Statkraft UK LTD

Little South Solar Farm

Geophysical Report

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RSK GEOSCIENCES GEOPHYSICS

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EXECUTIVE SUMMARY

On the instructions of Headland Archaeology on behalf of Statkraft Ltd, RSK Environment Ltd has carried out a geophysical investigation to determine archaeological features of interest including the presence of a paleochannel in land to the to the south west of Richborough, Sandwich, Kent.

Project Findings

Site Setting and Current Usage	The site is located at the end of East Street, to the south west of the town of Richborough, Sandwich, Kent, CT3 2DA. The area of interest is for a proposed solar farm and is approximately 79 Ha and is currently given away to 18 no. fields of arable land.
Survey Objectives	To determine archaeological features of interest including the presence of paleochannels up to a depth of 12m together with any features of archaeological interest such as the former island causeway.
Geophysical Techniques Employed	The geophysical techniques employed were a phased investigation comprising: *Phase 1:* Reconnaissance Electromagnetic (EM) Ground Conductivity survey – Frequency Domain EM survey to determine buried channel features / changes in ground conditions and the presence of a linear causeway (up to depths of 6-7 m). A CMD Explorer instrument was used to coverage all accessible areas of the site at line spacings of 10 m. The maximum investigation depth of the EM survey was approximately 7 m. *Phase 2:* Electrical Resistivity Tomography (ERT) – 4 no. targeted profiles (totalling 1717 m length) on features of interest from the Phase 1 EM survey – use of a Syscal Pro resistivity meter to provide profiles of strata to deeper depths up to 12 m.
Geophysical Investigation Findings	EM data is presented in **Figures 6** and **7**. The EM data shows two broad types of response; a low conductivity area in the centre of the site and south west boundary where less saturated and granular Thanet Sand near surface geology is present; which is surrounded by higher conductivity material indicative of more cohesive/saturated tidal flat channel deposits. There is no clear evidence from the data of a linear feature on the topographic high to indicate the presence of a causeway, however there are several discrete areas of lower conductivity on the topographic high that may indicate more granular ground. ERT data is presented in **Figures 10a** to **10d** for ERT survey lines 1 to 4 respectively. The ERT data shows the presence of high resistivity material where more granular bedrock is present at or near the surface, and lower resistivity material where more cohesive and saturated tidal flat deposits are presence. Within the inferred tidal flat deposits are areas of higher resistivity which may indicate the presence of localised channel features. The interpretation is shown in panel C of the figures. The combined interpretation is shown on **Figure 11**.
Recommendations	It is recommended that the a number of representative features are further investigated by intrusive means to verify the nature of the ground conditions present, in particular any channel edge features which are well constrained by multiple datasets and the EM features on crest of field 9.

1 INTRODUCTION

1.1 Introductions

On the instructions of Sam Harrison of Headland Archaeology on behalf of Statkraft UK Ltd, RSK Environment Limited, carried out a geophysical site investigation to seek to determine archaeological features of interest including the presence of paleochannels up to depths of 12 m together with any features of archaeological interest such as a former island causeway on land at the proposed Little South Solar Farm, to the south west of Richborough, Sandwich.

1.2 Details of the Project

The project was carried out to an agreed brief as set out in RSK quotation reference 2192489-T01(01) dated 10 May 2024, and included the following:

- An Electromagnetic (EM) ground conductivity survey,
- An Electrical Resistivity Tomography (ERT) survey,
- An Interpretative report.

1.3 Limitations

Non-intrusive geophysical techniques seek to locate boundaries across which there is a marked contrast in physical properties. Such a contrast may be detected remotely because it gives rise to a geophysical anomaly, which is indicative of variation in a physical property relative to some background value. Insufficient contrast (including high levels of cultural noise) can result in masking of the sought anomaly. Therefore, there may be other conditions prevailing at the site which have not been revealed by this investigation and which have therefore not been taken into account in this report.

The response of the ground to different physical forces can be highly variable. Interpretation of the responses contained in this report is based on experience in similar environments and site conditions.

The materials encountered and samples obtained during on-site intrusive investigations represent only a small proportion of the materials present on-site. It should be accepted, therefore, that the interpretation from remotely sensed geophysical data may be inconsistent with that arising from direct methods of investigation.

2 THE SITE

2.1 Site Location

Site location details are presented in **Table 1** and an extract of the 1:50,000 Ordnance Survey map showing the location of the site is given in **Figure 1**.

Table 1. Site location details

Site name	Little South Solar Farm
Full site address and postcode	Off East Street, Canterbury, Kent, CT3 2DA
National Grid reference (centre of site)	TR 310 593

2.2 Site Description

The site boundary and current site layout are shown on **Figure 2**.

The site covers an area of approximately 79 Ha across 18 no. fields (See **Plate 1** below). The fields are currently used for crops and livestock. The six most westerly fields are used for cattle and the remaining fields are used for crops. At the time of the survey only field refs 9 and 10 in the centre of the site were heavily cropped (bean crop) (see **Plates 2** and **3**). The remaining fields were fallow. The elevation is relatively flat across the entire site varying between 1 and 3 mAOD, with the exception of a topographic high in the centre of the site in field refs 9 and 10 where the elevation rises up to 4.5 mOAD. Topographic Lidar data showing this feature is shown in **Figure 4**.

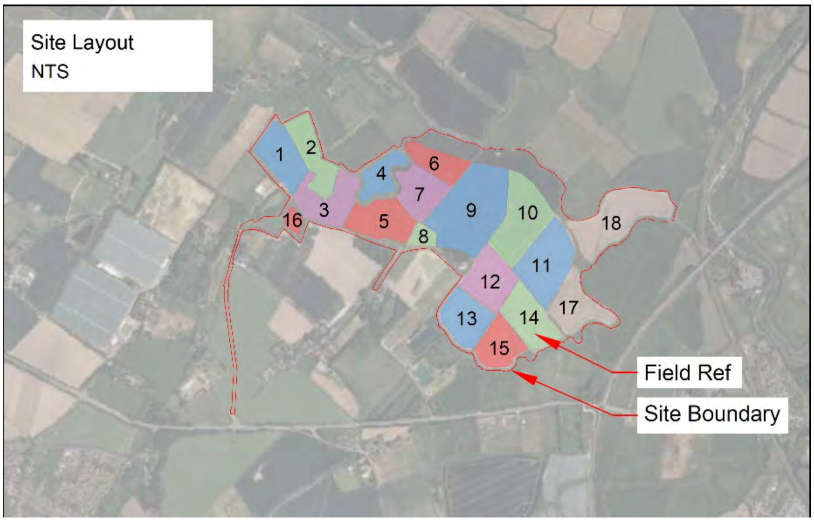


Plate 1: Field ref and Solar PV areas taken from Statkraft drawing ref SCUKX-LISOU-000-100 (R)

2.3 Geology and Ground Conditions

The published 1:50,000 scale geological map of the area (Sheet 265, 1965) indicates that the site is generally underlain by Tidal Flat deposits (clays and silts) formed around 12,000 years ago overlying The Thanet Formation (sands, silts and clays). The map shows the Thanet Formation cropping at the surface (no tidal deposits indicated) in field refs 9 in the centre of the site and part of field ref 1 and 16 in the west of the site.

Plate 2: Livestock field (west part of site) with cows, showing good survey conditions.

Plate 3: Field 9 with bean crop showing restricted access.

3 THE SURVEY

3.1 Objective and Geophysical Approach

The objective of the geophysical survey is determine archaeological features of interest including the presence of paleochannels up to depths of 12 m together with any features of archaeological interest such as a former island causeway on land at the proposed Little South Solar Farm.

The majority of the site falls into the land previously occupied by the Wantsum Channel. The Wantsum Channel separated the Isle of Thanet – situated to the the north of the site - from the remainder of Kent. It in understood that the channel was up to 12 m in depth. The channel silted up in the Middle Ages and its course is now represented by the rivers the River Stour and the River Wantsum. The current drainage at the site flows via field ditches which border each field parcel into the Goshall Stream which borders the north of the site. This flows eastwards into the River Stour to the east of the site. Approximately 800 m north west of the site lies the Richborough Roman Fort. It is understood that a trackway may lead south of the fort site towards and across the site, approximately north-south along the topographic high ground in field 9.

Based on the information available to us and of the approach requested to us is to employ a phased geophysical investigation. Phase 1 comprises a reconnaissance electromagnetic (EM) ground conductivity survey to map the variation in ground conductivity across entire site as access allows, and Phase 2 comprises Electrical Resistivity Tomography (ERT) profiles along a number of targeted transects based on the EM data.

Details on the theory of each of the geophysical techniques, their application to the site, the equipment used, and the data processing and presentation are discussed below. **Table 2** summarises the techniques used.

Table 2: Summary of geophysical techniques used at the site

Technique	Targets	Typical Penetration Depth# and Resolution	Deployment notes
Phase 1 – Reconnaissance survey			
Frequency Domain Electromagnetic (FDEM) Mapping (CMD Explorer)	Ground Conductivity to highlight areas of differing geological units, channel features, buried structures and metallic objects.	*Depth:* Up to 6-7m *Resolution:* 1m diameter or greater	Deployed at 10m line spacing in a unidirectional grid in all accessible areas.
Phase 2 – Targeted Profiling survey			
Electrical Resistivity Tomography (ERT) Imaging	Thickness of strata, Bedrock (rock head) profile Variation in moisture content	*Depth:* Up to 12m in centre of profile *Resolution:* 1-2m	4 no. lines. 2m or 3m electrode spacing with line lengths between 214 m and 537 m.

3.2 The Electromagnetic Technique

In electromagnetic surveying the electrical properties of the ground are measured as a function of depth and/or horizontal distance. Different rocks (and buried structures/objects) exhibit different values of electrical conductivity. Mapping variations in electrical conductivity can identify anomalous areas worthy of further geophysical or intrusive investigation.

3.2.1 Theory

The electromagnetic method is based on the induction of electric currents in the ground by the magnetic component of electromagnetic waves generated at the surface (**Figure 5A**). An alternating current, of variable frequency, is passed through a coil of wire (a transmitter coil, T_X). This process generates an alternating primary magnetic field which, in turn, induces very small eddy currents in the earth, the magnitude of which is directly proportional to the ground conductivity in the vicinity of the coil. These eddy currents then generate a secondary magnetic field, a part of which is intercepted by a receiver coil (R_X). The interaction between the primary and secondary magnetic flux and the receiver coil generates a voltage that is linearly related to the electrical conductivity of the subsurface.

In electromagnetic mapping, individual measurements are recorded across a site at a suitable density and plotted as a contoured map (**Figure 5B**). Measurements may also be recorded at different depths according to the orientation and/or spacing of the transmitter and receiver coils.

3.2.2 Application to Site

Frequency Domain EM survey was used to determine buried channel features / changes in ground conditions and the presence of a linear causeway. EM techniques are very successful in identifying areas of contrasting conductive properties of the ground. Different geological materials may have different physical properties. In this case it is expected that varying near surface superficial deposits related to discrete channel features (gravels and silts) will exhibit different conductivities compared to surrounding bedrock (Thanet sands). Additionally, the presence of discrete manmade features such as a causeway should exhibit different conductivities which can be mapped out as linear feature in plan view.

3.2.3 Equipment

CMD Explorer

The equipment used was the CMD Explorer manufactured by GF Instruments (see **Appendix A** for equipment specifications). The serial no. of the instrument used was 18100571. This consists of a transmitter and receiver coils separated at a distances of 1.48m, 2.82m and 4.49m mounted on a single beam. The coil separation is such that the measurements recorded represent ground conditions down to an effective depth of 2.3m, 4.2m and 6.7m respectively. The CMD Explorer has the facility to record two types of measurement as the secondary field may be separated into the *quadrature* component and the *in-phase* response. The quadrature response measures the bulk electrical properties of the ground. The electrical properties are expressed as an apparent electrical conductivity in millisiemens per metre (mS/m). The in-phase response is essentially the same as a metal detector and is expressed in units of parts per thousand of the primary transmitted field.

Plate 4: Data acquisition using the CMD system at the site (Field 12 looking north)

3.3 The Electrical Resistivity Imaging Technique

Different rocks/objects/saturating fluids exhibit different values of electrical resistivity. An electrical resistivity image describes the distribution of electrical resistivity as a function of depth and horizontal distance.

3.3.1 Theory

For any single measurement of ground resistance, an alternating electric current is injected into the subsurface via two metal stakes (electrodes) planted into the ground. One electrode behaves as the current source, whilst the current is returned to the surface to complete the electrical circuit through a second electrode. The current passing through the ground sets up a distribution of potential in the subsurface which is sampled by two additional electrodes (potential electrodes) across which a voltage is measured. The ratio of voltage to current is the resistance, R, of the ground through which the current has passed (**Figure 8A)**.

Dipole-Dipole Array

The basic principle of the Dipole-Dipole array resistivity imaging method is shown in **Figure 8B**. A cable containing x electrode connections is positioned in a straight line and the electrodes are deployed along this line with an equal inter-electrode spacing, a. For each measurement, the two current electrodes (C1 & C2) are located adjacent to each other on the left end of the electrode set up, and the two potential electrodes (P1 & P2) are located adjacent to each other on the right end of the electrode set up. Once a measurement of ground resistance has been determined for one set of four electrodes, the next set of four electrodes is automatically selected and second measurement made. The process is repeated until the end of the line is reached. The line is then resurveyed with the spacing between the two centre electrode increasing to 2a, 3a, 4a, etc., up to a maximum central electrode spacing of 70a. The measured resistance values are converted to values of what is termed as apparent resistivity (ρ_a) using the equation

$$\rho_a = \pi n(n+1)(n+2)aR$$

The values measured are intimately related to the geometry of the electrodes used to obtain them and hence are termed apparent, not true, resistivities.

The results are displayed as a pseudosection, which is made up of individual apparent resistivity values plotted at the mid-point of the four electrodes used to acquire them and at a depth of approximately half the inter-electrode spacing. The depth at which the apparent resistivity values are plotted reflects the depth of investigation of the measurement. Although the pseudosection can be viewed as an approximate image of the subsurface and indeed contains information on the subsurface geology, it is also influenced by the electrode geometry. In order to separate geometrical effects and produce an image of true resistivities of the ground and true depths to features within the ground, the data set is put through a sophisticated processing stage called *inversion*. The result of this is a final image of the distribution of resistivity with depth, along the line of the survey (**Figure 8C**).

3.3.2 Application to Site

Electrical resistivity imaging requires the formation of an electrical pathway, or ‘galvanic circuit’, through the subsurface. The passage of electrical current through the subsurface occurs predominantly through pore-space and interstitial moisture, although saturation is not necessary. As such a detectable contrast between the electrical properties of the different subsurface materials may exist. Sandy bedrock or superficial granular materials in the shallow subsurface are likely to manifest themselves as areas of higher resistivity compared to more cohesive overbank tidal deposits.

3.3.3 Equipment

Syscal Pro

The equipment employed was the IRIS Instruments Syscal Pro system (see **Appendix A** for equipment specifications). The serial no. of the equipment used was 14609-1079061783-577. Seventy-two equally spaced electrodes are connected via multicore cables to a Syscal Pro earth resistance meter. Addressable electronic switching units, allow any four electrodes to be connected directly to the resistance meter. The measurement scheme is designed on a laptop computer, and then uploaded to the Syscal Pro. Measurements are taken automatically by the Syscal Pro as per the pre-defined survey sequence. Additional length to the end of the survey line is undertaken by collecting an additional of 'roll-ons'.

Plate 5. Data acquisition using the Syscal system in Field 9

3.4 Survey Design

3.4.1 EM Survey Design

The layout of the EM survey is shown in **Figure 3.** In all areas except field refs 9 and 10, the EM data were acquired at line intervals at 10 m spacing. The location of each survey line is shown coloured purple in the figure.

In the fields (ref 9 and 10) currently occupied by bean crop, surveying was restricted to the farm tram tracks due to dense chest high crop. Therefore, the spacing in these fields is greater than 10m, this has been outlined in orange in the figure.

All EM survey lines were collected by walking alternate lines in a south to north orientation across the survey area as access allowed. The orientation was selected as the most likely orientation to intersect any channel features (which would be more likely to be oriented west-east). In field ref 9 where a roman trackway may be present, additional lines oriented west-east were collected. Positioning data for all EM survey lines was recorded using a dGPS linked to the EM instrument.

3.4.2 ERT Survey Design

The location of the ERT survey lines was selected based on the EM results and with the agreement of the County Archaeologist. **Figure 9** shows the location of the 4 no. ERT survey lines (ERT Lines 1-4) together with the EM conductivity data.

The survey lines were positioned in locations where the EM data shows variation in ground types between the inferred tidal flat / channel features and the topographic upstand areas. A further description of the rationale for each line is presented below.

The resistivity technique produces a trapezium of data, with the maximum investigative depth in the centre of the line and the data shallowing out to the edges. For this reason, where possible, the lines were extended past the extents of the potential features to ensure the best possible depth penetration within the area of interest.

ERT Line 1 is located in the west of the site and is orientated southwest to north east across an area of low conductivity observed in the EM data (where the channel edges onto Thanet bedrock) towards areas of variable conductivity in the centre of the channel. The survey line crosses two ditches, resulting in 4 missing electrodes / data points along the line. The electrode spacing was 3m to allow for a greater length of line coverage.

ERT Line 2 is located in the north of the site across field ref 6. The line is orientated west-east, crossing an area shown in the EM data as higher conductivity and a linear feature in the Lidar elevation data (**Figure 4**). The electrode spacing was 2m to allow for an increase in resolution of the data collected.

ERT Line 3 crosses perpendicular across the main topographic high feature and area of lower conductivity (inferred as an area of Thanet sand outcrop) in field ref 9 from the inferred channel area in the northwest to the channel area in the southeast. The line was extended at both ends to compare the topographic high feature to the surrounding areas either side. The electrode spacing was 3m to allow for a greater length of line.

ERT Line 4 is located to cover a representative area in the south east of the site from the topographic high south eastwards across field refs 12 and 14. The lien was selected to help investigate the onlap area between the topographic high and channel area and variations in ground conductivity to the east of the site. The electrode spacing was 3m to allow for a greater length of line. The line stops at its eastern end to avoid a buried metallic water pipe.

The locations and lengths of the resistivity survey lines are summarised in **Table 3**.

The maximum investigation depth of all resistivity survey lines was approximately 12m.

Table 2: Summary of Resistivity Survey Lines

ERT Line	Total Length	No. Electrodes	Electrode Spacing	Start Point	End Point
1	537m	180	3m	630433.31E 159340.28N	630890.62E 159619.16N
2	214m	108	2m	630952.40E 159654.89N	631165.92E 159655.11N
3	537m	180	3m	630968.08E 159572.09N	631431.35E 159301.88N
4	429m	144	3m	631134.85E 159239.46N	631478.01E 158982.18N

All the electrode locations were recorded using a Leica VIVA series Smart Rover, providing accurate location data referenced to the Ordnance Survey OSGB1936 National Grid system. The Leica VIVA series Smart Rover GPS has a horizontal accuracy of 5 mm +0.5 ppm and a vertical accuracy of 10 mm +0.5 ppm.

3.5 Data Processing and Presentation

3.5.1 EM Conductivity

CMD Explorer data were downloaded from the logger using the CMD Transfer software then exported as .DAT format.

Data were imported into Geosoft's specialist software Oasis Montaj. Within this software data are manipulated in a number of ways. Positional data are transformed from WGS84 format to British National Grid Co-ordinates, before data are filtered to remove spurious or bad data points and interrogated to remove or correct for other sources of 'noise'.

