APPENDIX C

Geophysical Report

AGL15302_02

REPORT

ON THE

GEOPHYSICAL SURVEY

AT

FASSAROE LANDFILL, CO. WICKLOW

FOR

RPS.

9TH MAY 2016

apex geoservices

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PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOSERVICES LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGL15302		
AUTHOR	**CHECKED**	**REPORT STATUS**	**DATE**
EurGeol Yvonne O'Connell P.Geo., M.Sc	EurGeol Peter O'Connor P.Geo., M.Sc., Dip. EIA Mgt.	V.01	20TH April 2016
EurGeol Yvonne O'Connell P.Geo., M.Sc	EurGeol Peter O'Connor P.Geo., M.Sc., Dip. EIA Mgt.	V.02	9TH May 2016

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1. EXECUTIVE SUMMARY

APEX Geoservices Limited was requested by RPS Group to carry out a geophysical investigation at 5 No. historical, disused landfill sites that occupy previous sand/gravel extraction sites at Fassaroe, County Wicklow. The sites are located west of the Greenstar Waste Transfer Centre, north and south of Berryfield Lane. The sites collectively cover an area of approximately 9 Ha.

The requirement for a geophysical survey to assess the areas of landfill has come about due to the proposed development of the area into residential and parkland areas. The investigation consisted of Electromagnetic ground conductivity mapping, Electrical Resistivity Tomography (ERT) and seismic refraction profiling.

The survey was carried out to identify the lateral extent of the waste bodies, identify the thickness of the waste bodies and presence of any anomalous features and identify any leachate plumes outside of or below the waste body. It was indicated that the geophysical survey was unlikely to provide information on trace metals that could potentially be leaching from the site.

The sites lie at elevations ranging from c.50 to 100 m OD, sloping downwards sharply to the north and northeast towards a stream at the base of the slope.

The integrated interpretation of the geophysical results with the borehole and trial pit data identified 0.53 Ha waste at Site 1, 4.1 Ha at Site 2, 1.75 Ha at Site 3a, 0.44 Ha at Site 3b, and 0.8 Ha at Site 3c.

Interpreted waste thicknesses of up to 16 m at Site 1, up to 26m at Site 2, up to 20 m at Site 3a, up to 8.5 m at Site 3b, and up to 20.5 m at Site 3c were identified.

Very low resistivities (<30 Ohm-m) beneath the waste bodies suggest high levels of leachate in the underlying material at Sites 2, 3a and 3c.

The migration of leachate beyond the boundary of the waste bodies, down-slope to the north and north east is suggested at Sites 2, 3a and 3c with the strongest likelihood at Site 2.

Evidence of landslide/slip material is also suggested on the northern/north eastern slopes of Sites 2, 3a and 3c.

The slope material should be investigated by hand dug trial pits to confirm the presence of and determine the extent of waste material from landslides/slips. Consideration should be made to the slope stability when targeting any intrusive investigations on the slope.

Seepage was noted on the slope at Site 2. Sampling should be carried out at the base of the slopes at Sites 1, 2, 3a and 3c to investigate the migration of leachate.

The findings of the geophysical investigation should be reviewed following any further intrusive investigations.

2. INTRODUCTION

APEX Geoservices Limited was requested by RPS Group to carry out a geophysical investigation at 5 No. historical, disused landfill sites at Fassaroe, County Wicklow. The requirement to assess the areas of landfill has come about due to the proposed development of the area into residential and parkland areas.

2.1 Survey Objectives

The objectives of the investigation were:

- Identify the lateral extent of the waste body,
- Identify the thickness of the waste body and presence of any anomalous features,
- Identify any leachate plumes outside of or below the waste body,
- *Trace metals that could potentially be leaching from the site.

**It was indicated that the geophysical survey was unlikely to provide information on trace metals.*

2.2 Site Background

The sites are located in Fassaroe, west of the Greenstar Waste Transfer Centre, north and south of Berryfield Lane. The sites collectively cover an area of approximately 9 Ha. The sites have been referenced as site 1, 2, 3a, 3b and 3c by the client as highlighted on Figure 2.1 below. It is understood that the disused landfill occupies previous sand/gravel extraction sites.

Fig 2.1: Location map (site marked in magenta)

Fig 2.2: Site 1 Looking towards the south east

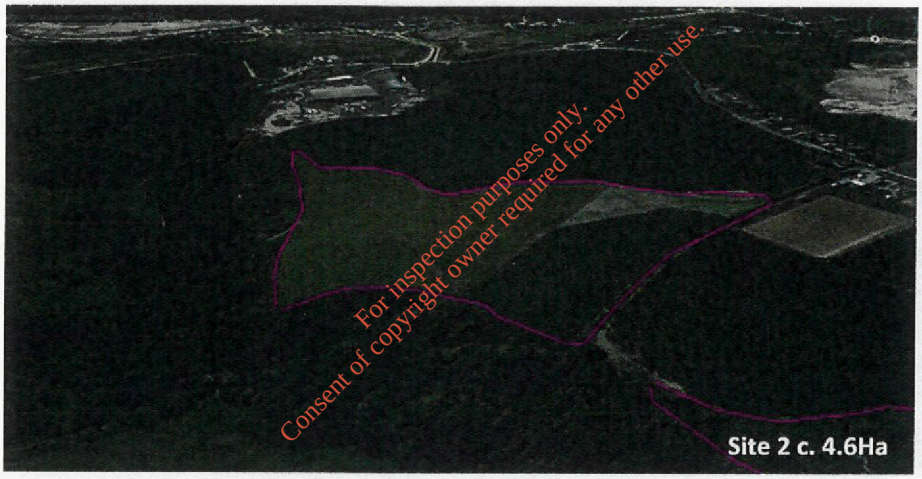


Fig 2.3: Site 2 Looking towards the south east

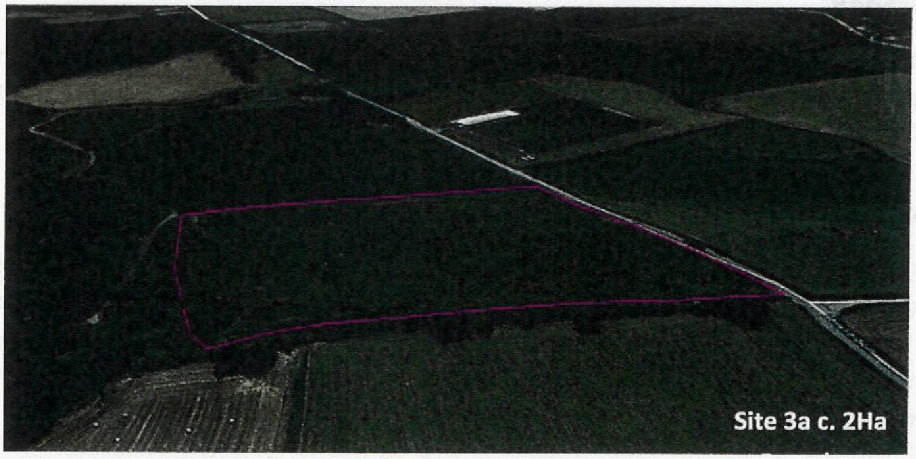


Fig 2.4: Site 3a Looking towards the south east

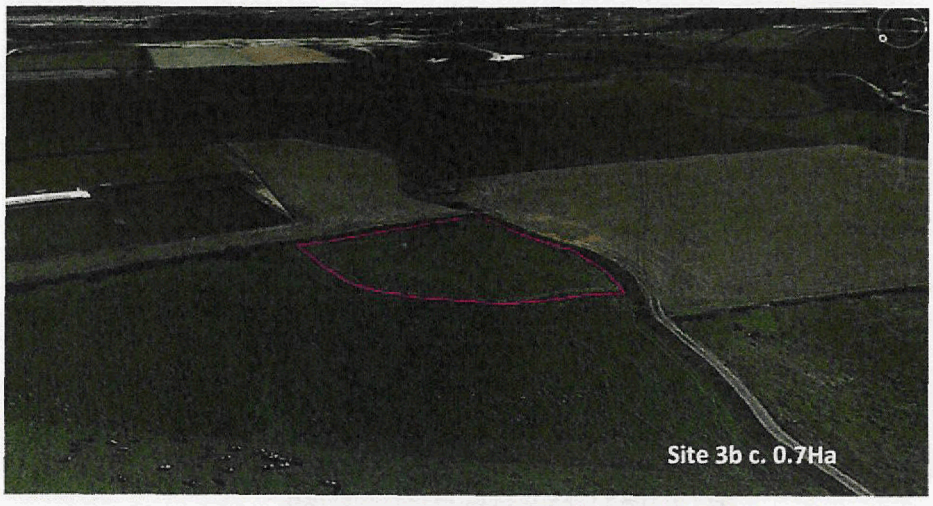


Fig 2.6: Site 3b Looking towards the south east

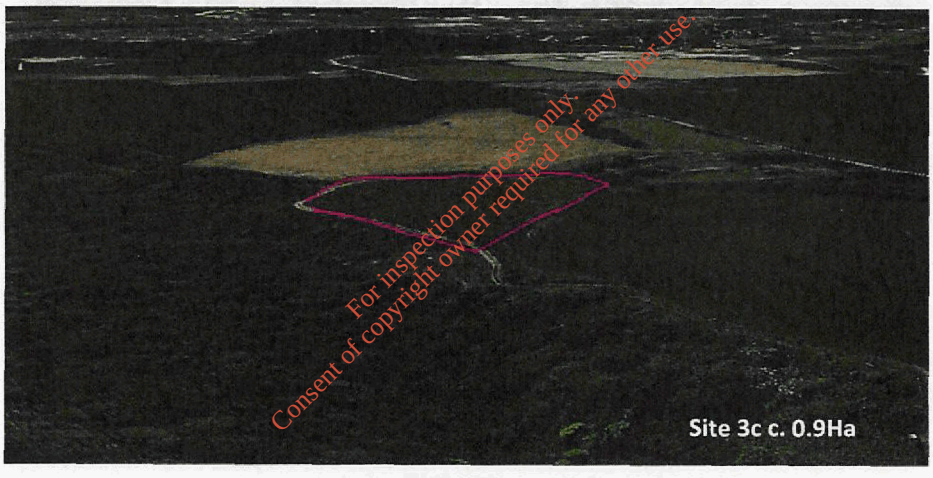


Fig 2.5: Site 3c Looking towards the south east

2.2.1 Topography

The sites lie at elevations ranging from c.50 to 100 mOD, sloping downwards sharply to the north and northeast towards a stream at the base of the slope. Elevations range from 50-90 mOD at Site 2, 90-95 mOD at 1 and 3c and c. 100mOD at Site 3a and 3b.

2.2.2 Geology

The GSI bedrock geology map (Fig. 2.7) shows that all sites are underlain by slate, commonly laminated with pale siltstones with some schists of the Maulin Formation. South of the landfill sites, the bedrock is comprised of tuff & greywacke of the Glencullen River Formation. A fault line between the Glencullen and Maulin Formations is inferred to run south of the site in an east-west direction. Bedrock is buried at depth across the site, overlain by significant thickness of subsoil.

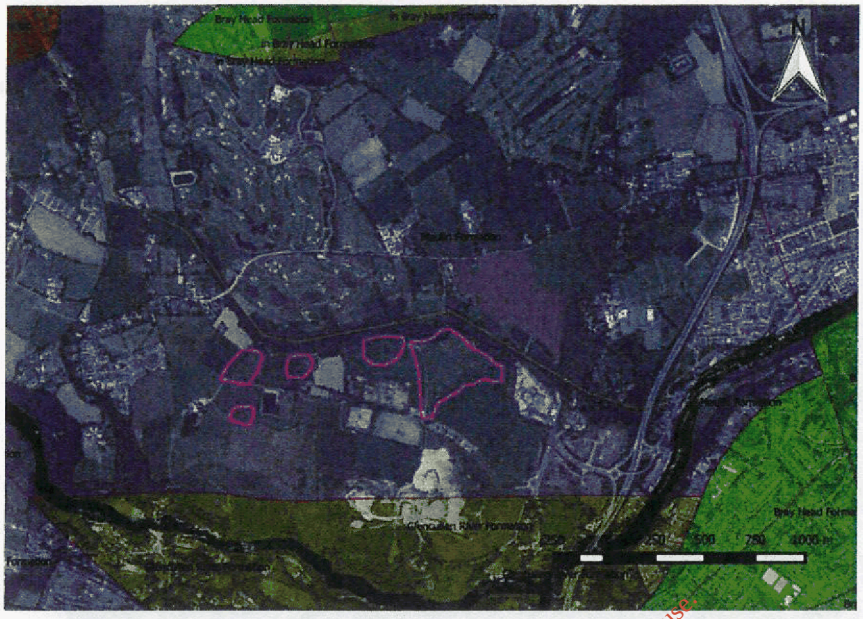


Fig 2.7: The GSI bedrock map (sites marked in magenta, Maulin Formation (purple) and Glencullen River Formation (brown))

2.2.3 Soils

According to the Teagasc Subsoil map the soil across the sites consist of sands and gravels derived from Carboniferous limestone.

Fig 2.8: The Teagasc soil map with Limestone sands and gravels (GLs) (sites marked in magenta). Alluvium is indicated at the bottom of the valley that bounds the site to the north.

2.2.4 Vulnerability

The groundwater vulnerability map shows an area of high vulnerability (green) at the landfill locations and moderate vulnerability (purple) to the north of the sites.

Fig 2.9: The Vulnerability map (sites marked in magenta).

2.2.5 Aquifer Classification

The gravels have been categorised as a locally important gravel aquifer while the bedrock is aquifer is classified as locally important (Li) i.e. the bedrock is only productive in localised zones.

Fig 2.10: The GSI aquifer map indicating Li bedrock aquifer(pale blue) with sites marked in magenta.

2.2.6 Site investigation data

Borehole and trial pit data was provided for the five sites in April 2016. Twenty cable percussive and rotary cored boreholes and twenty five trial pits were opened across the five waste bodies. A further thirty eight boreholes were cored outside the bounds of the waste bodies. The natural ground comprises sandy gravelly clay, silty clayey sand/gravel and sand/gravel. The waste material predominantly contains household waste, metals, glass, plastic, timber, paper and textiles mixed with clay and/or gravel.

2.3 Survey Rationale

The following techniques have been employed to achieve the objectives of the survey:

- Electromagnetic EM31 ground conductivity mapping has been carried out over the filled area in order to map the extent of the fill and variations in the fill, and also to screen for any leachate plumes and obtain background values for the soils and rock.

- Electrical Resistivity Tomography (ERT) has been carried out across the fill to investigate variations in the thickness and extent of the fill material and leachate, as well as to investigate the overburden and bedrock geology.

- Seismic refraction was carried out at selected locations. The results of the seismic survey have been used to outline the fill/soil boundary and confirm depth to bedrock.

By employing complimentary geophysical techniques it is possible to produce an integrated interpretation with less ambiguity and more confidence.

The initial output from the geophysical investigation should be used to target further investigations where necessary and to produce a final integrated ground model for the site.

