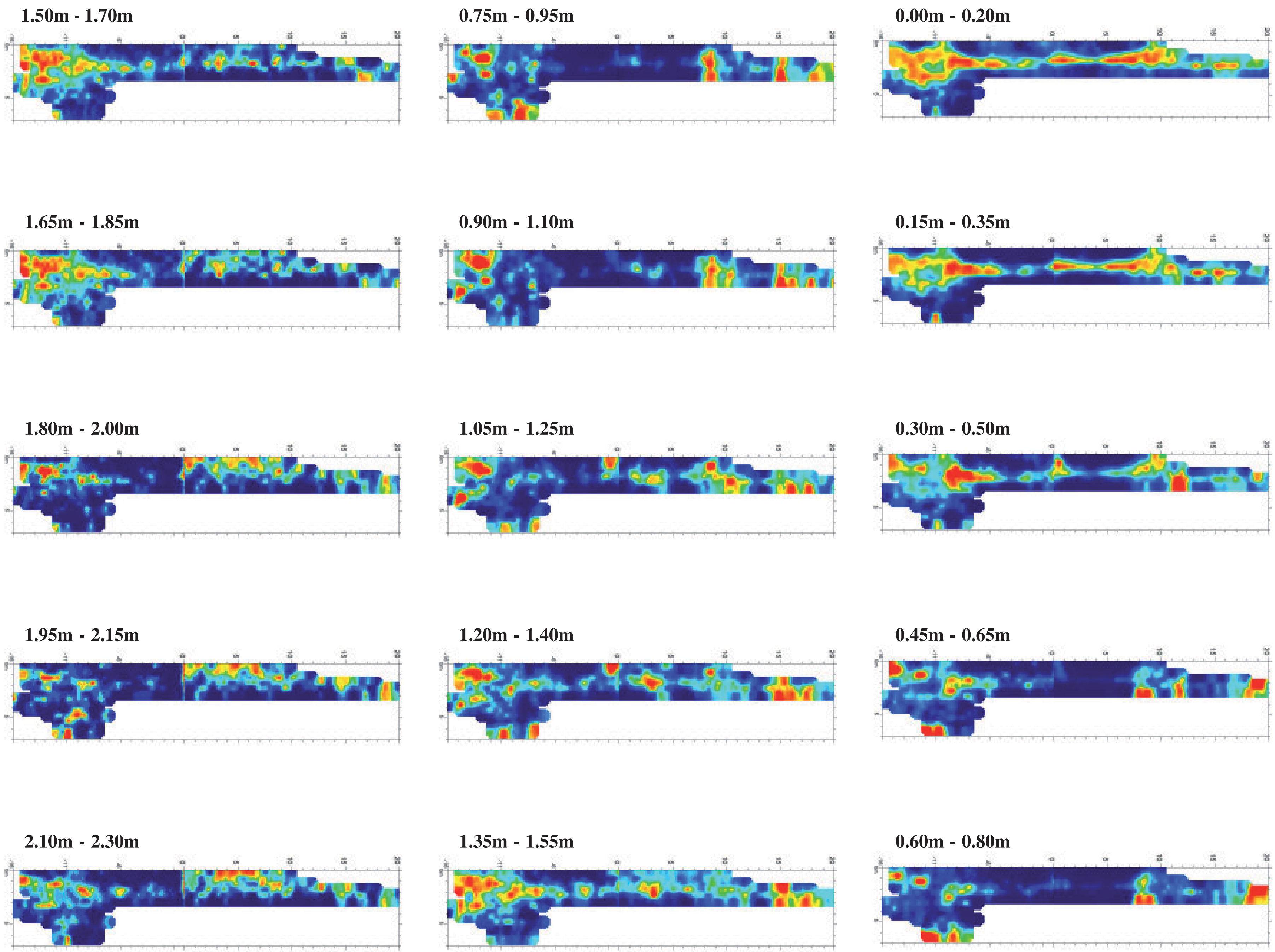
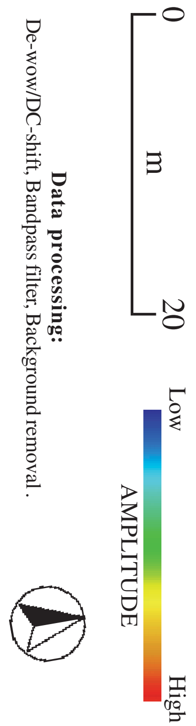
GPR Data - Area 2A
Figure A7





Data processing:
De-wow/DC-shift, Bandpass filter, Background removal.

