Sure Partners Limited

ARKLOW BANK WIND PARK PHASE 2 **ONSHORE GRID INFRASTRUCTURE**

VOLUME III

Chapter 9 APPENDICES

Appendix 9.1d GI Reports - Geophysics Report

ARUP

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Appendix 9.1d

Geophysical Report

Arklow Bank Wind Park Onshore Cable Route
Co. Wicklow
LF100034-ENG-GP-ONX-RPT-0001

Geophysical Survey

Report Status: Draft

MGX Project Number: 6527

MGX File Ref: 6527d-005.doc

15th January 2021

Confidential Report To:

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Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of EM31 ground conductivity, 2D-Resistivity, seismic refraction (p-wave) and MASW (s-wave) for the onshore ground investigation for the Arklow Bank Wind Park project LF100034-ENG-GP-ONX-RPT-0001.
2. The main objectives of the survey were to determine the ground conditions under the site: to determine the depth to rock and the overburden thickness; estimate the strength/stiffness/compaction of overburden and the rock quality; to map the extent of very soft ground layers; to establish the presence of faults and fracture zones.
3. The 2D-Resistivity survey was carried out along or close to the center line of the proposed underground cable route while the EM31 Ground Conductivity survey was carried out within a 100 m wide corridor along the route. Additional geophysics (seismic refraction and MASW) were carried out in locations specified in the tender document or proposed after the initial geophysics surveying was carried out.
4. The overburden changes from consisting of clay and silt from the start of both cable routes up to Ch600 to mainly sandy gravelly clay and silt after Ch600. There are some smaller areas of clay and silt and clayey silty sand and gravel overburden across the route as well as some possible sand and gravel deposits from Ch2843 – 2945, Ch3030 – 3540, Ch3945 – 3955, Ch4760 – 5055 along Route 1A and Ch2735 – 2805 along Route 1B.
5. Most of the overburden could be broadly described as boulder clay with varying mineral compositions. This type of overburden is suitable for excavation and the construction of the cable route.
6. Very soft ground was not observed anywhere geophysical surveys were carried out and very soft layer was not interpreted in the seismic refraction survey.
7. The bedrock geology remains reasonably consistent up to Ch 5133 where there is a significant change in the geology, likely due to a fault zone.
8. The shallowest weathered rock surveyed is 2.5 - 3m below ground level from Ch1480 – 1505. There may be shallower highly or extremely weathered rock in some areas, specifically between Ch1425 – 1565 and after Ch5133.
9. A fault noted near Ch510, shown on the GSI Online Geological Map (GSI, 2020) is not evident in the bedrock geology from the geophysical survey and should not affect the cable route construction.
10. Rock underlying the M11 crossing is at an elevation of approx. 15 mOD before becoming deeper to the SW along the chainage.
11. Possible dumped material such as metal noted on the surface during a walkover study was not evident along the chainage but may be present 70 m to the north at Ch5100.
12. From Ch5133, a change in geology, associated with a fault zone indicates very shallow extremely to highly weathered rock. This rock may be diggable and will likely become deeper towards the substation.

13. Direct ground investigation information has been used where it was available and abbreviated borehole logs were added to the cross sections.
14. Recommendations for targeted ground investigation are made.
15. This report will be reviewed and finalised after the complete direct ground investigation data has been received.

CONTENTS

List of Tables, Maps and Figures:

1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey for the Arklow Bank Wind Park Onshore Ground Investigations. The survey consisted of EM31 ground conductivity, 2D-Resistivity, seismic refraction (p-wave) and MASW (s-wave) measurements. The survey was commissioned by Irish Drilling Ltd who are the main contractor for Sure Partners Limited.

The survey employed various geophysical methods that complement each other and provide a better-quality interpretation. The role of geophysics as a non-destructive fast method is to provide a geological interpretation over a wide area and to complement direct ground investigations at specific locations. The direct ground investigation results can be used to improve the initial geophysical results and interpretation.

The proposed development is a cable route running from an offshore wind farm to a planned substation north of Arklow Town in the Avoca River Business Park.

There were two cable route options proposed, (1A & 1B). Route 1A is the preferred route while route 1B is an alternative route which deviates from route 1A in two places, at the landfall site and half way along the cable route. An EM31 ground conductivity survey was carried out along a 100m corridor along both proposed cable routes where access was possible. 2D-Resistivity was also carried out along the whole of both routes where access was possible. Data was not acquired in fields where access was not permitted and at road crossings. Some lines were stopped at impenetrable field boundaries.

No geophysical surveying was carried out along the final section of chainage into the substation as the ground was very steep and overgrown and not suitable to acquiring useful geophysical data.

Seismic refraction and MASW lines were carried out with the purpose of detecting shallow rock. Some lines were at select locations along the route, which were proposed before works began, and others were proposed after considering the EM31 ground conductivity and 2D-Resistivity results.

The survey was aimed at determining the ground conditions along proposed cable routes and investigating ground stability.

1.2 Objectives

The main objectives of the geophysical survey were:

- To determine the ground conditions under the site
- To determine the depth to rock and the overburden thickness
- To estimate the strength/stiffness/compaction of overburden materials and the rock quality
- To determine the type of overburden and rock

- To detect lateral changes within the geological layers
- To map the extent of possible very soft ground layers
- To determine the presence of possible faults and fracture zones
- To determine the s-wave velocity and to calculate the small strain shear modulus G_{max}

1.3 Site Description

The site stretches from Ennerielly Beach, north of Arklow in the townland of Johnstown North towards the SW for approx. 5.5km to a substation in the Avoca River Business Park in the Townland of Shelton Abbey. There are two proposed landfalls locations and the cable route splits near the middle of the route with two optional routes. Most of the survey was carried out in agricultural fields.

1.4 Geology

The online geological map (GSI, 2020) shows the landfall site is underlain by the Maulin Formation, described as dark blue-grey slate, phyllite and schist. At Ch510 there is a fault indicated and the rest of the cable route is underlain by the Kilmacrea Formation described as dark grey slate and minor pale sandstone. A second fault runs parallel (WNW-ESE) to the final section of the cable route in the west within the Kilmacrea Formation.

For details on the geology please refer to the detailed geological desk study for this project by Arup Consulting engineers (ARUP, 2020).

1.5 Report

This report includes the results and interpretation of the geophysical survey. Maps, figures and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The description of soil, rock and the use of geotechnical terms (soft, stiff, dense etc) follows Eurocode (2007) and BSI (2015) standards. Geophysical parameters are used to determine these terms by using guidelines and from experience. The geophysical survey has been acquired, processed, interpreted and reported on in accordance with these guidelines.

The client provided maps of the site and the digital version was used as the background map in this report. Elevations were surveyed on site and are used in the vertical sections.

Map 1 is an overview map showing the full survey area and locations of the different geophysical survey methods as well as locations of boreholes provided before this survey was carried out. Map 2 shows an overview of the results from the EM31 Ground Conductivity survey across the project. Map 3 is an interpretation map which shows geological features identifiable in the geophysical survey including areas of shallow rock and sand and gravel overburden.

Plans 1a – 1h cover the preferred route, 1A; plans 1i – 1l show the results along the alternative route, 1B where it deviates from route 1A. The top panels display the EM31 ground conductivity as well as the location of the different geophysical surveys, while the bottom panels show the results from the 2D-Resitivity survey. Plans 2a – 2l show the interpretations of the 2D-Resistivity survey results as well as the interpretation map utilising all the geophysical data.

Plans 3a – 3e show seismic refraction and MASW lines at Geophysics sub-areas and locations proposed by Minerex Geophysics. Plans 4a – 4e show the interpretation of the seismic refraction data.

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, whilst using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.

2. GEOPHYSICAL SURVEY

2.1 Methodology

The methodology was given by the engineers and consisted of EM31 Ground Conductivity measurements within a 100m corridor along both cable route options as well as 2D-Resistivity surveying where access was available. Seismic Refraction and MASW surveying were carried out at selected locations targeting possible shallow rock.

The survey locations are indicated on the maps and on the top panel of the plans. The lines, locations, chainage and parameters are tabulated in Table 1 which is bound at the end of this written report.

2.2 EM31 Ground Conductivity

The EM31 ground conductivity survey was carried out along the area indicated on Map 1 on lines nominally 10m apart. Along each line a reading of ground conductivity was taken every second while walking along, thereby resulting in a survey grid of nominally 10 x 2m. The locations were measured with a Carlson NR3 RTK-GPS sub-meter accuracy SERES DGPS system attached to the EM31 and all data was jointly stored in a data logger. The conductivity meter was a GEONICS EM31 with Allegro data logger and NAV31 data acquisition software. The instrument was compared to base station readings and no EM drift was recorded.

The conductivity is typical for certain geological material types. Dry and clean Sand/Gravel and most rock types (Granite, Sandstone and clean Limestone) have relatively low conductivities while peat, clay and clay-rich rock types (mudstone, shale) have high conductivities.

EM31 ground conductivity determines the bulk conductivity of the subsurface over a typical depth between 0 and 6m below ground level (bgl). and over a radius of approx. 5m around the instrument. When looking for clay, silt and water infill within rock occurring at relatively shallow depth the EM31 can find anomalous rock zones with a vertical extent of approx. 3m. The measurements are disturbed by metal and other conductive objects within the range of the instrument and therefore no geological interpretations can be made in the vicinity of such man-made objects. Either readings were not taken near sources of interference in the first place or notes were taken by the operator in order to remove these during processing. An overhead cable which crosses the chainage at Ch3780, Ch3920 and Ch4130 can be seen in the conductivity readings. The line of this cable is shown in the background map and is highlighted as a cyan line on Interpretation Map 3.

Near the end of the cable route, dense vegetation and forestry restricted where the EM31 ground conductivity could be carried out, leaving some gaps in the data. It was also necessary to avoid metal fencing along the road leading to the Avoca River Business Park.

2.3 2D-Resistivity (ERT)

2D-Resistivity lines were surveyed with electrode spacing of 3m, up to 64 electrodes per set-up and a maximum length of 189m per set-up. The readings were taken with a Tigre Resistivity Meter, Imager Cables, stainless steel electrodes, laptop and ImagerPro acquisition software.

The 2D-Resistivity lines were as continuous as possible along the chainage. Lines were broken at impenetrable field boundaries and at road crossings. Two sections (Ch1170 – Ch1420, Ch2900 – Ch3210) were not completed due to land access restrictions.

During 2D-Resistivity surveying, data is acquired in the form of linear arrays using a suite of metal electrodes. A current is injected into the ground via a pair of electrodes whilst a potential difference is measured across a second pair of electrodes. This allows for the recording of the apparent resistivity in a two-dimensional arrangement below the line. The data is inverted after the survey to obtain a model of subsurface resistivities. The generated model resistivity values and their spatial distribution can then be related to typical values for different geological materials.

Although the achieved depth may be viewed as greater than required for the proposed project, it does not result in a loss of detail or accuracy in the shallow subsurface. It may however provide additional useful information, such as detecting areas of possible anomalous rock which may have implications for subsidence or other construction issues.

2.4 Seismic Refraction

Seismic refraction lines were surveyed with geophone spacing of 3m and 24 geophones per set-up resulting in a 69m length per set-up. The recording equipment consisted of a 24 Channel GEOMETRICS ES-3000 engineering seismograph with 4.5Hz vertical geophones. The seismic energy source consisted of a hammer and plate. A zero-delay trigger was used to start the recording. Normally 7 shot points per p-wave set-up were used.

Some set-ups were acquired in longer continuous lines using common shot points between set-ups and concatenating into longer lines at the processing stage.

In the seismic refraction survey method, a p-wave is generated by a source at the surface resulting in energy travelling through surface layers directly and along boundaries between layers of differing seismic wave velocities. Processing of the seismic data allows geological layer thicknesses and boundaries to be established.