The final data for each depth range sampled are contoured to produce colour filled grids. The CMD Explorer ground conductivity data for first, second and third coils are shown in **Figures 6A to 6C** to show conductivity data for shallow (2.2m), medium (4.2m) and deeper (6.7m) effective depths. **Figures 7A to 7C** display the in-phase electromagnetic response. Relatively high conductivity values are displayed with shades of red and pink, through yellows and greens, with shades of blue and purple representing lower conductivity values.

A summary of the EM processing methods are shown below in **Table 4**.

Table 4. Summary of EM processing methods

Method	Justification
Instrument nulling	An area of the site free of metallic objects is identified and the instrument is nulled. The location is marked and returned to prior to commencement of survey works in the survey area. The instrument was nulled in the same location each day.
Data download	Following completion of each survey area the data was downloaded to a laptop, to allow completion of quality control check.
Coordinate transform	Positional data was transformed from Geographic projection to OSGB (1936), British National Grid projection, for mapping and presentation.
Data filtering	Spurious data points were filtered from the datasets.
Gridding & contour plotting	Data is gridded and plotted as a contour plot in Oasis Montaj the various datasets can then be displayed using optimised colour palettes.

3.5.2 Electrical Resistivity

The results of the resistivity survey for ERT Lines 1 to 4 are presented in **Figures to 10A to 10D** respectively**.**

Raw resistivity data were filtered and 'despiked' to remove any erroneous data points. Topography was added to the resistivity data file, which was subsequently processed using the specialist software RES2DINV. Following initial processing, further manual removal of any remaining spurious or bad data points was undertaken, and an inversion algorithm was run.

The final resistivity depth data were calculated with all topographical effects accounted for to produce a two-dimensional pseudo section of apparent resistivity variation with depth.

The final resistivity profiles have been presented as contoured cross-sections, which are colour-optimised to aid interpretation of subsurface features. The data are presented on a normal distribution scale ranging from 0 to 12.7 Ωm with shades of red indicating low resistivity values through to shades of blue indicating relatively higher resistivity values. The colours have been selected to correlate with the EM data plots. The resistivity variations observed are attributed to a combination of the variations in the electrical properties of subsurface materials and in the fluid contained in pores and voids within them. As such, any lateral or vertical changes in the resistivity may be due to a change in material or lithology, man-made features, or pore fluid saturation and chemistry, or a combination of the two.

4 DATA INTERPRETATION

4.1 Data Quality

4.1.1 EM Conductivity

Recorded EM data were of good quality showing a large range of conductivity values across the site. A minimal number of spurious data points were removed from the final combined dataset. In a number of locations, the instruments suffered from interference from surrounding surface metallic objects such as animal troughs. In these areas there is a localised saturation of the sensors and therefore more subtle features from buried objects in these areas may be masked.

The EM data show a good correlation with the ERT dataset. Where conductivity values are high in the EM dataset, there is correspondingly low values in the ERT dataset at shallow depths (ERT values are inversely proportional to EM conductivity values). This implies that both the EM and ERT datasets are in good agreement and the trends seen are due to features seen within the subsurface.

4.1.2 Electrical Resistivity

The electrical resistivity data were of good quality. Noisy and spurious data points have been removed from the resistivity dataset before inversion. Contact resistances were within accepted quality check limits for all lines. The moist soil allowed for a good electrode contact with the ground.

Following a trial along Line 3 the dipole-dipole electrode array was chosen as the most appropriate sequence to achieve the survey objectives. This sequence is most sensitive to lateral variations along the line and hence more suitable for detecting discrete vertical features such as channel or made-made features. A Wenner-Schlumberger array was also trialled on Line 3 but suffered more noise and higher inversion errors (see below) than the Dipole-Dipole array therefore the dipole-dipole array was taken forwards for the reminder of the survey.

After 2D inversion through RES2DINV the resulting apparent resistivity models had final inversions less than 3.6% RMS error for dipole-dipole and 6.11% RMS error for the Wenner-Schlumberger survey, which for the dipole-dipole arrays, are considered to have converged to suitable degree to have a good level of confidence in the data. **Table 5** shows RMS values across obtained for all survey lines.

Table 5. Summary of Resistivity Inversion RMS values

SURVEY LINE	RMS ERROR (%)
Line 1	3.26
Line 2	2.83
Line 3	2.30
Line 3 (Wenner-Schlumberger)	6.11
Line 4	3.55

4.2 Results and Discussion

4.2.1 EM Results

The results of the Conductivity Mapping survey (CMD Explorer) are presented in **Figures 6A** to **6C** for ground conductivity and **Figures 7A** and **7C** for magnetic susceptibility.

All EM datasets show a similar trend with a broad area of lower conductivity in the centre of the site containing the whole of field ref 9, together with the southern half of field refs 1, 3 and 5, and the whole of field 16 in the southwest of the site along the southern boundary. This area of lower conductivity (values below approximately 80 mS/m in the Coil 2 data) is inferred as the areas underlain at or very near the ground surface by more granular/less saturated deposits of the Thanet Formation (pre-dominantly sands) and likely shows an absence of tidal flat deposits. These areas are shown hatched blue and red respectively in **Figure 11**.

Due to the low and relatively uniform conductivity values recorded in field 9, the figures also show the field data as an inset in the lower left panel with a narrower value range in order to better isolate and show any variation in conductivity values across field 9. The data shows the lowest conductivity values at the crest of the field (see Fig 6B). This likely shows where the ground is driest and may indicate more granular ground as a result of a possible linear trackway, however the evidence for this is the data is low confidence as there is no clear linear feature observed. These areas are shown shaded dark blue in **Figure 11**.

In the remainder of the fields across the flat, low lying areas, surrounding the topographic high of field 9, the conductivity values are moderate or high (between 80 and 200 mS/m) and are inferred as more cohesive and saturated tidal flat deposits. Given the high conductivity values, some amount of brackish or saline intrusion from the nearby coastline may be present in the groundwater which is likely present at shallow depth in these deposits. The EM data shows variation in these areas between moderate and high values. The moderate conductivity values may imply less saturated and/or granular deposits (possibly higher overbank material, as it is noted some of these areas correlate with existing ditch locations – such as the curvilinear feature observed between field refs 1, 2 and 3 in the west of the site), and the higher conductivity values may imply more saturated and/or more cohesive deposits which may be indicative of broader channel fill.

The in-phase data is broadly similar to the conductivity data, with the exception that the in-phase data more clearly shows the presence of a linear feature in the south east of the site crossing field refs 14, 15 and 17. This represents a buried metallic water pipe at this location.

The topographic high with low conductivity values in Field 9 in the centre of the site (and surrounding onlap areas) was further investigated by ERT Lines 3 and 4 (see section 4.2.2). The channel features to the west were further investigated by ERT Lines 1 and 2. The location of the ERT lines in relation to the EM conductivity data is shown presented in **Figure 9**.

4.2.2 ERT Results

The ERT data for Lines 1 to 4 are presented in **Figure 10A-D** respectively. Each figure shows 4 panels with Panel A showing the a profile of the conductivity data taken along the ERT profile. Panel B shows the apparent resistivity pseudo sections orientated west to east. Panel C shows the interpretation of the resistivity data. Panel D shows the topography of the ground surface along the ERT profile.

It should be noted that no borehole logs were available at the time of this report to calibrate the resistivity data, therefore the interpretation is based on the information provided in the BGS map which show the outcrop of Thanet Formation (predominantly sand) in Field 9 surrounded by tidal flat deposits.

The ERT data generally shows a two or three layer case on both the tidal flat areas and topographic high ground underlain by bedrock. Both areas are well constrained and correlate well with the EM conductivity data and BGS map data.

4.2.2.1 ERT Line 1

Line 1 is situated in the western part of the survey area, in a southwest - northeast orientation crossing fields 16, 3 and 4 and two ditches. The ERT Line 1 results are shown in **Figure 10A**.

The resistivity data (panel B) show two distinct zones of geology along the line. The area from the southwest end of line (0m chainage) up to the first ditch at 80m chainage contains highly resistivity material relative the rest of the line. This is indicative of granular or less saturated deposits and is likely where the Thanet Formation (predominantly sands) outcrops and is an absence of tidal flat deposits. The inferred Thanet unit has 3 distinct layers; layer 1 – near surface high resistivity layer; approximately 5m thickness indicating less saturated deposits; layer 2 – below 2mBOD level; lower resistivity indicative of saturated deposits, and a deeper layer 3 – below 10mBOD level; higher resistivity indicative of a possible change of geology such as chalk or more granular strata.

The remainder of the line from the ditch at 80m chainage to the end of line (537m chainage) onwards shows a broad area lower resistivity. This is inferred as the presence of the tidal flat deposits which are more cohesive and have a have a higher moisture content that the Thanet deposits. Within the inferred tidal flat deposits, there are generally 3 layers; layer 1 – near surface moderate to higher resistivity layer; approximately 0-3m thickness indicating less saturated deposits (soils and strata above water table to approx. 1mBOD level). Within this layer are discrete pockets of higher resistivity layer (shaded red in the interpretation panel C) which may indicate more granular near surface channel deposits. Layer 2 – below 1mBOD level; low resistivity material indicative of saturated channel fill deposits (possibly influenced by brackish groundwater), and a deeper layer 3 – around 10mBOD level and below with moderate resistivity values which may indicate bedrock below the channel fill deposits.

4.2.2.2 ERT Line 2

Line 2 is situated to the north of the survey area, in a west to east orientation crossing field 6. The ERT Line 2 results are shown in **Figure 10B**.

The data shows two generally uniform layers across the profile: layer 1 – near surface relative moderate or higher resistivity layer; approximately 0-3m thickness indicating less saturated deposits (soils and strata above water table to approx. 0mAOD level). Within this layer are thicker areas of higher resistivity layer (shaded red in the interpretation panel C) (between 90m and 140m chainage) which may indicate more granular near surface channel deposits. Layer 2 – below 0mAOD level; lower resistivity material indicative of saturated channel fill deposits (possibly influenced by brackish groundwater). This layer extends to the base of the profile at approximately 12mBOD. There is minimal change of resistivity observed at depth, therefore no bedrock has been interpreted to be present with all the section within the tidal flat channel deposits.

4.2.2.3 ERT Line 3

Line 3 crosses the centre of the site, covering field 9 with fields 7 and 10 on the western and eastern flanks of the relative high ground of field 9 respectively. The ERT Line 3 results are shown in **Figure 10C**.

Three distinct vertical geological units are clearly shown in the results along the profile, with a high resistivity section (between 140m and 430m chainage positioned between two low resistivity units either side up to each end of the profile). This pattern is in agreement with the EM data shown in **Figure 6** and correlates with the BGS mapping. The two outer low resistivity units have been inferred to be tidal flat deposits, with the central higher resistivity unit a more granular and less saturated area inferred as an outcrop of the Thanet Formation (likely dominated by sandier geology). The boundaries between the sections are very abrupt and steep further indicating their contrasting nature, which suggests the central area was once a peninsula with channel deposits incised on each edge of the outcrop.

At the crest of the central area in field 9 there is no obvious discrete feature indicative of a causeway or similar discrete man made obstruction. Below the central low resistivity unit at c. 10m depth (~7 mBOD) lies a moderate resistivity layer which is indicative of a possible change of geology such as the underlaying chalk or more granular strata.

In the tidal flat area to the west (field 7), the data shows a ~2m thick layer of moderate to high resistivity material (likely more granular or tidal flat material above the water table), and low resisitivity material below 0 mAOD indicative of saturated channel fill deposits (possibly influenced by brackish groundwater). The layering is uniform with no clear evidence of channel features within the unit.

In the tidal flat area to the east (field 10), the data shows a similar patter although is generally lower in resistivity near the surface. This may suggest the deposits are affected more by higher saturation, and/or salinity levels from the coast to the west.

4.2.2.4 ERT Line 4

Line 4 begins to the north west in field 9 and runs to the south east across fields 12 and 14, stopping immediately adjacent to a buried metal water main at the far end. The ERT Line 4 results are shown in **Figure 10D**.

The edge of the topographic upstand in field 9 shows similar characteristics to the centre of Line 3, with a higher resistivity compared to the areas surrounding to the east (from chainage 100m to the end of the profile). A unit of lower resistivity is present in fields 12 and 14 to the south east, inferred to be tidal deposits. This unit generally has 3 layers; layer 1 – near surface high resistivity layer; approximately 2m thickness indicating less saturated deposits; layer 2 – below 0mAOD level; lower resistivity indicative of saturated deposits, and a deeper layer 3 – below 10mBOD level; higher resistivity indicative of a possible change of geology such as the base of the channel and presence of bedrock. Bedrock in this area appears to be closer to the surface than observed in Line 2.

4.3 Combined Interpretation

The interpreted results of the two separate geophysical techniques have been combined in **Figure 11**. This allows identification and correlation of anomalies observed in multiple geophysical dataset to enable a more robust interpretation of ground conditions present. There is good agreement between the EM and ERT datasets and to the BGS geological map.

The figure highlights the low conductivity/high resistivity outcrop of inferred Thanet Formation (more granular sandier material and drier material shown hatched blue) in field 9, 1, 3 and 16, which is surrounded by the high conductivity/low resistivity areas of inferred tidal flat deposits (more cohesive silts and clays, and wetter deposits shown hatched red). There are local variations in the tidal flat deposits (higher resistivity shown shaded in pink) which may represent more granular channel deposit features whilst the more moderate resistivity/conductivity areas may represent more cohesive overbank/tidal deposits.

There is no clear evidence from the data of a linear feature on the topographic high on field 9 to indicate the presence of a causeway, however there are several discrete areas of lower conductivity on the topographic high that may indicate more granular ground. These have been marked in blue shading. The only other manmade feature detected in the EM data was a linear feature in the south east of the site which is generated by a buried metal water pipe.

4.4 Recommendations

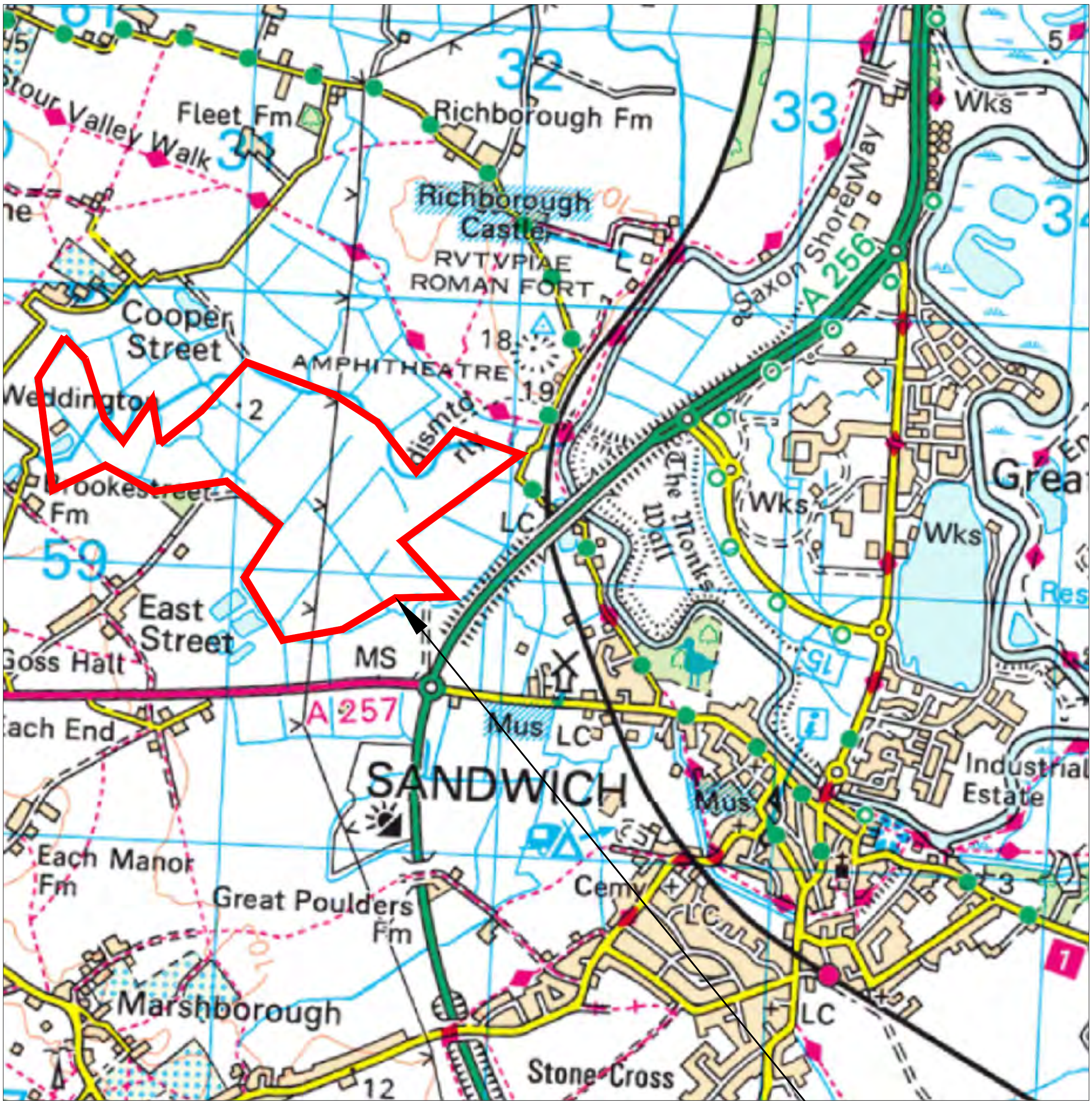
It is recommended that the a number of representative features are further investigated by intrusive means to verify the nature of the ground conditions present, in particular any channel edge features which are well constrained by multiple datasets and the EM features on crest of field 9.

5 SUMMARY AND CONCLUSIONS

- On the instructions of of Headland Archaeology on behalf of Sratkraft ('the Client') RSK Geophysics carried out a phased geophysical survey on land to the southwest of Richborough, Sandwich, Kent.
- To objective of the survey was to determine archaeological features of interest including the presence of discrete paleochannels in the former Wantsum Channel up to a depth of 12m together with any features of archaeological interest such as the former island causeway.The geophysical techniques employed included Electromagnetic (EM) Conductivity mapping across the full accessible survey area utilising a CMD Explorer at 10m survey line spacing, and Electrical Resistivity Tomography (ERT) conducted over 4 no. profiles which were targted base don't he results of the EM survey.
- EM data is presented in **Figures 6** and **7**. The EM data shows two broad types of response; a low conductivity area in the centre of the site and south west boundary where less saturated and granular Thanet Sand near surface geology is present; which is surrounded by higher conductivity material indicative of more cohesive/saturated tidal flat channel deposits. There is no clear evidence from the data of a linear feature on the topographic high to indicate the presence of a causeway, however there are several discrete areas of lower conductivity on the topographic high that may indicate more granular ground.
- ERT data is presented in Figures **10A** to **10D** for ERT survey lines 1 to 4 respectively. The ERT data shows the presence of high resistivity material where more granular bedrock is present at or near the surface, and lower resistivity material where more cohesive and saturated tidal flat deposits are presence. Within the inferred tidal flat deposits are areas of higher resistivity which may indicate the presence of localised channel features. The interpretation is shown in panel C of the figures. The combined interpretation is shown on **Figure 11**.
- It is recommended that the a number of representative features are further investigated by intrusive means to verify the nature of the ground conditions present, in particular any channel edge features which are well constrained by multiple datasets and the EM features on crest of field 9.
- Whilst a great deal of detailed data has been gathered by the geophysical surveys, the results should be used in the context of all available information regarding the location and depth of archaeological and geological features present, and should not be relied upon as a sole and complete record of the features present.

FIGURES

N
INDICATIVE NORTH



Scale
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Site Location

NOTES

(1) Extract from Ordnance Survey 1 : 50000 scale map.
(2) Reproduced from Ordnance Survey mapping with the permission of the Controller of His Majesty's Stationery Office. Crown Copyright reserved (Licence No:AL100014807).