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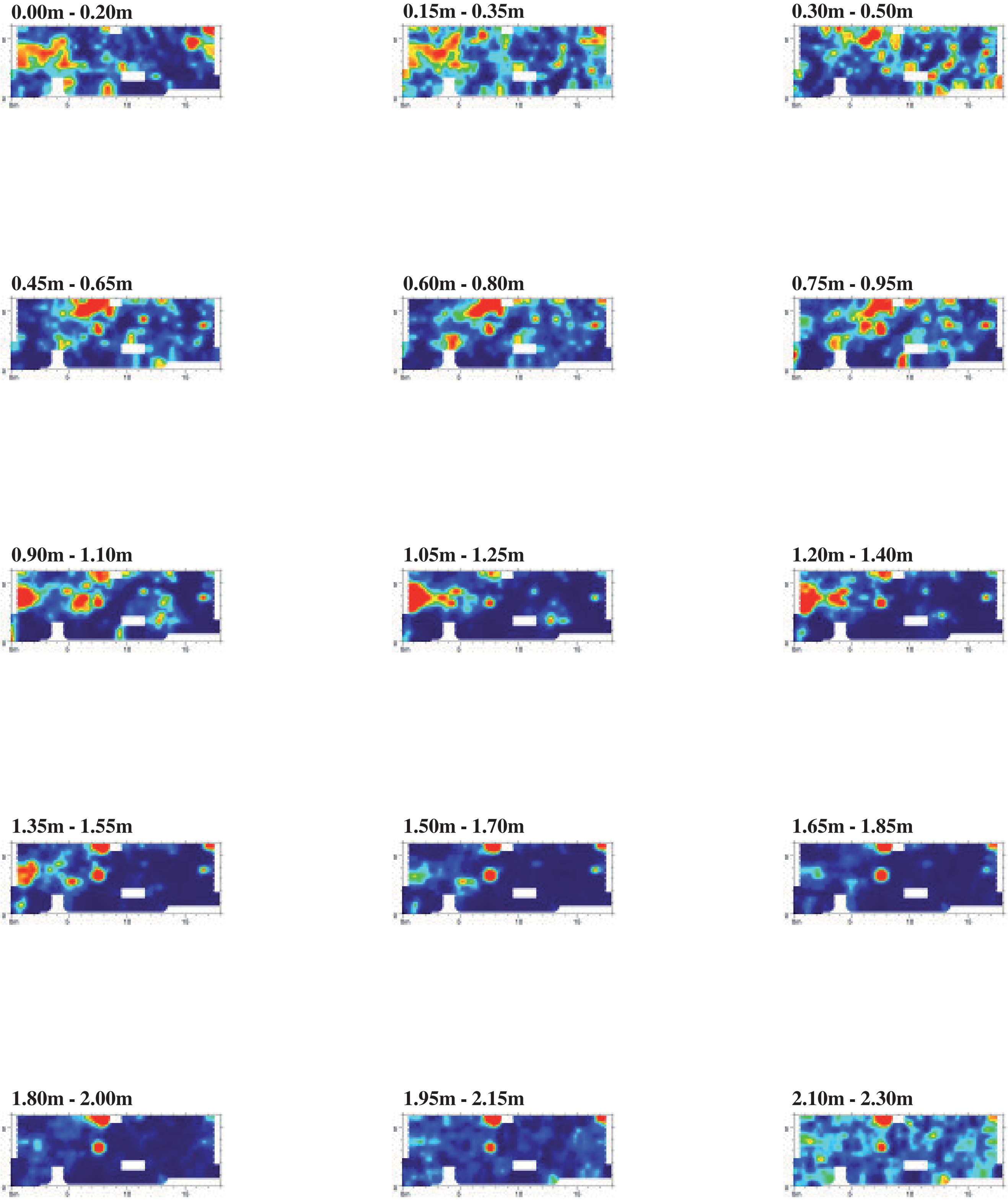
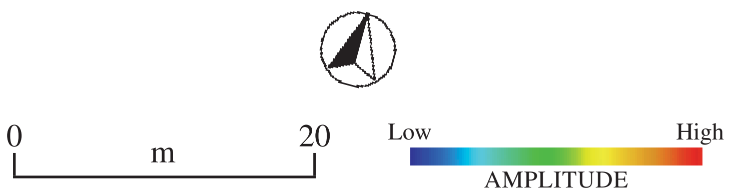
GPR Data - Area 2B

Figure A8





Data processing:
De-wow/DC-shift, Bandpass filter, Background removal .