Seismic refraction generally determines the depth to horizontal or near horizontal layers, where the compaction/strength/rock quality changes with an accuracy of 10 – 20% of depth to that layer. Where low velocity layers or shadow zones are present (e.g. below solid ground surface) or where layers dip more than 20 degrees, the accuracy becomes much less.

Line S20 was carried out along a concrete underpass under the M11 while Line S24 crossed a small road. The effect from the solid ground surface was minimal and did not affect the models.

The seismic refraction set-ups with 69m individual length have a reasonable penetration depth of around 12m. An internationally accepted maximum depth estimate for a seismic refraction set-up is 1/6 of the set-up length. The depth penetration varies according to the velocity structure of the subsurface. In this report we used a depth of 12m bgl. where the seismic modelling was ended as deeper modelling becomes less meaningful. A pink line below the seismic models shows the maximum depth modelled.

2.5 2D-MASW (Multichannel Analysis of Surface Waves)

The seismic shear wave velocity was determined by active 2D-MASW surveying. MASW (Multi-Channel Analysis of Surface Waves) determines the bulk seismic shear wave velocity versus depth. The velocities are used to determine the small strain shear modulus and to compute other geotechnical parameters. As the seismic p-wave velocities are measured along some of the same lines the density can be estimated and other elastic parameters like Poisson ratio and young's modulus are computed.

The MASW arrays consisted of a 1m geophone spacing and a 24 channels set-up resulting in an individual array length of 23m. Shots were carried out 8 m after the last geophone in the array. The whole set-up was then advanced by 8 m and the process is repeated across the full survey line.

The recording equipment consisted of a 24 Channel GEOMETRICS GEODE engineering seismograph with 4.5 Hz vertical geophones. The seismic energy source consisted of a hammer and plate. A zero-delay trigger was used to start the recording.

Each set-up provides information for the middle of the geophone array. The displayed results are therefore from 11.5 m after the first geophone of the first array and 11.5m before the last geophone of the last array. Table 1 shows the total length of the set-ups from the first geophone in the first array along a line to the last geophone of the final array and is therefore 23m longer than the displayed line on Map 1 which shows the locations of the midpoints of the MASW arrays.

The depth surveyed by the MASW method depends more on the ground itself than on the geophone spacing. The ground conditions determine the frequency of surface waves spreading through the subsurface. The frequency and the surface wave velocity determine the survey depth. The geophone spacing of 1m used for this survey ensures that all relevant wave form data can be captured. A low velocity ground (like peat) will give a shallow shear wave depth section while a high velocity ground (like shallow rock) will give a deeper section.

MASW lines were carried out alongside most seismic refraction lines. Some MASW models are shorter than the seismic refraction models where lines could not be extended 11.5m passed the end of the seismic lines.

Line S20 does not have MASW data along it as the concrete ground surface does not allow for the dispersion of surface waves. Similarly, Line M24 is broken in half with no data at the river or across the road for the same reason.

Line S26 does not have any MASW data as the area was proposed due to high resistivities indicating shallow rock while the MASW data is better for providing information on the overburden.

2.6 Site Work

The data acquisition was carried out between the 27th of October and the 4th of December 2020. The weather conditions were mixed throughout the acquisition period. Health and safety standards were adhered to at all times.

The locations and elevations were surveyed with a Carlson NR3 RTK-GPS to accuracy < 0.05 m.

3. RESULTS AND INTERPRETATION

The interpretation of geophysical data was carried out utilising the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors.

Separate interpretations are given for each geophysical method while all the available information was considered for each interpretation. Map 3 is a geophysical interpretation map which utilises all available information. The top panels on Plans 2a – 2l and Plans 4a – 4e show the same interpretation information. The interpretation map only highlights possible constraints for the construction of the cable route. Most of the survey area consists of deep overburden which is suitable for excavation and the cable route construction.

Some direct ground investigation results were available before and after the survey and the borehole logs are indicated on the sections. The rock was generally weathered based on the RQD value of less than 50%. This interpretation can be applied only to a certain extend as the rock is very variable, RQD values and fracture index often changes rapidly with depth and the small size of a borehole only represents a very small volume of ground. The geophysical survey on the other end of the scale averages over a large volume of ground.

3.1 EM31 Ground Conductivity

The EM31 ground conductivity values were merged into one data file for each survey area and contoured and gridded with the SURFER contouring package. The contours are created by gridding and interpolation and care must be taken when using the data. The contour map is overlaid over the location and base map (Map 2) and on the top panel of Plans 1a – 1l. The values in milliSiemens/metre (mS/m) are indicated on the colour scale bar.

Low conductivities indicate either shallow bedrock or unsaturated sand and gravel overburden while higher conductivities indicate deeper bedrock, and more clay-rich overburdens. As EM31 ground conductivity determines the bulk conductivity of the subsurface to a depth of 6m bgl, deep rock in this interpretation is considered anything greater than 6m bgl. Similarly, if rock is shallower than 6m bgl, the bulk conductivity will also be influenced by the composition of the overburden above it as well as the type and quality or the rock itself.

Table 2 shows the interpretation for the conductivity data alone. This interpretation is applied with consideration given to the other geophysical methods to provide specific lateral information on the interpretation map. The EM31 ground conductivity survey involved walking along a 10m grid within a 100m corridor along the proposed routes. No very soft ground was observed by the geophysical site operatives during this survey. This is described, for the purposes of this report as areas of deep peat or other organic materials or made ground with very soft stiffness or compaction rather than the thin topsoil layer which may have some very soft compaction.

Table 2: Summary of Interpretation (Conductivity only)

Layer	**General Conductivity Range (mS/m)**	**Interpretation**
C1	<8.5	Unsaturated Sand or Gravel Overburden, or Shallow Rock
C2	8.5-24	Boulder Clay Overburden, saturated Sand and Gravel, and deeper rock
C3	>24	Clay or Silt Overburden, deep rock

3.2 2D-Resistivity (ERT)

The 2D-Resistivity data was positioned and inverted with the RES2DINV inversion package. Lines using the roll-along method were concatenated for a joint inversion. The programme uses a smoothness constrained least-squares inversion method to produce a 2D model of the subsurface resistivities from the recorded apparent resistivity values. Three variations of the least squares method are available and for this project the Jacobian Matrix was recalculated for the first three iterations, then a Quasi-Newton approximation was used for subsequent iterations. Each dataset was inverted using seven iterations resulting in a typical RMS error of <3.0%. The resulting models were colour contoured with the same resistivity scale for all lines and they are displayed as cross sections (Plans 1a – 1l).

The models have been scaled to be imposed on the chainage along the proposed routes. Where the lines were not directly on the chainage some stretching or shortening was applied to the models.

Resistivities are characteristic for certain overburden and rock types. If there is a high content of clay minerals (which are electrically conductive) then the overburden resistivity will be lower than a section with a high content of clastic grains like sand or gravel. The purer the clay and the lower the sand/gravel content the lower the resistivity. Water content in overburden layers can influence the resistivities, but generally clay content has a more dominating effect.

Within bedrock types like clean sandstone, high resistivities indicate a fresh, strong, unweathered rock. As the weathering in the rock increases, the resistivity gets lower because of weathering products, remineralisation of rock and infill of cracks, faults and voids with clay and water. Weathering within rock is typically indicated by lower resistivity values in the cross sections.

While there are some areas with high resistivities at depth, there are generally medium resistivities within the rock layer. This may indicate weathering of the rock or lower resistivities due to the minerals within the rock. For example, siltstone and slate have similar resistivities to weathered sandstone due to their higher clay mineral content. For this reason, the interpretation given here does not differentiate between weathered and fresh rock or different rock types.

The resistivities cover a range typical for materials from clay-rich overburden (low resistivities) to fresh strong unweathered bedrock or clean sand and gravel (high resistivities). The ranges have been taken into consideration for the interpretation. Very low resistivity values (<40Ωm) typically indicate overburden with high clay content. Low values (40 to 160Ωm) are interpretated as sandy gravelly clay and silt overburden. Medium values (160 to 640Ωm) show clayey silty sand and gravel in the overburden. Where medium resistivities occur at depth this layer may also indicate rock or, if below the water table, this layer can also include saturated sand and gravel. High resistivities (>640Ωm) indicate unsaturated sand and gravel if found at the surface. Where high resistivities occur at depth it likely means sandstone or a less weathered shale, however as stated above, these different rock types have not been defined in this interpretation.

The resistivities across most of the chainages indicate deep overburden. Where higher resistivities may indicate shallow rock, seismic refraction has been carried out as it is the primary geophysical method for determining the depth to rock. Table 3 gives the interpretation for the 2D-Resitivitity alone. 2D-Resistivity is a good method for determining the composition of overburden types while the differentiation between a high resistivity overburden or rock such as in layer E is addressed through the seismic refraction survey where it was carried out. Where this layer is present without seismic refraction data, it is generally deep and will not impact on the cable route construction.

The overburden could broadly be described as boulder clay throughout the survey area consisting of varying degrees of sand and gravel or clay and silt components as shown in the table below. This overburden type is suitable for excavation and the cable route construction.

Table 3: Summary of Interpretation (Resistivity only)

Layer	**General Resistivity Range (Ωm)**	**Interpretation**
A	>640 (Near Surface)	Sand and Gravel
B	160 - 640	Clayey silty Sand and Gravel
C	<40	Clay and Silt
D	40 – 160	Sandy Gravelly Clay and silt
E	>160 (At Depth)	Weathered Rock or Clayey silty Sand and Gravel Overburden

3.3 Seismic Refraction

The seismic refraction data was positioned and processed with the SEISIMAGER software package to give a layered model of the subsurface. The number of layers have been determined by analysing the seismic traces and between 2 and 5 layers were used in the models. All seismic lines were subject to a standardised processing sequence which consisted of a topographic correction which was based on integrated elevation data, first break picking, tomographic inversion, travel-time computation via ray-tracing and velocity modelling. Residual deviations of typically 0.4 to 1.8ms RMS have been obtained for each line. Following each processing stage QC procedures were adhered to. The resulting layer boundaries are shown as thick lines overlaid on the MASW cross sections (Plans 3a – 3e). The average seismic velocities obtained within the layers are annotated on the sections as bold black numbers.

The p-wave seismic velocity is closely linked to the density of subsurface materials and to parameters like compaction, stiffness, strength and rock quality. The higher the density of the subsurface materials, the higher the seismic velocity. More compacted, stiffer, denser and stronger material will have a higher seismic velocity. For rock, the seismic velocity is higher when the rock is stronger, less weathered and has a higher quality. If the rock is more weathered, broken, fractured or fissured, then the seismic velocity will be reduced compared to that of intact fresh rock.

Because of the above relationship, the seismic refraction method and seismic velocities are suitable to investigate ground where the layers get denser, more compacted and stronger with depth. A disadvantage is that some materials may have the same seismic velocity: Layers 4 – 6 are interpreted as either weathered rock or overburden depending on their geological setting.

The modelled seismic data has created the following layered ground model:

Layer 1 has seismic velocities of less than 300m/s. This overburden would be made ground, topsoil and soil with a soft or loose stiffness or compaction.

Layer 2 was modelled with a velocity range of 400 - 800m/s. The velocity indicates overburden material with firm or medium dense strength or compaction. This layer is at the surface after Ch5133.

Layer 3 velocities of 1500 - 1700m/s indicate predominantly overburden with stiff or dense strength or compaction.

Layer 4 has velocities of 2400 – 2600m/s and is interpreted as very stiff or very dense overburden. In some areas this layer may contain highly weathered rock.

Seismic velocities of 3000 - 3500m/s in Layer 5 indicate fair weathered rock. This is the highest seismic velocities found on this site to a depth of 12m.

Layer 6 velocities of 2000m/s indicates a very poor extremely weathered rock but may also contain stiff or dense overburden. This layer is only present after Ch5133 along Line S18 at the end of the proposed route where the geophysical results notably change.

Layer 7 is only present at the end of the cable route after Ch5133. This layer has a velocity of 2700m/s and is interpreted as poor highly weathered rock.