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Drawing Title	SITE LOCATION
National Grid Reference	TR 312 591
Client	STATKRAFT UK LTD
Project Title	LITTLE SOUTH SOLAR FARM
Drawn	LD
Date	24/07/24
Checked	MJS
Date	29/07/24
Approved	MJS
Date	29/07/24
Scale	1:50000
Orig Size	A4
Dimensions	
Project No.	2192489
Drawing File	2192489 Figure 1
Drawing No.	2192489 Figure 1 Sheet 1 of 1
Rev.	

NOTES

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Scale
0 40 80 120 160 200m

KEY

GEOPHYSICAL SURVEY AREA

TOPOGRAPHIC FEATURE

10 FIELD REFERENCE USED IN REPORT

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client

STATKRAFT UK LTD

Project Title

LITTLE SOUTH SOLAR FARM

Drawing Title

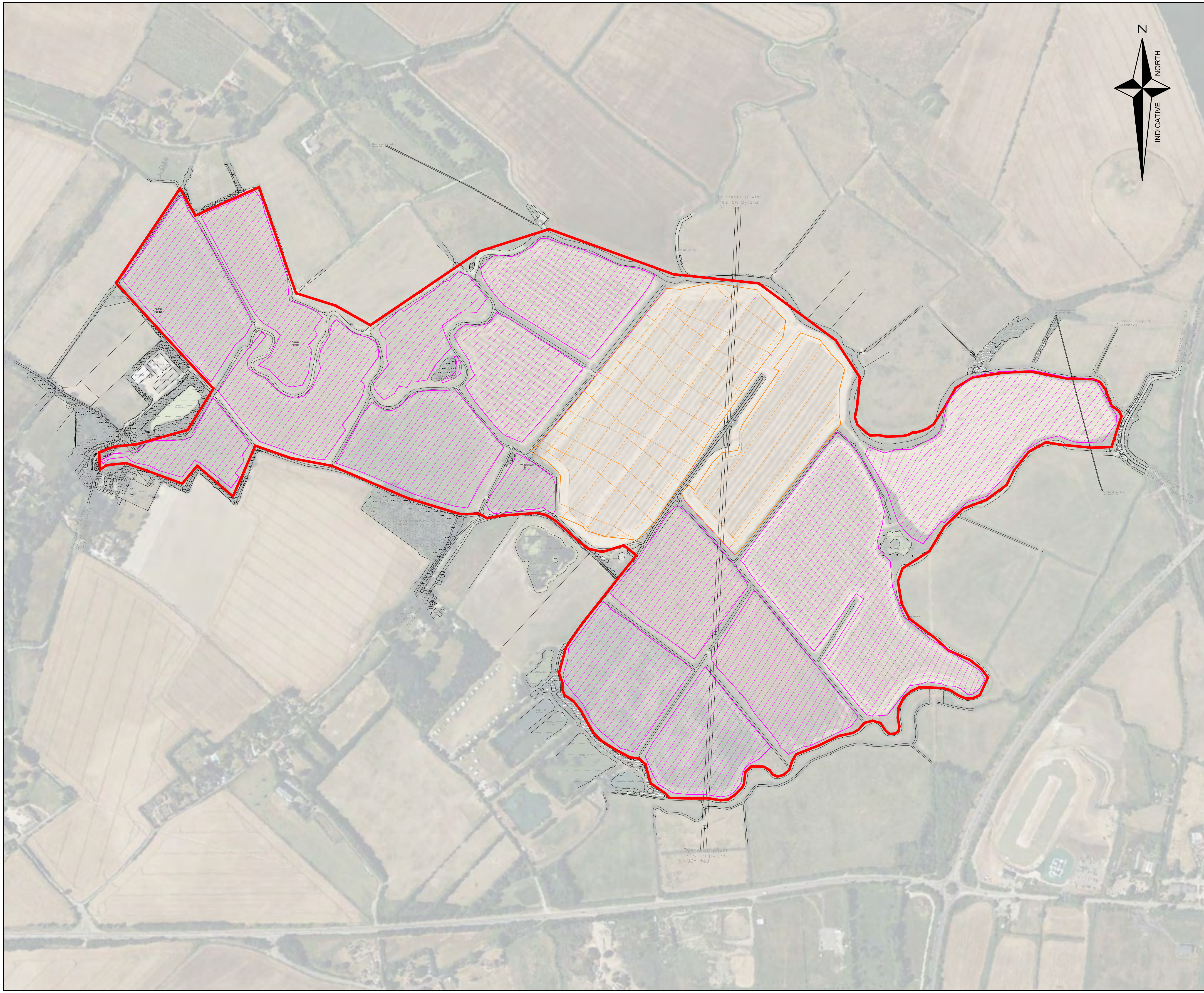
SITE LAYOUT

Drawn	Date	Checked	Date	Approved	Date
LD	26/07/23	MJS	29/07/24	MJS	29/07/24

Scale	Orig Size	Dimensions
1:6000	A3	

Project No.	Drawing File
2192489	2192489 Fig. 2

Drawing No.	Rev.
2192489 Fig.2ASheet 1 of 1	



NOTES

The specific risks associated with the content of this drawing are considered to be:-

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Scale

0 40 80 120 160 200m

KEY

- GEOPHYSICAL SURVEY AREA
- TOPOGRAPHIC FEATURE
- EM CONDUCTIVITY SURVEY AREA AND LOCATION OF 10m SPACED SURVEY LINES
- EM CONDUCTIVITY SURVEY AREA AND LOCATION OF SURVEY LINES RESTRICTED TO FIELD TRACKS (ACCESS RESTRICTED DUE TO CROP)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client

STATKRAFT UK LTD

Project Title

LITTLE SOUTH SOLAR FARM

Drawing Title

SITE LAYOUT AND EM CONDUCTIVITY SURVEY LAYOUT

Drawn	Date	Checked	Date	Approved	Date
LD	26/07/23	MJS	29/07/24	MJS	29/07/24

Scale	Orig Size	Dimensions
1:6000	A3	

Project No.	Drawing File
2192489	2192489 Fig. 3

Drawing No.	Rev.
2192489 Fig.3 Sheet 1 of 1	

NOTES

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(2) LIDAR data sourced online from Environment Agency National LIDAR Programme (1m resolution) from data.gov.uk. Use for indicative purposes only.

Scale
0 40 80 120 160 200m

KEY

GEOPHYSICAL SURVEY AREA

TOPOGRAPHIC FEATURE

2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2

GROUND LEVEL ELEVATION BASED ON LIDAR DATA (mAOD).

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client
STATKRAFT UK LTD

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
ELEVATION DATA

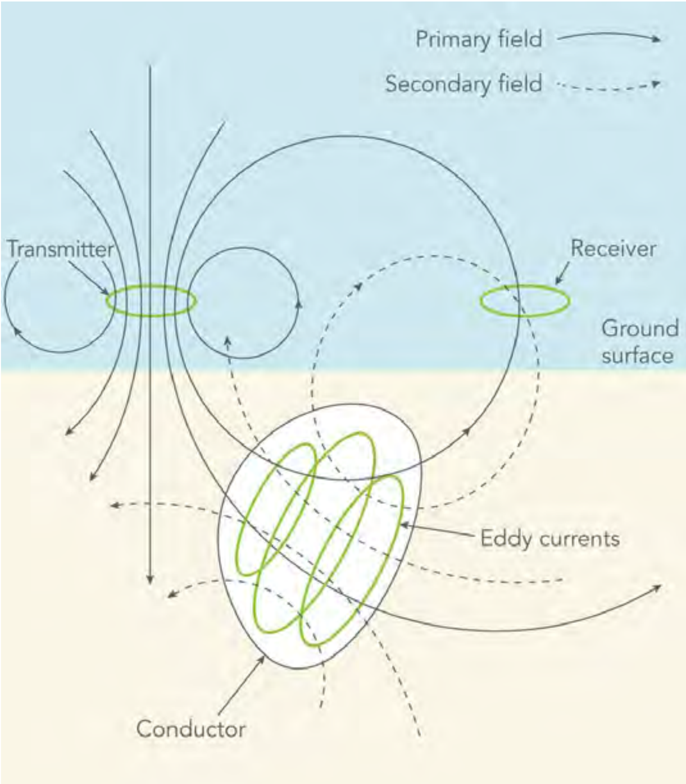
Drawn	Date	Checked	Date	Approved	Date
LD	26/07/23	MJS	29/07/24	MJS	29/07/24

Scale	Orig Size	Dimensions
1:6000	A3	

Project No.	Drawing File
2192489	2192489 Fig. 4

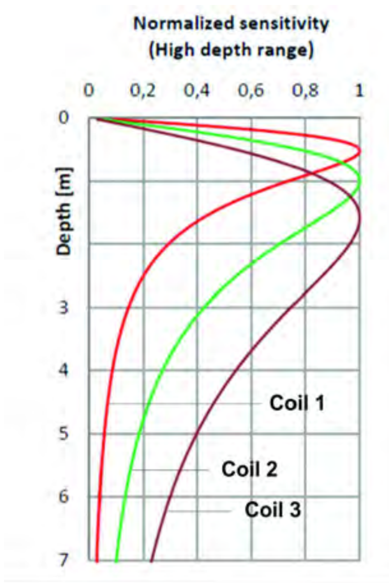
Drawing No.	Rev.
2192489 Fig.4 Sheet 1 of 1	

A The principle of electromagnetic induction

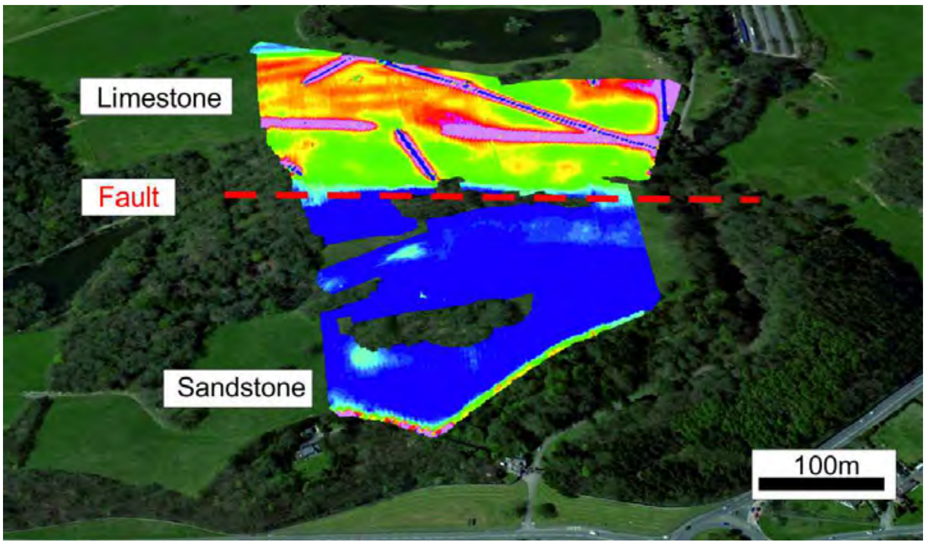


B The CMD Explorer

D CMD Response Curves



C An Example of Electromagnetic Data collected over varying geological terrains



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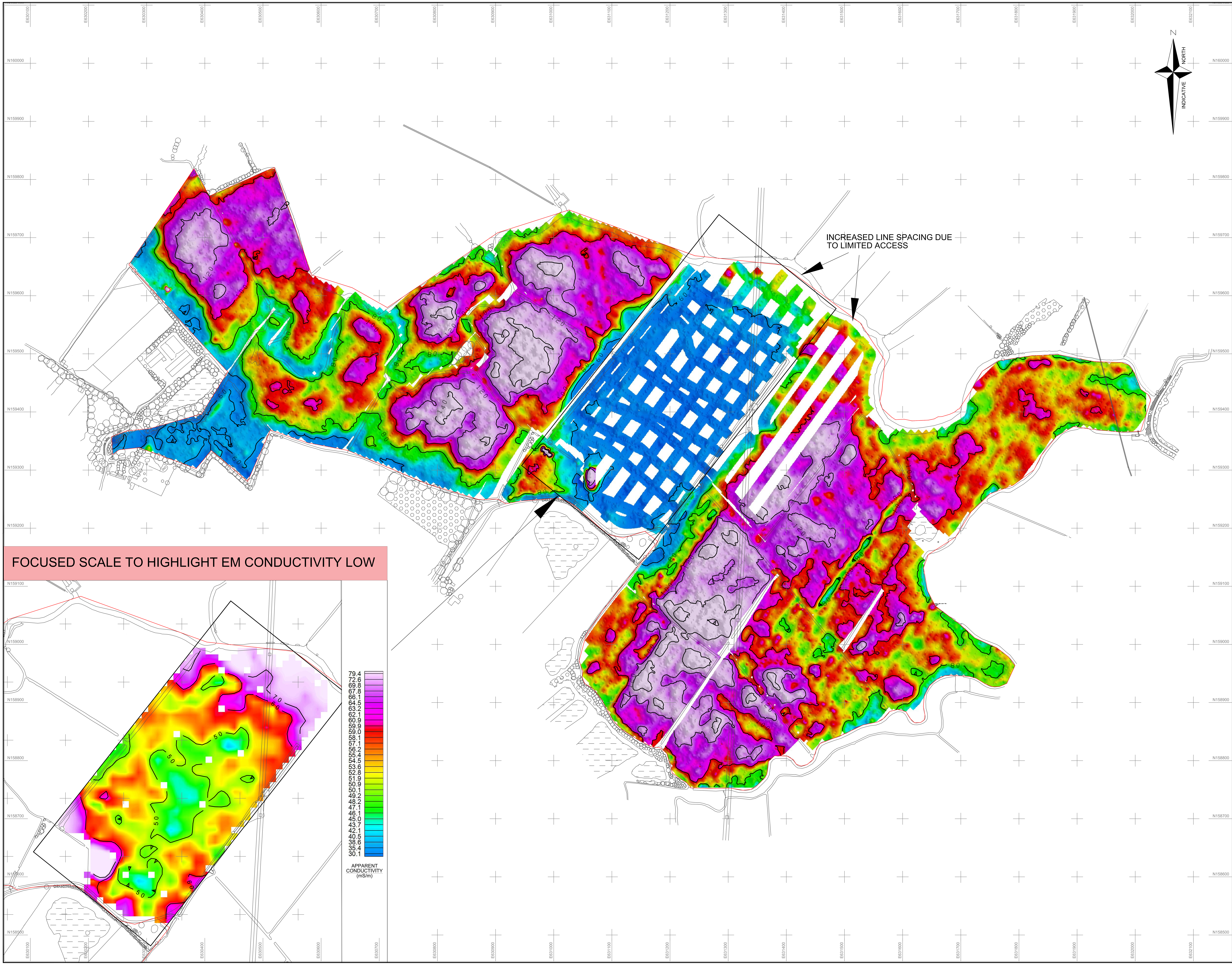
Client		
STATKRAFT UK LTD		
Project Title		
LITTLE SOUTH SOLAR FARM		
Drawing Title		
THE ELECTROMAGENTIC (FDEM) TECHNIQUE		
Drawn LD, Date 09/07/24	Checked MJS, Date 29/07/24	Approved MJS, Date 29/07/24
Scale: As shown	Orig Size: A4	Dimensions
Project No. 2192489	Drawing File: 2192489 Fig. 5	
Drawing No. 2192489 Fig.5 Sheet 1 of 1	Rev.	



NOTES

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(2) CMD Explorer data exported from Oasis v10
(3) It is recommended that the Client should confirm the location of the geophysical anomalies with hand dug pits within 0.5m to expose buried obstructions and services prior to the commencement of works.
(4) Although every reasonable effort has been made to locate buried obstructions using electromagnetic conductivity techniques, RSK Environment Ltd cannot guarantee that every obstruction has been located.

KEY

APPROXIMATE BOUNDARY OF SITE

SCALE

182.5, 157.9, 147.5, 140.1, 134.1, 128.2, 123.7, 119.6, 115.1, 111.6, 108.2, 104.9, 101.2, 98.1, 95.0, 92.0, 88.5, 85.5, 82.4, 78.8, 75.6, 72.4, 69.0, 64.9, 61.1, 57.0, 52.6, 46.8, 41.0, 33.9, 22.1, 2.9

Higher conductivity values indicative of more cohesive or saturated materials - proable tidal channel deposits

APPARENT CONDUCTIVITY (mS/m)

Lower conductivity values indicative of more granular or less saturated materials (probable Thanet Formation)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client
STATKRAFT UK LTD

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
RESULTS OF THE CMD SURVEY - CONDUCTIVITY COIL1 (2.3m EFFECTIVE DEPTH)

Drawn	Date	Checked	Date	Approved	Date
JM	10/07/24	MJS	11/07/24	MJS	30/07/24

Scale: 1:2000
Orig Size: A0
Dimensions:

Project No.: 2192489
Drawing File: 2192489 Figure 6A

Drawing No.: 2192489-Figure 6A Sheet 1 of 1
Rev.:

Scale
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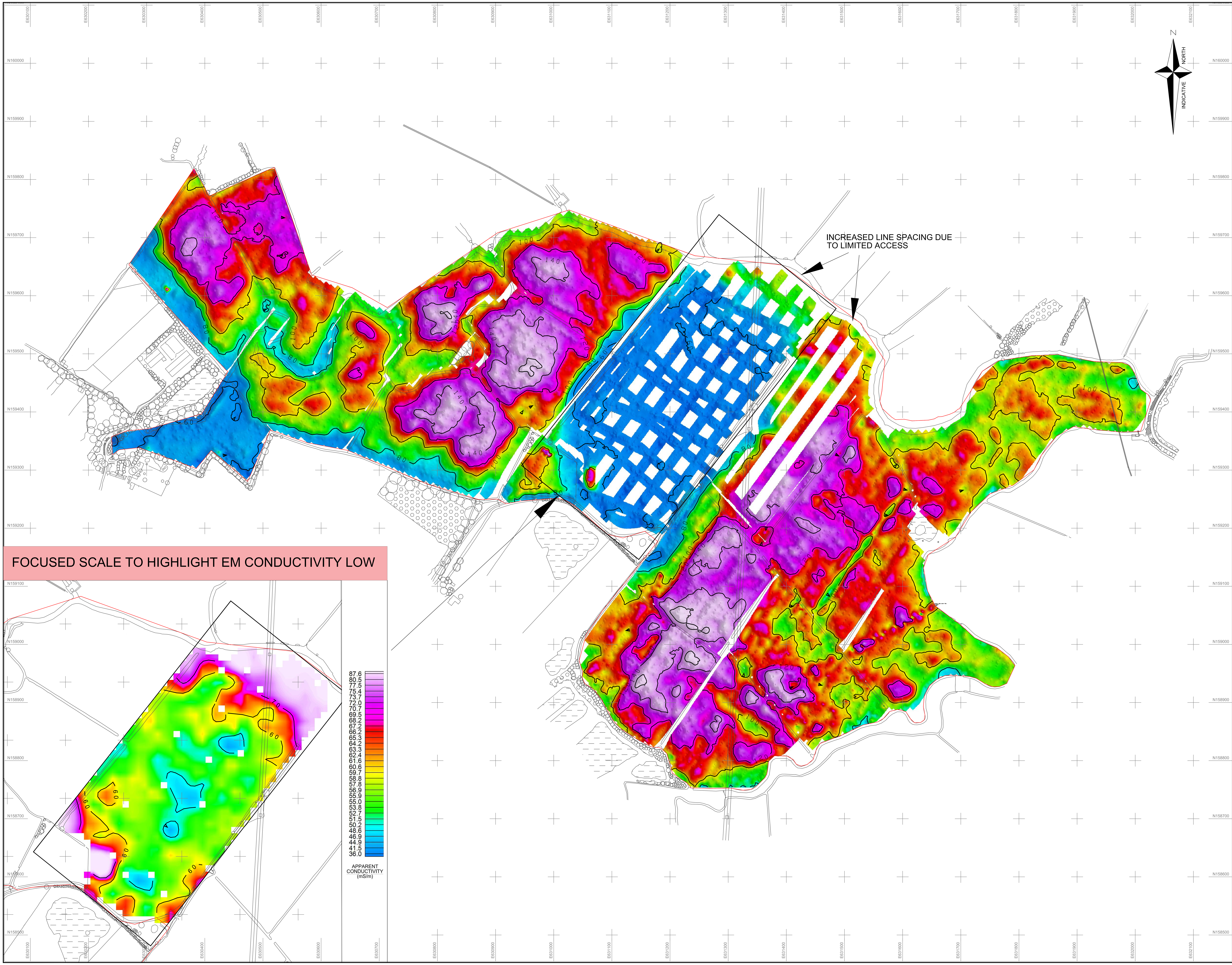