3. RESULTS

The survey was carried out between the 3rd and 9th December and on the 16th December 2015 with a return to site on the 29th March 2016. Geophysical surveying included EM conductivity mapping at all five sites and the collection of 15 no. ERT profiles and 5 no. seismic refraction profiles.

3.1 EM31 Electromagnetic Conductivity Mapping

The EM ground conductivity results are indicative of the bulk conductivity of the ground materials from 0-6.0m bgl. Drawings AGL15302_02 and _05 show the contoured conductivity results with values in the range 2 – 140 mS/m (milli Siemens/meter).

The recorded EM Inphase values were contoured and plotted on Drawings AGL15302_03 and _06. The inphase value is sensitive to the presence of metal objects. Large variations in the inphase values reflect the presence of surface or subsurface metal. High inphase values were found to be concurrent with high conductivity values (>37 mS/m) and localised anomalous variations were consistent with the presence of metal objects (e.g., metal box, container, fence, etc..) noted on the ground surface.

The ground conductivity values have been interpreted in conjunction with the inphase, ERT, borehole and trial pit data as follows:

Conductivity (mS/m)	*Interpretation*
2-17	Natural Ground
17-37	Extent of Waste with lower Organic & Metallic content Or Waste mixed with silty clayey SAND/GRAVEL
37-140	Extent of Waste with high Organic & Metallic content

Table 1: Conductivity values and corresponding interpretation.

3.2 Electrical Resistivity Tomography

Fifteen ERT profiles (R01 to R15) have been acquired across the 5 sites. The resistivity values ranged from 4 - 750 Ohm-m. Typical resistivities of Irish overburden deposits as experienced by the author range from 20 Ohm-m for pure clay to around 3000 Ohm-m for clean dry gravel, with the resistivity generally increasing as the sand/gravel content increases. Silty clay typically has values in the range 30-50 Ohm-m and silty gravelly clay typically has resistivity values in the range 50-100 Ohm-m. (An exception is the Irish Sea Till which occurs along the east coast of Wicklow and Wexford and which has resistivity values as low as 10 Ohm-m).

Deposits of predominantly organic waste such as those occurring in municipal landfills typically have resistivities in the range 5-30 Ohm-m. Inert C & D waste such as concrete, brick and mixed stone and clay will have resistivities similar to gravelly material (50-500 Ohm-m).

The resistivity of combined organic and inert material will depend on the percentage of organic material present. If sufficient organic content and moisture is present to for connecting electrical

conductivity pathways throughout the C & D material then resistivities would be expected to be similar to the range for municipal waste. If the organic waste only occurs in isolated lenses and pockets above the watertable then resistivities would be expected to be similar to the lower end of the range for C & D waste.

The resistivity data at the five sites has been interpreted in conjunction with the EM, borehole and trial pit data as follows:

	Resistivity (Ohm.m)	*Interpretation*
Waste	<30	Waste with high Organic & Metallic content
	30-130	Waste with lower Organic & Metallic content Or Waste mixed with silty clayey SAND/GRAVEL
Leachate	<30	Possible high level of LEACHATE in underlying material
	30-130	Possible lower level of LEACHATE in underlying material
Natural Ground	30-50	SILT/CLAY
	50-130	Sandy gravelly SILT/CLAY
	>130	Silty clayey SAND/GRAVEL

Table 2: Resistivity values and corresponding interpretation.

3.3 Seismic refraction profiling

Five seismic refraction spreads were recorded on selected ERT profiles. Profiles were recorded to assist in determining the base of the landfill material which may be masked in the ERT results by the migration of leachate. Data quality was poor due as signal transmission was limited due to the significant thickness and heterogeneous nature of the unconsolidated waste material. The processed P-wave seismic velocities across the survey area range from 100 to 2200 m/s. A base of landfill material was estimated between 500 and 600 m/s. these values would typically indicative of soft-firm or loose to medium dense material. Underlying velocities indicated firm to very stiff or medium dense to very dense material.

3.4 Interpretation

The integrated interpretation of the geophysical results with the borehole and trial pit data is presented below and summarised in Drawings AGL15302_04 and _07. Interpreted ERT profiles are presented in Drawings AGL15302_08 to _22.

3.4.1 Landfill Site 1

The interpreted lateral extent of the waste material is c. 0.53 Ha and is indicated on Drawing AGL15302_04. Two ERT profiles (R11 and R12) were collected across the site (Drawings AGL15302_18 and 19 respectively). Up to 16m waste has been interpreted based on values contained in Table 2. A maximum thickness of 6m of waste with high organic and metallic content has been observed.

3.4.2 Landfill Site 2

The interpreted lateral extent of the waste material is c. 4.1 Ha and is indicated on Drawing AGL15302_04. Four ERT profiles (R01, R02, R03 & R15) were collected across the site (Drawings AGL15302_08, 09, 10 and 22 respectively). Up to 26m waste has been interpreted based on values contained in Table 2 containing up to18.5m of waste with high organic and metallic content. The landfill waste appears to extend beyond the site boundary fence towards the lower ground to the north east.

Very low resistivities (<30 Ohm-m) beneath the waste body suggest high levels of leachate in the underlying material, focussed at two locations as indicated on Drawing AGL15302_04. In addition, a possible leachate plume has been mapped on R15, migrating downslope to the northeast from the bounds of the landfill material. Seepage was also noted part way down the slope on R15 at the location indicated on Drawing AGL15302_ 22.

After periods of heavy rainfall surface water runoff is high with the water being funnelled down-slope to the north east. A previous collapse of the bank to the river occurred sometime in the past with the water being diverted over the edge of the scarp slope slightly further to the east. The previous collapse was c. 5m wide with a back wall of c. 2-3m high. This collapse appears to have occurred at the edge of the current waste extents. On diverting the water, subsequent erosion exposed a number of pipes draining from the landfill to the north east. During the survey session on the 3rd December 2015 extremely high rainfall was observed with surface water streams running off the landfill. Erosion of the embankment to the north east resulted in a minor landslide washing soil into the stream. The soil slope was found to be very unstable in localised areas where the affect of the surface water runoff was greatest. Evidence of landslide/slip material is suggested on R02 and R15 (Drawings AGL15302_09 and 22 respectively). Waste was observed on surface of slope.

3.4.3 Landfill Site 3a

The interpreted lateral extent of the waste material is c. 1.75 Ha and is indicated in Drawing AGL15302_07. The western boundary of the waste body was not defined by the geophysical survey and may extend beyond the boundary indicated on Drawing AGL15302_07. Six ERT profiles (R04, R05, R06, R07, R10 & R14) were collected across the waste site (Drawings AGL15302_11, 12, 13, 14, 17 and 21 respectively). Up to 20m of waste with high organic and metallic content has been interpreted based on values contained in Table 2.

Very low resistivities (<30 Ohm-m) beneath the waste body suggest high levels of leachate in the underlying material, focussed at the location in the north east of Site 3a, indicated on Drawing AGL15302_074. In addition, a possible leachate plume has been mapped on R14, migrating downslope to the northeast from the bounds of the landfill material.

Anecdotal evidence suggests that landfill 3a has previously suffered landslides/slips to the north east. The presence of rock drains on the surface may be an indication of previous remediation works. Evidence of landslide/slip material is suggested on R14 (Drawing AGL15302_21).

3.4.4 Landfill Site 3b

The interpreted lateral extent of the waste material is c. 0.44 Ha and is indicated in Drawing AGL15302_07. One ERT profile (R13) was collected across the waste site (Drawing AGL15302_20). Up to 8.5m waste with high organic and metallic content has been interpreted based on values contained in Table 2.

Low resistivities beneath the waste body suggest downward migration of leachate in to the underlying material. No leachate plume has been mapped exiting the bounds of the landfill material.

3.4.5 Landfill Site 3c

The interpreted lateral extent of the waste material is c. 0.8 Ha and is indicated in Drawing AGL15302_07. Two ERT profiles (R08 & R09) were collected across the waste site (Drawings AGL15302_15 and 16 respectively). Up to 20.5m of waste with high organic and metallic content has been observed.

Very low resistivities (<30 Ohm-m) beneath the waste body on suggest high levels of leachate in the underlying material, focussed in the north east of the site as indicated on Drawing AGL15302_04. A possible leachate plume has been mapped on R09, migrating down-slope to the northeast from the bounds of the landfill material.

Anecdotal evidence suggests that landfill 3b has previously suffered landslides/slips to the north east. The presence of rock drains on the surface may be an indication of previous remediation works. Evidence of landslide/slip material is suggested on R09 (Drawing AGL15302_16).

3.5 Discussion

Sites 1, 2, 3a and 3c which slope to the north appear to exhibit leachate migration down-slope.

A landslide/slip was observed on the north east of Site 2 while anecdotal evidence suggests that landfills 3a and 3c have previously suffered landslides/slips to the north east. Evidence of landslides/slips on the northern slopes is confirmed by the geophysical data at sites 2, 3a and 3c.

4. RECOMENDATIONS

The slope material should be investigated by hand dug trial pits to confirm the presence of and determine the extent of waste material from landslides/slips.

Consideration should be made to the slope stability when targeting any intrusive investigations on the slope to the north and north east of the landfill.

Seepage was noted on the slope at Site 2. Sampling should be carried out at the base of the slopes at Sites 1, 2, 3a and 3c to investigate the migration of leachate.

Additional EM31 mapping and ERT should be considered to the west of Site 3a to confirm/determine the western extent of the waste body.

The findings of the geophysical investigation should be reviewed following any further intrusive investigations.

5. REFERENCES

Bell F.G., 1993;

'Engineering Geology', Blackwell Scientific Press.

Hagedoorn, J.G., 1959;

'The plus - minus method of interpreting seismic refraction sections', Geophysical Prospecting, 7, 158 - 182.

Redpath, B.B., 1973;

'Seismic refraction exploration for engineering site investigations', NTIS, U.S. Dept. of Commerce

SeisImager, 2009;

'SeisImager / 2D Manual version 3.3'. OYO Corporation.

Soske, J.L., 1959;

'The blind zone problem in engineering geophysics', Geophysics, 24, pp 359-365.

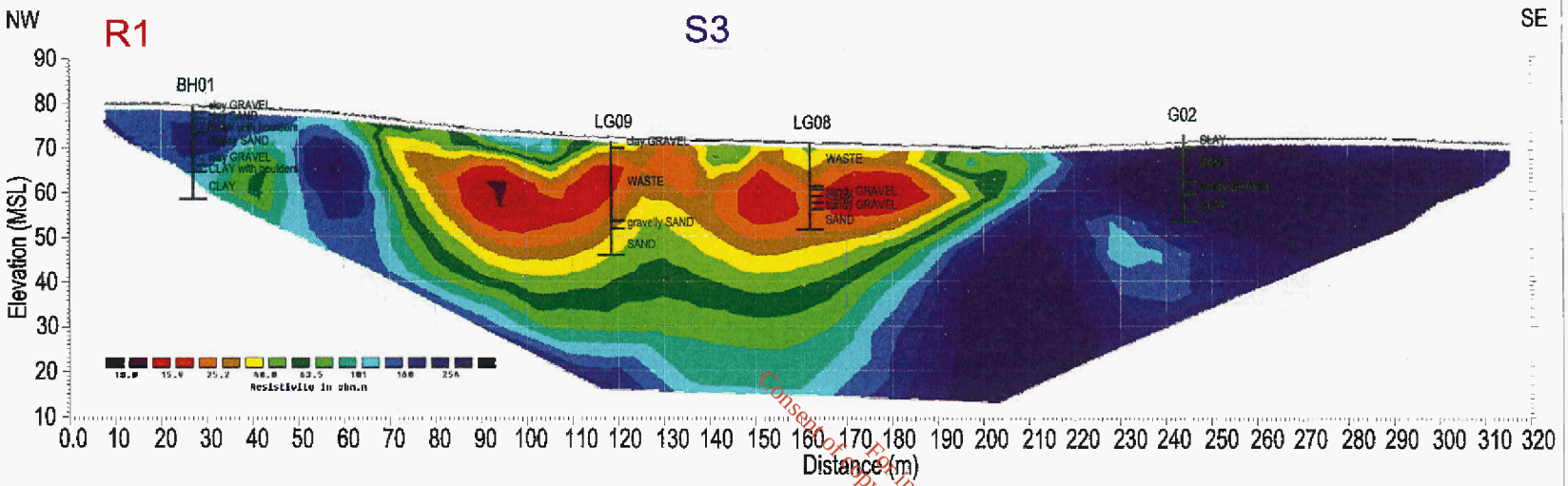
APPENDIX A: DRAWINGS

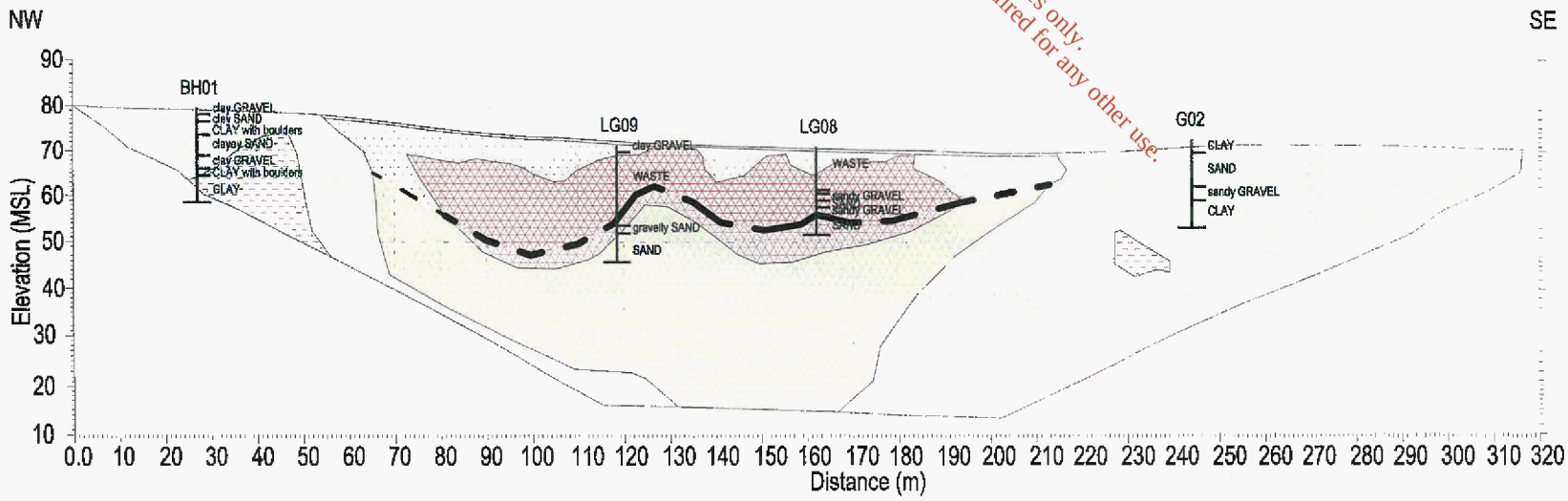
The information derived from the geophysical investigation as well as correlation with the available direct investigation is presented in the following drawings:

AGL15302_01	Geophysical survey locations	Scale 1:5000 @A3
AGL15302_02	Conductivity Contours – Sites 1 & 2	Scale 1:2000 @A3
AGL15302_03	Inphase Contours – Sites 1 & 2	Scale 1:2000 @A3
AGL15302_04	Summary interpretation Map – Sites 1 & 2	Scale 1:2000 @A3
AGL15302_05	Conductivity Contours – Sites 3a, 3b & 3c	Scale 1:2000 @A3
AGL15302_06	Inphase Contours – Sites 3a, 3b & 3c	Scale 1:2000 @A3
AGL15302_07	Summary interpretation Map – Sites 3a, 3b & 3c	Scale 1:2000 @A3
AGL15302_08	ERT Profile R1	Scale 1:1500 @A3
AGL15302_09	ERT Profile R2	Scale 1:1000 @A3
AGL15302_10	ERT Profile R3	Scale 1:1500 @A3
AGL15302_11	ERT Profile R4	Scale 1:1000 @A3
AGL15302_12	ERT Profile R5	Scale 1:1000 @A3
AGL15302_13	ERT Profile R6	Scale 1:1000 @A3
AGL15302_14	ERT Profile R7	Scale 1:1000 @A3
AGL15302_15	ERT Profile R8	Scale 1:1000 @A3
AGL15302_16	ERT Profile R9	Scale 1:1000 @A3
AGL15302_17	ERT Profile R10	Scale 1:1000 @A3
AGL15302_18	ERT Profile R11	Scale 1:1000 @A3
AGL15302_19	ERT Profile R12	Scale 1:1000 @A3
AGL15302_20	ERT Profile R13	Scale 1:1000 @A3
AGL15302_21	ERT Profile R14	Scale 1:1000 @A3
AGL15302_22	ERT Profile R15	Scale 1:1000 @A3

FIGURE 1 : E[illegible] "ILE - R1

SCALE 1: 15[illegible]





INDEX MAP:

LEGEND:

- Capping Material
- Waste with high Organic & Metallic content
- Waste with lower Organic & Metallic content Or Waste mixed with silty clayey SAND/GRAVEL
- Natural Ground with possible high level of LEACHATE in underlying material
- Natural Ground with possible lower level of LEACHATE in underlying material
- SILT/CLAY
- Sandy gravelly SILT/CLAY
- Silty clayey SAND/GRAVEL
- Interpreted Base of Waste Material

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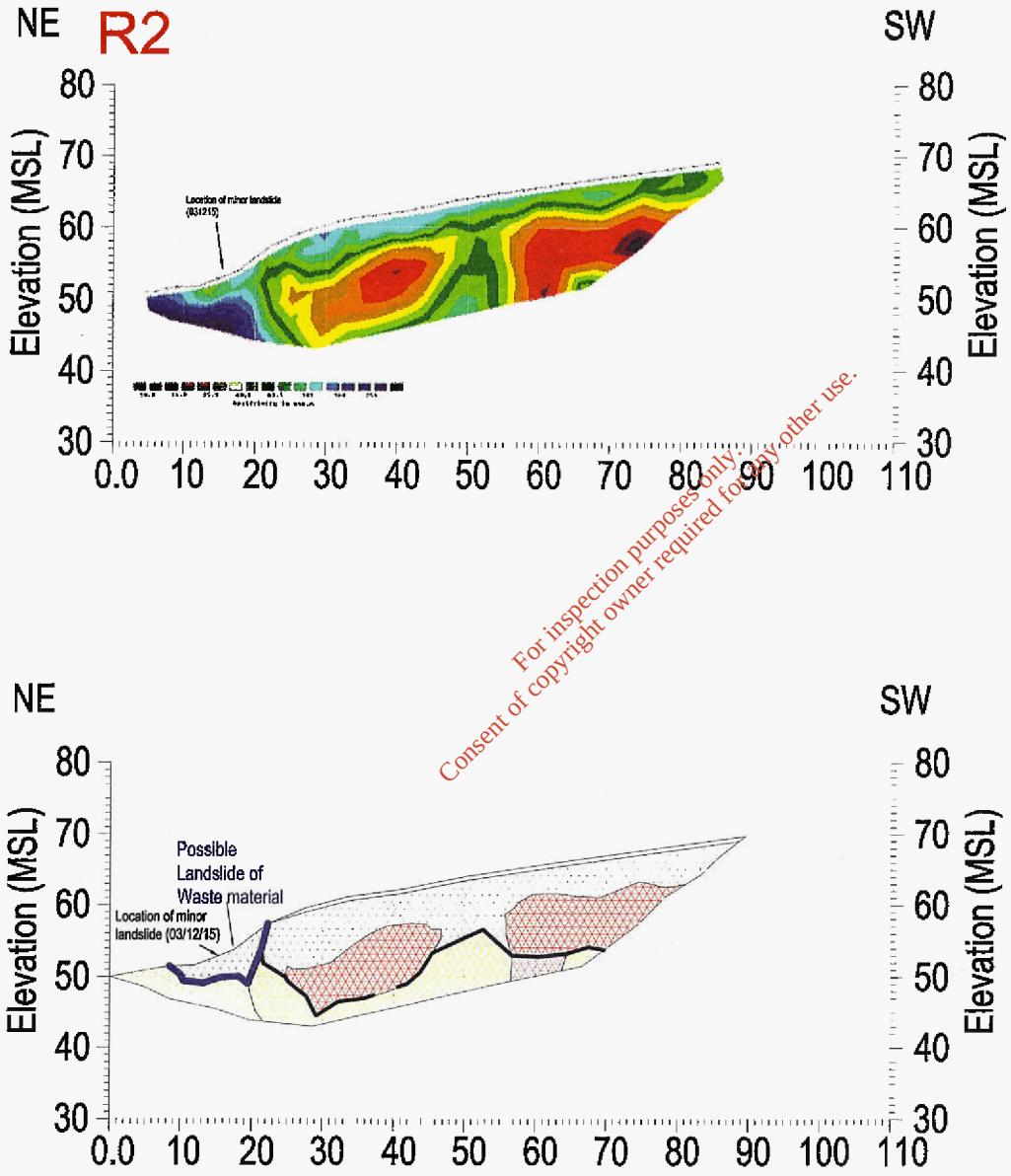
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_08
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

FIGURE 1 : ERT PROFILE - R2

SCALE 1: 1000



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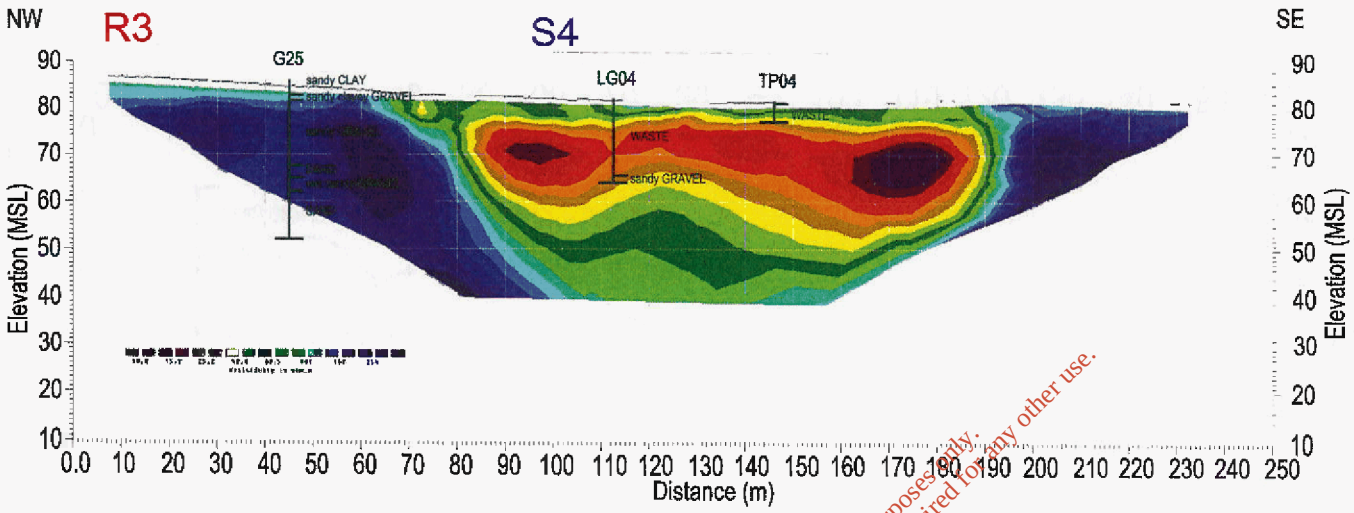
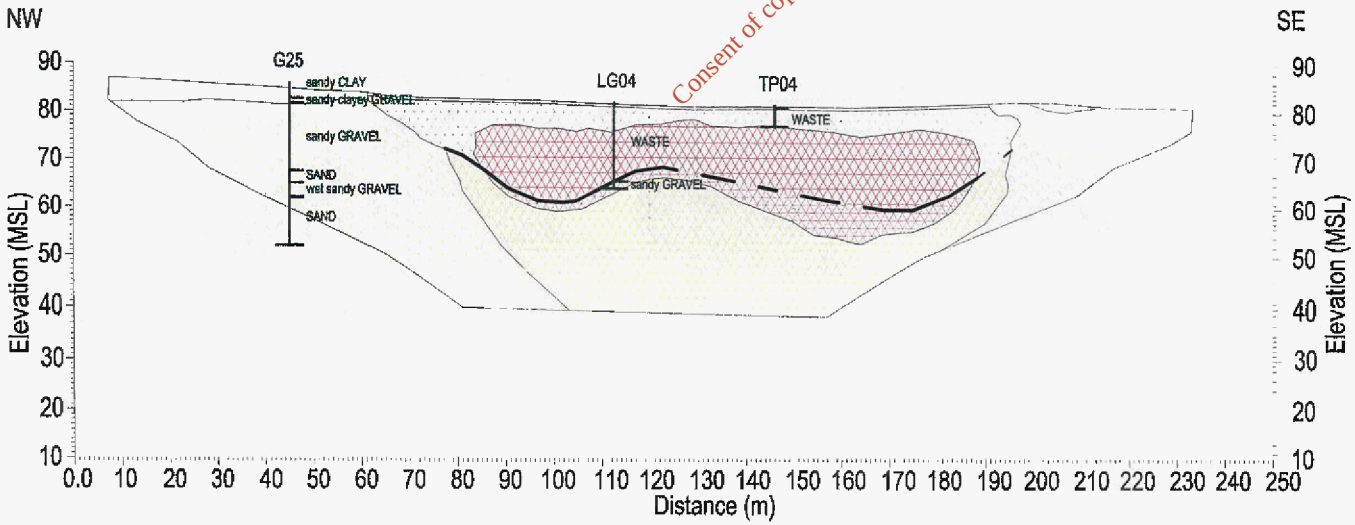
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_09
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2015	YOC	

FIGURE 1 : EF TILE - R3

SCALE 1: 150.





INDEX MAP:

LEGEND:

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- Waste with lower Organic & Metallic content Or Waste mixed with silty clayey SAND/GRAVEL
- Natural Ground with possible high level of LEACHATE in underlying material
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- Interpreted Base of Waste Material

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PROJECT: FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION

DRAWING No: AGL15302_10

DATE: 20th April 2016

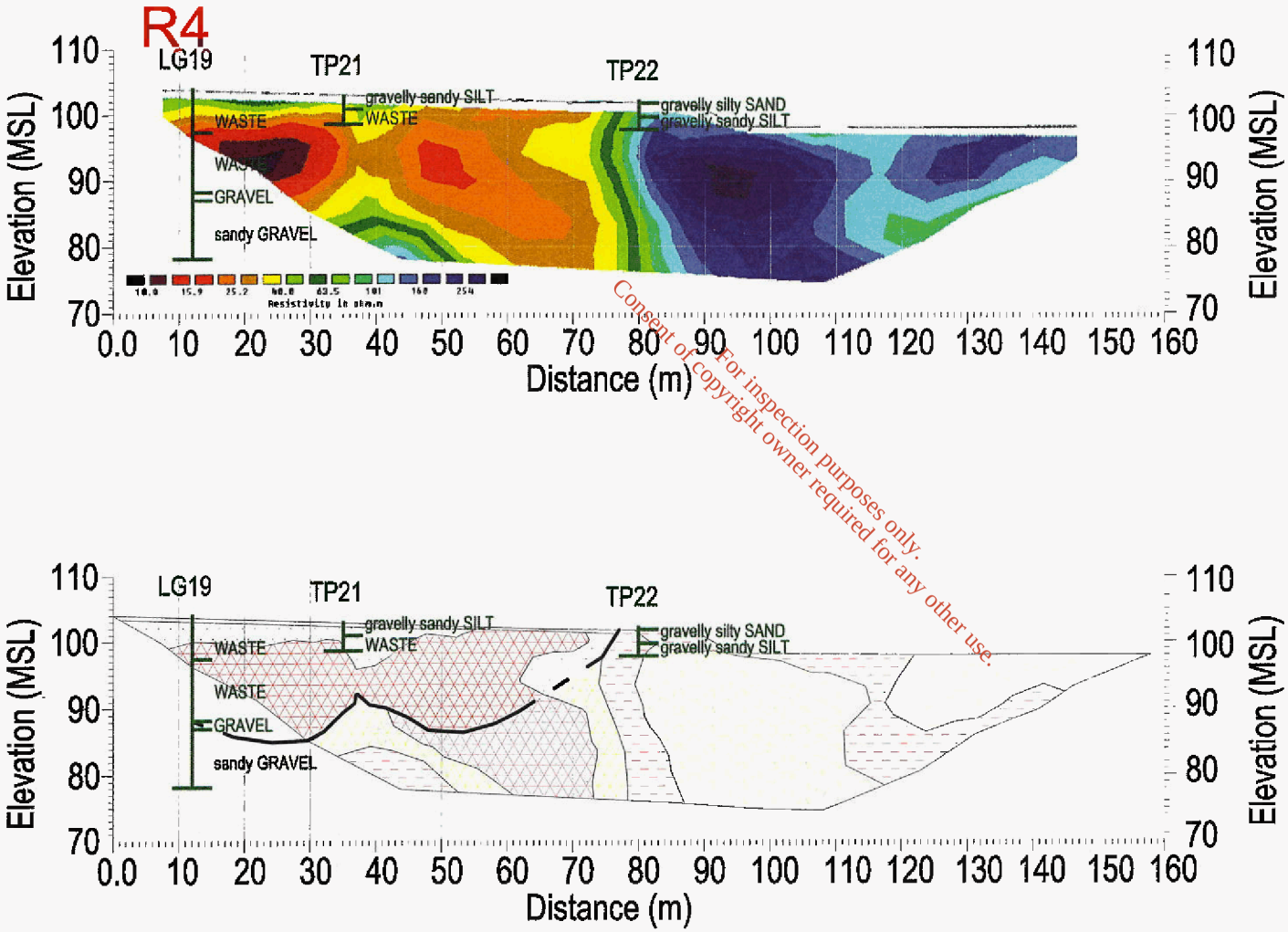
CLIENT: RPS CONSULTING ENGINEERS

SCALE: AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	
02	09/05/2016	YOC	

FIGURE 1 : ERT PROFILE - R4

SCALE 1: 1000



INDEX MAP:

LEGEND:

- Capping Material
- Waste with high Organic & Metallic content
- Waste with lower Organic & Metallic content Or Waste mixed with silty clayey SAND/GRAVEL
- Natural Ground with possible high level of LEACHATE in underlying material
- Natural Ground with possible lower level of LEACHATE in underlying material
- SILT/CLAY
- Sandy gravelly SILT/CLAY
- Silty clayey SAND/GRAVEL
- Interpreted Base of Waste Material

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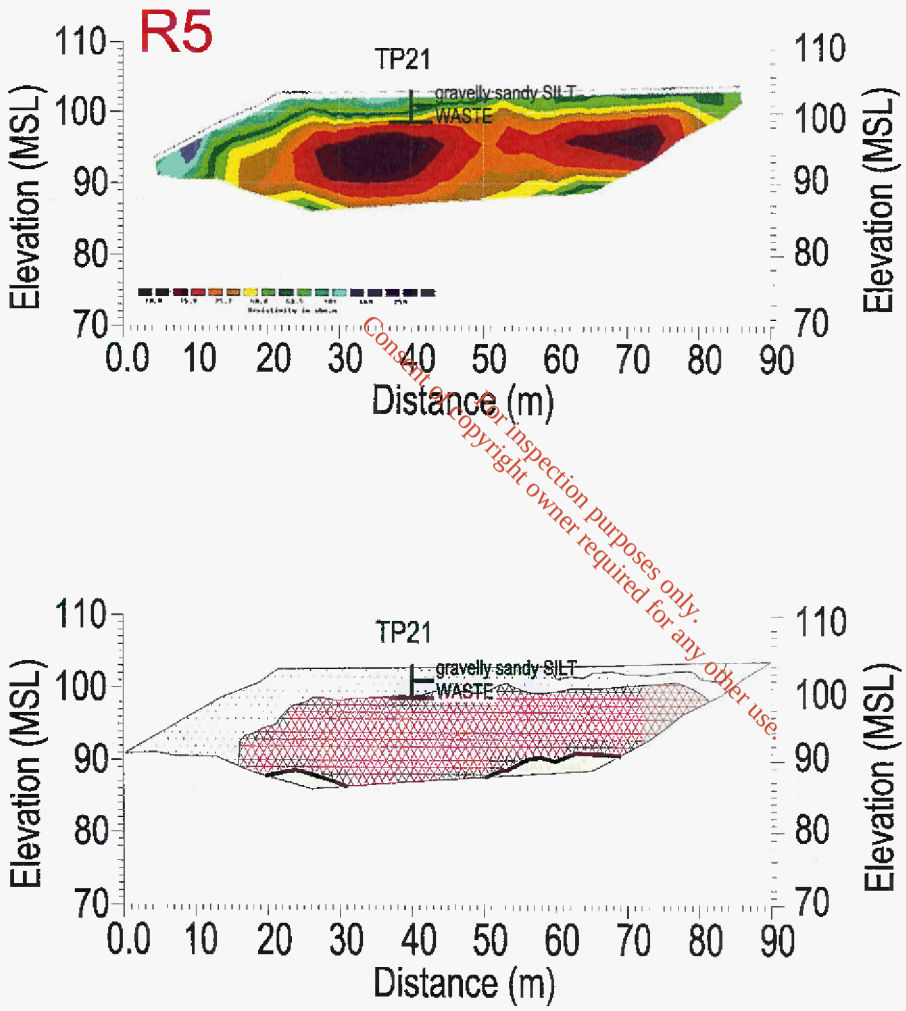
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_11
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

FIGURE 1 : EF FILE - R5

SCALE 1: 100



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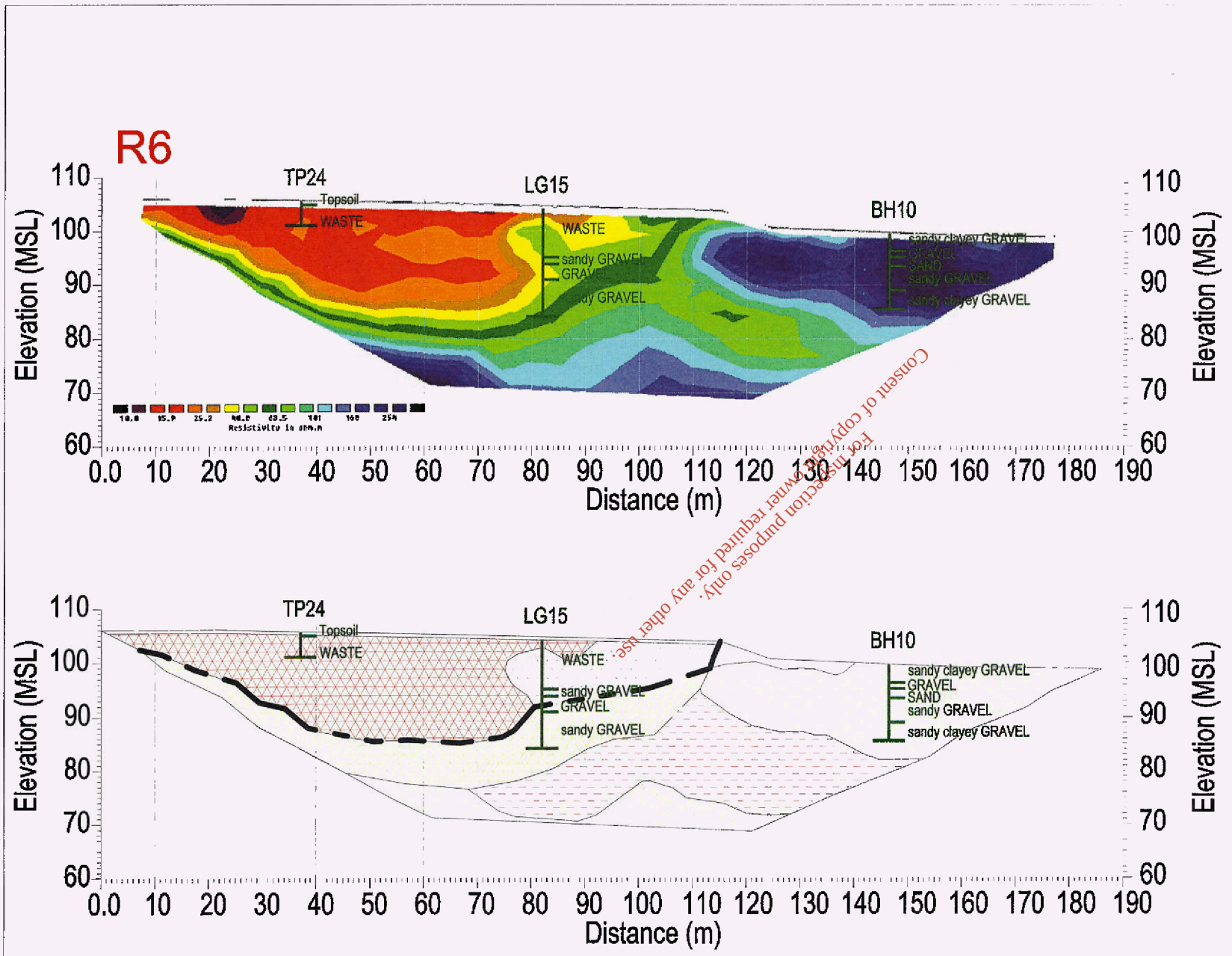
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_12
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

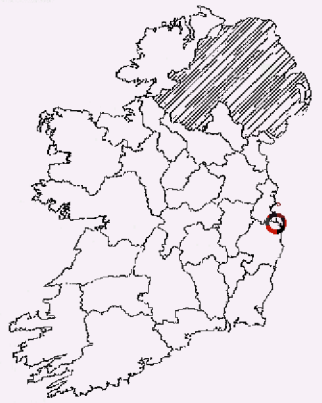
Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

FIGURE 1 : ERT PROFILE - R6

SCALE 1: 1000



INDEX MAP:



LEGEND:

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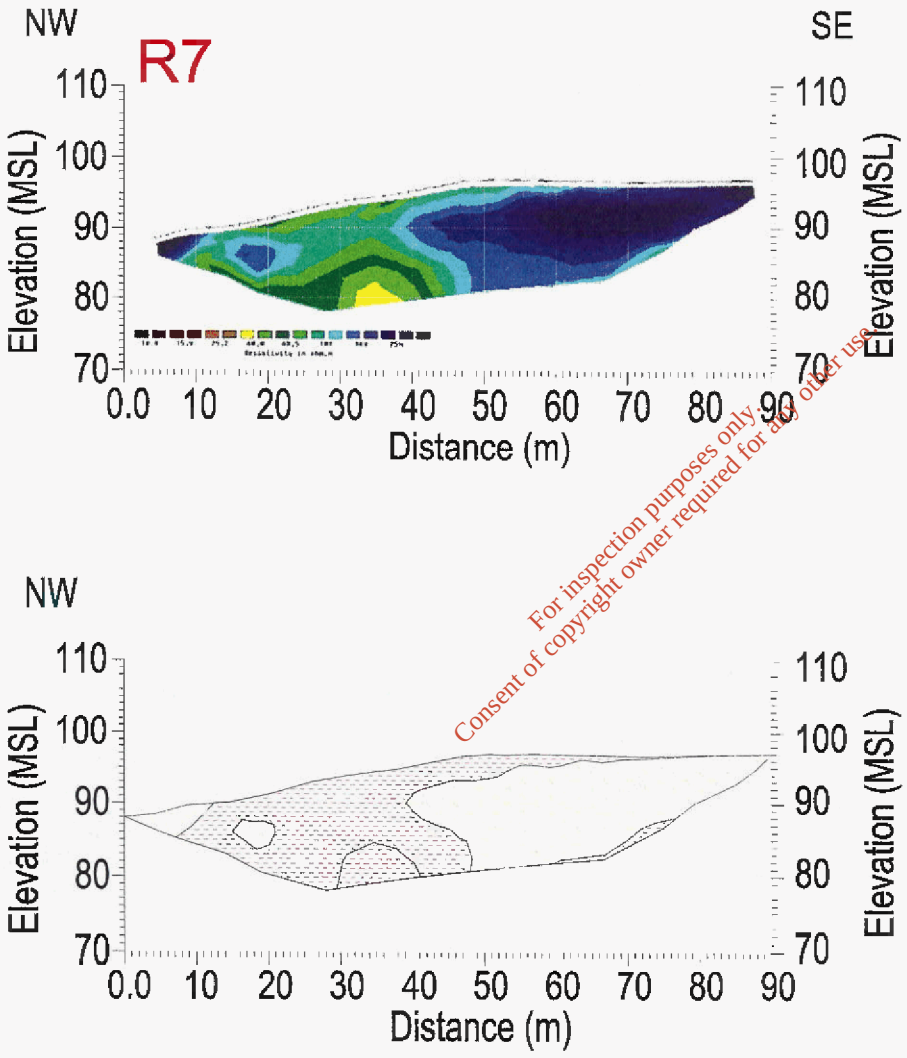
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_13
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	
02	09/05/2016	YOC	

FIGURE 1 : EF TILE - R7

SCALE 1: 100



INDEX MAP:

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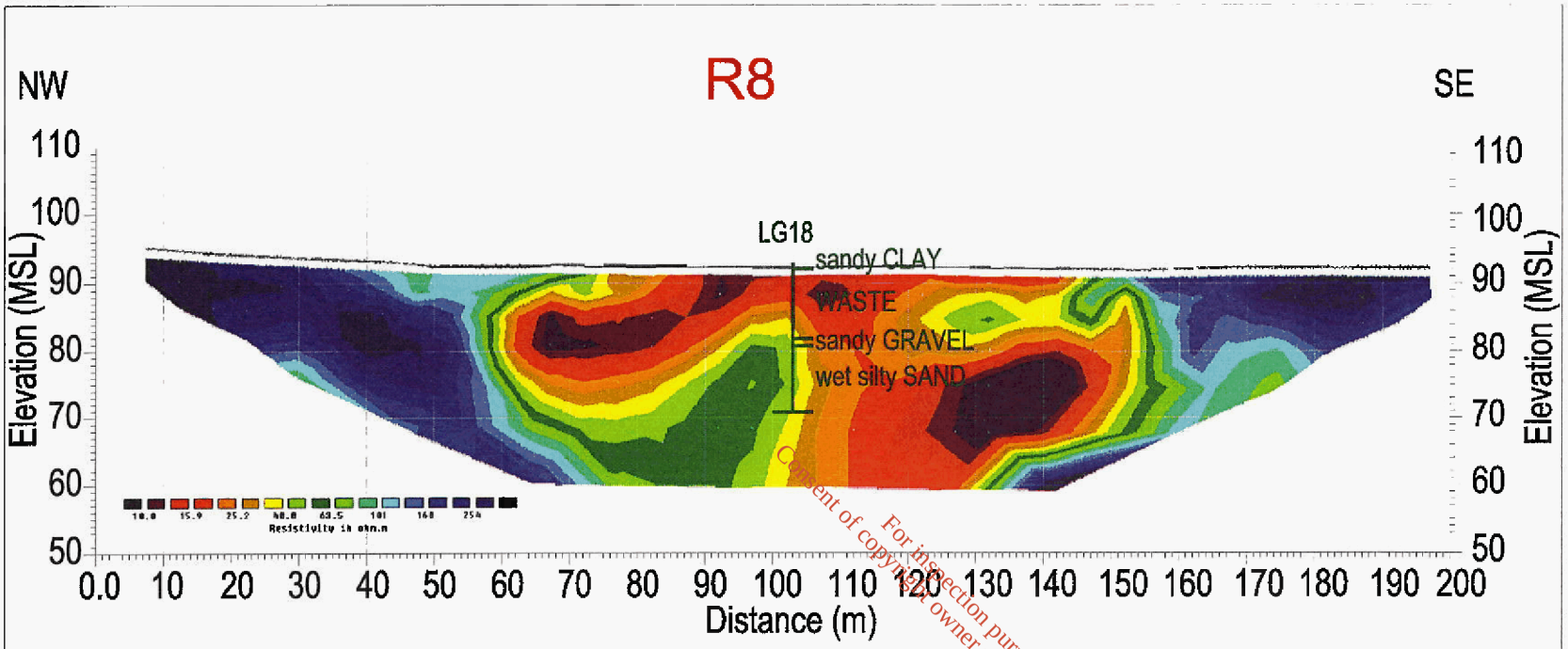
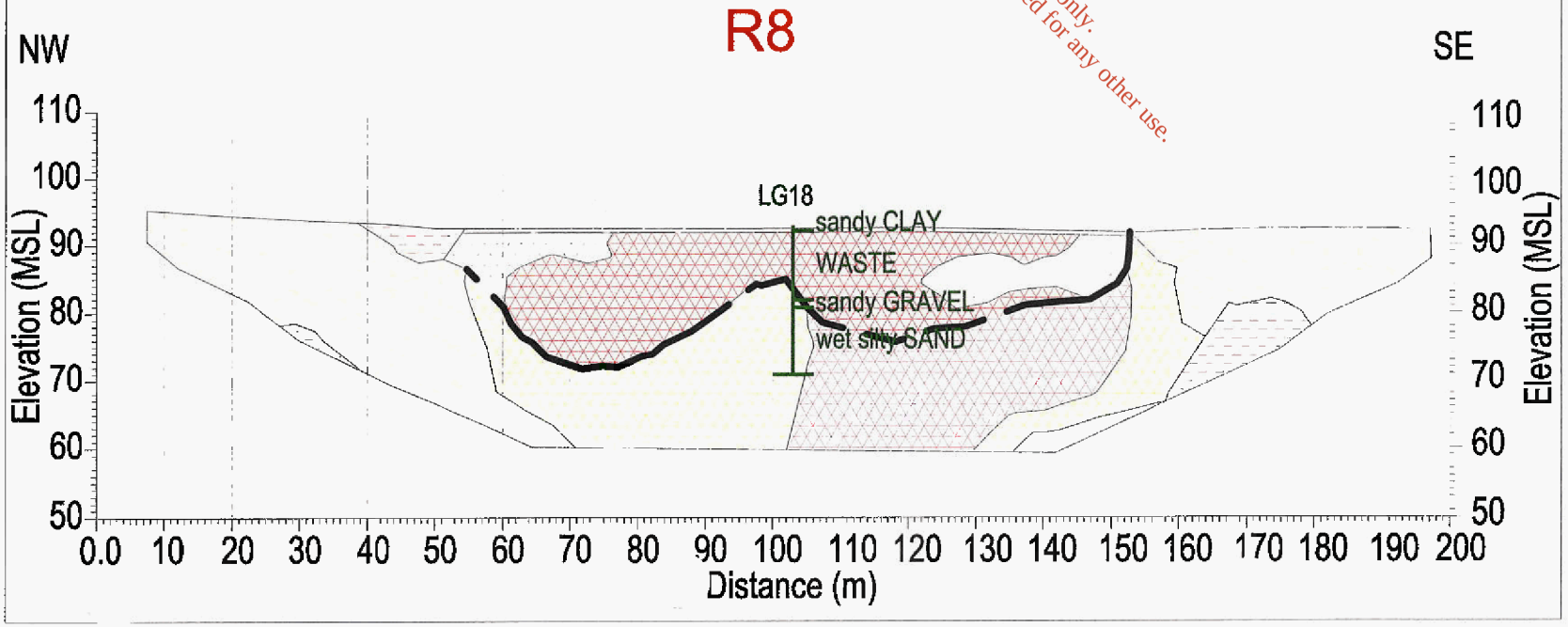
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_14
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