Table 4a summarises the seismic refraction interpretation from the landfall site to Ch5133. There is a change in geology at this point which is notable in all the geophysical data. Table 4b summarises the seismic refraction interpretation from Ch5133 to the substation site. The stiffness or compaction and the rock strength or quality have been estimated from the seismic velocity. The estimation of the excavatability for the bedrock has been made according to the caterpillar chart published in Reynolds (1997). The geotechnical assessment for rippability will have to take factors like rock type and jointing into account and the estimation in this report is solely based on the seismic velocities. Seismic refraction interpreted cross sections are shown in Plans 4a – 4e.

Where the seismic refraction survey was carried out, no very soft ground was identified.

Table 4a: Summary of Interpretation (Seismic Refraction only, From Start – Ch5133)

Layer	**General Seismic Velocity Range (m/s)**	**Stiffness/ Compaction or Rock Strength/ Quality**	**Interpretation**	**Estimated Excavation Method**
1	<300	Soft or Loose	Topsoil or Made ground	Diggable
2	400 - 800	Firm or Medium Dense	Overburden	Diggable
3	1500 - 1700	stiff or dense	Overburden	Diggable
4	2400 - 2600	Very stiff or Very dense	Overburden	Diggable
5	3000 - 3500	Fair	Weathered Rock	Breaking & Blasting

Table 4b: Summary of Interpretation (Seismic Refraction only, From Ch5133 – End)

Layer	**General Seismic Velocity Range (m/sec)**	**Stiffness/ Compaction or Rock Strength/ Quality**	**Interpretation**	**Estimated Excavation Method**
2	400 – 800	Firm or Medium Dense	Overburden	Diggable
6	2000	very poor	Extremely weathered Rock	Diggable or rippable to marginal rippable
7	2700	Poor	Highly Weathered rock	Breaking & Blasting
5	3000 - 3500	Fair	Weathered Rock	Breaking & Blasting

3.4 2D-MASW (Multichannel Analysis of Surface Waves)

The MASW data was positioned, processed, analysed and modelled with the SURFSEIS6 software packages. The objective is to obtain a model of shear wave velocity versus depth and to calculate the small strain shear modulus G_{max} from the shear wave velocities (using an assumed density of 2000 kg/m^3 typical for overburden). This is achieved for individual shot records acquired along a line and the results are then combined and displayed as a 2D-Contour image on cross-sections (Plans 3a – 3e).

Following processing steps are done to achieve this:

1. Edit the shot point geometry and display the shot points for each array set-up along a line.
2. A dispersion curve (phase velocity versus frequency plot or dispersion image) is computed.
3. For each shot the maximum amplitude at each frequency of the dispersion image is selected and then saved.
4. An elevation file using the elevations surveyed at the centre of each array is imported into the program.
5. An initial model of shear-wave velocity Vs versus depth is computed from the saved picks.
6. An inversion is carried out to create the final V_s curve (Shear wave versus depth).
7. The small strain shear modulus (also named Gmax) for each shot point and depth is computed by using a density of 2000 kg/m^3 typical for highly consolidated overburden (Eq. 1)

   (Eq. 1) $G = V_s^2 \rho 10^{-6}$

   where G = Shear Modulus (MPa)

   V_s = Seismic Shear Wave Velocity (m/s)

   ρ = Density (kg/m^3)

8. The values for shear velocity (m/s) and small strain shear modulus (in MPa) are then gridded and contoured versus the distance on the line and the depth.
9. The contour section for shear wave velocity and small strain shear modulus are then displayed with a colour scale that ranges from 100 – 1200m/s for the shear wave velocities and from 80 – 2880MPa for the shear modulus on Plans 3a – 3e.

The dispersion curves produced on this site were generally good. This indicates the ground is undisturbed and consists of overburden with a gradual velocity gradient increase with depth. A significant change in shear velocities after Ch5133 indicates a shift to shallow rock.

The model depth depends on the frequency and wavelength of the surface wave. MASW deriving values at ground level would require an indefinitely high frequency which is not possible. The colour contours start at the depth of the shallowest model values derived from the software. This leaves a data 'gap' between the ground surface and the top of the model. The models are generally valid only for overburden. Deeper penetration into rock below is not realistic as the jump in density and velocity from overburden to rock would not accommodate surface waves. Line M18 at the end of the cable route shows dispersion curves within the rock layer rather than he overburden due to the very shallow rock on this area.

Table 5: Shear Wave Velocity to Stiffness Relationship

Shear Wave Velocity Vs Range in m/s	**Material Stiffness**
< 150	Soft
150 to 300	Firm
300 to 500	Stiff
> 500	Very Stiff

4. Geophysical Results by Features and Chainage

The following is a description of notable features along the proposed routes utilising all available information:

From Ch 0 – 600, there is generally deep clay rich overburden. Near the landfall site, lower conductivities show an area of shallow rock. This is shown in BH01, BH03 and BH05 which shows rock from 2.3 – 3m below ground level (bgl). BH02 and BH04 which are outside this area show rock between 6 and 9 m deep respectively.

The ground elevations drop at Ch500 towards a small watercourse. At the lower elevations, the seismic refraction survey indicates rock at a depth of 5m bgl. Similarly, at Ch890 there is another watercourse where rock is 3m bgl. The top of rock elevation stays reasonably level while the ground elevations rise either side of both watercourses. From Ch600 to Ch1165, from where there is a gap in surveying due to landowner access restrictions, the overburden is generally a sandier gravellier clay and silt.

There is a fault noted on the GSI map crossing the chainage at around Ch510. While there is a change in the overburden geology in this area there is no evidence of a fault within the rock layer. It is likely the fault in the rock, if present, is overlain by deep overburden and will not affect the construction of the cable.

The geophysical survey begins again at Ch1425 where there is 140m of shallow rock. This rock is as shallow as 2.5 m close to a small watercourse flowing along the boundary between two fields but is generally between 4 and 6m deep. Seismic layer 4 in this area likely contains highly weathered rock rather than hard or very dense overburden. This layer is approx. 1m bgl in this area. This shallow rock may extend to the north where there is currently no geophysical data available.

The overburden is generally sandy gravelly clay and silt with some small areas of clay and silt and some areas of clayey silty sand and gravel. Two sections from Ch2113 – 2182 and Ch2311 – 2380 along route 1A had seismic refraction and MASW surveying which confirms rock deeper than 8m bgl.

From Ch2450 – 2600 there are medium resistivities close to the surface. The seismic refraction and MASW survey in this area indicates this is clayey silty sand and gravel or possibly saturated sand and gravel rather than shallow rock. This change in overburden may be due to alluvium deposits from an old watercourse at this location.

Continuing along Route 1A, the rock remains deep while the overburden type varies. Dry clean sand and gravel extending to a depth of over 3m is visible on the 2D-Resistivity data from Ch2843 – 2945 and Ch3030 – 3540. The area this sand and gravel covers is given by the conductivity survey and is limited to the width of the corridor that survey was carried out within. The overburden below and around it varies between sandy gravelly clay and silt and clayey silty sand and gravel.

This deep overburden continues up to the underpass at the M11 Motorway with one small area of sand and gravel at the top of a hill at Ch3950. The rock is around 6.5m below the underpass. The locations of the lines in this area are offset from the chainage and were carried out where access was possible. The elevations therefore vary between some lines by 2 – 4m. Generally, from Ch4385 at the north end of the underpass to Ch4370, the elevation of the top of rock is close to 15 mOD. From there, the ground elevation and rock elevation begin to fall along the survey lines with rock generally at a depth of between 7 and 10m bgl to the end of this section of seismic refraction and MASW lines at Ch 4804.

The overburden changes from sandy gravelly clay and silt to approx. 3m of sand and gravel near the surface from Ch4765 – 5055. The lateral extent of this sand and gravel is not well defined as there was only a small amount of conductivity surveying carried out in this area.

The walkover study carried out by ARUP (2020) indicated the possible presence of dumped material such as metal on the surface in the area north of Ch 5050 – Ch 5150. The 2D-Resistivity survey which was carried out 10 – 15 m north of the cable route in this area does not show any evidence of dumped material. Conductivities 70 m north of the cable route show an increase in conductive materials which may be cause by dumped material. It is not likely this area of dumped material extends close to the cable route.

At Ch5133 there is a significant change in the overall geology to the end of the survey area. This is evident in the 2D-Resistivity, seismic refraction and MASW data and has been interpreted as a fault zone within the Kilmacrea Formation. High surface wave velocities and medium – high resistivities near the surface are interpreted as rock. The seismic velocities indicate this rock is extremely to highly weathered to a depth ranging from 3 – 12m and is underlain by weathered rock. Much of the extremely - highly weathered rock may be excavated as gravel but there may be some larger rock fragments within this matrix.

The final section of chainage was not surveyed as the area consisted of very steep, overgrown land into the substation site. The boreholes carried out within the substation site indicate the depth to rock drops off rapidly towards the SW from the higher ground in the NE.

Along the alternative route 1B, there is no shallow rock noted. The overburden is generally sandy gravelly clay and silt with some clayey silty sand and gravel. In the field west of the R772 the overburden is generally interpreted as clayey silty sand and gravel. This overburden may also be saturated sand and gravel. There is also some dry sand and gravel noted in this field from Ch2735 – 2805.

5. Conclusions and Recommendations

The following conclusions and recommendations are made:

- The geophysical surveys carried out along the cable route shows the geology consists primarily of sandy gravelly clay and silt overburden underlain by weathered rock. The overburden thickness, depth to rock and overburden type varies across the cable route.
- There is a significant change in geology after Ch5133 associated with a fault zone which is evident in the geophysical data.
- 2D Resistivity and EM31 Ground conductivity was carried out along the whole cable route where access was available. Additional geophysics consisting of seismic refraction and MASW was carried out at specific locations.
- No very soft ground was noted anywhere the various geophysical surveys were carried out and the seismic refraction survey did not interpret any very soft ground.
- At the landfall site, an area of lower conductivity is interpreted as shallow rock. No seismic refraction was carried out here to determine its depth but BH01, BH03, BH05 indicate it is between 2.3 and 3m deep. BH02 and BH04 which are outside this area give the rock at 6 and 9 m deep respectively.
- From the landfall site to Ch600, the overburden is described as clay and silt. From here the overburden is generally described as sandy gravelly clay and silt or clayey silty sand and gravel with some smaller areas of clay and silt overburden.
- The different overburden types could all broadly be described as boulder clay with varying compositions and should be suitable for excavation and the cable route construction.
- Rock underlying the M11 crossing is at an elevation of approx. 15 mOD before becoming deeper to the SW along the chainage.
- In a number of areas, the overburden is described as unsaturated sand and gravel. These areas are shown with green hatching on Map 3. These sand and gravels are generally found on higher ground along the route.
- Map 3 shows areas along the chainage where the depth to rock is between 2.5 and 6m below ground level. There was no weathered rock noted shallower than 2.5m up to Ch5133, however between Ch1425 – 1565, highly weathered rock may be as shallow as 1 m bgl, while after Ch5133, extremely weathered rock is found shallower than 1m. Weathered rock in this area is 3m bgl or deeper.
- Recommendations for targeted ground investigation are made and are shown in Table 6 below.

- This report will be reviewed and finalised after the complete direct ground investigation data has been received.