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KEY

APPROXIMATE BOUNDARY OF SITE

SCALE

154.6, 144.6, 139.2, 134.8, 130.9, 127.5, 124.4, 121.6, 119.0, 116.6, 114.6, 112.8, 110.9, 109.1, 107.4, 105.8, 104.1, 102.3, 100.7, 99.0, 97.1, 95.2, 93.2, 90.7, 87.5, 83.0, 76.1, 68.2, 62.9, 59.0, 55.8, 52.2

Higher conductivity values indicative of more cohesive or saturated materials - proable tidal channel deposits

APPARENT CONDUCTIVITY (mS/m)

Lower conductivity values indicative of more granular or less saturated materials (probable Thanet Formation)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client: STATKRAFT UK LTD

Project Title: LITTLE SOUTH SOLAR FARM

Drawing Title: RESULTS OF THE CMD SURVEY - CONDUCTIVITY COIL2 (4.2m EFFECTIVE DEPTH)

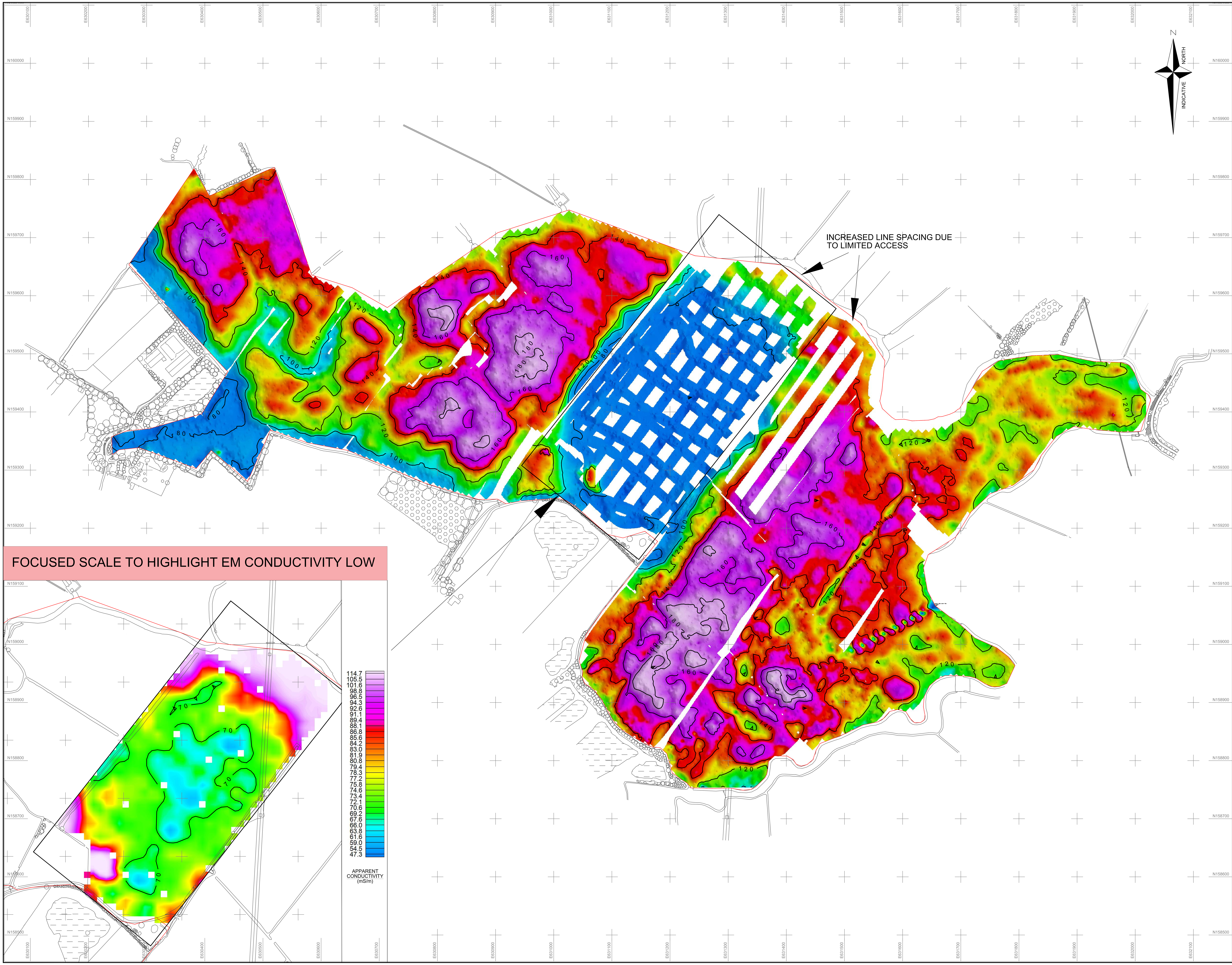
Drawn	Date	Checked	Date	Approved	Date
JM	10/07/24	MJS	11/07/24	MJS	30/07/24

Scale: 1:2000 | Orig Size: A0 | Dimensions:

Project No.: 2192489 | Drawing File: 2192489 Figure 6B

Drawing No.: 2192489-Figure 6B Sheet 1 of 1 | Rev.:

Scale: 0 40 80 120 160 200m



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KEY

APPROXIMATE BOUNDARY OF SITE

SCALE

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180.9
173.1
167.6
163.1
158.6
155.3
152.2
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93.2
87.9
79.1
64.7

Higher conductivity values indicative of more cohesive or saturated materials - proable tidal channel deposits

APPARENT CONDUCTIVITY (mS/m)

Lower conductivity values indicative of more granular or less saturated materials (probable Thanet Formation)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client
STATKRAFT UK LTD

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
RESULTS OF THE CMD SURVEY - CONDUCTIVITY COIL3 (6.7m EFFECTIVE DEPTH)

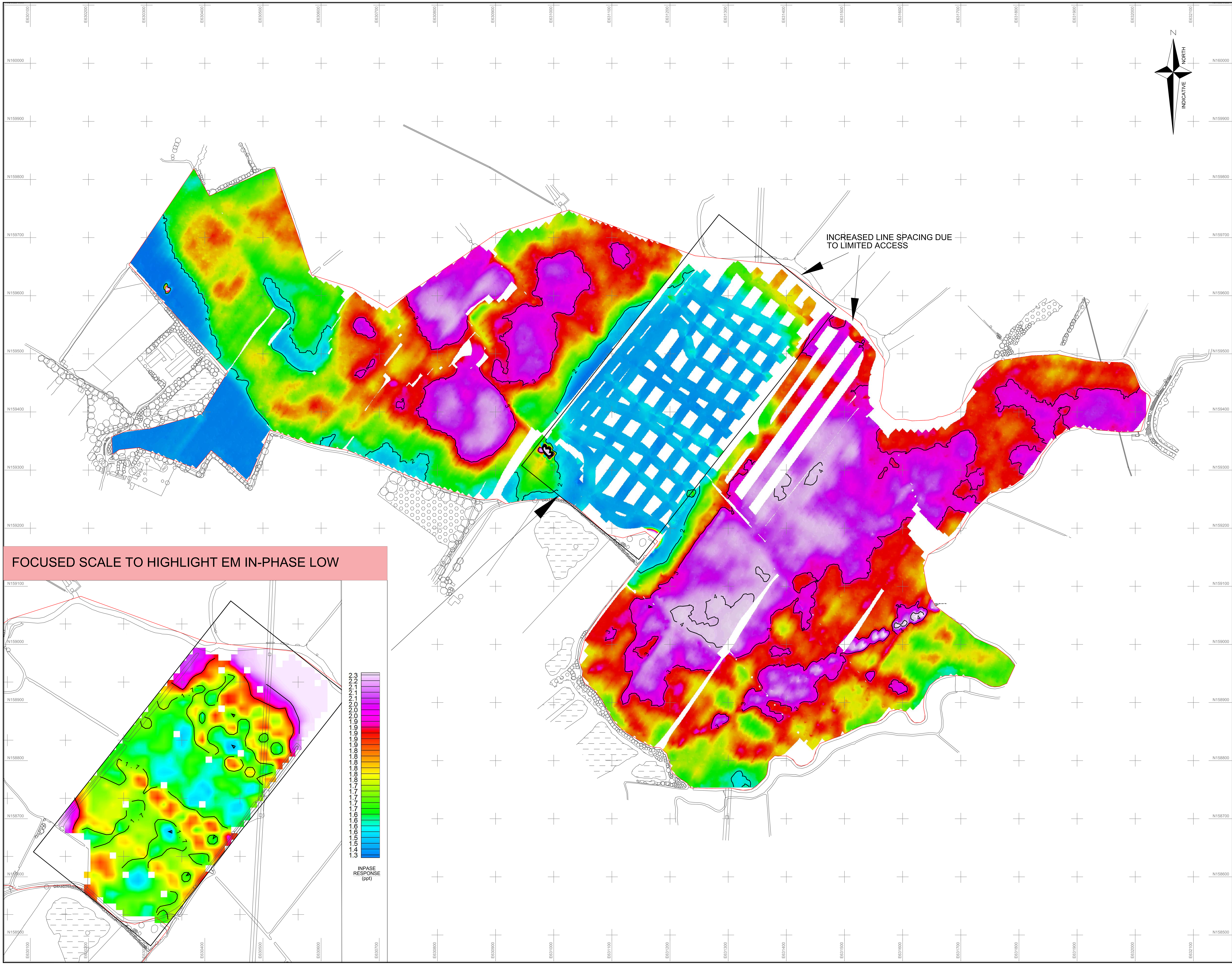
Drawn	Date	Checked	Date	Approved	Date
JM	10/07/24	MJS	11/07/24	MJS	30/07/24

Scale: 1:2000
Orig Size: A0
Dimensions:

Project No.: 2192489
Drawing File: 2192489 Figure 6C

Drawing No.: 2192489-Figure 6C Sheet 1 of 1
Rev.:

Scale
0 40 80 120 160 200m



NOTES

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(4) Although every reasonable effort has been made to locate buried obstructions using electromagnetic conductivity techniques, RSK Environment Ltd cannot guarantee that every obstruction has been located.

KEY

APPROXIMATE BOUNDARY OF SITE

SCALE

4.1 3.7 3.5 3.4 3.3 3.2 3.2 3.1 3.0 3.0 2.9 2.8 2.8 2.7 2.7 2.6 2.6 2.5 2.5 2.4 2.4 2.3 2.3 2.2 2.1 2.1 2.0 1.9 1.8 1.7 1.5 1.2

Higher conductivity values indicative of more cohesive or saturated materials - proable tidal channel deposits

INPASE RESPONSE (ppt)

Lower conductivity values indicative of more granular or less saturated materials (probable Thanet Formation)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client
STATKRAFT UK LTD

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
RESULTS OF THE CMD SURVEY - INPHASE COIL1 (2.3m EFFECTIVE DEPTH)

Drawn	Date	Checked	Date	Approved	Date
JM	10/07/24	MJS	11/07/24	MJS	30/07/24

Scale	Orig Size	Dimensions
1:2000	A0	

Project No.	Drawing File
2192489	2192489 Figure 7A

Drawing No.	Rev.
2192489-Figure 7A Sheet 1 of 1	

Scale
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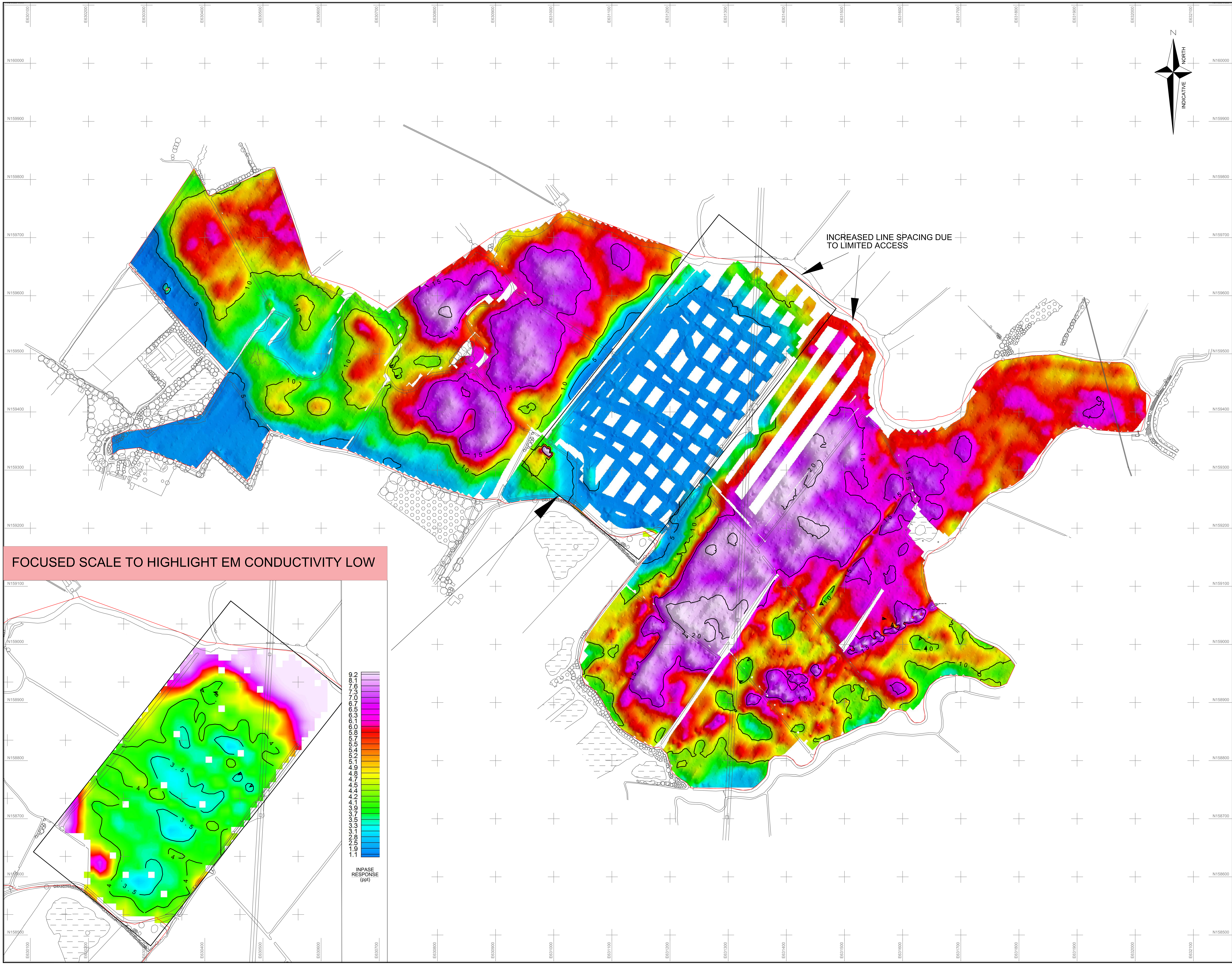

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KEY

APPROXIMATE BOUNDARY OF SITE

SCALE

182.5, 157.9, 147.5, 140.1, 134.1, 128.2, 123.7, 119.6, 115.1, 111.6, 108.2, 104.9, 101.2, 98.1, 95.0, 92.0, 88.5, 85.5, 82.4, 78.8, 75.6, 72.4, 69.0, 64.9, 61.1, 57.0, 52.6, 46.8, 41.0, 33.9, 22.1, 2.9

Higher conductivity values indicative of more cohesive or saturated materials - proable tidal channel deposits

INPASE RESPONSE (ppt)

Lower conductivity values indicative of more granular or less saturated materials (probable Thanet Formation)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Web: www.RSKGroup.co.uk
www.RSKGeophysics.co.uk

Client

STATKRAFT UK LTD

Project Title

LITTLE SOUTH SOLAR FARM

Drawing Title

RESULTS OF THE CMD SURVEY - INPHASE COIL2 (4.2m EFFECTIVE DEPTH)

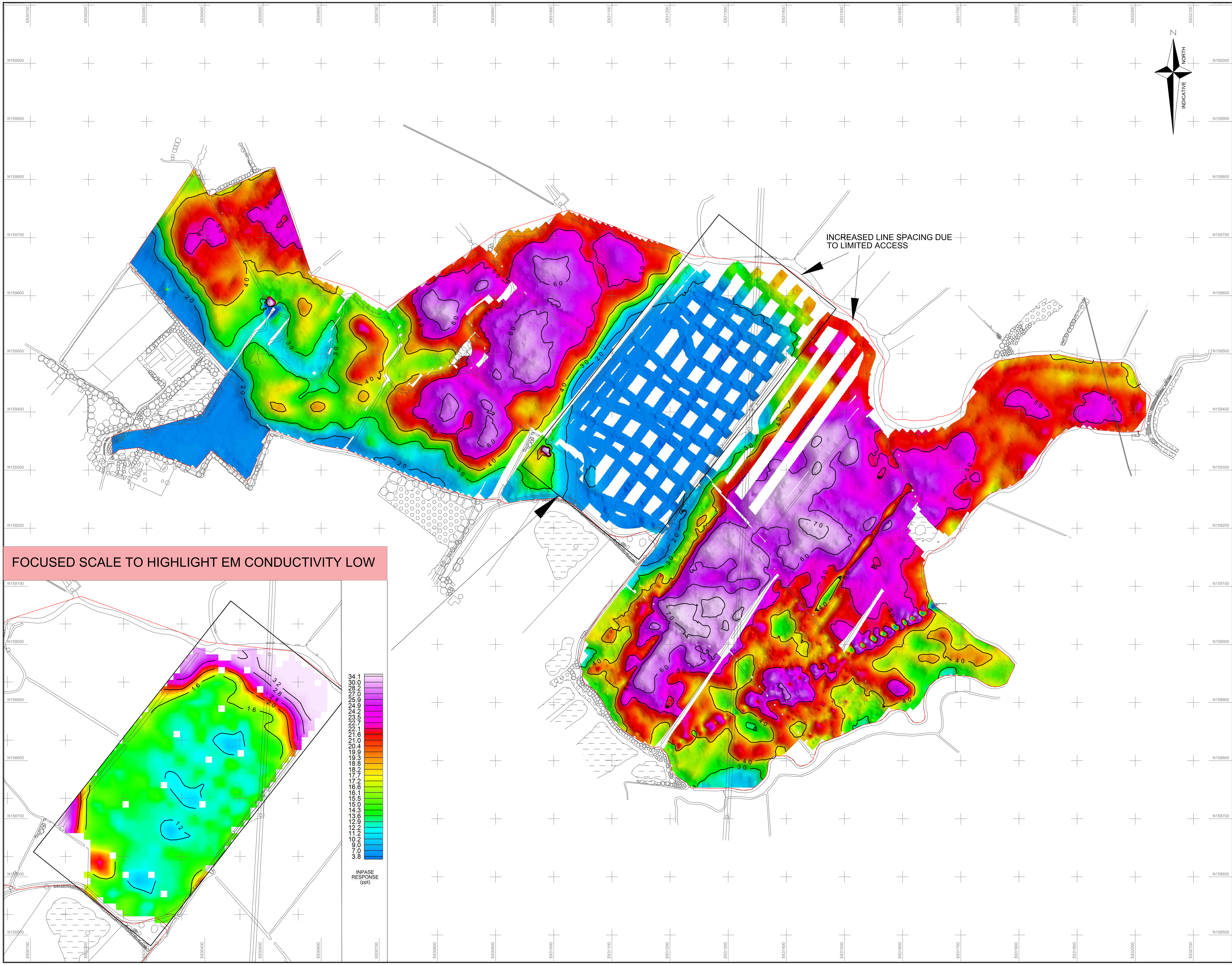
Drawn	Date	Checked	Date	Approved	Date
JM	10/07/24	MJS	11/07/24	MJS	30/07/24

Scale: 1:2000
Orig Size: A0
Dimensions

Project No.: 2192489
Drawing File: 2192489 Figure 6B

Drawing No.: 2192489-Figure 7B Sheet 1 of 1
Rev.