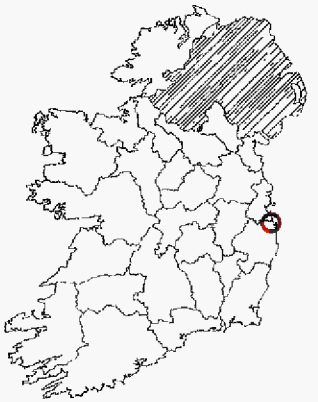
FIGURE 1 : ERT PROFILE - R8

SCALE 1: 1000





INDEX MAP:



LEGEND:

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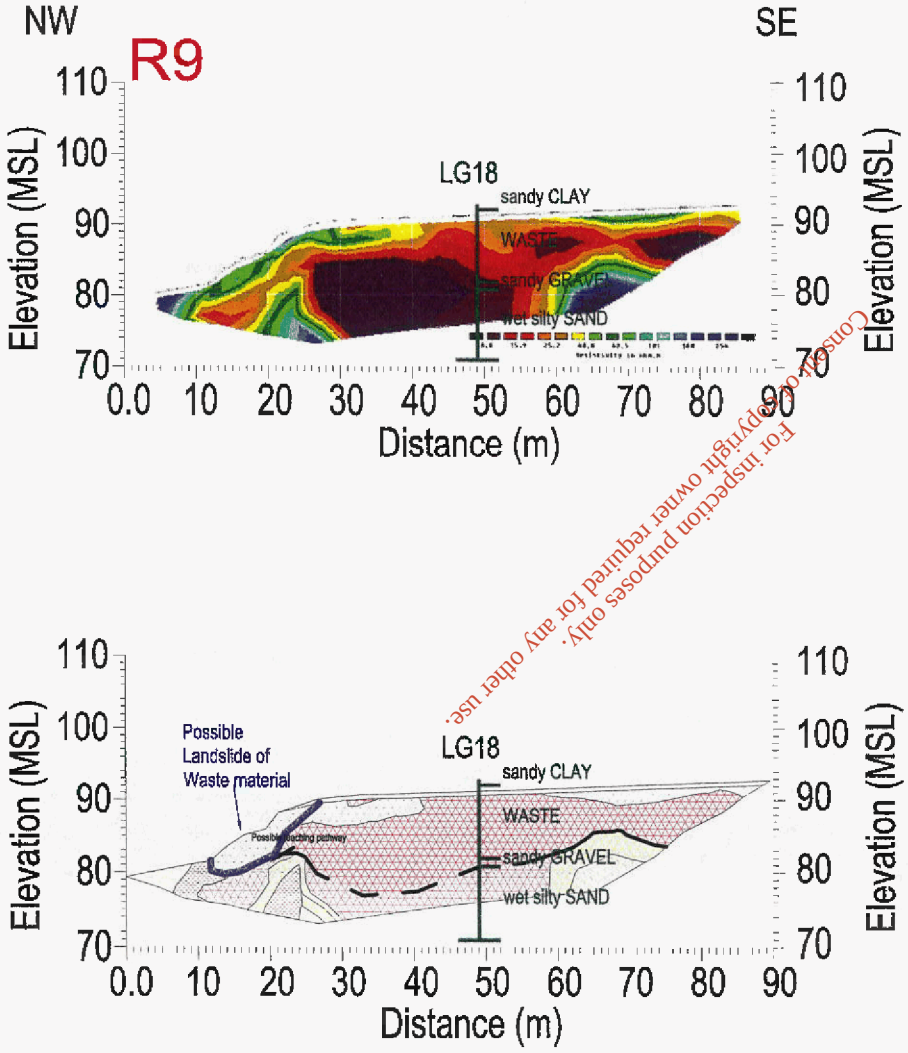
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_15
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

FIGURE 1 : EF ILE - R9

SCALE 1: 100



INDEX MAP:

LEGEND:

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PROJECT: FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION

DRAWING No.: AGL15302_16

DATE: 20th April 2016

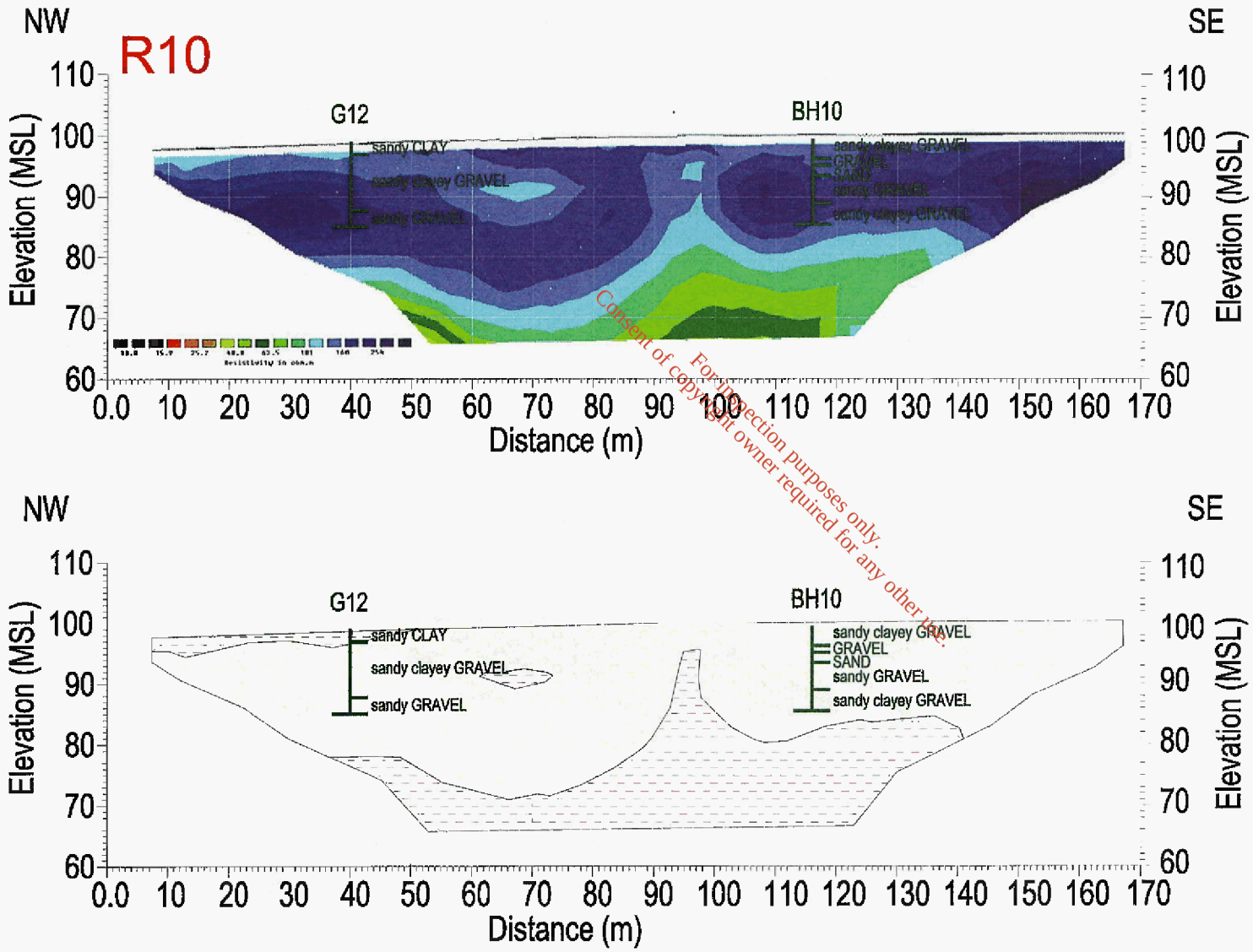
CLIENT: RPS CONSULTING ENGINEERS

SCALE: AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

FIGURE 1 : ERT PROFILE - R10

SCALE 1: 1000



INDEX MAP:

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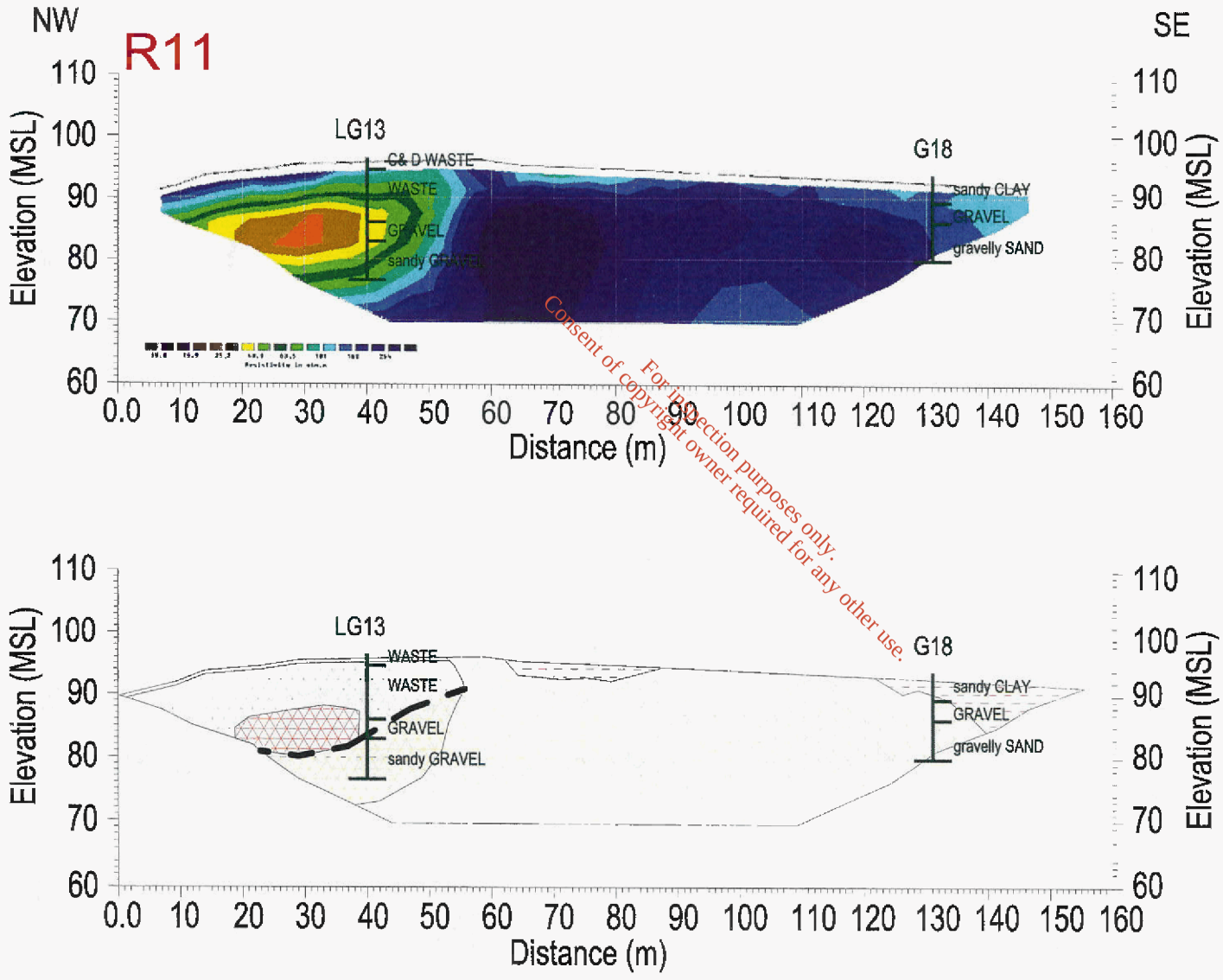
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_17
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	
02	09/05/2016	YOC	

FIGURE 1 : EF ILE - R11

SCALE 1: 100



INDEX MAP:

LEGEND:

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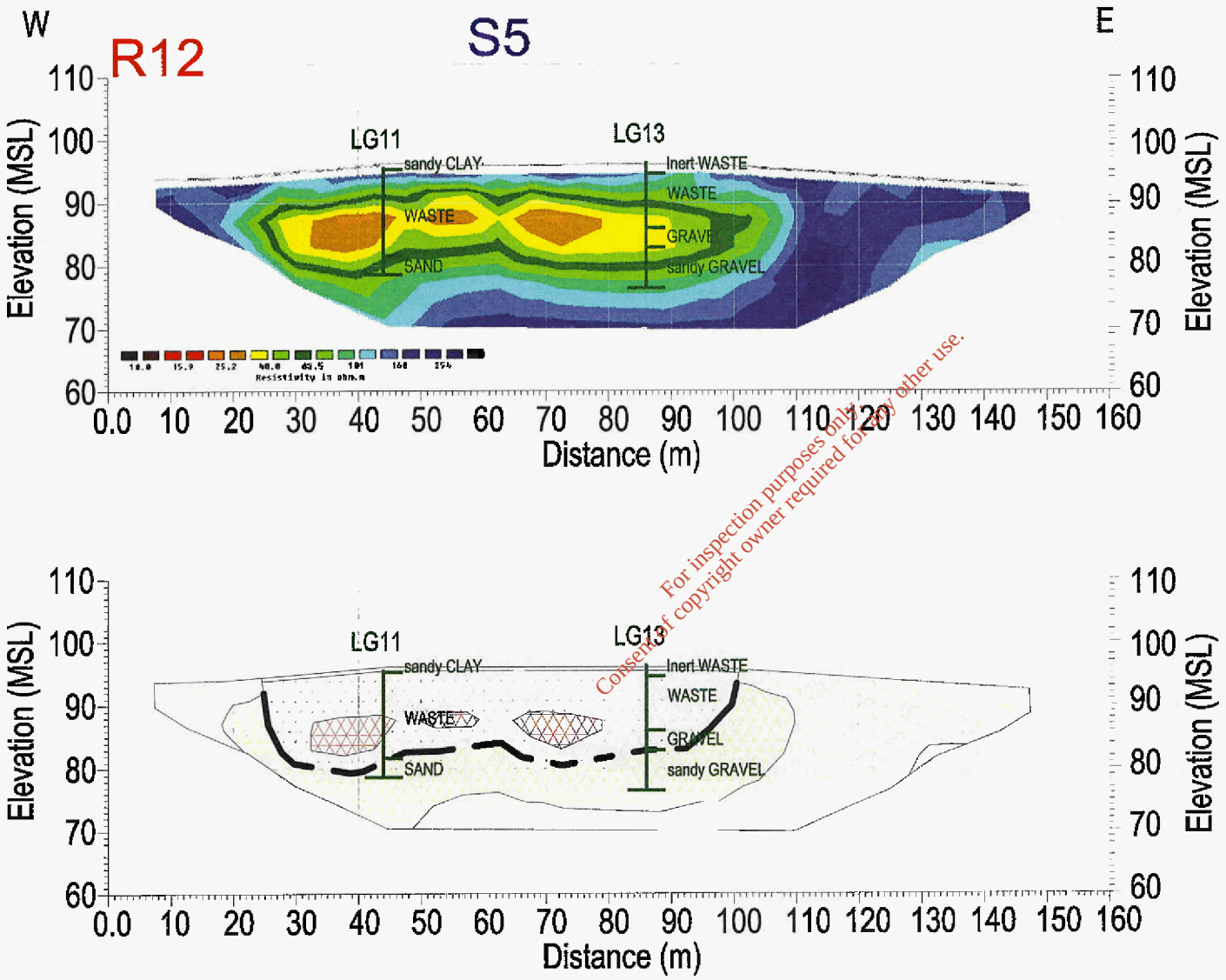
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_18
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn by:	Checked:
01	20/04/2016	YOC	

FIGURE 1 : ERT PROFILE - R12

SCALE 1: 1000



INDEX MAP:

LEGEND:

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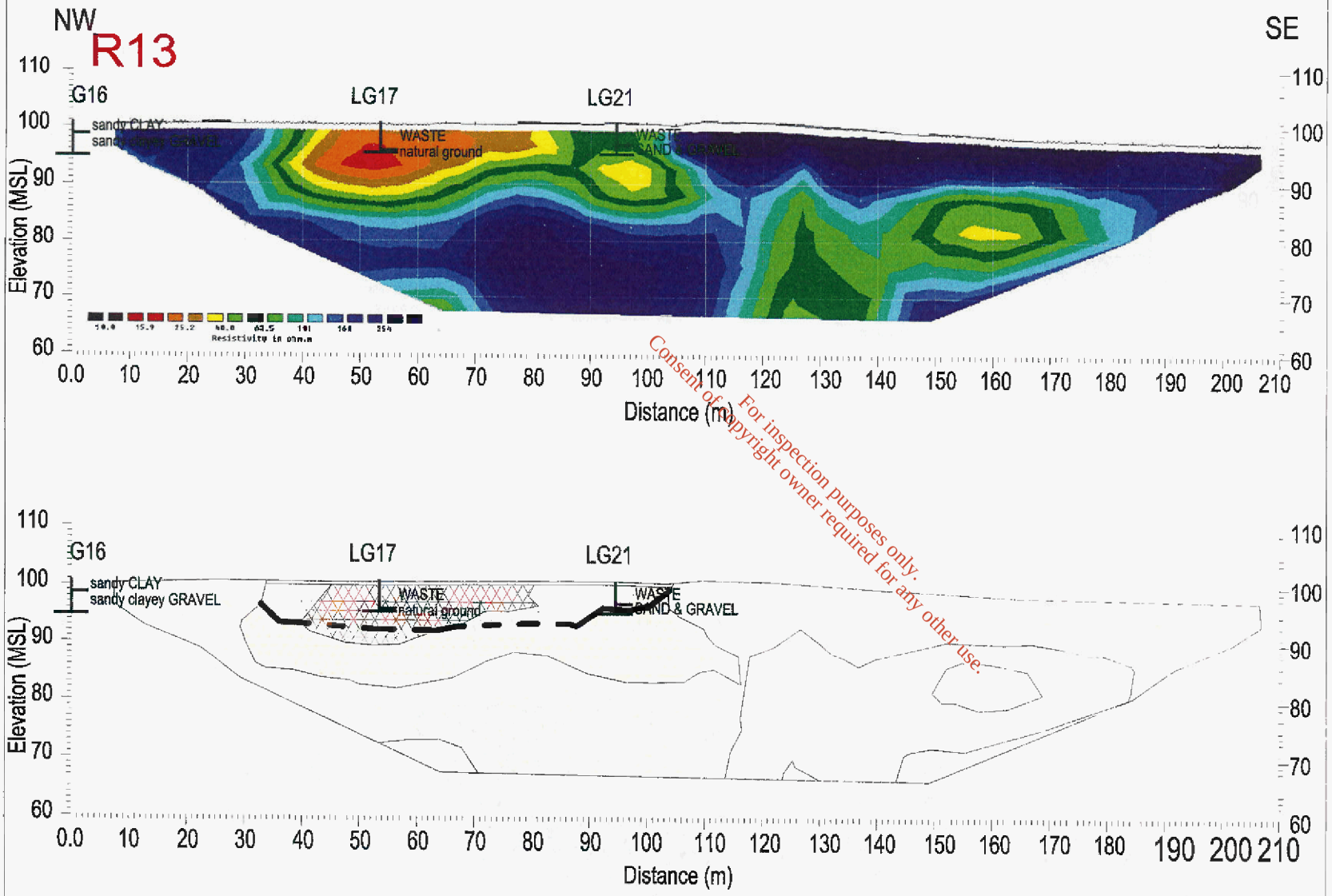
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_19
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

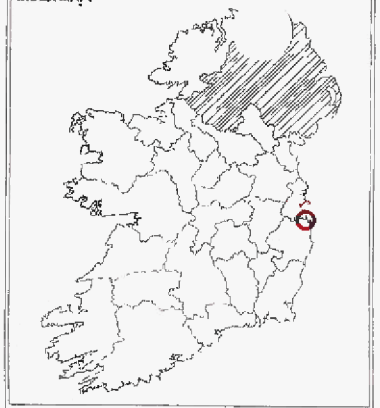
Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

FIGURE 1 : ER TILE - R13

SCALE 1: 100



INDEX MAP:



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PROJECT: FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION

DRAWING No.: AGL15302_20

DATE: 20th April 2016

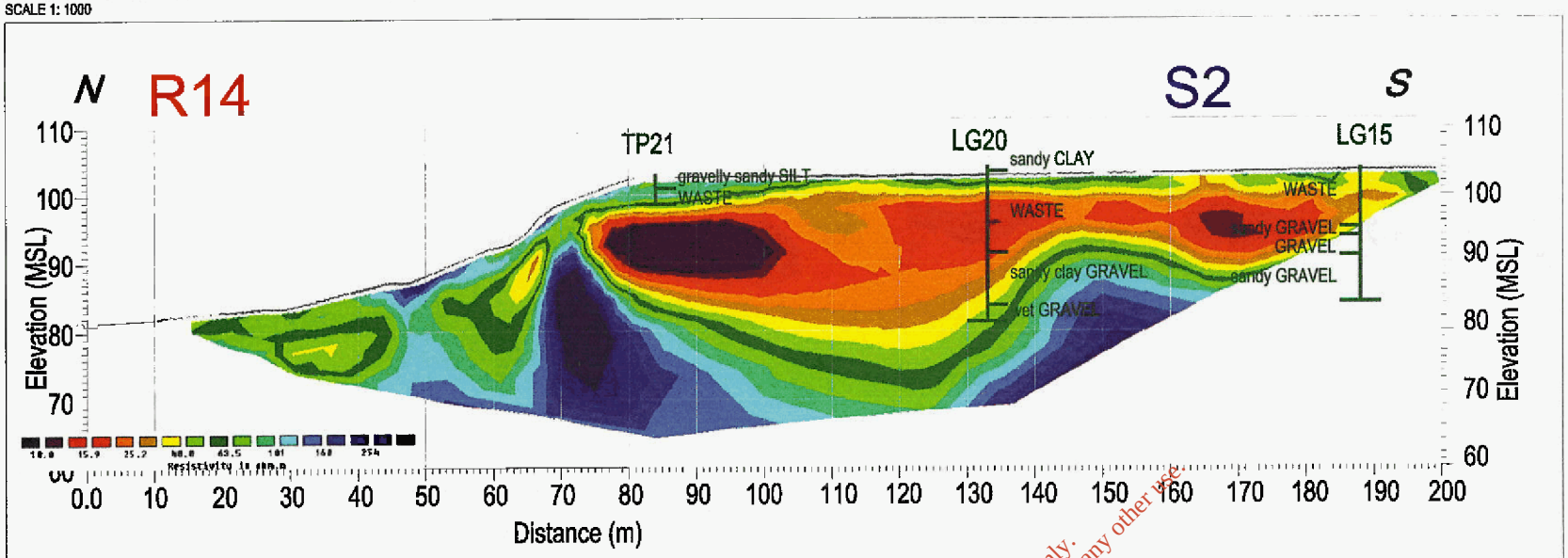
CLIENT: RPS CONSULTING ENGINEERS

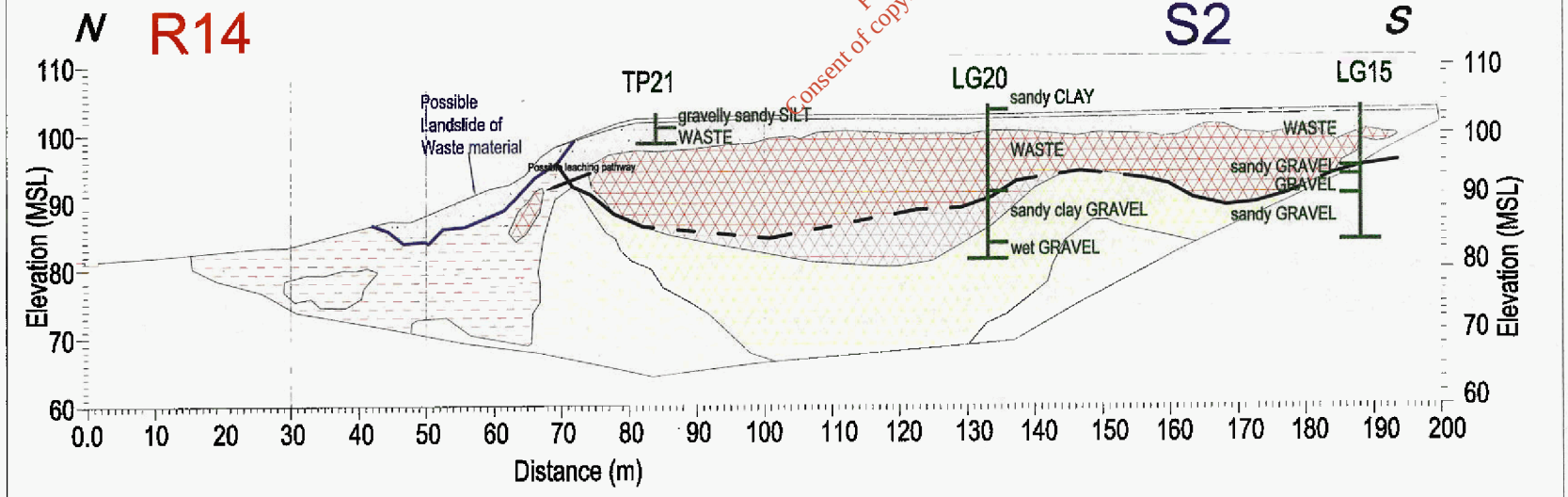
SCALE: AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