Table 6: Recommended Direct Ground Investigation

Name	Location (ITM)	Specifics	Objective
RC-A	723654, 675139	Rotary Core Hole	Determine depth and quality of rock
TP-A	726262, 676313	Trial Pit and Rock Breaking	Determine depth and excavatability of rock
TP-B	725892, 675867	Trial Pit and Rock Breaking	Determine depth and excavatability of rock
TP-C	723019, 675071	Trial Pit and Rock Breaking	Determine depth and excavatability of rock

6. REFERENCES

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2. **Eurocode, 2007.** EN 1997-2:2007. Eurocode 7. Part 2 Ground Investigation and Testing 2007.
3. **GSEG 2002.** Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002.
4. **GSI, 2020.** Online Bedrock Geological Map of Ireland. Geological Survey of Ireland 2020.
5. **Milsom, 1989.** Field Geophysics. John Wiley and Sons.
6. **Reynolds, 1997.** An Introduction to Applied and Environmental Geophysics. John Wiley and Son.
7. **Weaver, 1975.** Geological Factors significant in the Assessment of Rippability.
8. **ARUP, 2020.** ABWP Onshore Cable Route Geotechnical Desk Study

Table 1: Geophysical Survey Locations and Acquisition Parameters
LF100034-ENG-GP-ONX-RPT-0001

2D-Resistivity Survey

Cable Route	Profile	Electrode Spacing (m)	Combined Length (m)	Start Chainage	Sub-Area
Route 1A	R1A	3	321	-318	Mainline
Route 1B	R2A	3	573	-567	Mainline
Route 1A	R3A	3	669	498	Mainline
Route 1A	R4A	3	540	13	Mainline
Route 1B	R5	3	126	2706	Mainline
Route 1A	R6A	3	861	2716	Mainline
Route 1A	R7	3	162	2649	Mainline
Route 1A	R8A	3	345	4034	Mainline
Route 1A	R9A	3	243	3824	Mainline
Route 1A	R10	3	75	3783	Mainline
Route 1A	R11	3	177	3600	Mainline
Route 1A	R12A	3	663	1941	Mainline
Route 1B	R13A	3	741	1941	Mainline
Route 1B	R14A	3	333	3224	Mainline
Route 1A	R15A	3	702	4689	Mainline
Route 1A	R16A	3	207	4517	Mainline
Route 1A	R17	3	93	4433	Mainline
Route 1A	R18	3	504	1433	Mainline
		SUM	**7335**		

Seismic Refraction Survey

Cable Route	Profile	Geophone Spacing (m)	Combined Length (m)	Start Chainage	
Route 1B	S1	3	123	2558	10
Route 1B	S2	3	69	2680 Crossing	10
Route 1B	S3	3	123	2706	11
Route 1B	S4	3	69	2712 Crossing	11
Route 1A	S5	3	87	474	1
Route 1A	S6	3	120	575	2
Route 1A	S7	3	69	3787 Crossing	6
Route 1A	S8	3	69	3577 Crossing	5
Route 1A	S9	3	90	2705	4
Route 1A	S10	3	90	2706 Crossing	4
Route 1A	S11	3	141	2914	Mainline
Route 1A	S12	3	108	2498	3
Route 1A	S13	3	105	2603 Crossing	3
Route 1A	S14	3	105	2661 Crossing	4
Route 1A	S15	3	66	2312	Mainline
Route 1A	S16	3	69	2115	Mainline
Route 1A	S17	3	69	854	Mainline
Route 1A	S18	3	357	5026	Mainline
Route 1A	S19	3	126	4266	7
Route 1A	S20	3	96	4393	7
Route 1A	S21	3	93	4428	8
Route 1A	S22	3	201	4517	8
Route 1A	S23	3	105	4690	8
Route 1A	S24	3	171	4729 Crossing	8
Route 1A	S25	3	99	4741	8
Route 1A	S26	3	213	1434	Mainline
		SUM	**3033**		

MASW

Cable Route	Profile	Geophone Spacing (m)	Length (m)	Start Chainage	
Route 1B	M1	1	135	2557	10
Route 1B	M2	1	87	2680 Crossing	10
Route 1B	M3	1	119	2717	11
Route 1B	M4	1	95	2712 Crossing	11

Table 1: Geophysical Survey Locations and Acquisition Parameters
LF100034-ENG-GP-ONX-RPT-0001

Route 1A	M5	1	95	474	1
Route 1A	M6	1	135	587	2
Route 1A	M7	1	111	3787 Crossing	6
Route 1A	M8	1	79	3577 Crossing	5
Route 1A	M9	1	119	2705	4
Route 1A	M10	1	111	2706 Crossing	4
Route 1A	M11	1	167	2914	Mainline
Route 1A	M12	1	103	2515	3
Route 1A	M13	1	119	2603 Crossing	3
Route 1A	M14	1	111	2661 Crossing	4
Route 1A	M15	1	95	2313	Mainline
Route 1A	M16	1	95	2115	Mainline
Route 1A	M17	1	95	860	Mainline
Route 1A	M18	1	431	5026	Mainline
Route 1A	M19	1	119	4266	7
Route 1A	M21	1	87	4444	8
Route 1A	M22	1	215	4530	8
Route 1A	M23	1	119	4700	8
Route 1A	M24a	1	55	4729 Crossing	8
Route 1A	M24b	1	103	4729 Crossing	8
Route 1A	M25	1	111	4742	8
		SUM	**3111**		

Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	CLIENT	Irish Drilling Ltd Sure Partners Ltd.	SCALE: 1:6000 @ A1 PROJECT: 6527
	PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey	DRAWN: HS DATE: 10/11/2020
	TITLE	Map 1: Overview Map	MGX FILE: 6527d_Plans.dwg STATUS: Draft

LEGEND: **Geophysical Survey Locations:**

R2 (blue line)	2D-Resistivity Profile
S1 (red line)	Seismic Refraction Profile
M3 (green line)	MASW Profile
(magenta outline)	EM31 Survey Area
CH0100 (black line)	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1	Bore Hole

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Map 2: EM31 Ground Conductivity Contour Map

SCALE:	1:6000 @ A1
PROJECT:	6527
DRAWN:	HS
DATE:	10/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Map 3: Geophysical Survey Interpretation Map

SCALE:	1:6000 @ A1
PROJECT:	6527
DRAWN:	HS
DATE:	10/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1	Bore Hole
TP-A	Proposed Trial Pit

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consists of deep boulder clay which is suitable for the construction of a cable route.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 1a: Survey Locations and Models for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	10/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0, 40.0, 80.0, 160, 320, 640, 1280, 2560

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 1b: Survey Locations and Models for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3 4.2 6 8.5 12 17 24 34 48 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0 40.0 80.0 160 320 640 1280 2560

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 1c: Survey Locations and Models for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3 4.2 6 8.5 12 17 24 34 48 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0 40.0 80.0 160 320 640 1280 2560

Reference No:
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LEGEND: Geophysical Survey Locations:

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0, 40.0, 80.0, 160, 320, 640, 1280, 2560

CLIENT	Irish Drilling Ltd Sure Partners Ltd.	SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey	PROJECT:	6527
		DRAWN:	JC
		DATE:	18/11/2020
TITLE	Plan 1e: Survey Locations and Models for Cable Route 1A	MGX FILE:	6527d_Plans.dwg
		STATUS:	Draft

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LEGEND: Geophysical Survey Locations:

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3 4.2 6 8.5 12 17 24 34 48 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0 40.0 80.0 160 320 640 1280 2560

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 1f: Survey Locations and Models for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0, 40.0, 80.0, 160, 320, 640, 1280, 2560

Reference No:
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	PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey	
	TITLE	Plan 1g: Survey Locations and Models for Cable Route 1A	

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3 4.2 6 8.5 12 17 24 34 48 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0 40.0 80.0 160 320 640 1280 2560

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 1h: Survey Locations and Models for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3 4.2 6 8.5 12 17 24 34 48 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0 40.0 80.0 160 320 640 1280 2560

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 1i: Survey Locations and Models for Cable Route 1B

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3 4.2 6 8.5 12 17 24 34 48 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0 40.0 80.0 160 320 640 1280 2560

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	CLIENT	Irish Drilling Ltd Sure Partners Ltd.
	PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
	TITLE	Plan 1j: Survey Locations and Models for Cable Route 1B

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3 4.2 6 8.5 12 17 24 34 48 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0 40.0 80.0 160 320 640 1280 2560

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 1k: Survey Locations and Models for Cable Route 1B

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3 4.2 6 8.5 12 17 24 34 48 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0 40.0 80.0 160 320 640 1280 2560

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited
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Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 11: Survey Locations and Models for Cable Route 1B

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

20.0, 40.0, 80.0, 160, 320, 640, 1280, 2560

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited

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Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 2a: Survey Locations and Interpretation for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND:

Geophysical Survey Locations:

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- CH0100 — Centreline with Chainage
- EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1. Top of Rock between 2.5 - 6 m below ground level
2. >3m sand and gravel deposit at surface
3. Area of possible dumping

Interpretation (Res Only):

- A Sand and Gravel
- B Clayey silty Sand and Gravel
- C Clay and Silt
- D Sandy gravelly Clay and Silt
- E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited

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Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 2b: Survey Locations and Interpretation for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- CH0100 — Centreline with Chainage
- EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Res Only):

A Sand and Gravel
B Clayey silty Sand and Gravel
C Clay and Silt
D Sandy gravelly Clay and Silt
E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 2c: Survey Locations and Interpretation for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
CH0100	Centreline with Chainage
	EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Res Only):

A Sand and Gravel
B Clayey silty Sand and Gravel
C Clay and Silt
D Sandy gravelly Clay and Silt
E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	
CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 2d: Survey Locations and Interpretation for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- CH0100 — Centreline with Chainage
- EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Res Only):

A Sand and Gravel
B Clayey silty Sand and Gravel
C Clay and Silt
D Sandy gravelly Clay and Silt
E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex
Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
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Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 2e: Survey Locations and Interpretation for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- CH0100 — Centreline with Chainage
- EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1. Top of Rock between 2.5 - 6 m below ground level
2. >3m sand and gravel deposit at surface
3. Area of possible dumping

Interpretation (Res Only):

- A Sand and Gravel
- B Clayey silty Sand and Gravel
- C Clay and Silt
- D Sandy gravelly Clay and Silt
- E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd	SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
		PROJECT:	6527
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey	DRAWN:	JC
		DATE:	03/12/2020
TITLE	Plan 2f: Survey Locations and Interpretation for Cable Route 1A	MGX FILE:	6527d_Plans.dwg
		STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
CH0100	Centreline with Chainage
	EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Res Only):

A Sand and Gravel
B Clayey silty Sand and Gravel
C Clay and Silt
D Sandy gravelly Clay and Silt
E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	CLIENT	Irish Drilling Ltd Sure Partners Ltd	
	PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey	
	TITLE	Plan 2g: Survey Locations and Interpretation for Cable Route 1A	

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
CH0100	Centreline with Chainage
	EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Res Only):

A Sand and Gravel
B Clayey silty Sand and Gravel
C Clay and Silt
D Sandy gravelly Clay and Silt
E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited

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Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 2h: Survey Locations and Interpretation for Cable Route 1A

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
CH0100	Centreline with Chainage
	EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Res Only):

A Sand and Gravel
B Clayey silty Sand and Gravel
C Clay and Silt
D Sandy gravelly Clay and Silt
E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	CLIENT	Irish Drilling Ltd Sure Partners Ltd.	
	PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey	
	TITLE	Plan 2i: Survey Locations and Interpretation for Cable Route 1B	

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	18/11/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Res Only):

A Sand and Gravel
B Clayey silty Sand and Gravel
C Clay and Silt
D Sandy gravelly Clay and Silt
E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 2j: Survey Locations and Interpretation for Cable Route 1B

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- CH0100 — Centreline with Chainage
- EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1. Top of Rock between 2.5 - 6 m below ground level
2. >3m sand and gravel deposit at surface
3. Area of possible dumping

Interpretation (Res Only):

- A Sand and Gravel
- B Clayey silty Sand and Gravel
- C Clay and Silt
- D Sandy gravelly Clay and Silt
- E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Email: info@mgx.ie Web: www.mgx.ie	CLIENT	Irish Drilling Ltd Sure Partners Ltd	
	PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey	
	TITLE	Plan 2k: Survey Locations and Interpretation for Cable Route 1B	

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- CH0100 — Centreline with Chainage
- EM31 Survey Area

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1. Top of Rock between 2.5 - 6 m below ground level
2. >3m sand and gravel deposit at surface
3. Area of possible dumping