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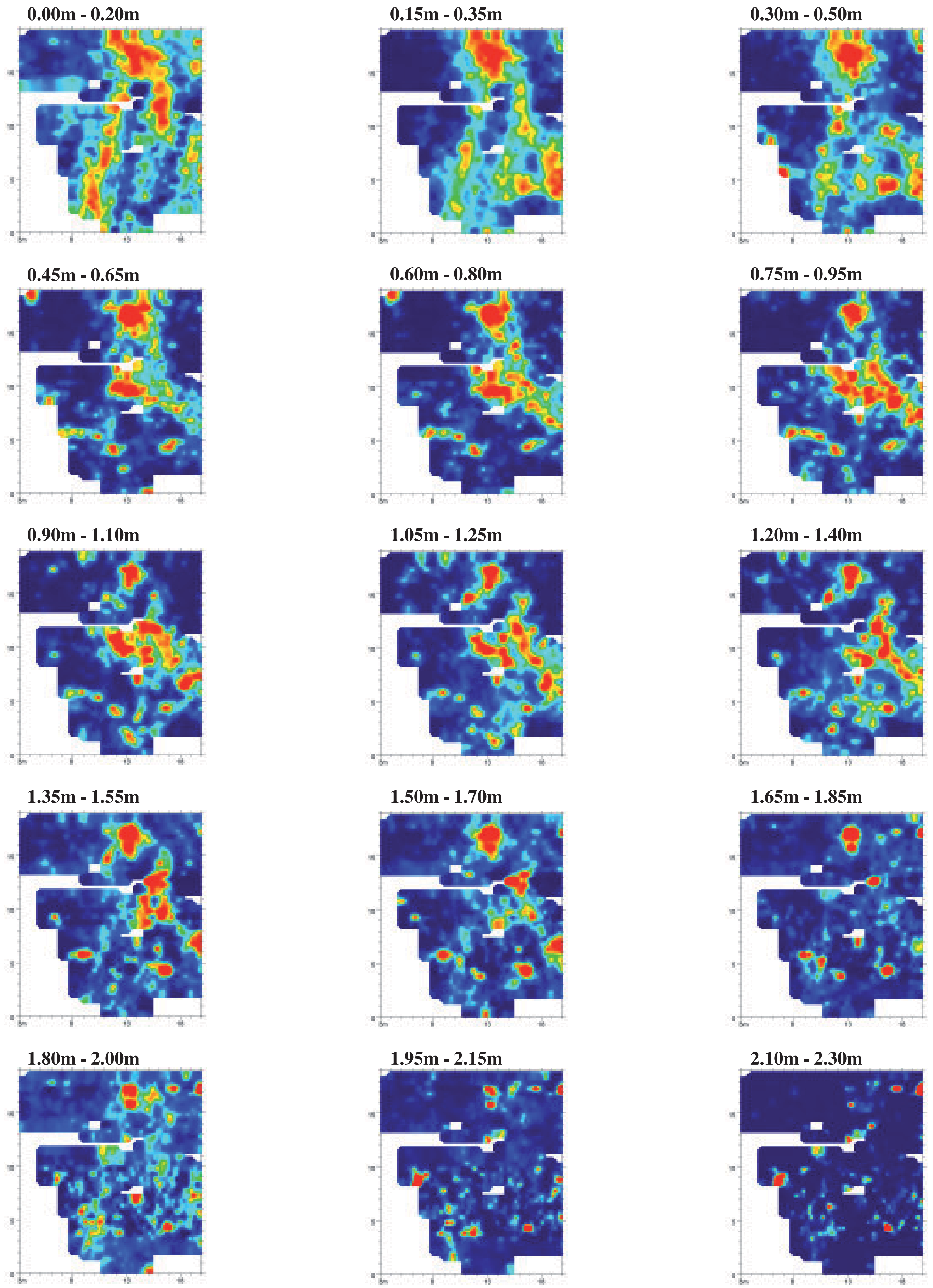
GPR Data - Area 3A
Figure A9



0 m 20

Low High
AMPLITUDE

Data processing:
De-wow/DC-shift, Bandpass filter, Background removal .