Scale 0 40 80 120 160 200m



NOTES

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Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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www.RSKGeophysics.co.uk

Client
STATKRAFT UK LTD

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
RESULTS OF THE CMD SURVEY - INPHASE COIL3 (6.7m EFFECTIVE DEPTH)

Drawn	Date	Checked	Date	Approved	Date
JM	10/07/24	MJS	11/07/24	MJS	30/07/24

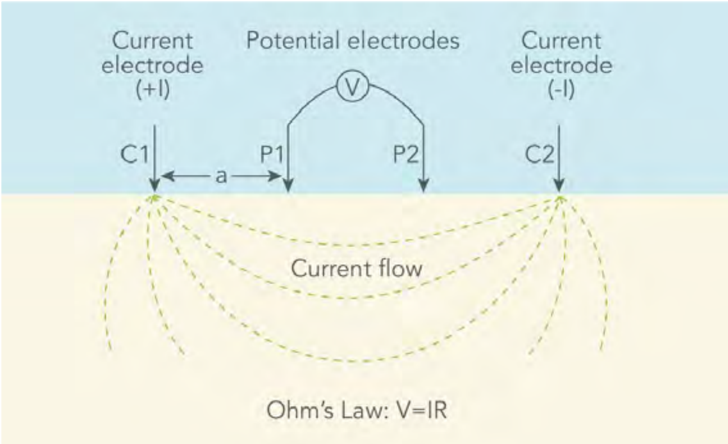
Scale: 1:2000
Orig Size: A0
Dimensions

Project No.: 2192489
Drawing File: 2192489 Figure 7C

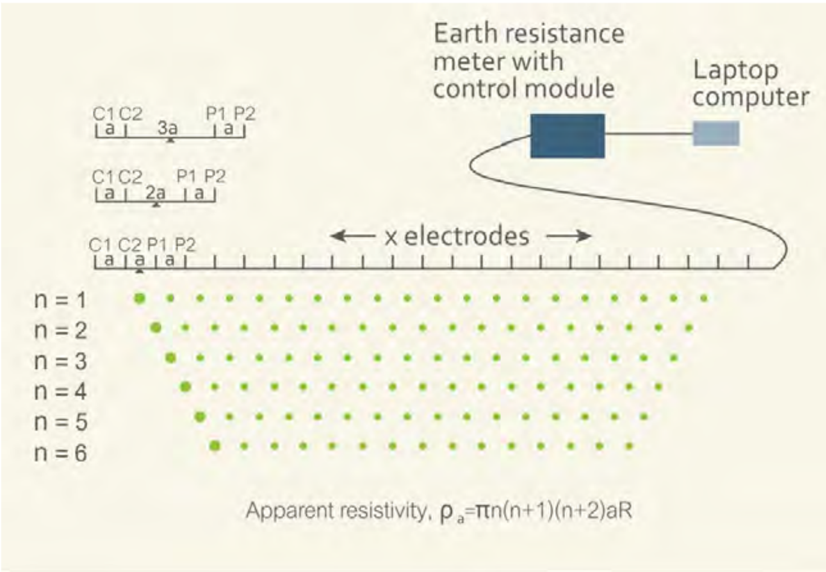
Drawing No.: 2192489-Figure 7C Sheet 1 of 1
Rev.

Scale 0 40 80 120 160 200m

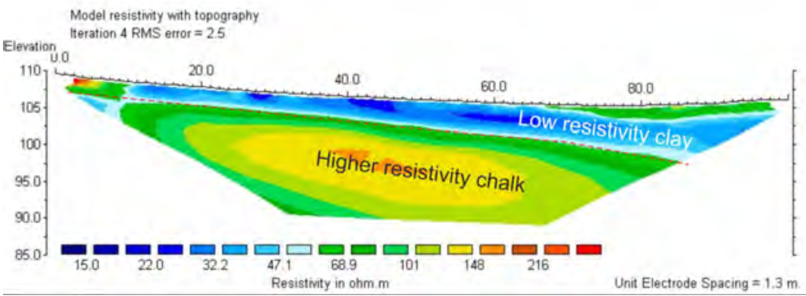
A Obtaining a measurement of ground resistance



B An imaging survey setup
(dipole-dipole array configuration)



C A fully processed electrical resistivity pseudosection
(typical example of clay over chalk strata)



RSK GEOSCIENCES GEOPHYSICS
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Tel: +44 1442 437500
Twitter: follow @RSK_Geophysics
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Web: www.RSKgroup.com
www.RSKgeophysics.com

Client
STATKRAFT

Project Title
LITTLE SOUTH SOLAR

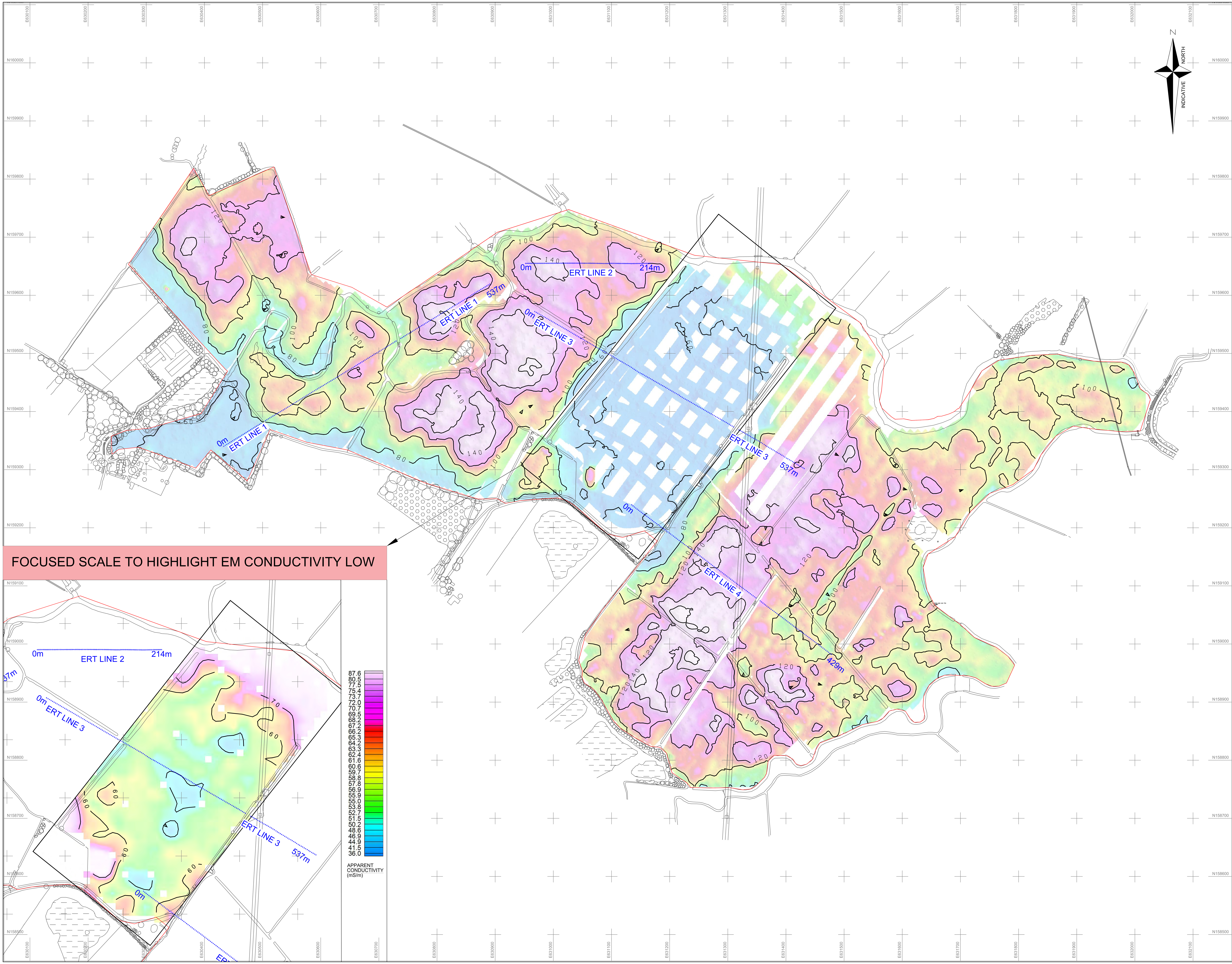
Drawing Title
THE ELECTRICAL RESISTIVITY IMAGING TECHNIQUE
DIPOLE-DIPOLE

Drawn	Date	Checked	Date	Approved	Date
LD	26/07/24	MJS	30/07/24	MJS	30/07/24

Scale	Orig Size	Dimensions
As shown	A4	

Project No.	Drawing File
2192489	2192489 Fig. 8

Drawing No.	Rev.
2192489 Fig.8 Sheet 1 of 1	



NOTES

The specific risks associated with the content of this drawing are considered to be:-

(1) The topographical baseplan has been supplied by the client and has not been checked for accuracy.

(2) ERT electrode locations located with high precision dGPS

KEY

APPROXIMATE BOUNDARY OF SITE

LINE 1 — ELECTRICAL RESISTIVITY TOMOGRAPHY SURVEY LINE, LENGTH OF LINE AND ELECTRODE LOCATION

SCALE (EM DATA IN BACKGROUND FOR REFERENCE)

154.6, 144.6, 139.2, 134.8, 130.9, 127.5, 124.4, 121.6, 119.0, 116.6, 114.6, 112.8, 110.9, 109.1, 107.4, 105.8, 104.1, 102.3, 100.7, 99.0, 97.1, 95.2, 93.2, 90.7, 87.5, 83.0, 76.1, 68.2, 62.9, 59.0, 55.8, 52.2

Higher conductivity values indicative of more cohesive or saturated materials - possible channel deposits

APPARENT CONDUCTIVITY (mS/m)

Lower conductivity values indicative of more granular or less saturated materials

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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www.RSKGeophysics.co.uk

Client
STATKRAFT UK LTD

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
ERT SURVEY LAYOUT

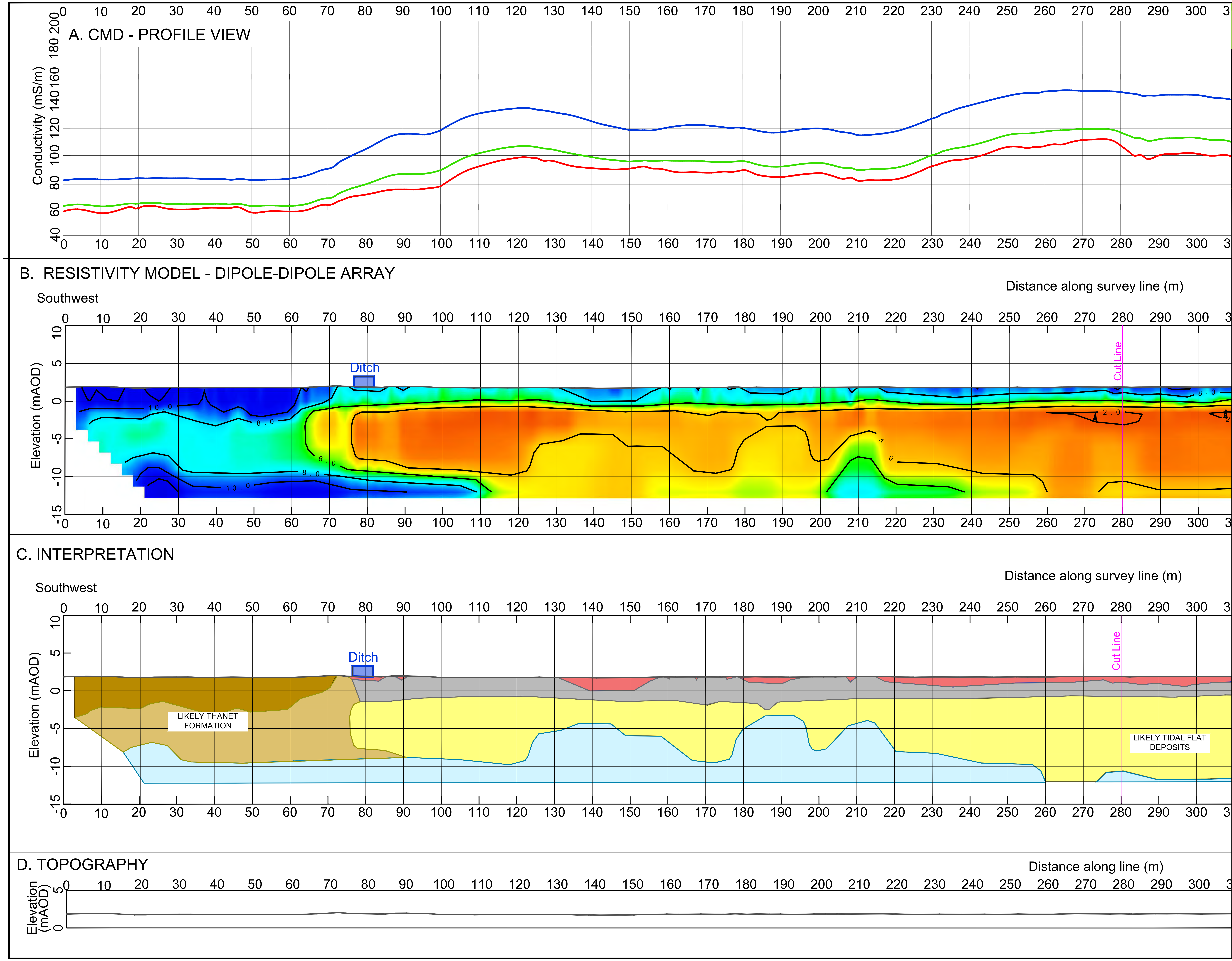
Drawn	Date	Checked	Date	Approved	Date
JM	26/07/24	MJS	30/07/24	MJS	30/07/24

Scale	Orig Size	Dimensions
1:2000	A0	

Project No.	Drawing File
2192489	2192489 Figure 9

Drawing No.	Rev.
2192489-Figure 9 Sheet 1 of 1	

Scale
0 40 80 120 160 200m

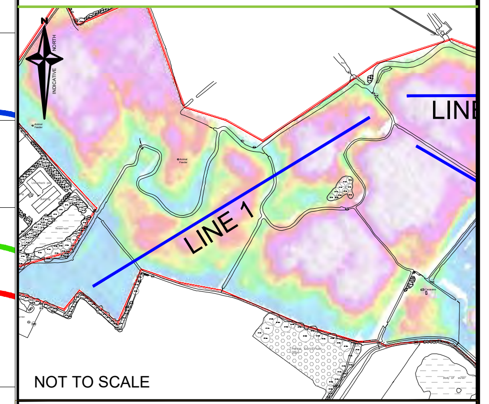


NOTES

The specific risks associated with the content of this drawing are considered to be:-

(1) Data gridded in Oasis Montaj.

ERT LINE 1 LOCATION



PANEL A
(CONDUCTIVITY PROFILES)

- Coil 3 (6.7 m effective depth)
- Coil 2 (4.2 m effective depth)
- Coil 1 (2.3 m effective depth)

PANEL B
RESISTIVITY SCALE

Higher resistivity values indicate presence of more granular or less saturated deposits (Thanet bedrock and unsaturated tidal flat deposits)

Apparent Resistivity (Ohm/m)

Lower resistivity values indicate presence of more cohesive or more saturated deposits (tidal flat deposits below groundwater table)

LOCATION OF A DITCHCOURSE CROSSING

PANEL C - INTERPRETATION

- HIGHER RESISTIVITY SHALLOW SOILS OVER PROBABLE GRANULAR, UNSATURATED BEDROCK (THANET FORMATION / SANDS)
- MODERATE RESISTIVITY - POSSIBLE SATURATED BEDROCK (THANET FORMATION / SANDS)
- INCREASED RESISTIVITY AT DEPTH - PROBABLE CHANGE IN GEOLOGY
- CHANNEL FILL DEPOSITS - HIGHER RESISTIVITY SOILS / UNSATURATED / GRANULAR DEPOSITS
- CHANNEL FILL DEPOSITS - MODERATE RESISTIVITY - POSSIBLE COHESIVE SILTS / LESS SATURATED
- CHANNEL FILL DEPOSITS - LOWER RESISTIVITY - MORE SATURATED

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www.RSKGeophysics.co.uk

Client: STATKRAFT

Project Title: LITTLE SOUTH SOLAR FARM

Drawing Title: RESULTS OF THE ERT SURVEY ERT LINE 1

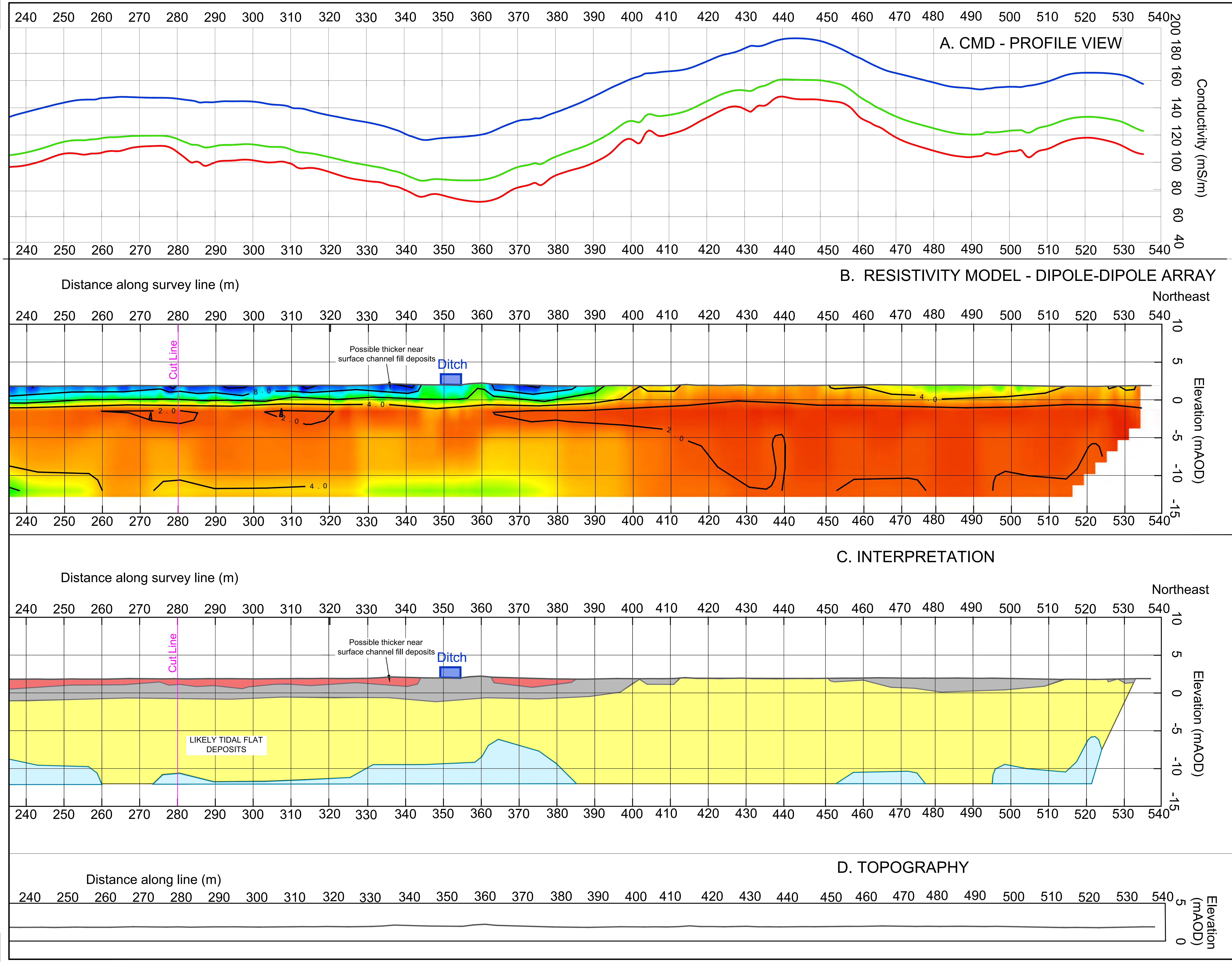
Drawn	Date	Checked	Date	Approved	Date
JM	25/07/24	MJS	30/07/24	MJS	30/07/24