Interpretation (Res Only):

- A Sand and Gravel
- B Clayey silty Sand and Gravel
- C Clay and Silt
- D Sandy gravelly Clay and Silt
- E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 2l: Survey Locations and Interpretation for Cable Route 1B

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1. Top of Rock between 2.5 - 6 m below ground level
2. >3m sand and gravel deposit at surface
3. Area of possible dumping

Interpretation (Res Only):

- A Sand and Gravel
- B Clayey silty Sand and Gravel
- C Clay and Silt
- D Sandy gravelly Clay and Silt
- E Weathered Rock or Clayey silty Sand and Gravel Overburden

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

Minerex Geophysics Limited
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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 3a: Survey Locations and Models from sub-areas 1, 2-Ch 2400

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

Layers from Seismic Refraction Model: (From Start - Ch5133)

- Ground Surface/Top of Layer 1 (<300 m/s)
- Top of Layer 2 (400 - 800 m/s)
- Top of Layer 3 (1500 - 1700 m/s)
- Top of Layer 4 (2400 - 2600 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 Seismic Velocity in m/s

Layers from Seismic Refraction Model: (From Ch5133 - End)

- Ground Surface/Top of Layer 2 (400 - 800 m/s)
- Top of Layer 6 (2000 m/s)
- Top of Layer 7 (2700 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 Seismic Velocity in m/s

MASW Results:

Shear Wave Velocity in m/s:

100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200

20, 80, 180, 320, 500, 720, 980, 1280, 1620, 2000, 2420, 2880

Shear Modulus in MPa (computed with 2000kg/m3)

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 3b: Survey Locations and Models from sub-areas 3, 4-Ch 3070

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

Layers from Seismic Refraction Model: (From Start - Ch5133)

- Ground Surface/Top of Layer 1 (<300 m/s)
- Top of Layer 2 (400 - 800 m/s)
- Top of Layer 3 (1500 - 1700 m/s)
- Top of Layer 4 (2400 - 2600 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 — Seismic Velocity in m/s

Layers from Seismic Refraction Model: (From Ch5133 - End)

- Ground Surface/Top of Layer 2 (400 - 800 m/s)
- Top of Layer 6 (2000 m/s)
- Top of Layer 7 (2700 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 — Seismic Velocity in m/s

MASW Results:

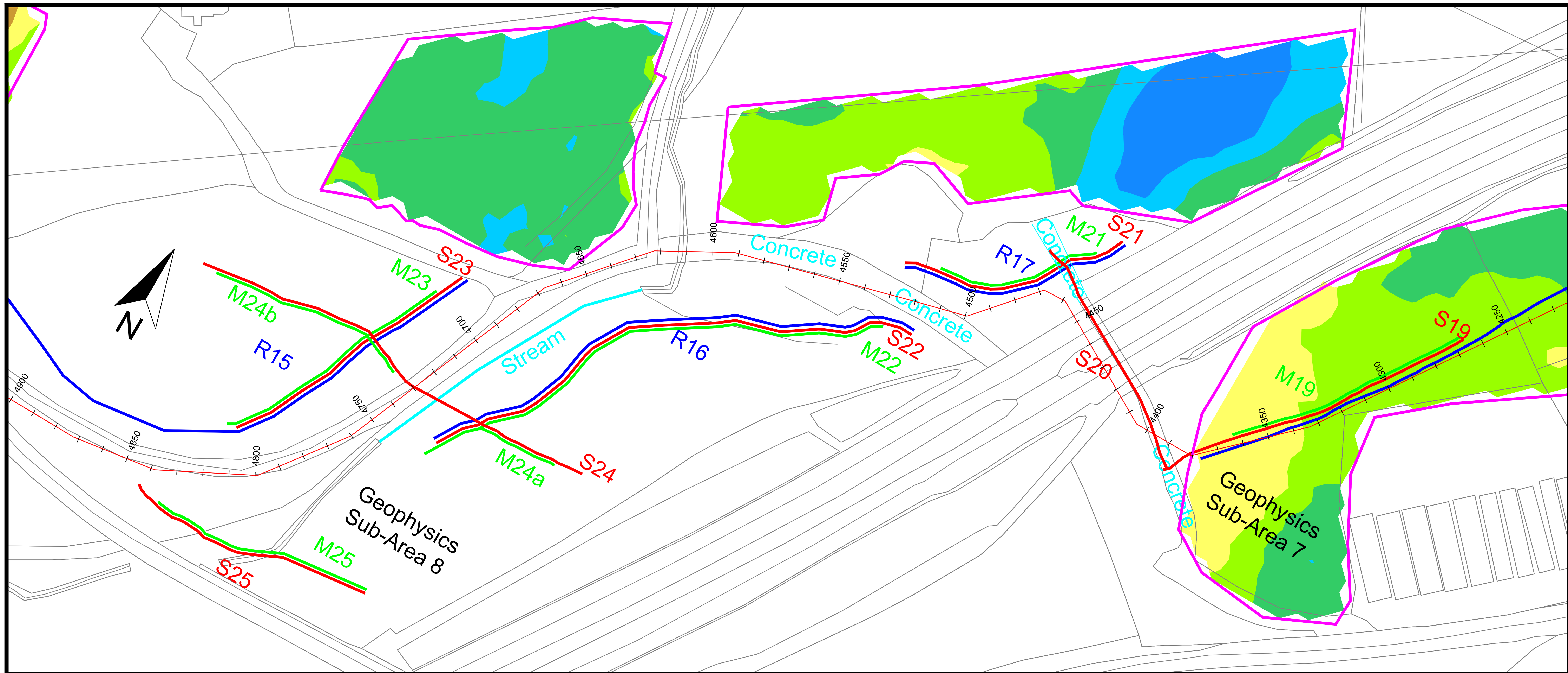
Shear Wave Velocity in m/s:

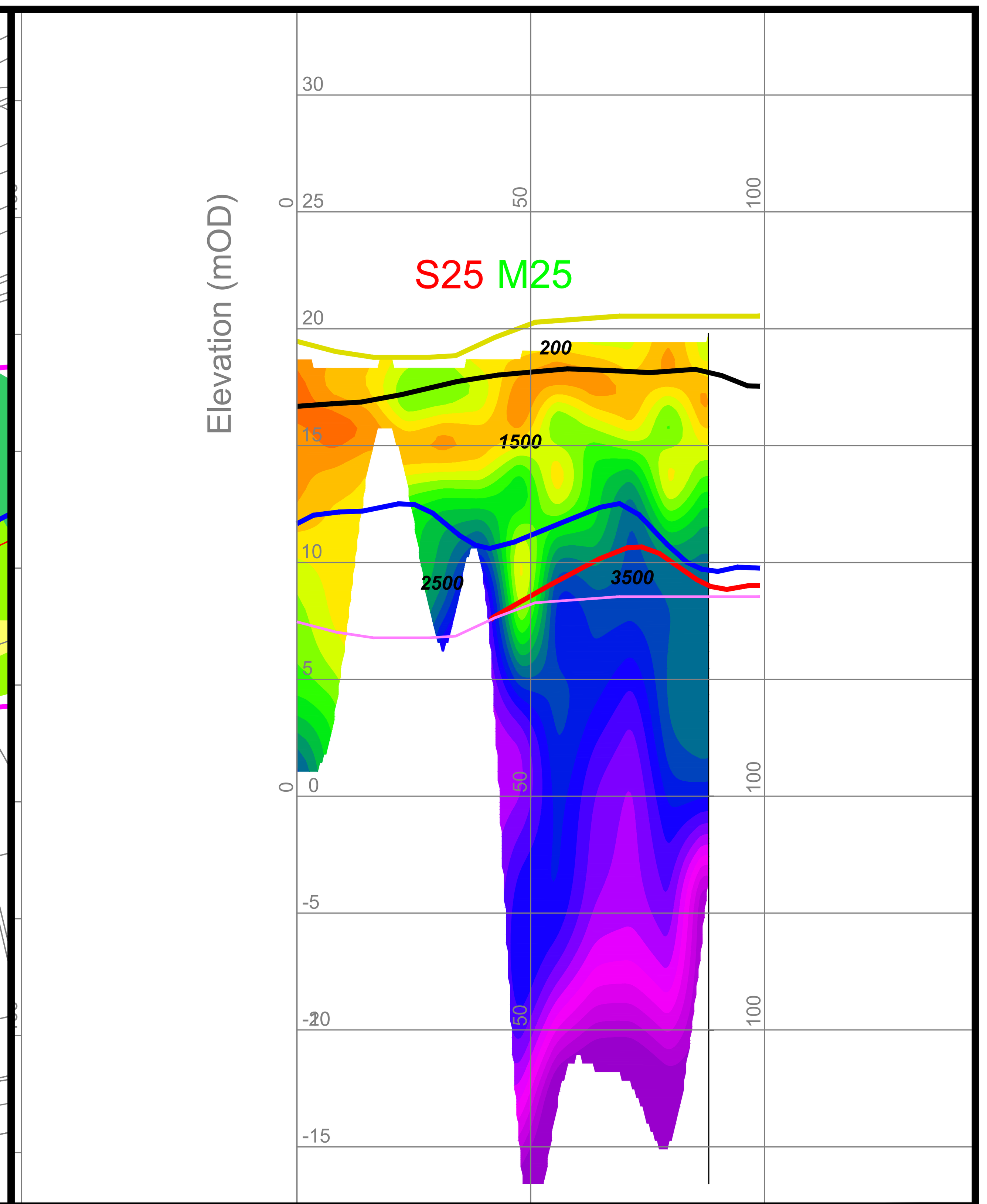
100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200

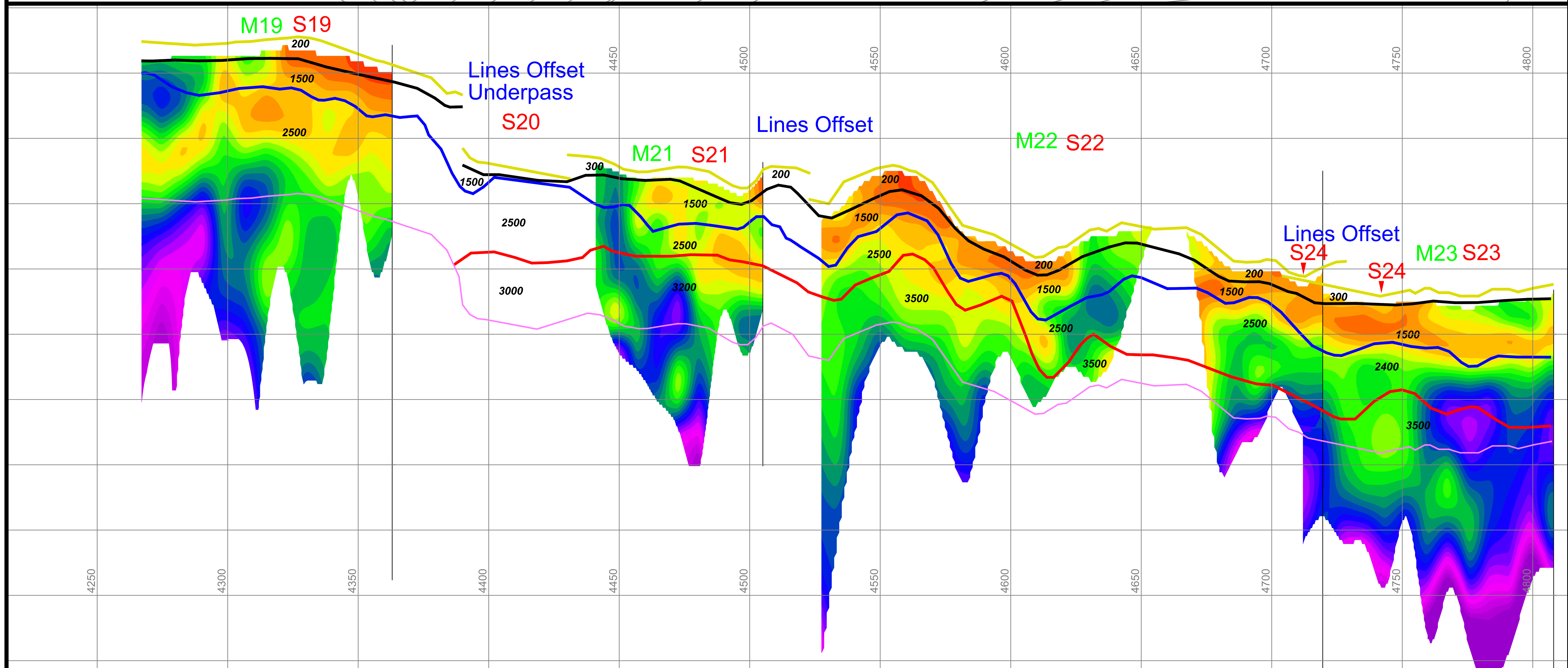
20, 80, 180, 320, 500, 720, 980, 1280, 1620, 2000, 2420, 2880