FIGURE 1 : ERT PROFILE - R14

SCALE 1: 1000





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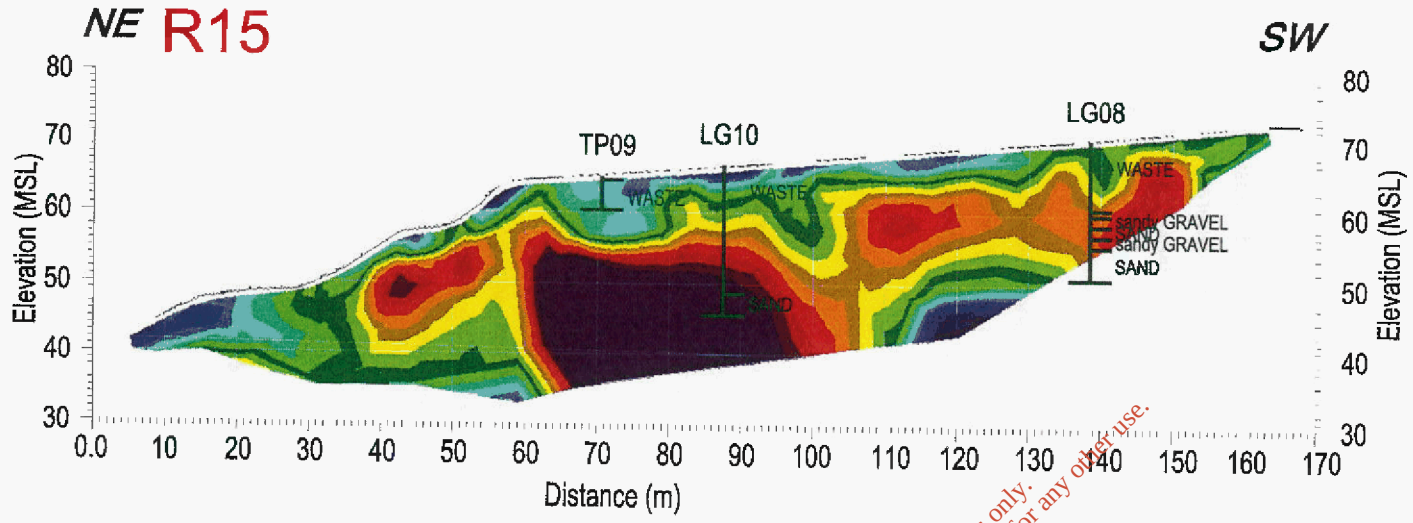
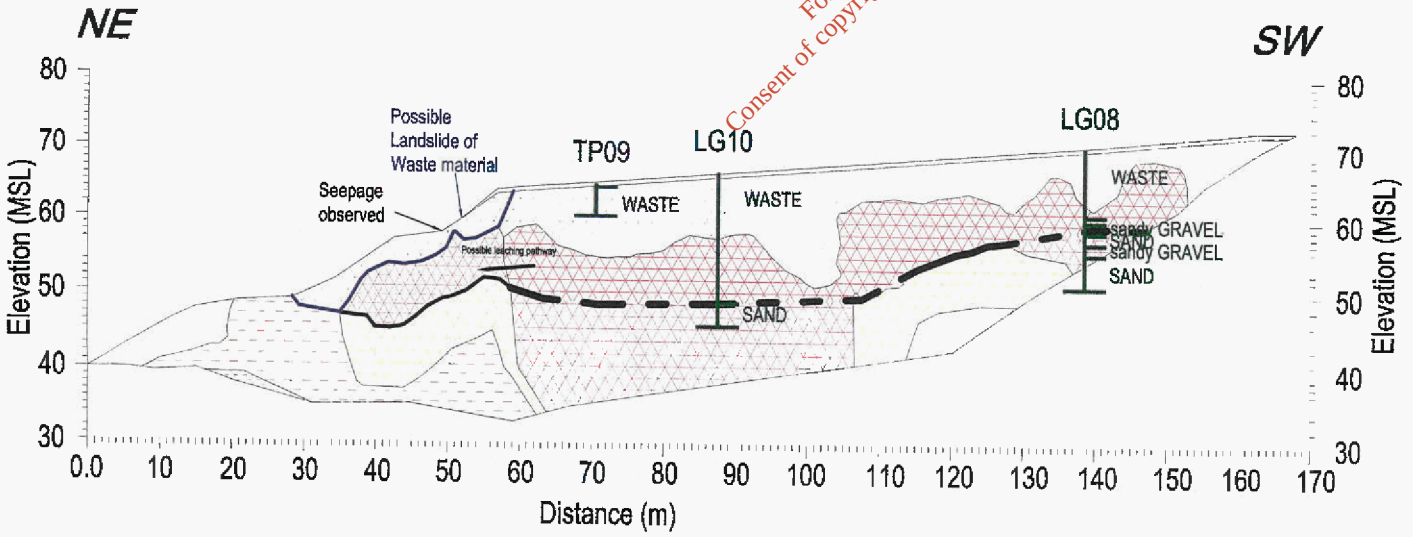
PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_21
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

FIGURE 1 : EF TILE - R15

SCALE 1: 100





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PROJECT:	FASSAROE UNATHOURISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
DRAWING No.:	AGL15302_22
DATE:	20th April 2016
CLIENT:	RPS CONSULTING ENGINEERS
SCALE:	AS INDICATED @ A4

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	

APPENDIX B: DETAILED METHODOLOGY

A combination of a number of geophysical techniques was used to provide the high quality interpretation and reduce any ambiguities, which may otherwise exist.

B.1 EM ground conductivity mapping

This is an electromagnetic technique used to investigate lateral variations in overburden material and to assist with the indication of the depth to bedrock.

B.1.1 Principles

This method operates on the principle of inducing currents in conductive substrata and measuring the resultant secondary electro-magnetic field. The strength of this secondary EM field is calibrated to give apparent ground conductivity in milliSiemens/metre (mS/m). Readings over material such as organic waste and peat give high conductivity values while readings over dry materials with low clay mineral content such as gravels, limestone or quartzite give low readings.

The EM31 survey technique determines the apparent conductivity of the ground material from 0-6m bgl depending on the dipole mode used. Depending on the dipole mode used, the measured conductivity is a function of the different overburden layers and/or rock from 0 to 6m below ground level.

B.1.2 Data collection

The EM31 equipment used was a GF CMD-4 conductivity meter equipped with data logger. This instrument features a real time graphic display of the previous 20 measurement points to monitor data quality and results. Conductivity and in-phase values were recorded across the site. Local conditions and variations were recorded.

B.1.3 Data processing

The conductivity and in-phase field readings were downloaded, contoured and plotted using the SURFER 9 program (Golden Software, 2009). Data which was affected by metallic objects was removed. Assignation of material types and possible anomaly sources was carried out, with cross-reference to other data.

B.1.4 Relocation

All data were referenced using a GPS system and all positions are given in Irish National Grid coordinates.

B.2 Electrical Resistivity Tomography

Electrical Resistivity Tomography was carried out to provide information on lateral variations in the overburden material as well as on the underlying overburden and bedrock.

B.2.1 Principles

This surveying technique makes use of the Wenner resistivity array. The 2D-resistivity profiling method records a large number of resistivity readings in order to map lateral and vertical changes in material types. The 2D-resistivity profiling method involves the use of 64 electrodes connected to a resistivity meter, using computer software to control the process of data collection and storage.

B.2.2 Data collection

Profiles were recorded using a Tigre resistivity meter, imaging software, two 32 takeout multicore cables and up to 64 stainless steel electrodes. Saline solution was used at the electrode/ground interface in order to gain a good electrical contact required for the technique to work effectively. The recorded data were processed and viewed immediately after survey.

B.2.3 Data processing

The field readings were stored in computer files and inverted using the RES2DINV package (Campus Geophysical Instruments, 1997) with up to 5 iterations of the measured data carried out for each profile to obtain a 2D-Depth model of the resistivities.

The inverted 2D-Resistivity models and corresponding interpreted geology are displayed on the accompanying drawings alongside the processed seismic sections. Distance is indicated along the horizontal axis of the profiles. Profiles have been contoured using the same contour intervals and colour codes.

B.3 Seismic refraction profiling

B.3.1 Principles

This method measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

Seismic profiling measures the p-wave velocity (Vp) of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher Vp velocities while soft, loose or fractured materials have lower Vp velocities. Readings are taken using geophones connected via multi-core cable to a seismograph.

B.3.2 Data collection

A Geode high resolution 24 channel digital seismograph, 24 10HZ vertical geophones and a 10 kg hammer were used to provide first break information, with a 24 take-out cable (3m spacing). Equipment was carried was operated by a two-person crew.

Readings are taken using geophones connected via multi-core cable to a seismograph. The depth of resolution of soil/bedrock boundaries is determined by the length of the seismic spread, typically the depth of resolution is about one third the length of the profile (eg. 69m profile ~23m depth, 33m profile ~ 11m depth)

Shots from seven different positions were taken (2 x off-end, 2 x end, 3 x middle) to ensure optimum coverage of all refractors. All profiles were surveyed to Irish National Grid using a ProXR dGPS system.

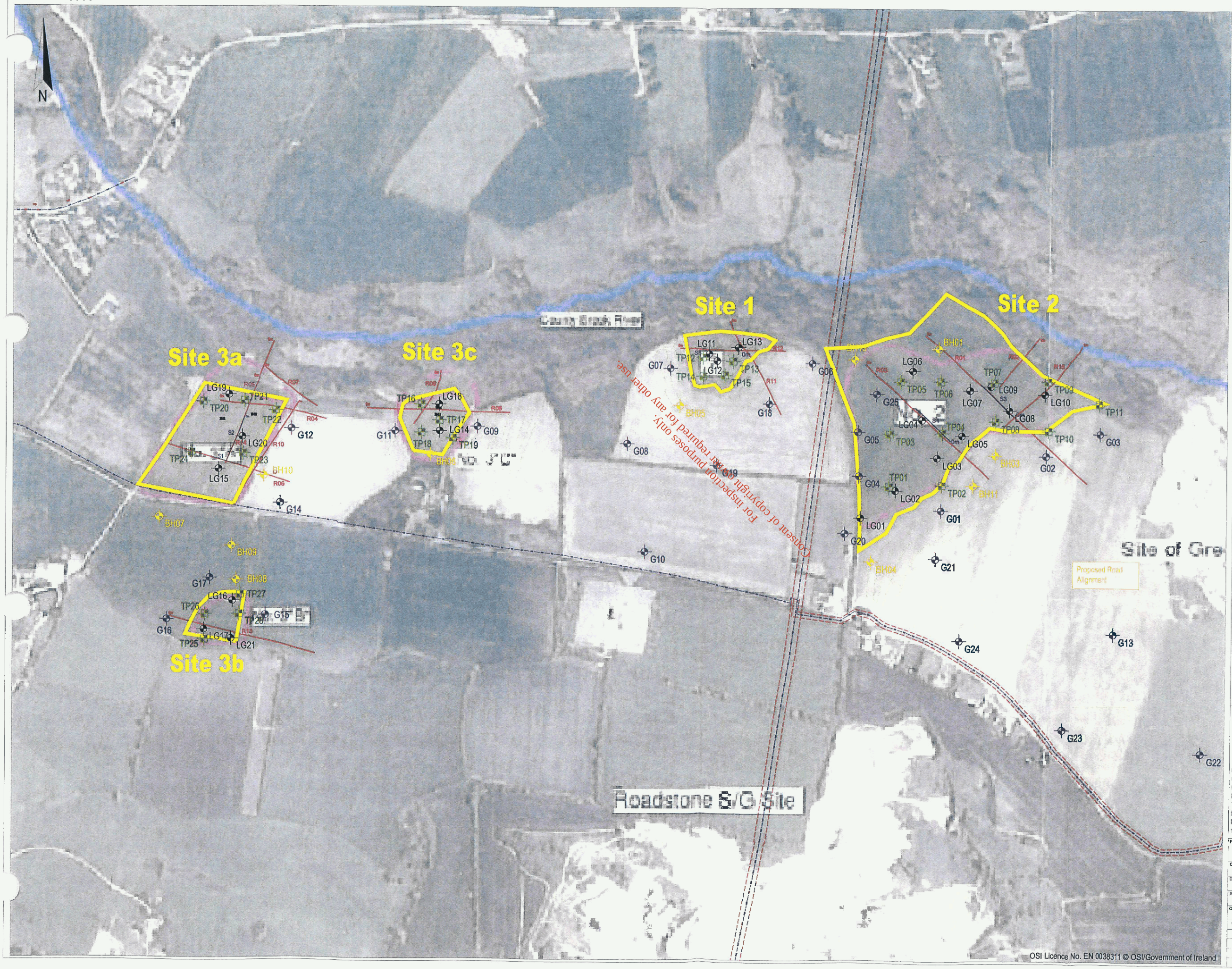
B.3.3 Data processing

First break picking in digital format was carried out using the FIRSTPIX software program to construct p-wave (Vp) traveltime plots for each spread. Velocity phases were selected from these plots using the GREMIX software program and were used to calculate the thickness of individual velocity units. Topographic data were input. Material types were assigned and estimation made of material properties, cross-referenced to borehole and MASW data. The processed seismic data are displayed in Appendix A.

Approximate errors for Vp velocities are estimated to be +/- 10%. Errors for the calculated layer thicknesses are of the order of +/-20%. Possible errors due to the "hidden layer" and "velocity inversion" effects may also occur (Soske, 1959).

FIGURE 1: GEOPHYSICAL AND (AS BUILT) SI LOCATIONS

SCALE 1:5000



INDEX MAP:

LEGEND:

- Site boundary
- R1 — ERT profile
- S1 — Seismic refraction profile
- Conductivity measurments
- LG20 — Cable/Rotary Core
- BH10 — Rotary Core
- G13 — Rotary Core
- TP23 — Trial Pit
- Water Main

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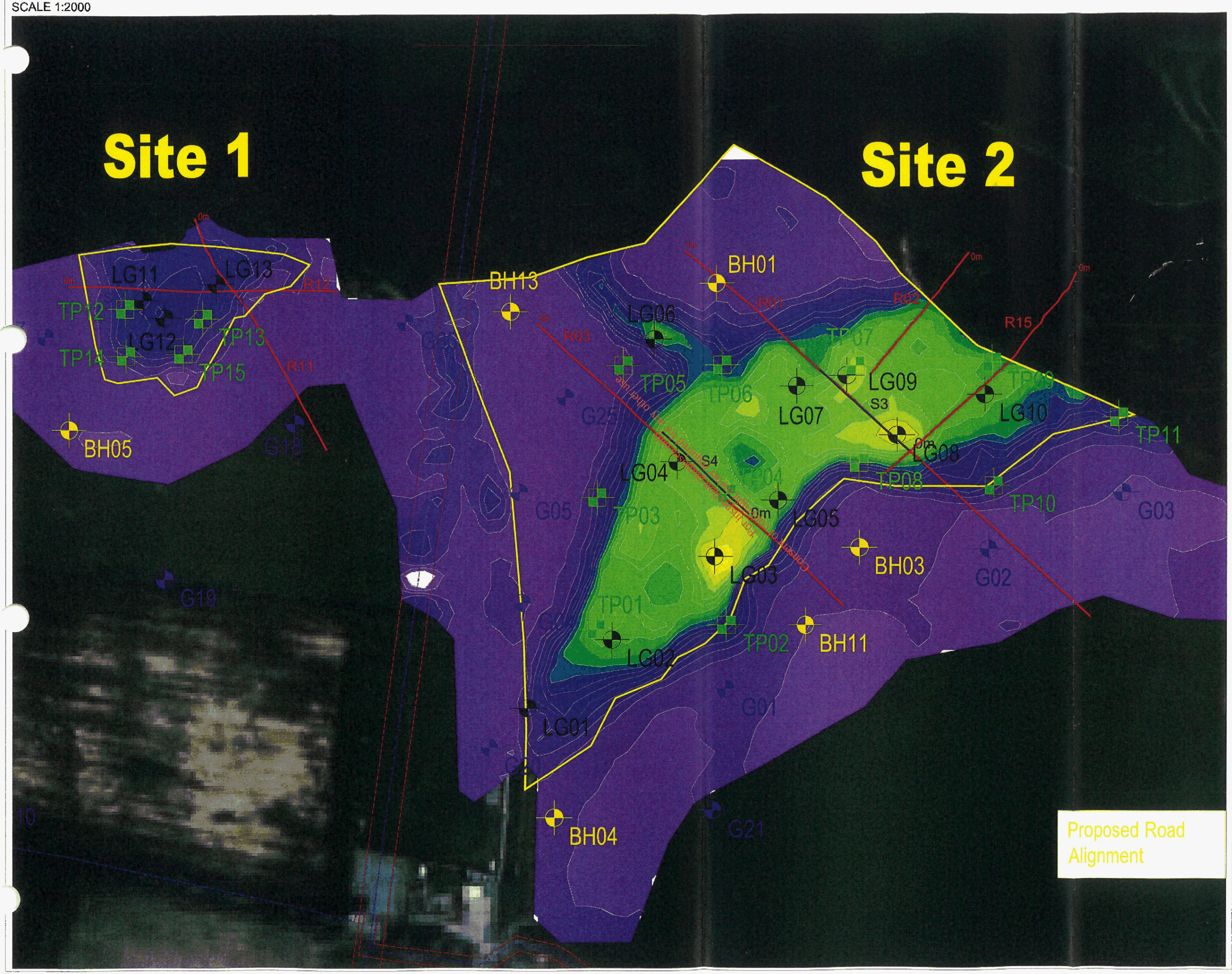
PROJECT:	FASSAROE UNAUTHORISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
CLIENT:	RPS CONSULTING
DRAWING NO:	AGL15302_01
SCALE:	AS INDICATED @ A3
DATE:	20th April 2016