Scale: 1:625 | Orig Size: A2 | Dimensions:

Project No.: 2192489 | Drawing File: 2192489-Figure.10A

Drawing No.: 2192489-Figure.10A Sheet 1 of 2 | Rev.:

Scale
0 6 12 18 24 30m



NOTES

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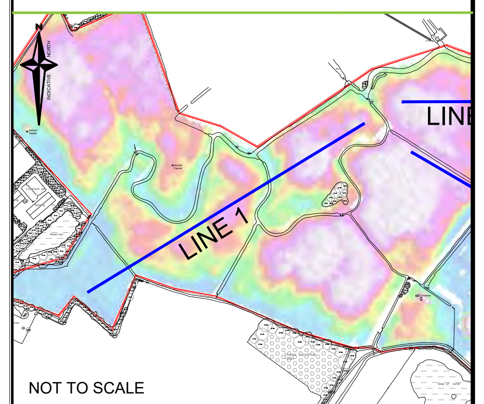
ERT LINE 1 LOCATION



PANEL A
(CONDUCTIVITY PROFILES)

- Coil 3 (6.7 m effective depth)
- Coil 2 (4.2 m effective depth)
- Coil 1 (2.3 m effective depth)

PANEL B
RESISTIVITY SCALE

Higher resistivity values indicate presence of more granular or less saturated deposits (Thanet bedrock and unsaturated tidal flat deposits)

Apparent Resistivity (Ohm/m)

Lower resistivity values indicate presence of more cohesive or more saturated deposits (tidal flat deposits below groundwater table)

LOCATION OF A DITCHCOURSE CROSSING

PANEL C - INTERPRETATION

- HIGHER RESISTIVITY SHALLOW SOILS OVER PROBABLE GRANULAR, UNSATURATED BEDROCK (THANET FORMATION / SANDS)
- MODERATE RESISTIVITY - POSSIBLE SATURATED BEDROCK (THANET FORMATION / SANDS)
- INCREASED RESISTIVITY AT DEPTH - PROBABLE CHANGE IN GEOLOGY
- CHANNEL FILL DEPOSITS - HIGHER RESISTIVITY SOILS / UN-SATURATED / GRANULAR DEPOSITS
- CHANNEL FILL DEPOSITS - MODERATE RESISTIVITY - POSSIBLE COHESIVE SILTS / LESS SATURATED
- CHANNEL FILL DEPOSITS - LOWER RESISTIVITY - MORE SATURATED

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Web: www.RSKGroup.co.uk
www.RSKGeophysics.co.uk

Client: STATKRAFT

Project Title: LITTLE SOUTH SOLAR FARM

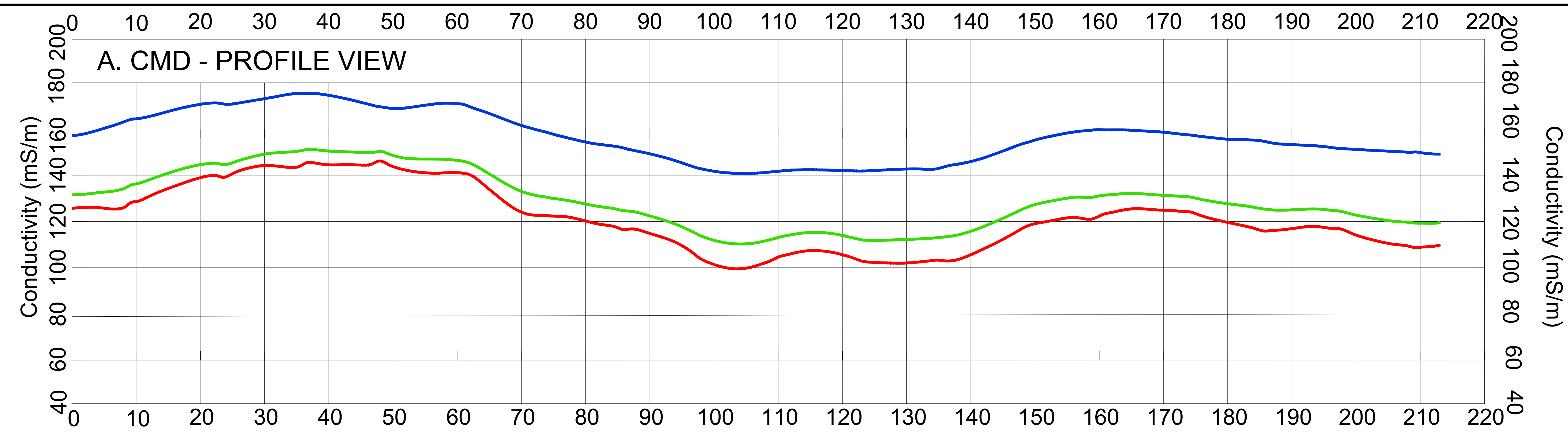
Drawing Title: RESULTS OF THE ERT SURVEY ERT LINE 1

Drawn	Date	Checked	Date	Approved	Date
JM	25/07/24	MJS	30/07/24	MJS	30/07/24

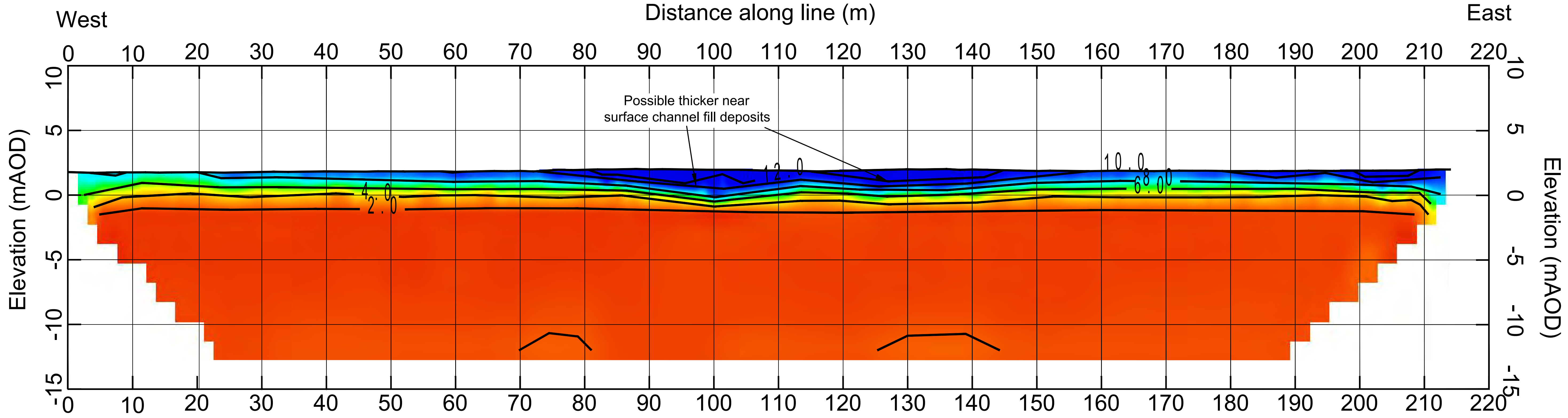
Scale	Orig Size	Dimensions
1:625	A2	

Project No.: 2192489
Drawing File: 2192489-Figure.10A
Drawing No.: 2192489-Figure.10A Sheet 2 of 2
Rev.:

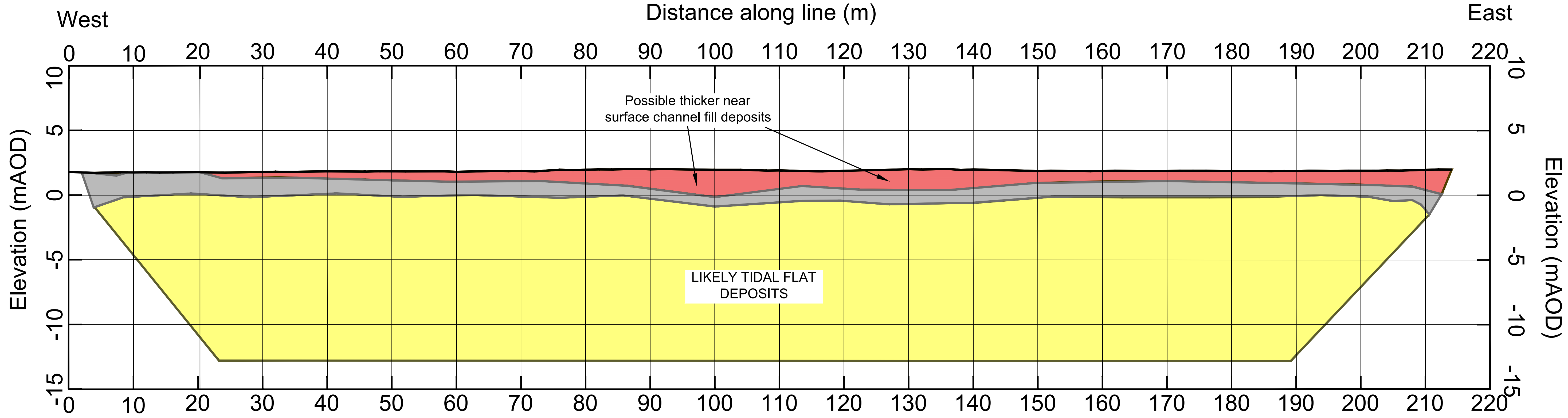
Scale 0 6 12 18 24 30m



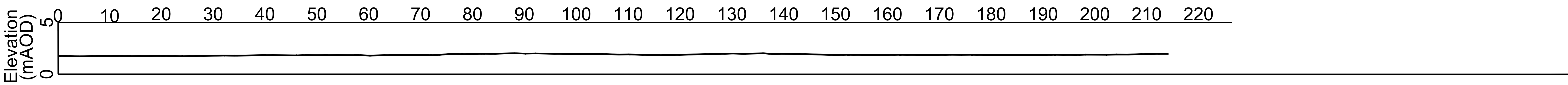
B. RESISTIVITY MODEL - DIPOLE-DIPOLE ARRAY



C. INTERPRETATION



D. TOPOGRAPHY

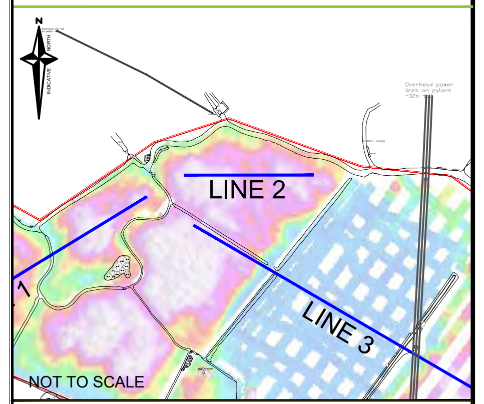


NOTES

The specific risks associated with the content of this drawing are considered to be:-

(1) Data gridded in Oasis Montaj.

ERT LINE 2 LOCATION



PANEL A
(CONDUCTIVITY PROFILES)

- Coil 3 (6.7 m effective depth)
- Coil 2 (4.2 m effective depth)
- Coil 1 (2.3 m effective depth)

PANEL B
RESISTIVITY SCALE

Higher resistivity values indicate presence of more granular or less saturated deposits (Thanet bedrock and unsaturated tidal flat deposits)

Apparent Resistivity (Ohm/m)

Lower resistivity values indicate presence of more cohesive or more saturated deposits (tidal flat deposits below groundwater table)

12.7, 9.9, 8.9, 8.3, 7.8, 7.4, 7.0, 6.7, 6.4, 6.1, 5.8, 5.5, 5.2, 5.0, 4.7, 4.5, 4.2, 3.9, 3.7, 3.4, 3.1, 2.8, 2.4, 2.1, 1.6, 1.1, 0.5

LOCATION OF A DITCHCOURSE CROSSING

PANEL C - INTERPRETATION

- HIGHER RESISTIVITY SHALLOW SOILS OVER PROBABLE GRANULAR, UNSATURATED BEDROCK (THANET FORMATION / SANDS)
- MODERATE RESISTIVITY - POSSIBLE SATURATED BEDROCK (THANET FORMATION / SANDS)
- INCREASED RESISTIVITY AT DEPTH - PROBABLE CHANGE IN GEOLOGY
- CHANNEL FILL DEPOSITS - HIGHER RESISTIVITY SOILS / UN-SATURATED / GRANULAR DEPOSITS
- CHANNEL FILL DEPOSITS - MODERATE RESISTIVITY - POSSIBLE COHESIVE SILTS / LESS SATURATED
- CHANNEL FILL DEPOSITS - LOWER RESISTIVITY - MORE SATURATED

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Client
STATKRAFT

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
RESULTS OF THE ERT SURVEY ERT LINE 2

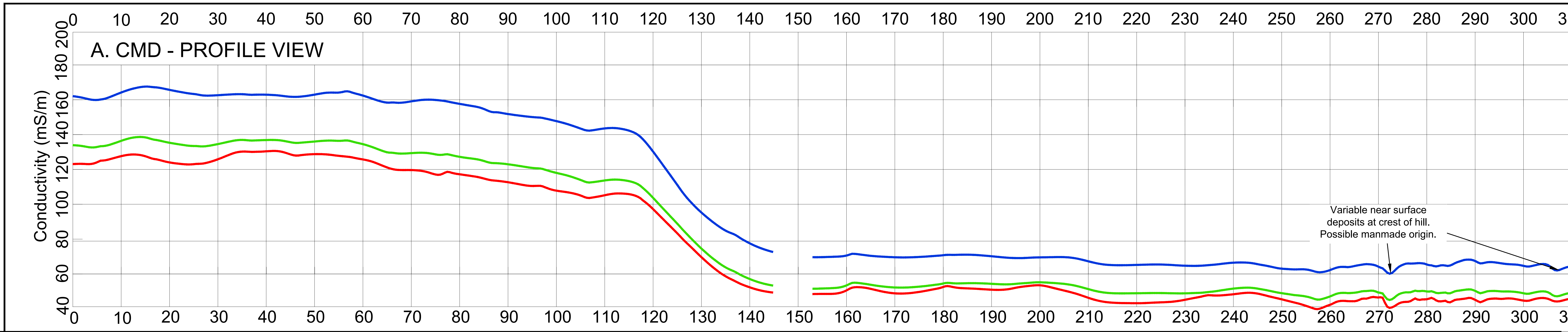
Drawn	Date	Checked	Date	Approved	Date
JM	25/07/24	MJS	30/07/24	MJS	30/07/24

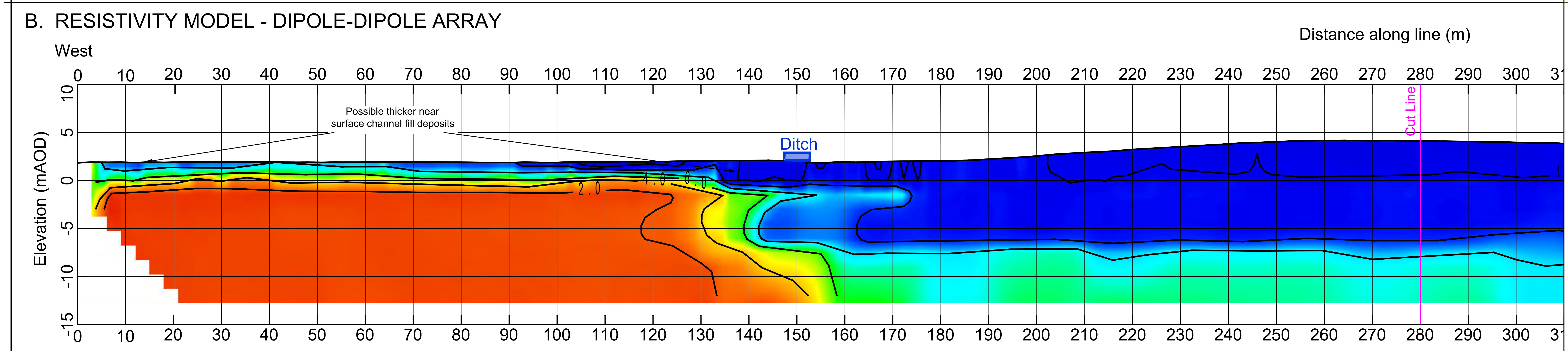
Scale	Orig Size	Dimensions
1:625	A2	

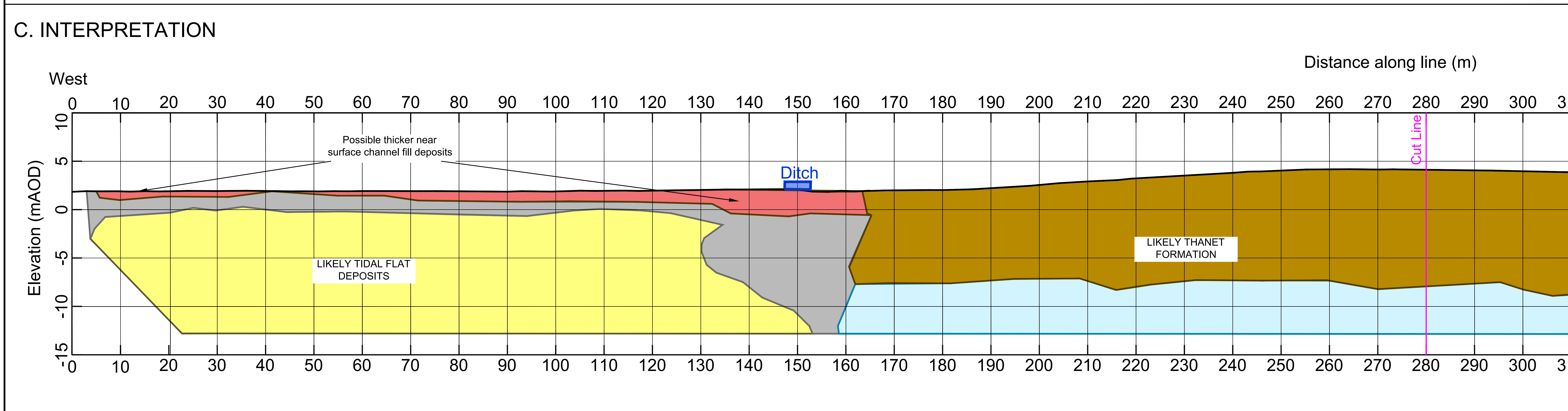
Project No.	Drawing File
2192489	2192489-Figure.10B

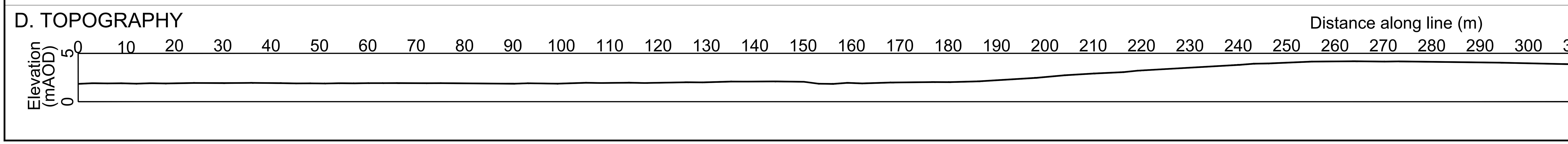
Drawing No.	Rev.
2192489-Figure.10B Sheet 1 of 1	

Scale
0 6 12 18 24 30m





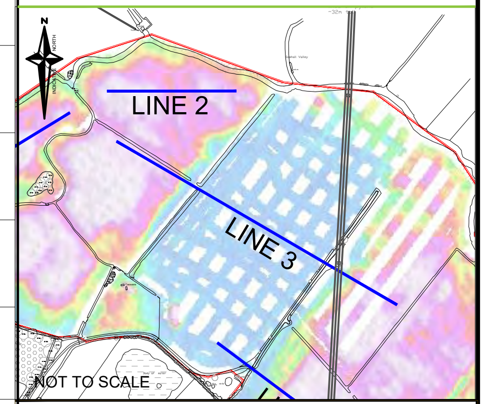




NOTES

(1) Data gridded in Oasis Montaj.