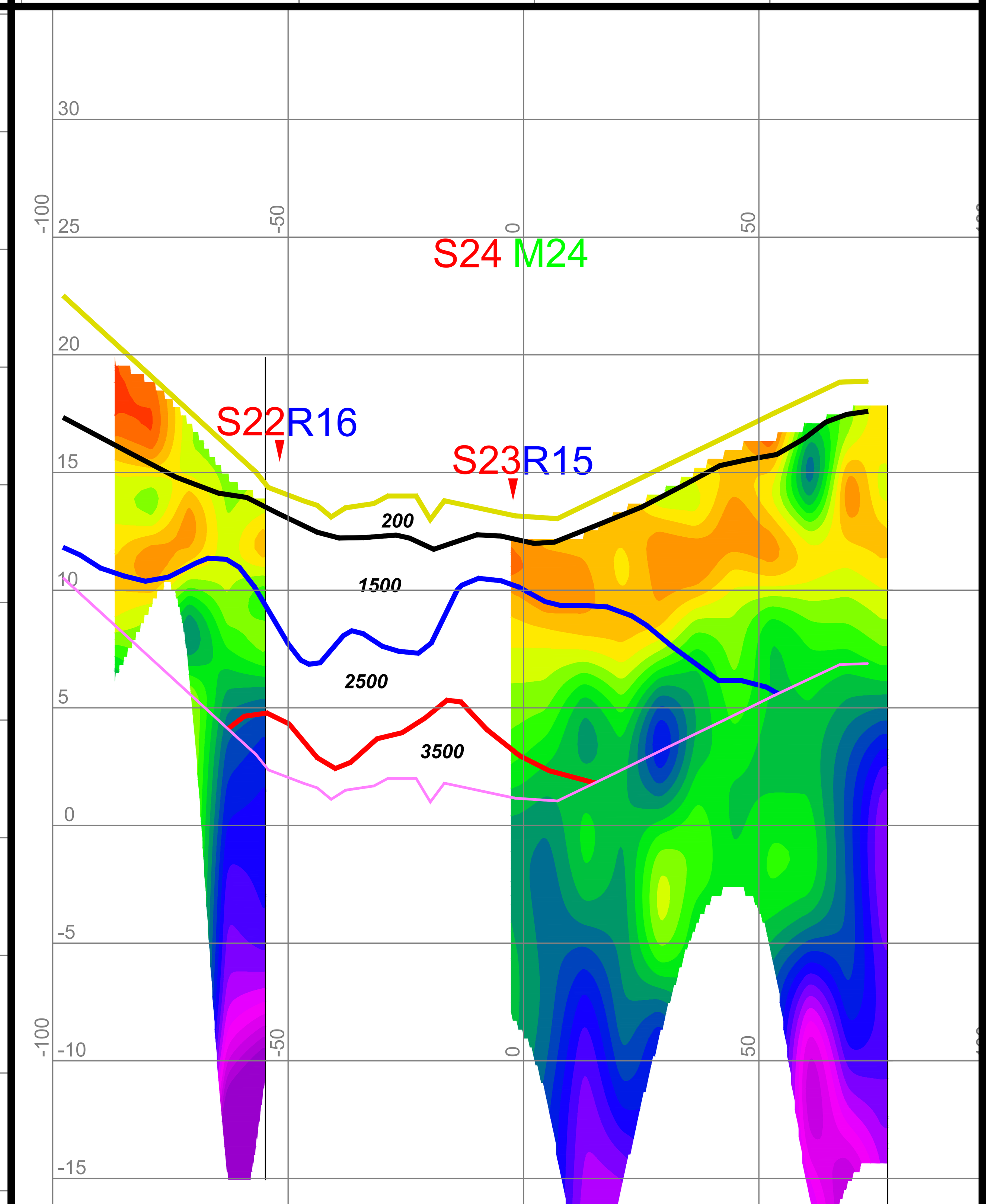
Shear Modulus in MPa (computed with 2000kg/m3)

Reference No:
LF100034-ENG-GP-ONX-RPT-0001









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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 3c: Survey Locations and Models from sub-areas 7 & 8

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

Layers from Seismic Refraction Model:
(From Start - Ch5133)

- Ground Surface/Top of Layer 1 (<300 m/s)
- Top of Layer 2 (400 - 800 m/s)
- Top of Layer 3 (1500 - 1700 m/s)
- Top of Layer 4 (2400 - 2600 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 Seismic Velocity in m/s

Layers from Seismic Refraction Model:
(From Ch5133 - End)

- Ground Surface/Top of Layer 2 (400 - 800 m/s)
- Top of Layer 6 (2000 m/s)
- Top of Layer 7 (2700 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 Seismic Velocity in m/s

MASW Results:

Shear Wave Velocity in m/s:

100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200

20, 80, 180, 320, 500, 720, 980, 1280, 1620, 2000, 2420, 2880

Shear Modulus in MPa (computed with 2000kg/m3)

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 3d: Survey Locations and Models from Ch5000 - Ch5500

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

Layers from Seismic Refraction Model: (From Start - Ch5133)

- Ground Surface/Top of Layer 1 (<300 m/s)
- Top of Layer 2 (400 - 800 m/s)
- Top of Layer 3 (1500 - 1700 m/s)
- Top of Layer 4 (2400 - 2600 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 — Seismic Velocity in m/s

Layers from Seismic Refraction Model: (From Ch5133 - End)

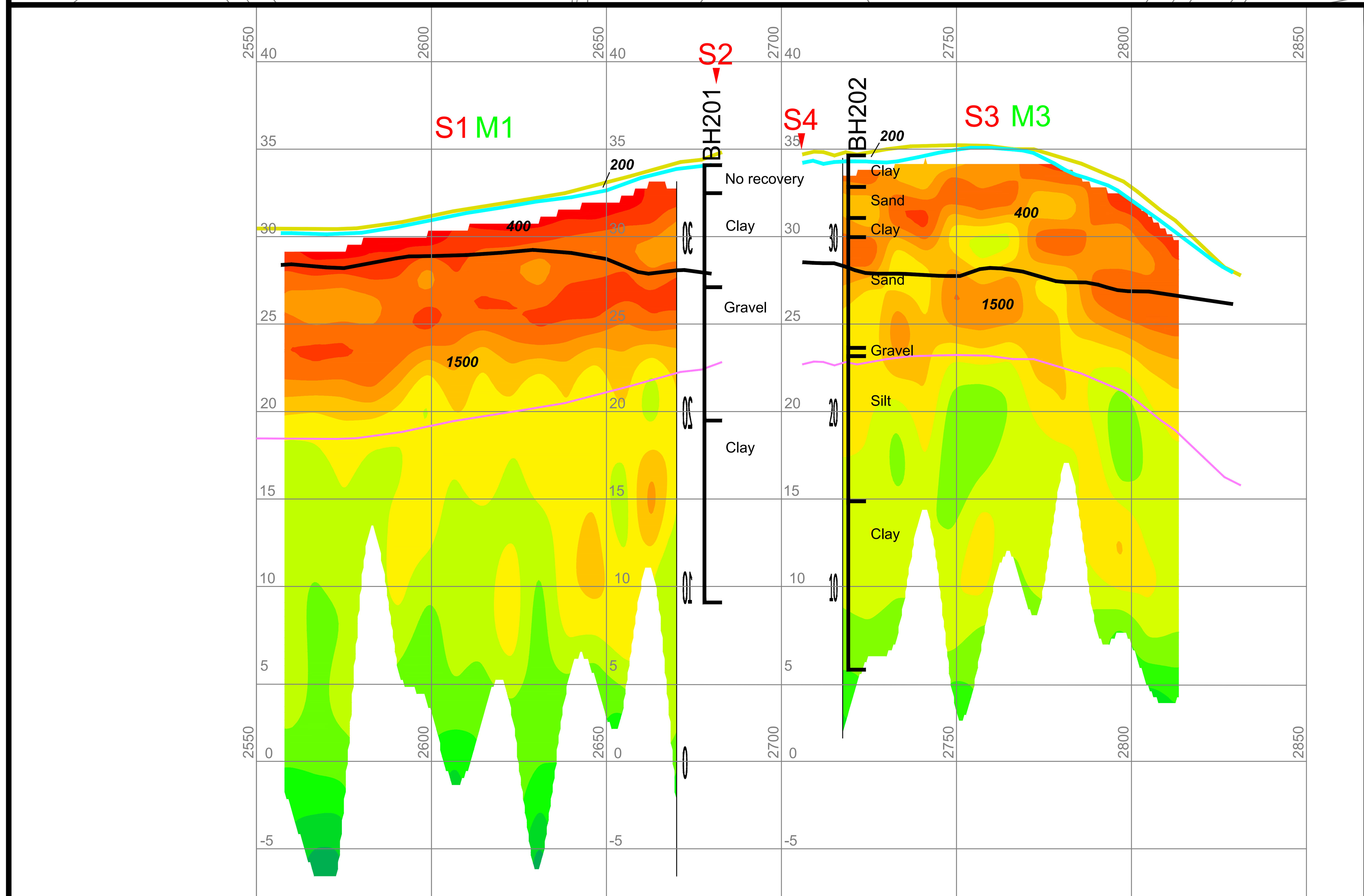
- Ground Surface/Top of Layer 2 (400 - 800 m/s)
- Top of Layer 6 (2000 m/s)
- Top of Layer 7 (2700 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 — Seismic Velocity in m/s