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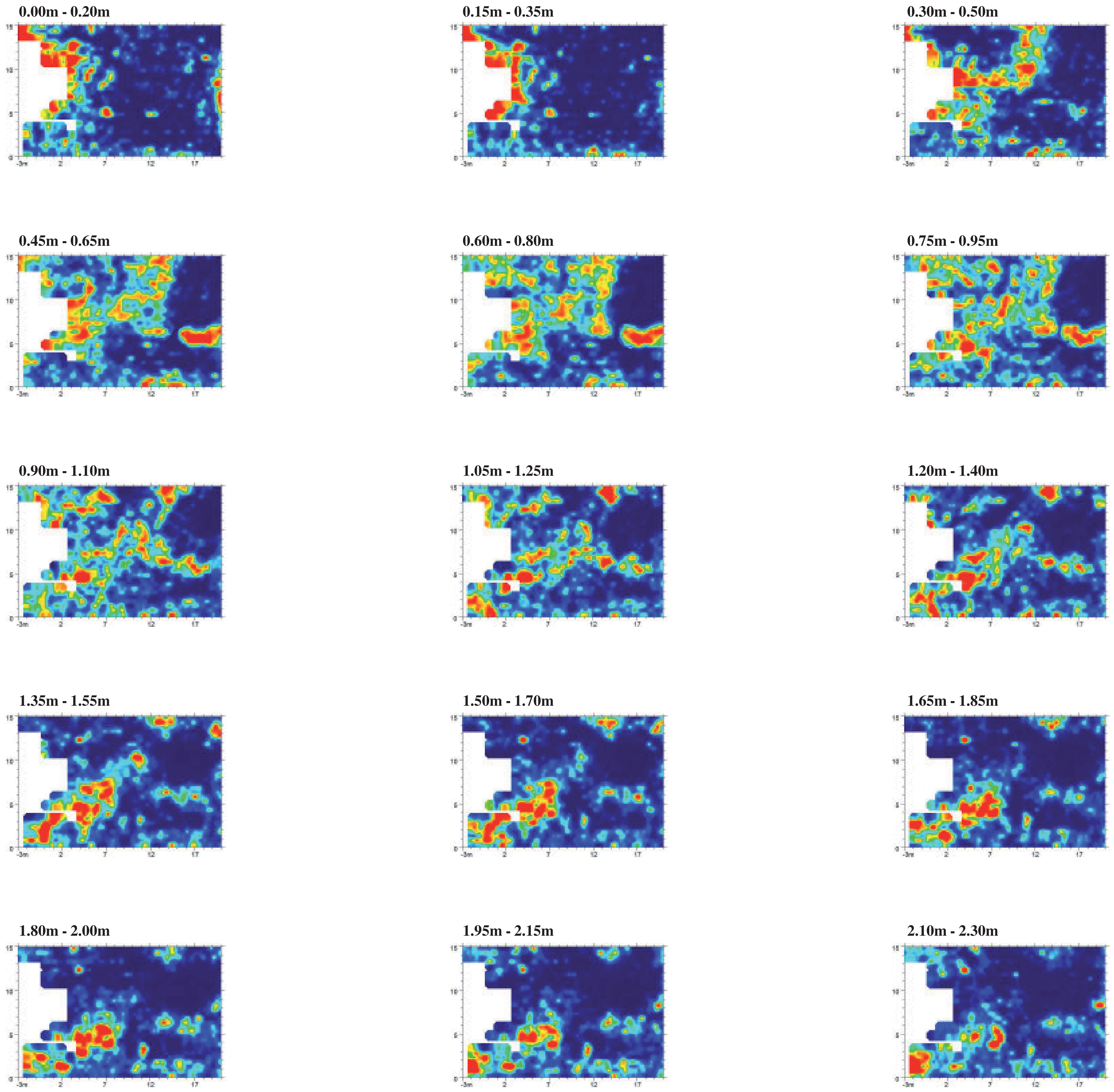
GPR Data - Area 3B
Figure A10



Low High
AMPLITUDE

Data processing:
De-wow/DC-shift, Bandpass filter, Background Removal.