ERT LINE 3 LOCATION



PANEL A
(CONDUCTIVITY PROFILES)

- Coil 3 (6.7 m effective depth)
- Coil 2 (4.2 m effective depth)
- Coil 1 (2.3 m effective depth)

PANEL B
RESISTIVITY SCALE

Higher resistivity values indicate presence of more granular or less saturated deposits (Thanet bedrock and unsaturated tidal flat deposits)

Apparent Resistivity (Ohm/m)

Lower resistivity values indicate presence of more cohesive or more saturated deposits (tidal flat deposits below groundwater table)

LOCATION OF A DITCHCOURSE CROSSING

PANEL C - INTERPRETATION

- HIGHER RESISTIVITY SHALLOW SOILS OVER PROBABLE GRANULAR, UNSATURATED BEDROCK (THANET FORMATION / SANDS)
- MODERATE RESISTIVITY - POSSIBLE SATURATED BEDROCK (THANET FORMATION / SANDS)
- INCREASED RESISTIVITY AT DEPTH - PROBABLE CHANGE IN GEOLOGY
- CHANNEL FILL DEPOSITS - HIGHER RESISTIVITY SOILS / UN-SATURATED / GRANULAR DEPOSITS
- CHANNEL FILL DEPOSITS - MODERATE RESISTIVITY - POSSIBLE COHESIVE SILTS / LESS SATURATED
- CHANNEL FILL DEPOSITS - LOWER RESISTIVITY - MORE SATURATED

RSK GEOSCIENCES
GEOPHYSICS

Client
STATKRAFT

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
RESULTS OF THE ERT SURVEY
ERT LINE 3

Drawn	Date	Checked	Date	Approved	Date
JM	25/07/24	MJS	30/07/24	MJS	30/07/24

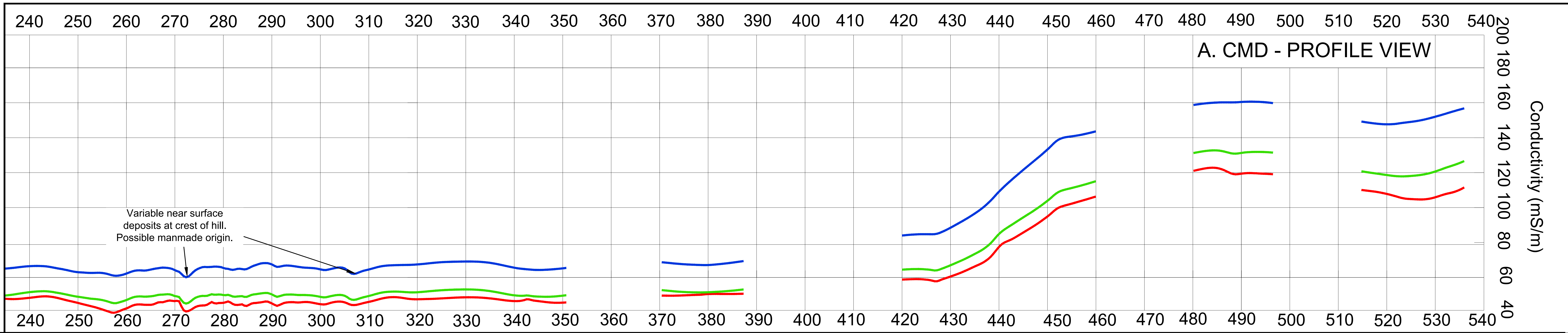
Scale	Orig Size	Dimensions
1:625	A2	

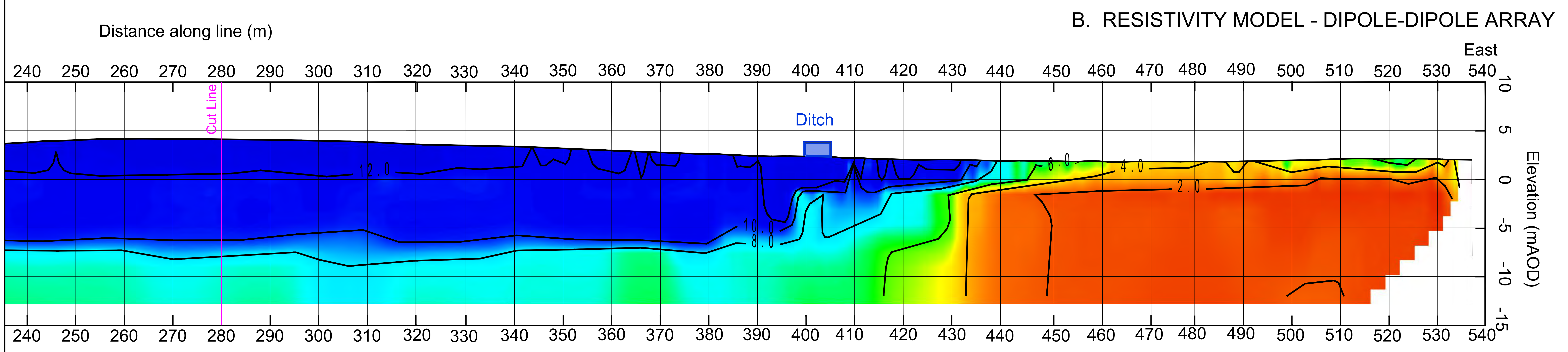
Project No.	Drawing File
2192489	2192489-Figure.10C

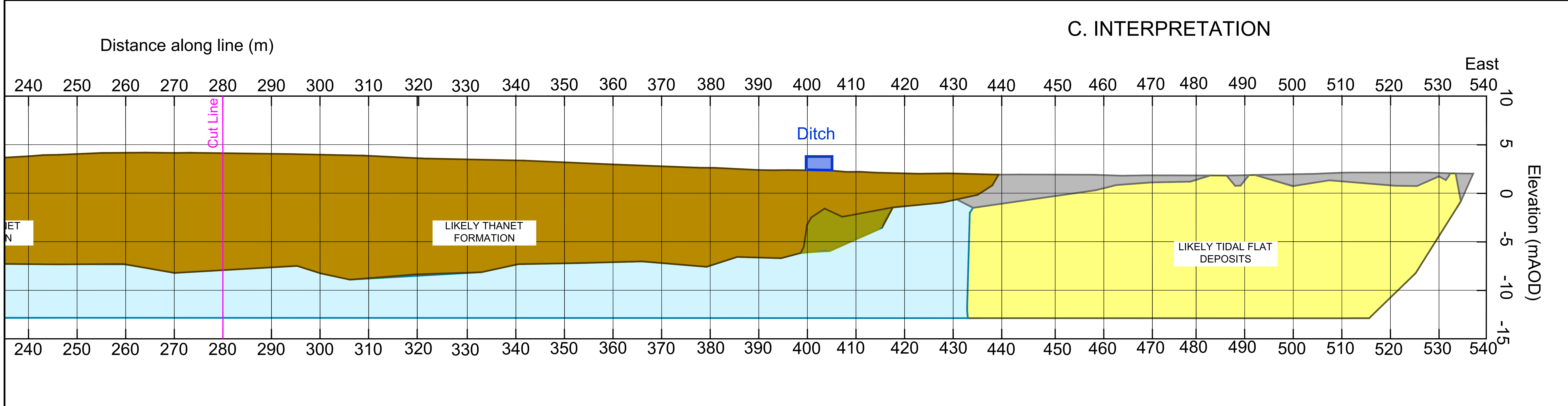
Drawing No.
2192489-Figure.10C Sheet 1 of 2

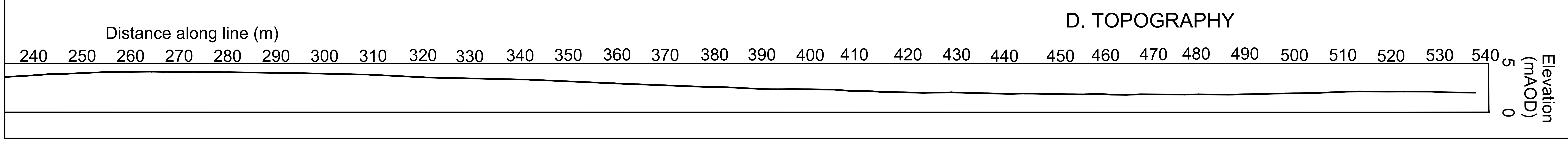
Rev.

Scale
0 6 12 18 24 30m







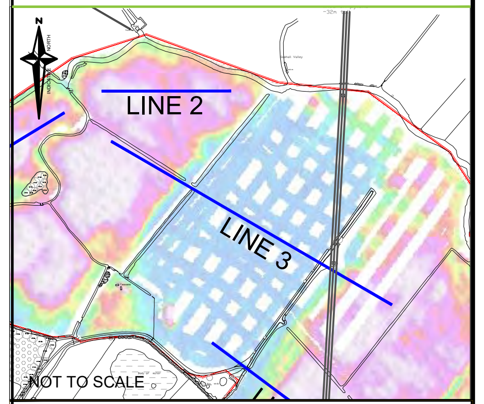


NOTES

The specific risks associated with the content of this drawing are considered to be:-

(1) Data gridded in Oasis Montaj.

ERT LINE 3 LOCATION



PANEL A
(CONDUCTIVITY PROFILES)

Coil 3 (6.7 m effective depth)
Coil 2 (4.2 m effective depth)
Coil 1 (2.3 m effective depth)

PANEL B
RESISTIVITY SCALE

Higher resistivity values indicate presence of more granular or less saturated deposits (Thanet bedrock and unsaturated tidal flat deposits)

Apparent Resistivity (Ohm/m)

Lower resistivity values indicate presence of more cohesive or more saturated deposits (tidal flat deposits below groundwater table)

LOCATION OF A DITCHCOURSE CROSSING

PANEL C - INTERPRETATION

HIGHER RESISTIVITY SHALLOW SOILS OVER PROBABLE GRANULAR, UNSATURATED BEDROCK (THANET FORMATION / SANDS)

MODERATE RESISTIVITY - POSSIBLE SATURATED BEDROCK (THANET FORMATION / SANDS)

INCREASED RESISTIVITY AT DEPTH - PROBABLE CHANGE IN GEOLOGY

CHANNEL FILL DEPOSITS - HIGHER RESISTIVITY SOILS / UN-SATURATED / GRANULAR DEPOSITS

CHANNEL FILL DEPOSITS - MODERATE RESISTIVITY - POSSIBLE COHESIVE SILTS / LESS SATURATED

CHANNEL FILL DEPOSITS - LOWER RESISTIVITY - MORE SATURATED

RSK GEOSCIENCES GEOPHYSICS

Client
STATKRAFT

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
RESULTS OF THE ERT SURVEY ERT LINE 3

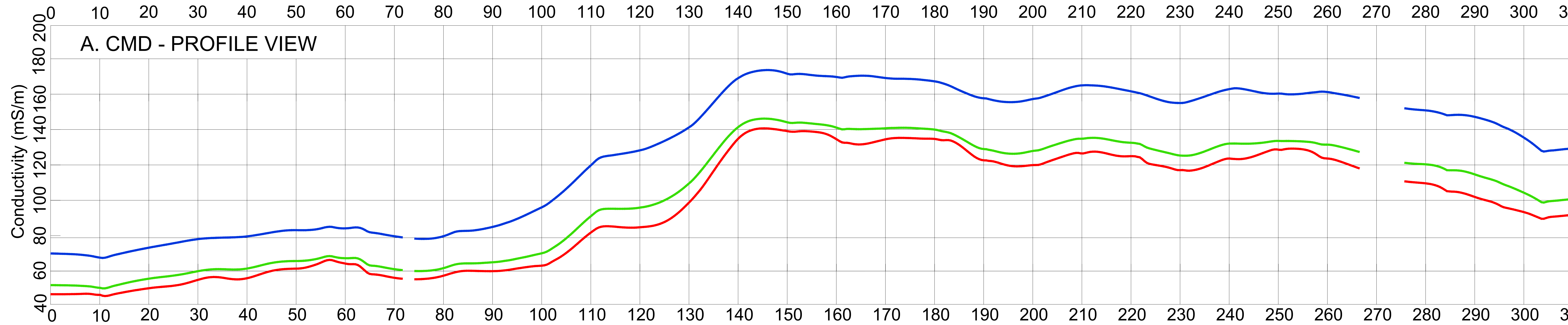
Drawn	Date	Checked	Date	Approved	Date
JM	25/07/24	MJS	30/07/24	MJS	30/07/24

Scale	Orig Size	Dimensions
1:625	A2	

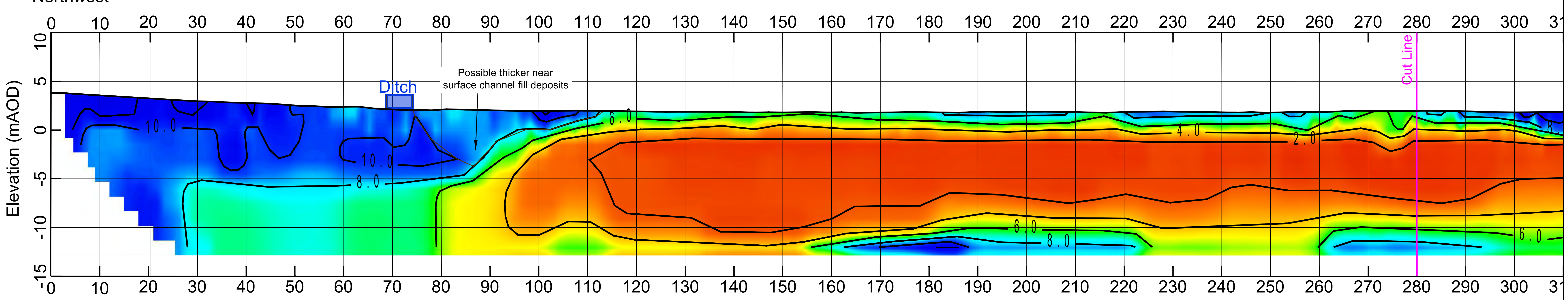
Project No. 2192489
Drawing File 2192489-Figure.10C
Drawing No. 2192489-Figure.10C Sheet 2 of 2
Rev.

Scale
0 6 12 18 24 30m

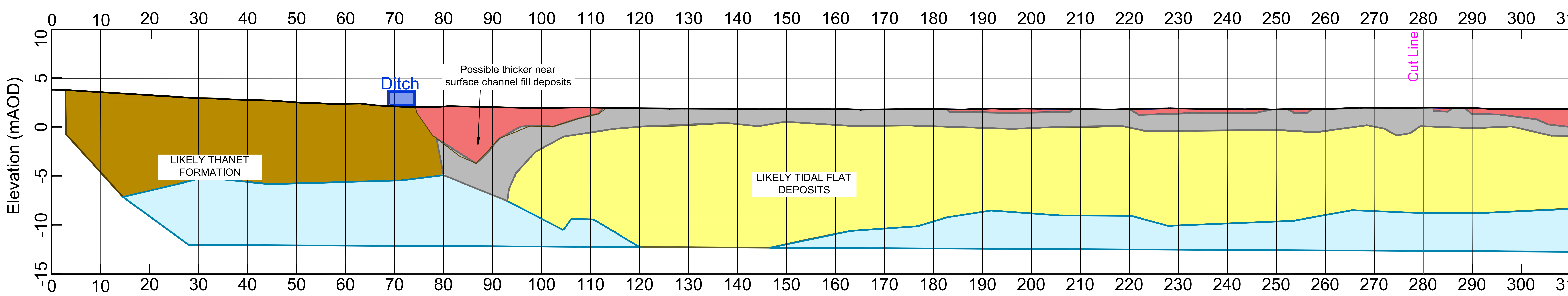
A. CMD - PROFILE VIEW



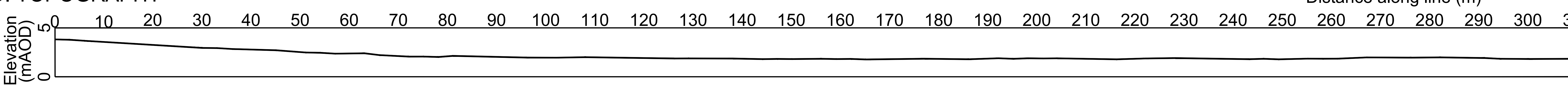
B. RESISTIVITY MODEL - DIPOLE-DIPOLE ARRAY



C. INTERPRETATION



D. TOPOGRAPHY

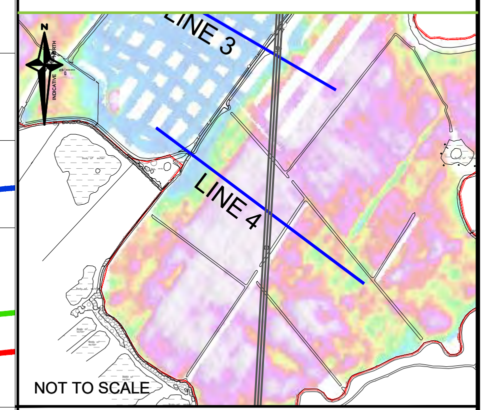


NOTES

The specific risks associated with the content of this drawing are considered to be:-

(1) Data gridded in Oasis Montaj.