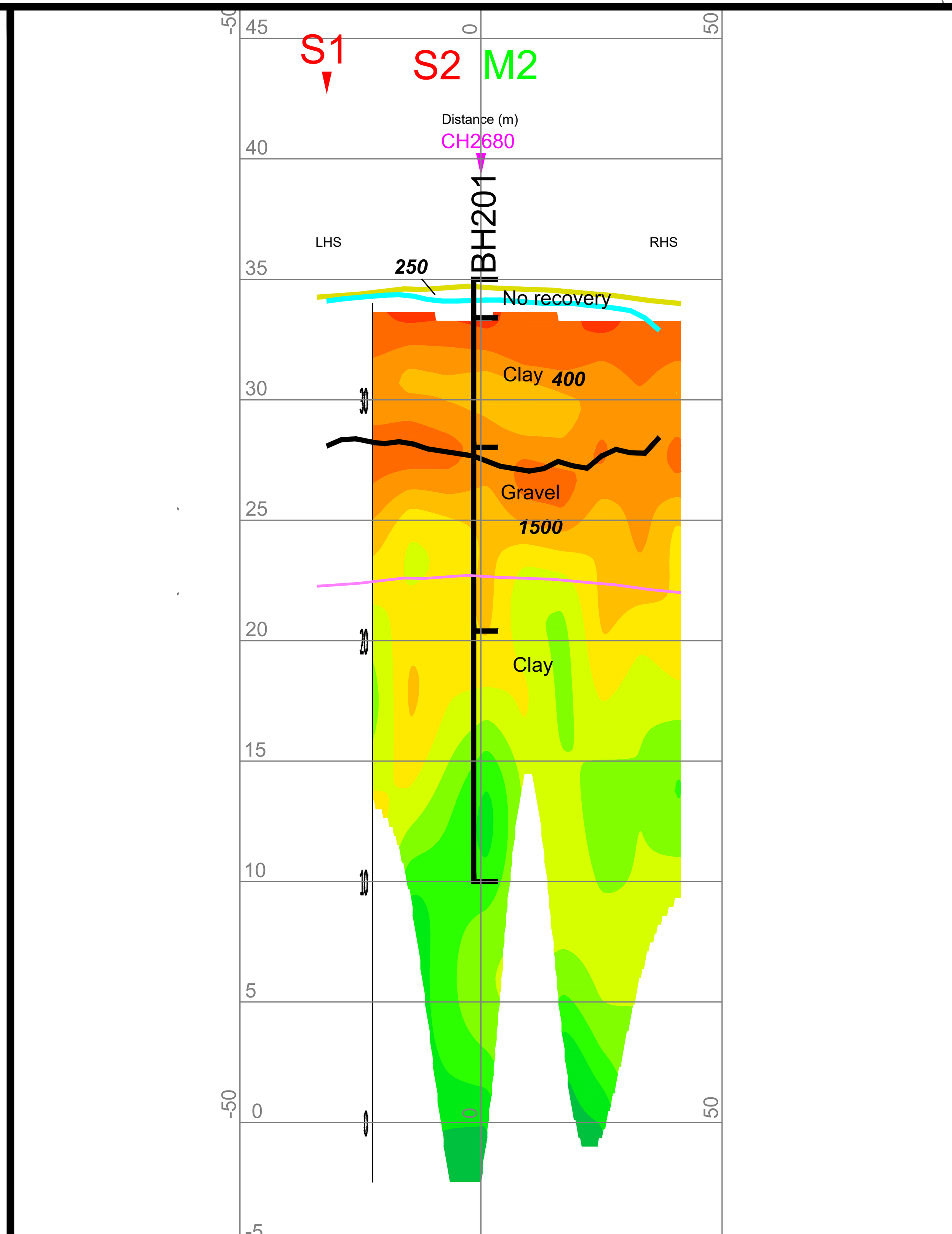
MASW Results:

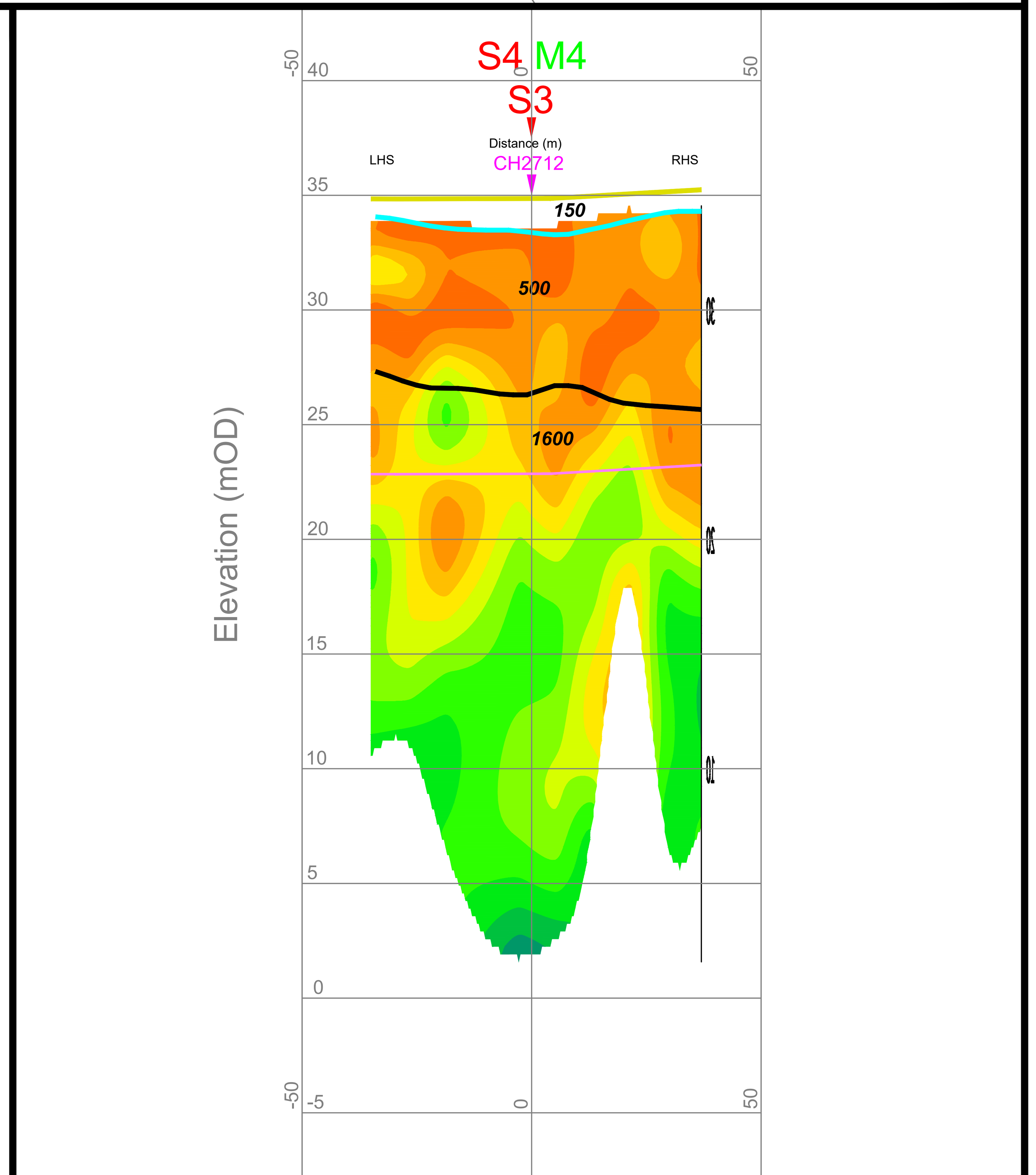
Shear Wave Velocity in m/s: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200

Shear Modulus in MPa (computed with 2000kg/m3): 20, 80, 180, 320, 500, 720, 980, 1280, 1620, 2000, 2420, 2880

Reference No:
LF100034-ENG-GP-ONX-RPT-0001







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CLIENT	Irish Drilling Ltd Sure Partners Ltd.
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 3e: Survey Locations and Models from sub-areas 10 & 11

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

EM31 on Map View (Top Drawing)

EM31 Ground Conductivity (mS/m)

3, 4.2, 6, 8.5, 12, 17, 24, 34, 48, 68

Layers from Seismic Refraction Model: (From Start - Ch5133)

- Ground Surface/Top of Layer 1 (<300 m/s)
- Top of Layer 2 (400 - 800 m/s)
- Top of Layer 3 (1500 - 1700 m/s)
- Top of Layer 4 (2400 - 2600 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 — Seismic Velocity in m/s

Layers from Seismic Refraction Model: (From Ch5133 - End)

- Ground Surface/Top of Layer 2 (400 - 800 m/s)
- Top of Layer 6 (2000 m/s)
- Top of Layer 7 (2700 m/s)
- Top of Layer 5 (3000 - 3500 m/s)
- Seismic Modelling Depth
- 1800 — Seismic Velocity in m/s

MASW Results:

Shear Wave Velocity in m/s: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200

Shear Modulus in MPa (computed with 2000kg/m3): 20, 80, 180, 320, 500, 720, 980, 1280, 1620, 2000, 2420, 2880

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 4a: Survey Locations and Interp. from sub-areas 1, 2-Ch 2400

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Seis Only): (Start - Ch5133)

1 Soft or loose Topsoil or Made Ground
2 Firm or Medium Dense Overburden
3 Stiff or dense Overburden
4 Very stiff or very dense Overburden
5 Fair Weathered Rock

Interpretation (Seis Only): (Ch5133 - End)

2 Firm or Medium Dense Overburden
6 Very poor Extremely Weathered Rock
7 Poor Very weathered Rock
5 Fair Weathered Rock

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 4b: Survey Locations and Interp. from sub-areas 3, 4-Ch 3070

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1. Top of Rock between 2.5 - 6 m below ground level
2. >3m sand and gravel deposit at surface
3. Area of possible dumping

Interpretation (Seis Only): (Start - Ch5133)

1 Soft or loose Topsoil or Made Ground
2 Firm or Medium Dense Overburden
3 Stiff or dense Overburden
4 Very stiff or very dense Overburden
5 Fair Weathered Rock

Interpretation (Seis Only): (Ch5133 - End)

2 Firm or Medium Dense Overburden
6 Very poor Extremely Weathered Rock
7 Poor Very weathered Rock
5 Fair Weathered Rock

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001

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CLIENT: Irish Drilling Ltd
Sure Partners Ltd

PROJECT: Arklow Bank Onshore Cable Route
Geophysical Survey

TITLE: Plan 4c: Survey Locations and Interpretation from sub-areas 7 & 8

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: Geophysical Survey Locations:

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Seis Only):
(Start - Ch5133)

1 Soft or loose Topsoil or Made Ground
2 Firm or Medium Dense Overburden
3 Stiff or dense Overburden
4 Very stiff or very dense Overburden
5 Fair Weathered Rock

Interpretation (Seis Only):
(Ch5133 - End)

2 Firm or Medium Dense Overburden
6 Very poor Extremely Weathered Rock
7 Poor Very weathered Rock
5 Fair Weathered Rock

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
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CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 4d: Survey Locations and Interpr. Models from Ch5000 - 5500

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

R2	2D-Resistivity Profile
S1	Seismic Refraction Profile
M3	MASW Profile
	EM31 Survey Area
CH0100	Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

BH1 Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1 Top of Rock between 2.5 - 6 m below ground level
2 >3m sand and gravel deposit at surface
3 Area of possible dumping

Interpretation (Seis Only): (Start - Ch5133)