0 m 20

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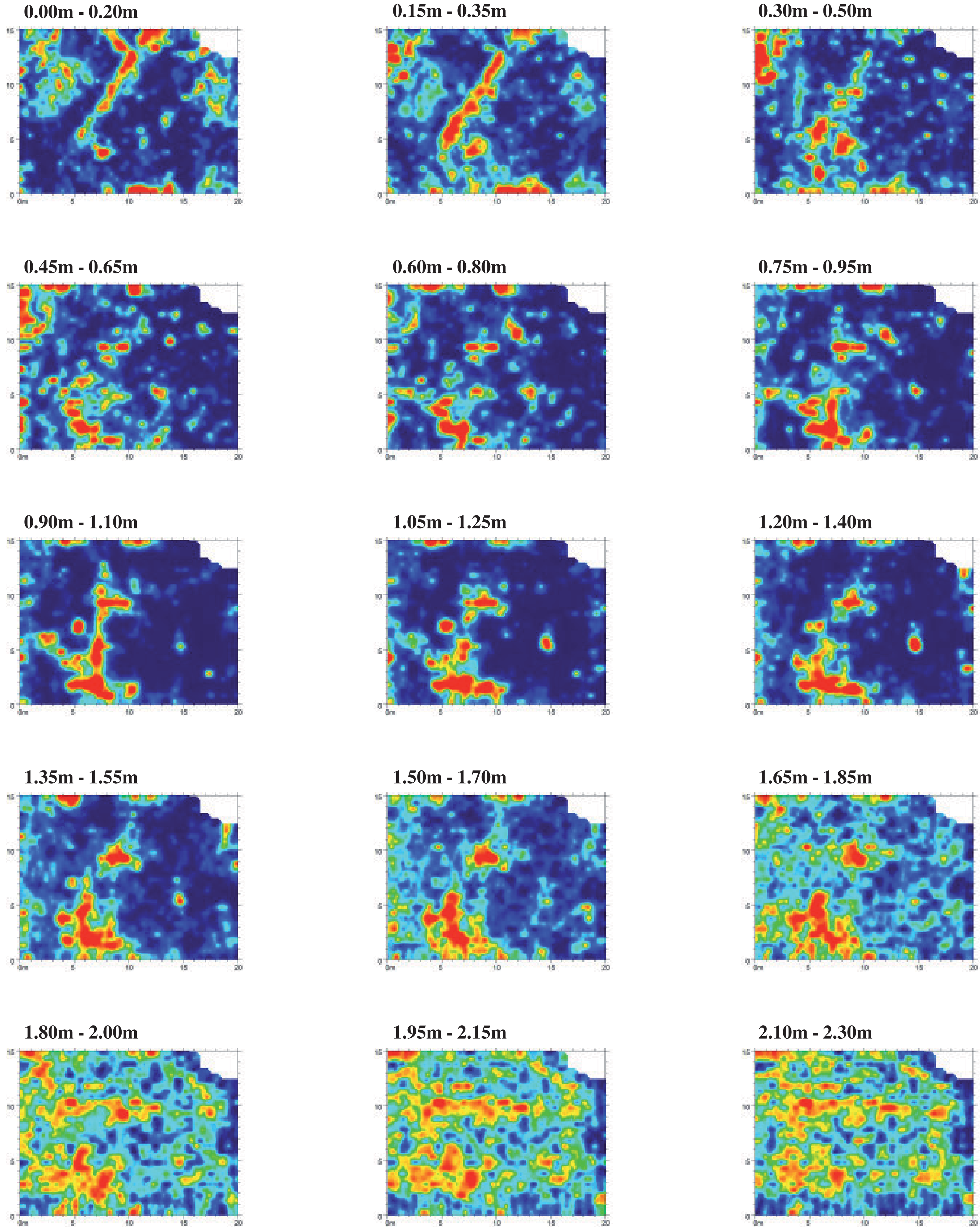
GPR Data - Area 4
Figure A11



0 m 20

Low High
AMPLITUDE

Data processing:
De-wow/DC-shift, Bandpass filter, Background removal .