ERT LINE 3 LOCATION



PANEL A
(CONDUCTIVITY PROFILES)

- Coil 3 (6.7 m effective depth)
- Coil 2 (4.2 m effective depth)
- Coil 1 (2.3 m effective depth)

PANEL B
RESISTIVITY SCALE

Apparent Resistivity (Ohm/m)

12.7, 9.9, 8.9, 8.3, 7.8, 7.4, 7.0, 6.7, 6.4, 6.1, 5.8, 5.5, 5.2, 5.0, 4.7, 4.5, 4.2, 3.9, 3.7, 3.4, 3.1, 2.8, 2.4, 2.1, 1.6, 1.1, 0.5

Higher resistivity values indicate presence of more granular or less saturated deposits (Thanet bedrock and unsaturated tidal flat deposits)

Lower resistivity values indicate presence of more cohesive or more saturated deposits (tidal flat deposits below groundwater table)

LOCATION OF A DITCHCOURSE CROSSING

PANEL C - INTERPRETATION

- HIGHER RESISTIVITY SHALLOW SOILS OVER PROBABLE GRANULAR, UNSATURATED BEDROCK (THANET FORMATION / SANDS)
- MODERATE RESISTIVITY - POSSIBLE SATURATED BEDROCK (THANET FORMATION / SANDS)
- INCREASED RESISTIVITY AT DEPTH - PROBABLE CHANGE IN GEOLOGY
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- CHANNEL FILL DEPOSITS - LOWER RESISTIVITY - MORE SATURATED

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Web: www.RSKGroup.co.uk
www.RSKGeophysics.co.uk

Client
STATKRAFT

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
RESULTS OF THE ERT SURVEY ERT LINE 4

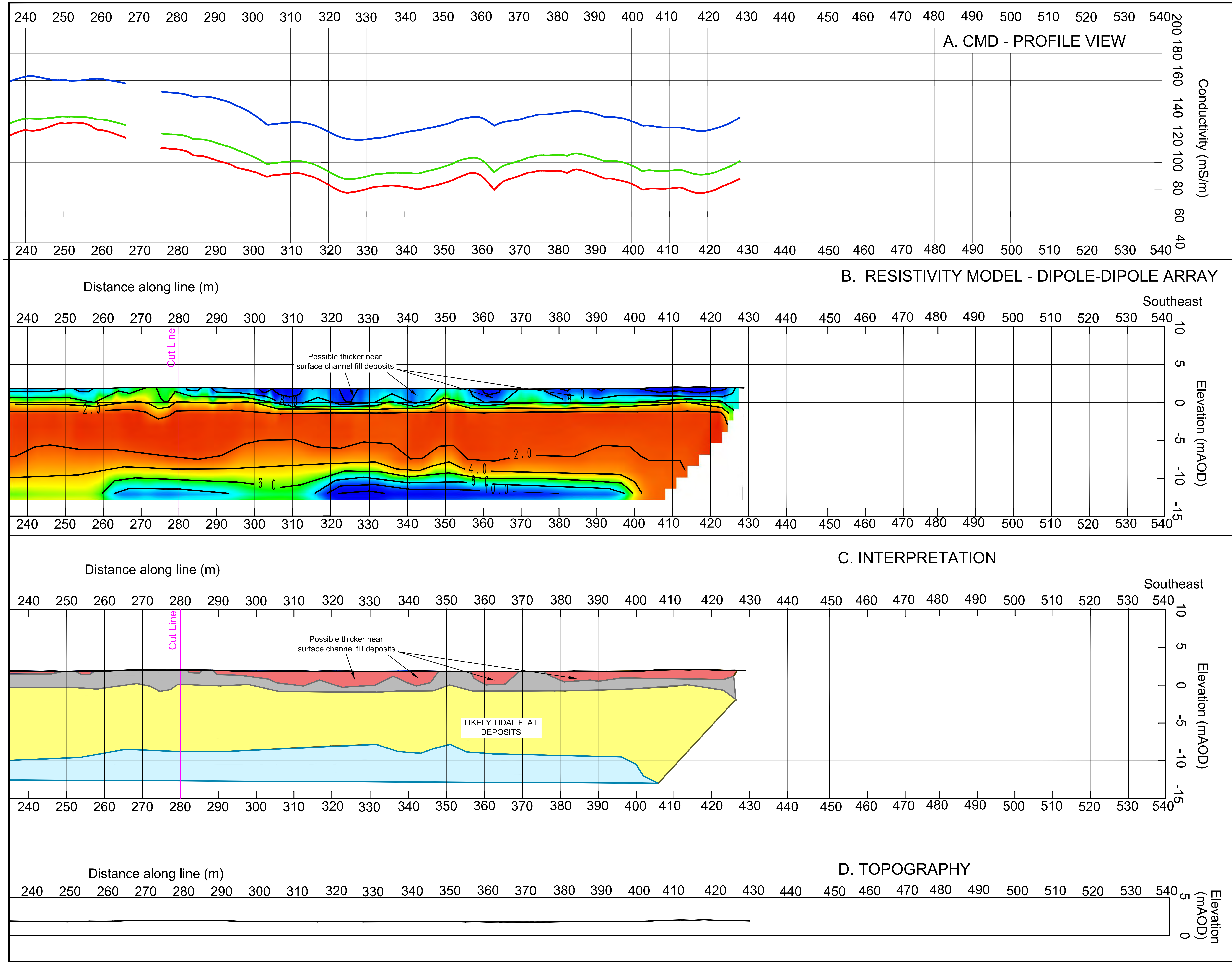
Drawn	Date	Checked	Date	Approved	Date
JM	25/07/24	MJS	30/07/24	MJS	30/07/24

Scale	Orig Size	Dimensions
1:625	A2	

Project No.	Drawing File
2192489	2192489-Figure.10D

Drawing No.	Rev.
2192489-Figure.10D Sheet 1 of 2	

Scale
0 6 12 18 24 30m



NOTES

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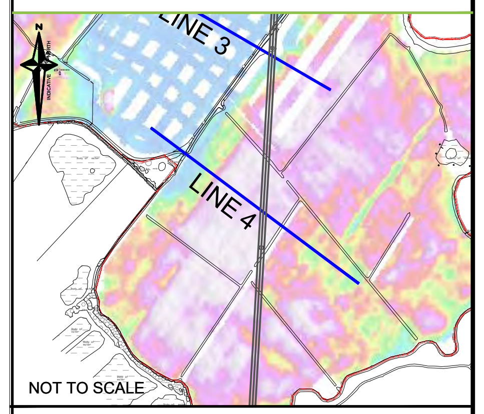
(1) Data gridded in Oasis Montaj.

ERT LINE 3 LOCATION



PANEL A
(CONDUCTIVITY PROFILES)

- Coil 3 (6.7 m effective depth)
- Coil 2 (4.2 m effective depth)
- Coil 1 (2.3 m effective depth)

PANEL B
RESISTIVITY SCALE

Higher resistivity values indicate presence of more granular or less saturated deposits (Thanet bedrock and unsaturated tidal flat deposits)

Apparent Resistivity (Ohm/m)

Lower resistivity values indicate presence of more cohesive or more saturated deposits (tidal flat deposits below groundwater table)

LOCATION OF A DITCHCOURSE CROSSING

PANEL C - INTERPRETATION

- HIGHER RESISTIVITY SHALLOW SOILS OVER PROBABLE GRANULAR, UNSATURATED BEDROCK (THANET FORMATION / SANDS)
- MODERATE RESISTIVITY - POSSIBLE SATURATED BEDROCK (THANET FORMATION / SANDS)
- INCREASED RESISTIVITY AT DEPTH - PROBABLE CHANGE IN GEOLOGY
- CHANNEL FILL DEPOSITS - HIGHER RESISTIVITY SOILS / UN-SATURATED / GRANULAR DEPOSITS
- CHANNEL FILL DEPOSITS - MODERATE RESISTIVITY - POSSIBLE COHESIVE SILTS / LESS SATURATED
- CHANNEL FILL DEPOSITS - LOWER RESISTIVITY - MORE SATURATED

RSK GEOSCIENCES GEOPHYSICS

Client
STATKRAFT

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
RESULTS OF THE ERT SURVEY ERT LINE 4

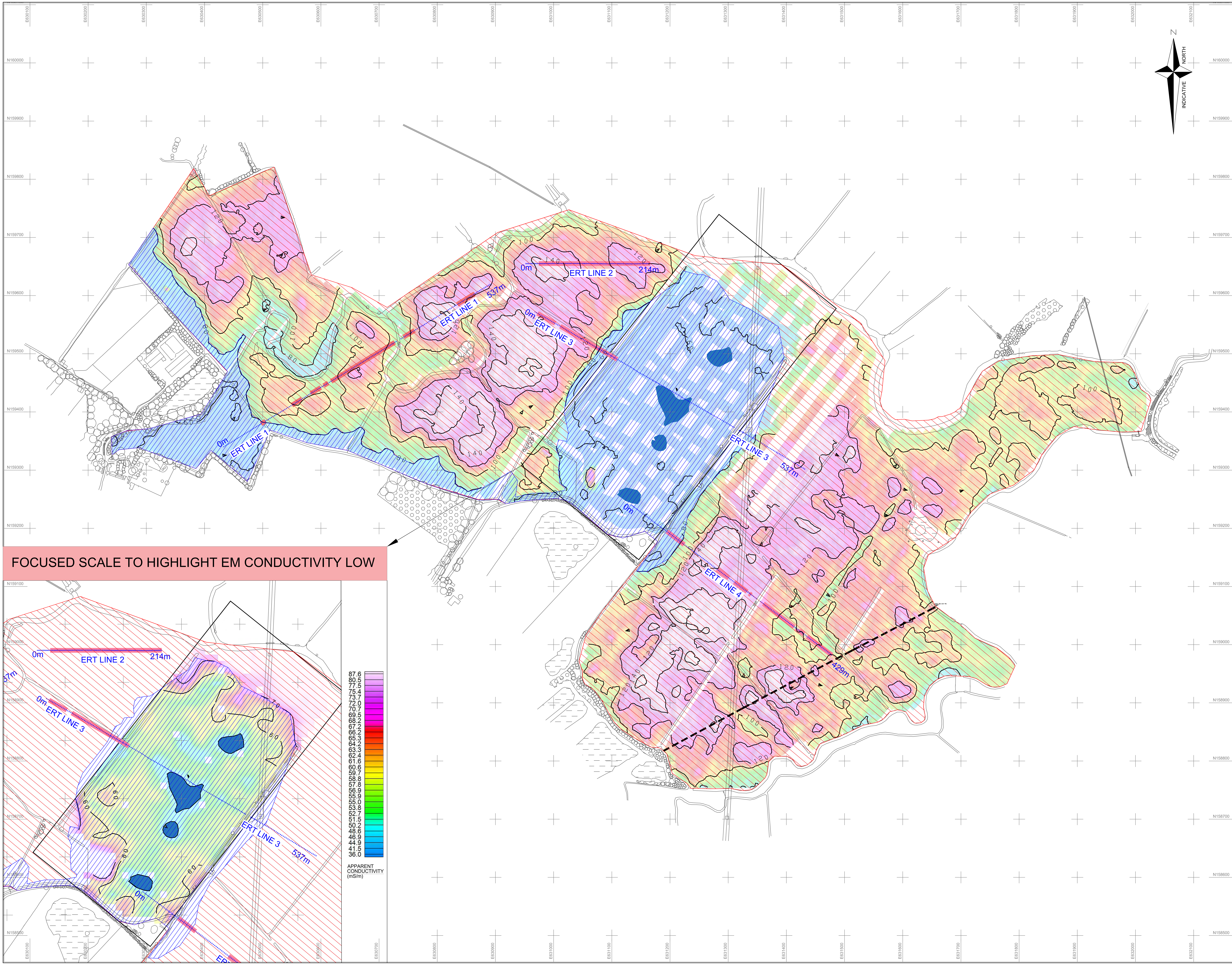
Drawn	Date	Checked	Date	Approved	Date
JM	25/07/24	MJS	30/07/24	MJS	30/07/24

Scale: 1:625 | Orig Size: A2 | Dimensions:

Project No.: 2192489 | Drawing File: 2192489-Figure.10D

Drawing No.: 2192489-Figure.10D Sheet 2 of 2 | Rev.:

Scale 0 6 12 18 24 30m



NOTES

The specific risks associated with the content of this drawing are considered to be:-

(1) The topographical baseplan has been supplied by the client and has not been checked for accuracy.
(2) ERT electrode locations located with high precision dGPS

KEY

APPROXIMATE BOUNDARY OF SITE

LINE 1 — ELECTRICAL RESISTIVITY TOMOGRAPHY SURVEY LINE, LENGTH OF LINE AND ELECTRODE LOCATION

RESISTIVITY DATA:

POSSIBLE LOCATION OF GRANULAR CHANNEL FILL DEPOSITS (HIGHER RESISTIVITY MATERIAL DETECTED IN NEAR SURFACE)

EM CONDUCTIVITY DATA: (IN BACKGROUND)

154.6, 144.6, 139.2, 134.8, 130.9, 127.5, 124.4, 121.6, 119.0, 116.6, 114.6, 112.8, 110.9, 109.1, 107.4, 105.8, 104.1, 102.3, 100.7, 99.0, 97.1, 95.2, 93.2, 90.7, 87.5, 83.0, 76.1, 68.2, 62.9, 59.0, 55.8, 52.2

Higher conductivity values indicative of more cohesive or saturated materials - probable TIDAL CHANNEL deposits

APPARENT CONDUCTIVITY (2.3m EFFECTIVE DEPTH) (mS/m)

Lower conductivity values indicative of more granular or less saturated materials (probable THANET FORMATION outcrop at or near surface)

LOWER CONDUCTIVITY INFERRED AS OUTCROP OF THANET SANDS

HIGHER CONDUCTIVITY HIGH INFERRED AS TIDAL FLAT DEPOSITS

CONDUCTIVITY LOWS INDICATIVE OF LOCALISED MORE GRANULAR / LESS SATURATED AREAS ON TOPOGRAPHIC HIGH. POSSIBLE MANMADE ORIGIN?

LINEAR CONDUCTIVITY HIGH. BURIED METALLIC SERVICE (WATER MAIN)

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client
STATKRAFT UK LTD

Project Title
LITTLE SOUTH SOLAR FARM

Drawing Title
COMBINED INTERPRETATION

Drawn	Date	Checked	Date	Approved	Date
JM	30/07/24	MJS	30/07/24	MJS	30/07/24

Scale: 1:2000
Orig Size: A0
Dimensions:

Project No.: 2192489
Drawing File: 2192489 Figure 11

Drawing No.: 2192489-Figure 11 Sheet 1 of 1
Rev.:

Scale
0 40 80 120 160 200m

APPENDIX A

Equipment Specification Sheets

GF Instruments CMD Explorer

A portable, lightweight, multi receiver ground conductivity instrument designed for a broad range of environmental, geotechnical, geological and engineering applications.

The GF Instruments CMD Explorer maps geological variations, groundwater contaminants or any subsurface feature associated with changes in ground conductivity, using the electromagnetic induction technique that allows measurement without electrodes or ground contact. With this inductive method, surveys can be carried out under most conditions including those of high surface resistivity such as sand, gravel and asphalt.

Ground conductivity (quad-phase) and magnetic susceptibility (in-phase) measurements are read directly from a digital display. A choice of 5 different data collection modes are available including manual measurement, continuous measurement and GPS correlated data.

The effective depth of exploration is a maximum of about 6.7m, making it ideal for geotechnical and environmental site characterization. Important advantages of the CMD Explorer over conventional resistivity methods are the speed with which surveys can be performed, the precision in which small changes in conductivity can be measured and the continuous read out and data collection while traversing the area. Additionally, the in-phase component is particularly useful for the detection of buried metallic structure and waste material. The advantage of the CMD Explorer over other electromagnetic instruments is its ability to record data from multiple depths during a single survey traverse, providing a greater amount of information about the subsurface with no increase in collection times.

Specifications;

Measured quantities:	*1.* Apparent conductivity in millisiemens per metre (mS/m) *2.* In-phase ratio of secondary to primary magnetic field in parts per thousand (ppt)
Intercoil spacing:	1.48m, 2,82m, 4.49m
Power supply:	Internal Exchangeable rechargeable Li-Ion battery pack; (approx 24-32 hours continuous measurement.
Measuring Ranges:	Conductivity: 1000mS/m; In-phase: ±80ppt
Measurement Resolution:	Conductivity: 0.1mS/m; In-phase: 10ppm
Measurement Accuracy:	±4% at 50mS/m
Weights:	Instrument: 8kg Handset/Logger: 0.7kg

SYSCAL PRO SYSTEM

SYSCAL Pro *Switch*-48 unit with its graphic LCD screen

10 CHANNELS

RESISTIVITY AND IP SYSTEM

SWITCH CAPABILITY

- **10 simultaneous reception channels**
- **1000 V – 250 W – 2.5 A**
- **Automatic injection ranging**
- **Electrodes switching capability**

SYSCALPro: the SYSCAL Pro unit is a new system designed for high productivity resistivity and IP measurements. It features some high output capabilities allowing to work in any field conditions for groundwater exploration and for civil engineering or environment applications.

Automatic injection ranging: the output current can be automatically adjusted to optimize the input voltage values and ensure the best measurement quality. The system offers also the possibility to inject the current with a voltage specified by the operator.

IP measurement: IP curves of the 10 channels can be directly visualized in real time thanks to the graphic LCD screen.

Marine application: a specific mode allows the system to be used for continuous logging, especially dedicated to marine applications; in that mode, a GPS can be directly connected to the unit by a serial link for a continuous recording of the location of the 10 channels all along the profile ; a set of 10 resistivities is measured and stored approximately every 2 seconds. In that case, specific cables are supplied to fit to that environment. A specific remote PC software can be used for data storage and for a graphical picturing in real time of the resistivity pseudo-section.

Remote software: a specific remote software can be used to drive the unit from a PC. This function has the advantage to store the data directly in the PC hard disk without memory limitation (useful for Marine application) and offers also the opportunity to pre-program some sequences of measurement at user defined timing intervals (useful for ERT acquisition).

Switching capability: internal switching boards can be added to the basic SYSCAL Pro unit to make it a very fast resistivity imaging system; in that version, the unit is called SYSCAL Pro Switch-48 - 72 or 96 (for a 48 – 72 or a 96 electrodes switching configuration) and allows to obtain simultaneously a set of 10 measurements and performs the switching of the electrodes automatically. Some external switching box(es), called Switch Pro, can be added to the unit for 3D investigations. In the Switch version, the max. output features of the unit are: 800 V – 250 W – 2.5 A.

TECHNICAL FEATURES

OUTPUT SPECIFICATIONS

- Automatic injection ranging (microprocessor controlled)
- Current: up to 2.5 A
- Voltage: up to 1000 V (1500 V with an external DC/DC converter)
- Power: up to 250 W (500 W with an external DC/DC converter)
  Possibility to use an external AC/DC 1200 W converter
- Pulse duration: 0.2, 0.25, 0.5, 1, 2, 4 or 8 s
- Current measurement precision: 0.2 % typical
- *Switch* version output voltage: up to 800 V

INPUT SPECIFICATIONS

- Measuring process: automatic ranging and calibration
- Input impedance: 100 MΩ
- Input voltage:
  Max. channel 1: 15 V
  Max. channel 2 to channel 10: 15 V
  Protection up to 1000V
- 50 to 60 Hz power line rejection
- Voltage measurement:
  Precision: 0.2 % typical
  Resolution: 1 µV
- Noise reduction: automatic stacking number in relation with a given standard deviation value
- SP compensation through automatic linear drift correction
- Induced Polarization (chargeability) measured over up to 20 automatic or user defined slices

GENERAL SPECIFICATIONS.

- Up to 4000 electrodes can be used
- Data flash memory: more than 21 000 readings
- Serial link RS-232 data download
- Power supply: two internal rechargeable 12V, 7.2 Ah batteries ; optional external 12V standard car battery can be connected to the transmitter part
- Weather proof
- Shock resistant fiber-glass case
- Operating temperature: -20 to +70 °C
- Dimensions (SYSCAL Pro *Switch*-48): 31 x 23 x 36 cm
- Weight (SYSCAL Pro *Switch*-48): 13 kg
- Weight of a 24 take-outs (spaced 5 m) string on a reel: 23 kg