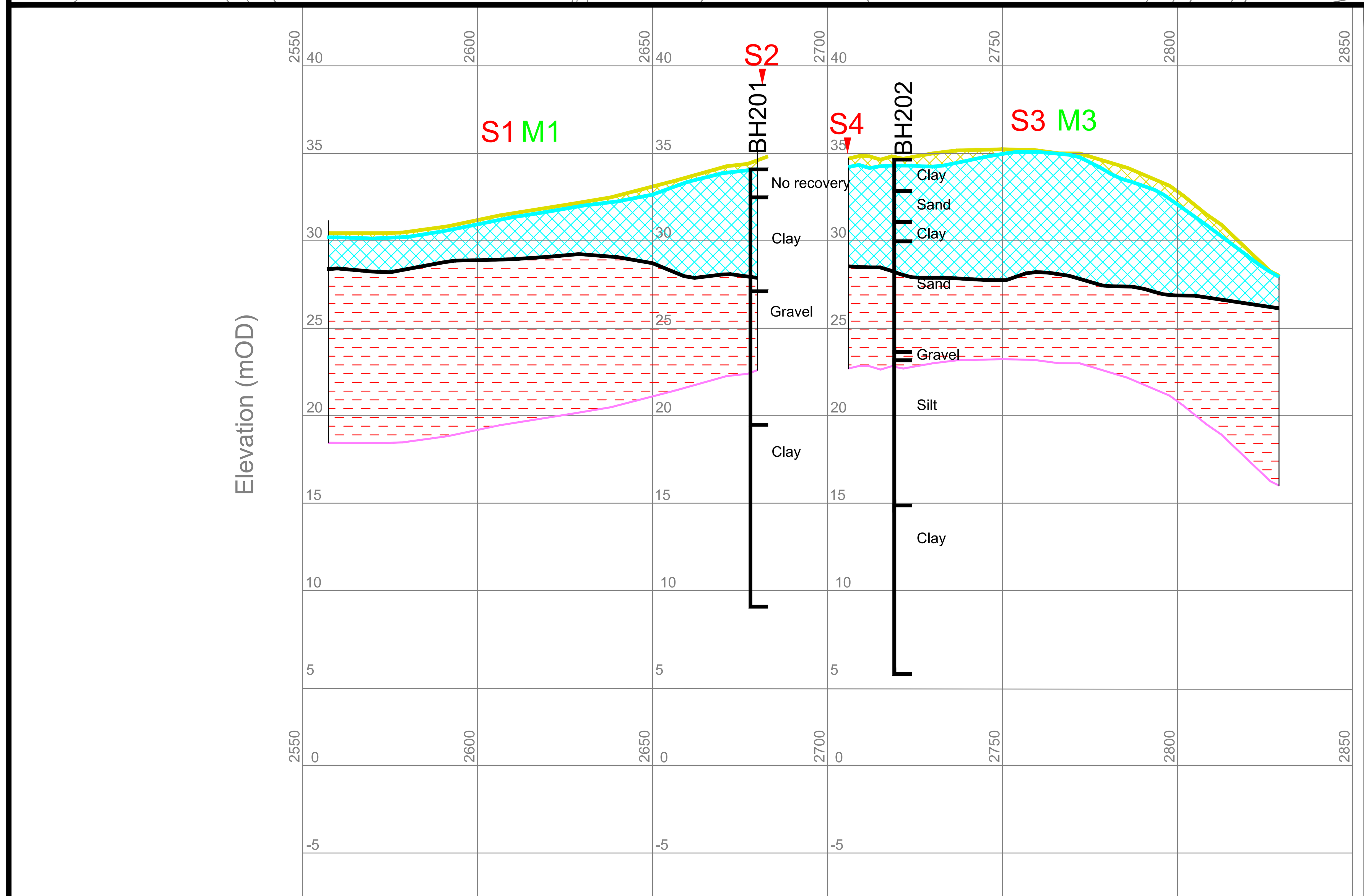
1 Soft or loose Topsoil or Made Ground
2 Firm or Medium Dense Overburden
3 Stiff or dense Overburden
4 Very stiff or very dense Overburden
5 Fair Weathered Rock

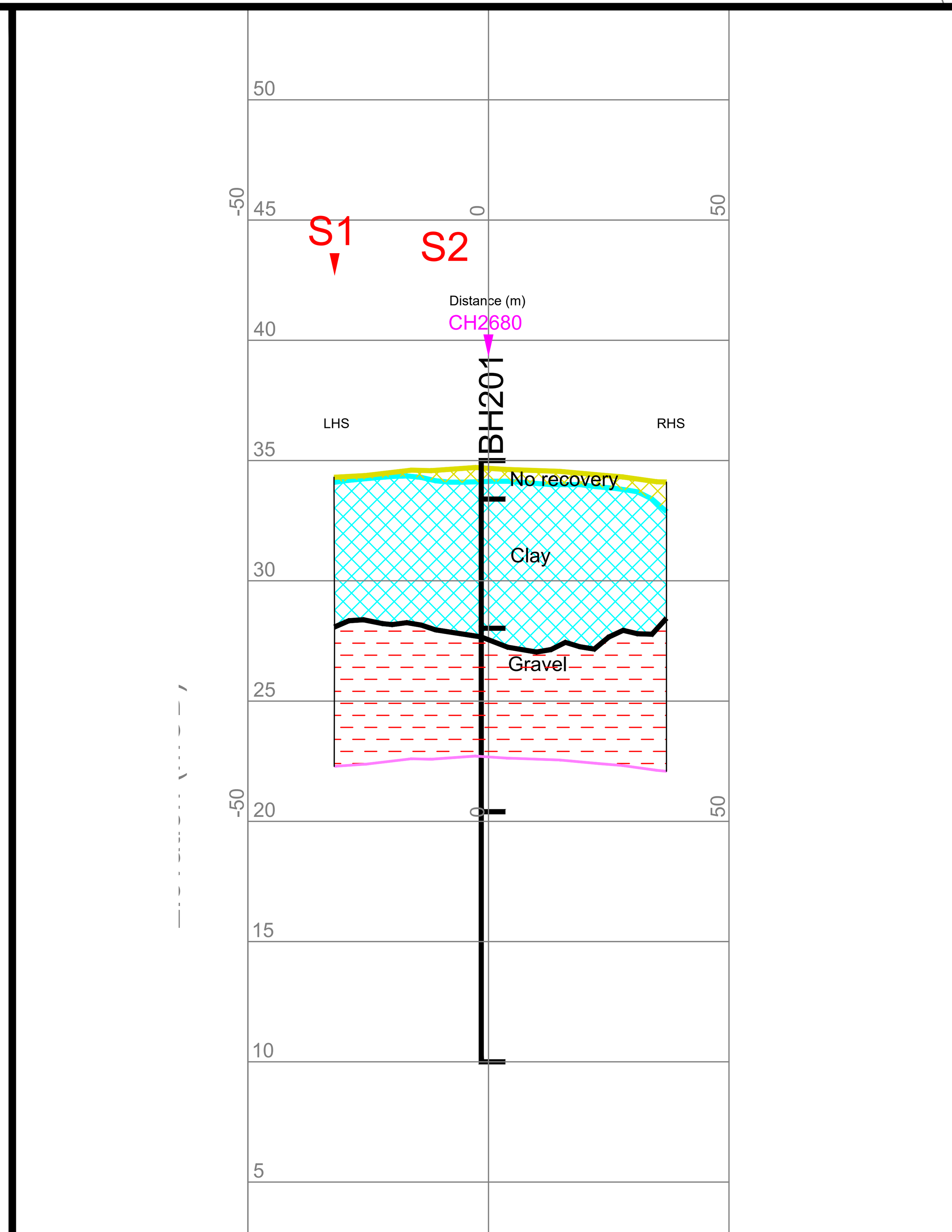
Interpretation (Seis Only): (Ch5133 - End)

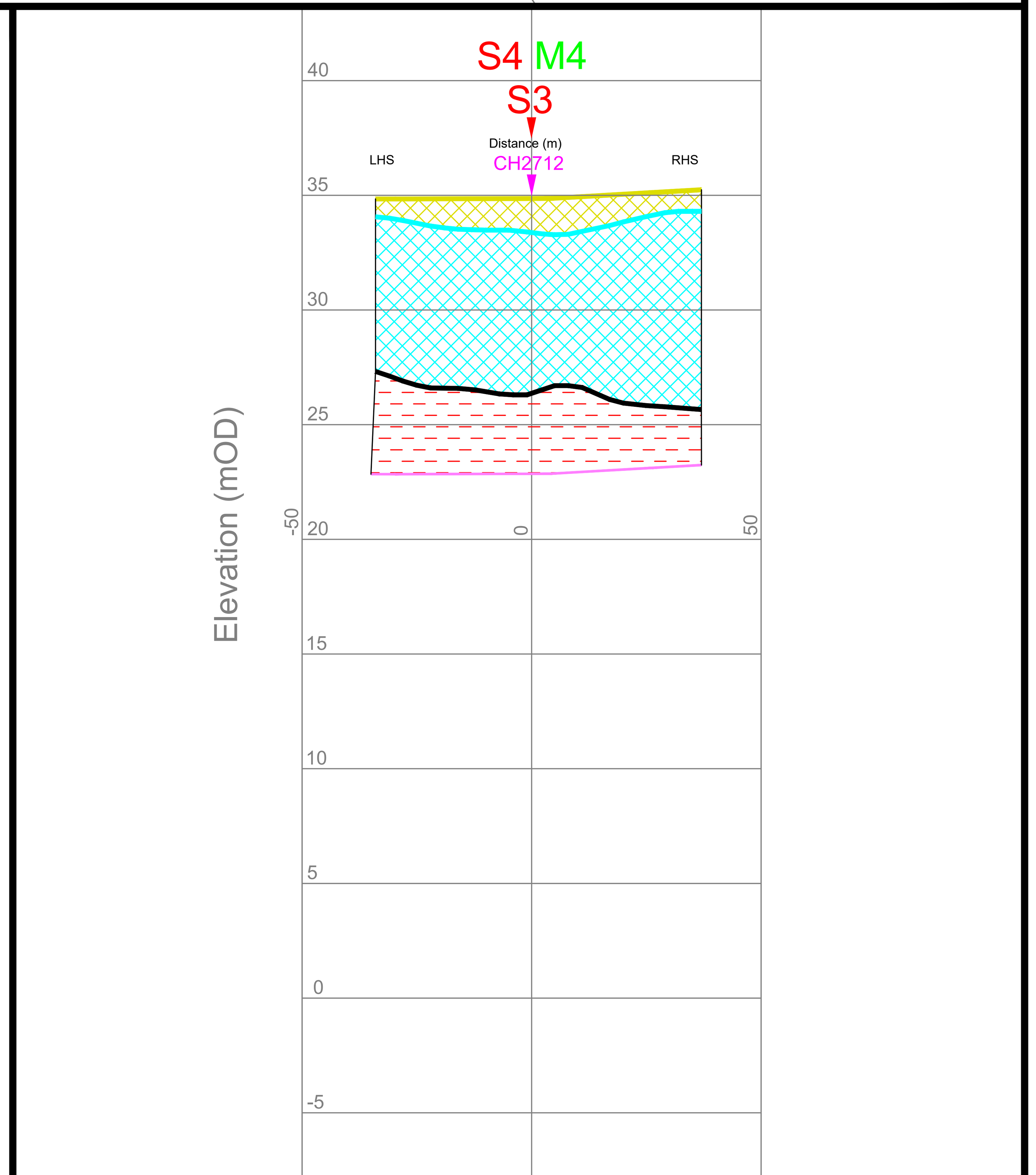
2 Firm or Medium Dense Overburden
6 Very poor Extremely Weathered Rock
7 Poor Very weathered Rock
5 Fair Weathered Rock

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001







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CLIENT	Irish Drilling Ltd Sure Partners Ltd
PROJECT	Arklow Bank Onshore Cable Route Geophysical Survey
TITLE	Plan 4e: Survey Locations and Interp. from sub-areas 10 & 11

SCALE:	Hor 1:1000 @ A1, Ver 1:200 @ A1, VE x 5
PROJECT:	6527
DRAWN:	JC
DATE:	03/12/2020
MGX FILE:	6527d_Plans.dwg
STATUS:	Draft

LEGEND: **Geophysical Survey Locations:**

- R2 — 2D-Resistivity Profile
- S1 — Seismic Refraction Profile
- M3 — MASW Profile
- EM31 Survey Area
- CH0100 — Centreline with Chainage

Locations are in Irish Transverse Mercator, Elevations are in mOD (Malin Head)

Direct Ground Investigation Locations:

- BH1 — Bore Hole

Abbreviated borehole logs are indicated on the sections. Generally the main soil or rock type is written along the layers from the borehole log. Thin layers have been excluded for clarity. For details refer to the logs in the main ground investigation report.

Interpretation Map:

1. Top of Rock between 2.5 - 6 m below ground level
2. >3m sand and gravel deposit at surface
3. Area of possible dumping

Interpretation (Seis Only): (Start - Ch5133)

1. Soft or loose Topsoil or Made Ground
2. Firm or Medium Dense Overburden
3. Stiff or dense Overburden
4. Very stiff or very dense Overburden
5. Fair Weathered Rock

Interpretation (Seis Only): (Ch5133 - End)

- 2 Firm or Medium Dense Overburden
- 6 Very poor Extremely Weathered Rock
- 7 Poor Very weathered Rock
- 5 Fair Weathered Rock

The interpretation map highlights the main constraints or areas of possible interest for the design and construction of the cable route utilising all the available information. Most of the site consisted of deep boulder clay which should be ideal for excavation and ground stability.

Reference No:
LF100034-ENG-GP-ONX-RPT-0001