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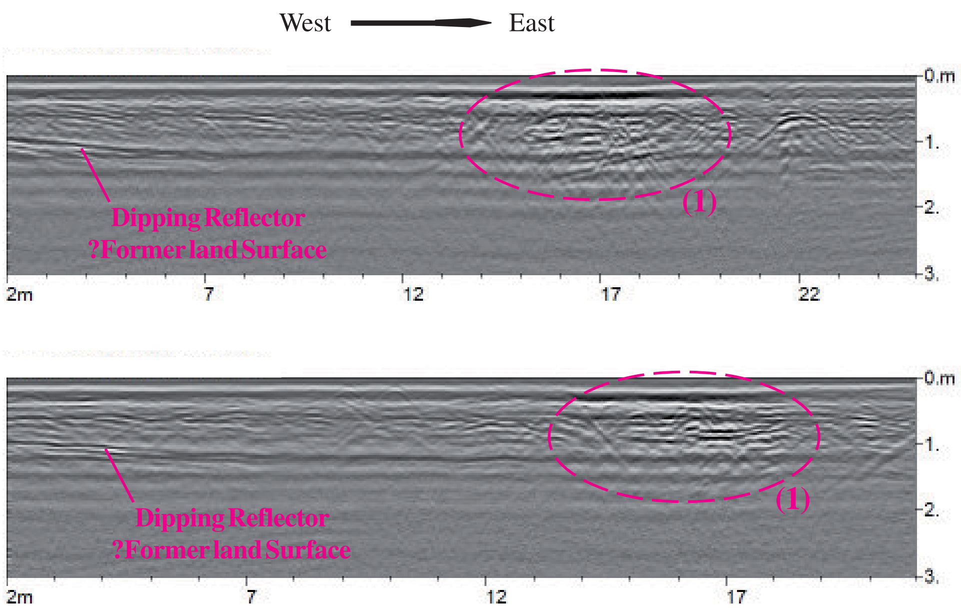
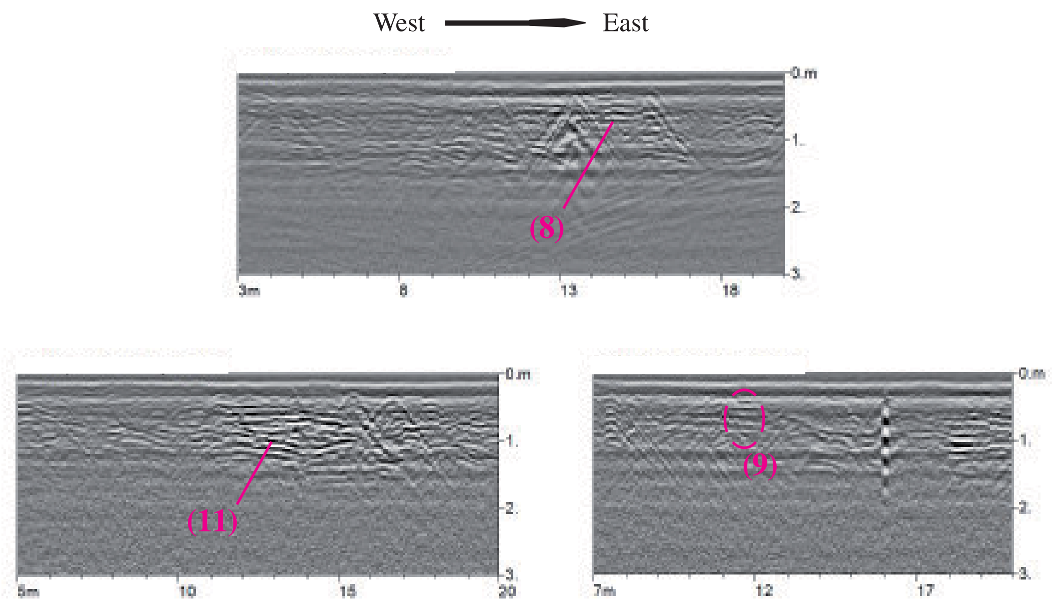
GPR Data - Area 5

Figure A12

AREA 2A:



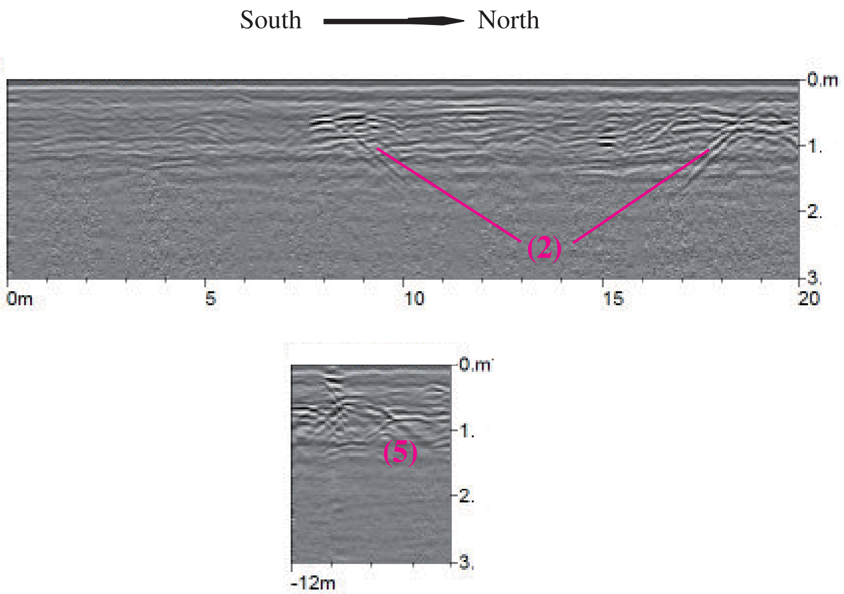
AREA 3B:



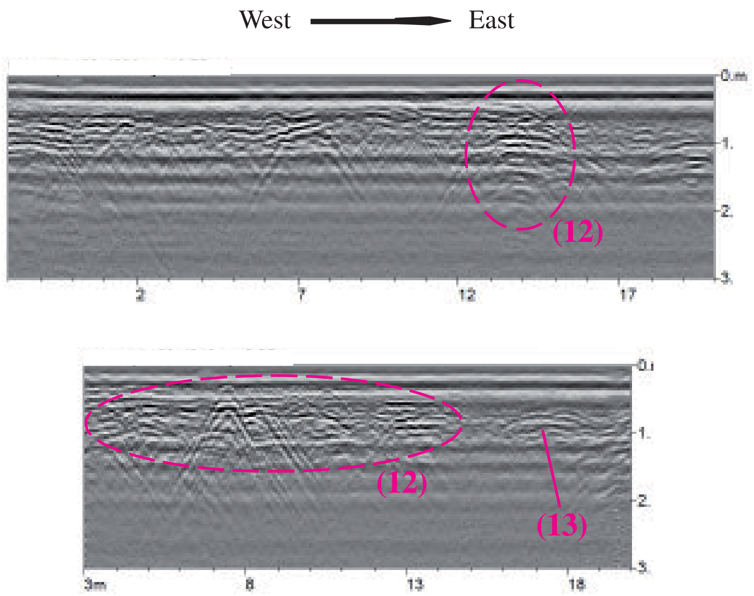
Raw Data

For Scale
See Plot Axes

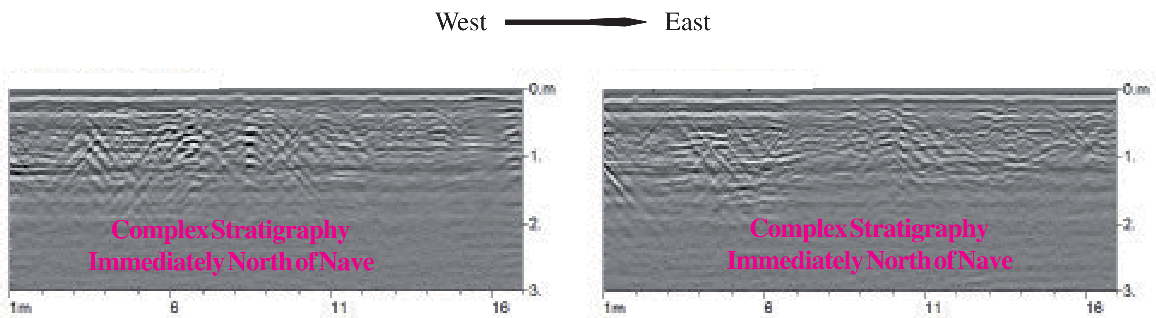
AREA 2B:



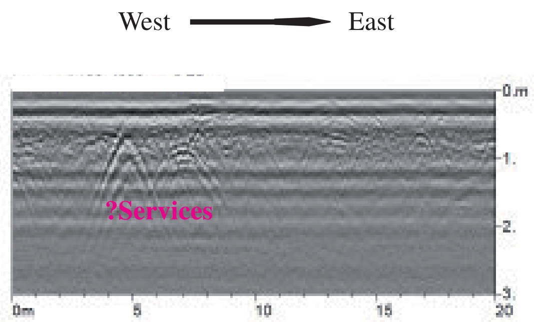
AREA 4:



AREA 3A:



AREA 5:



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GPR Data - Selected Radargrams
Figure A13