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	AT
02	09/05/2016	YOC	

FIGURE 1: CONDUCTIVITY CONTOURS (mS/m)

SCALE 1:2000



INDEX MAP:

LEGEND:

Site boundary

R1 ERT profile

S1 Seismic refraction profile

Conductivity (mS/m)

137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
62
57
52
47
42
37
32
27
22
17
12
7
2

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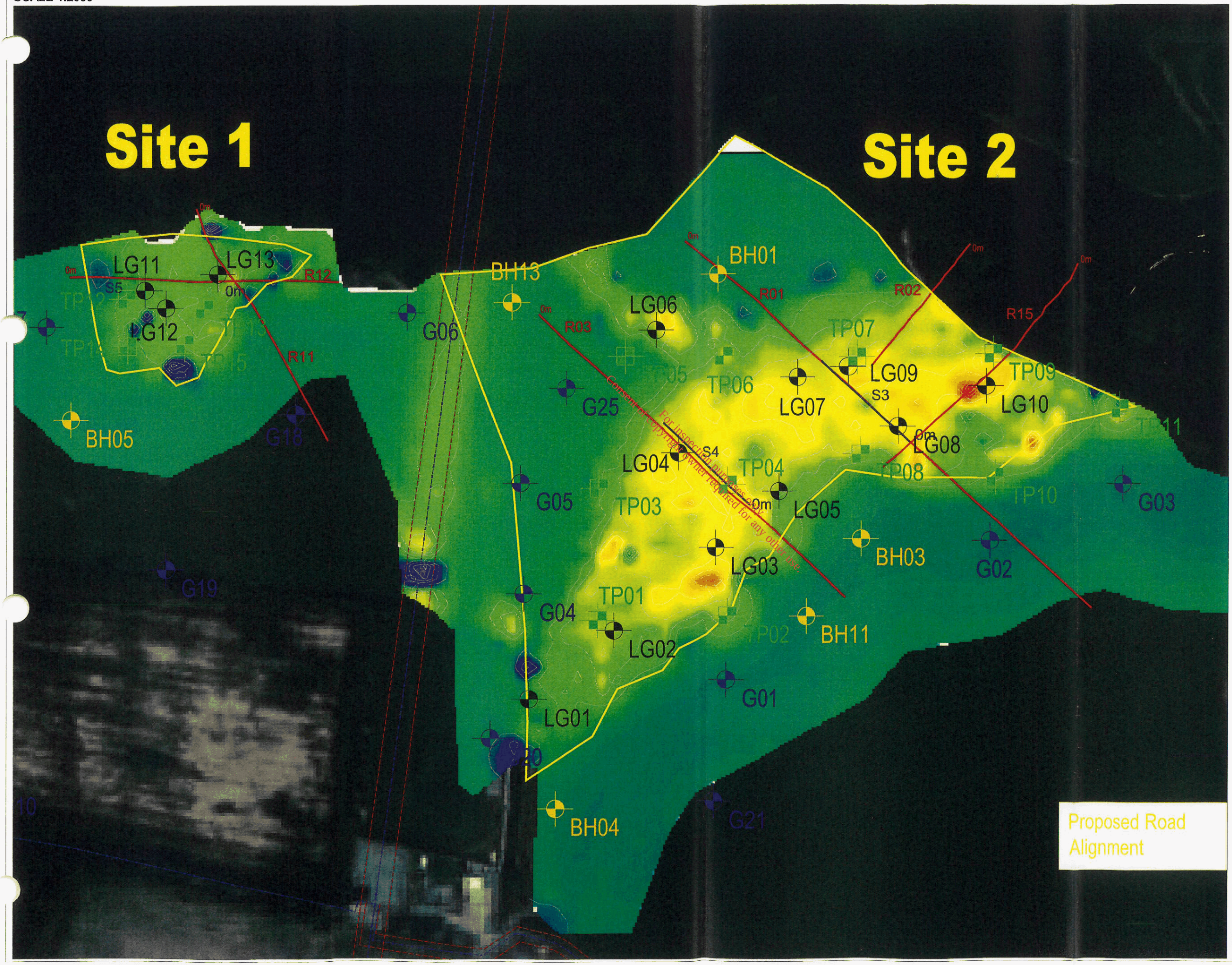
PROJECT:	FASSAROE UNAUTHORISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
CLIENT:	RPS CONSULTING
DRAWING NO:	AGL15302_02
SCALE:	AS INDICATED @ A3
DATE:	20th April 2016

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	AT
02	09/05/2016	YOC	

FIGURE 1: INPHASE CONTOURS

SCALE 1:2000



INDEX MAP:

LEGEND:

- Site boundary
- R1 — ERT profile
- S1 — Seismic refraction profile

Inphase Values: 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 -1 -2 -3 -4 -5 -6

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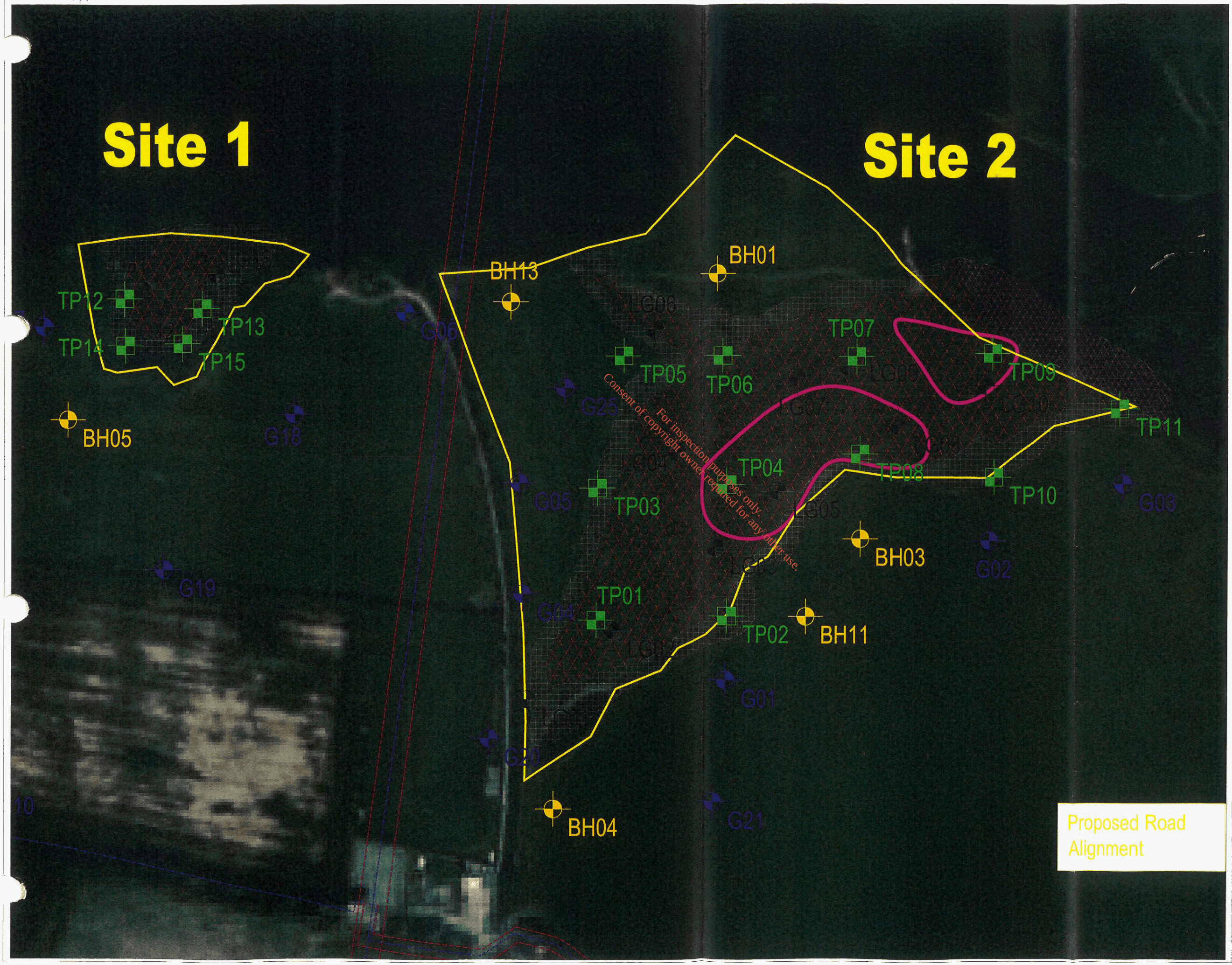
PROJECT:	FASSAROE UNAUTHORISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
CLIENT:	RPS CONSULTING
DRAWING NO:	AGL15302_03
SCALE:	AS INDICATED @ A3
DATE:	20th April 2016

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	AT
02	09/05/2016	YOC	

FIGURE 1: SUMMARY MAP - Sites 1 & 2

SCALE 1:2000



INDEX MAP:

LEGEND:

- Extent of Waste with high Organic & Metallic content
- Extent of Waste with lower Organic & Metallic content Or Waste mixed with silty clayey SAND/GRAVEL
- Landslide and/or potential leachate
- Zone of high levels of leachate beneath waste body

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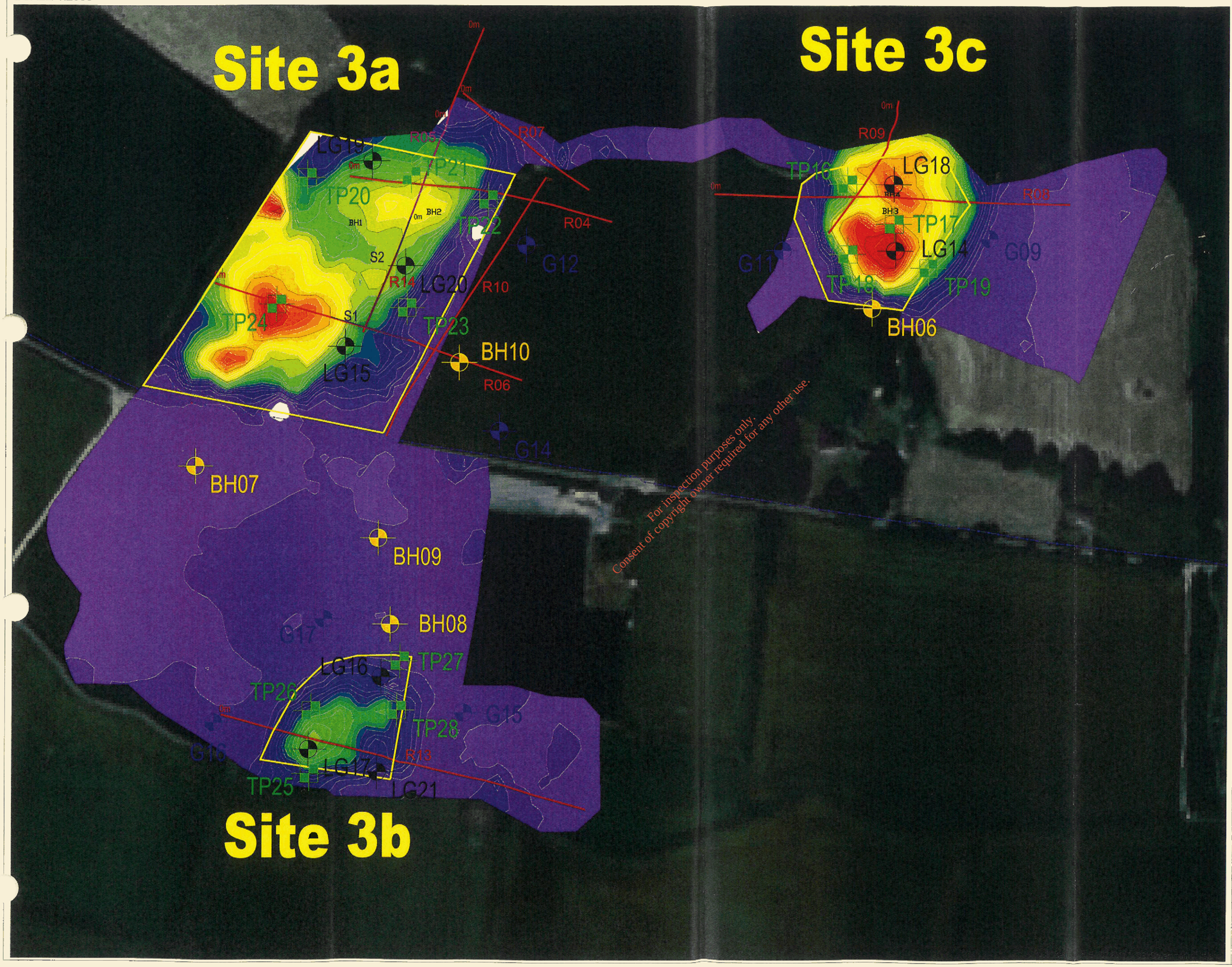
PROJECT:	FASSAROE UNAUTHORISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
CLIENT:	RPS CONSULTING
DRAWING NO:	AGL15302_04
SCALE:	AS INDICATED @ A3
DATE:	20th April 2016

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	AT
02	09/05/2016	YOC	

FIGURE 1: CONDUCTIVITY CONTOURS (mS/m)

SCALE 1:2000



INDEX MAP:

LEGEND:

- Site boundary
- R1 — ERT profile
- S1 — Seismic refraction profile

Conductivity (mS/m): 137, 132, 127, 122, 117, 112, 107, 102, 97, 92, 87, 82, 77, 72, 67, 62, 57, 52, 47, 42, 37, 32, 27, 22, 17, 12, 7, 2

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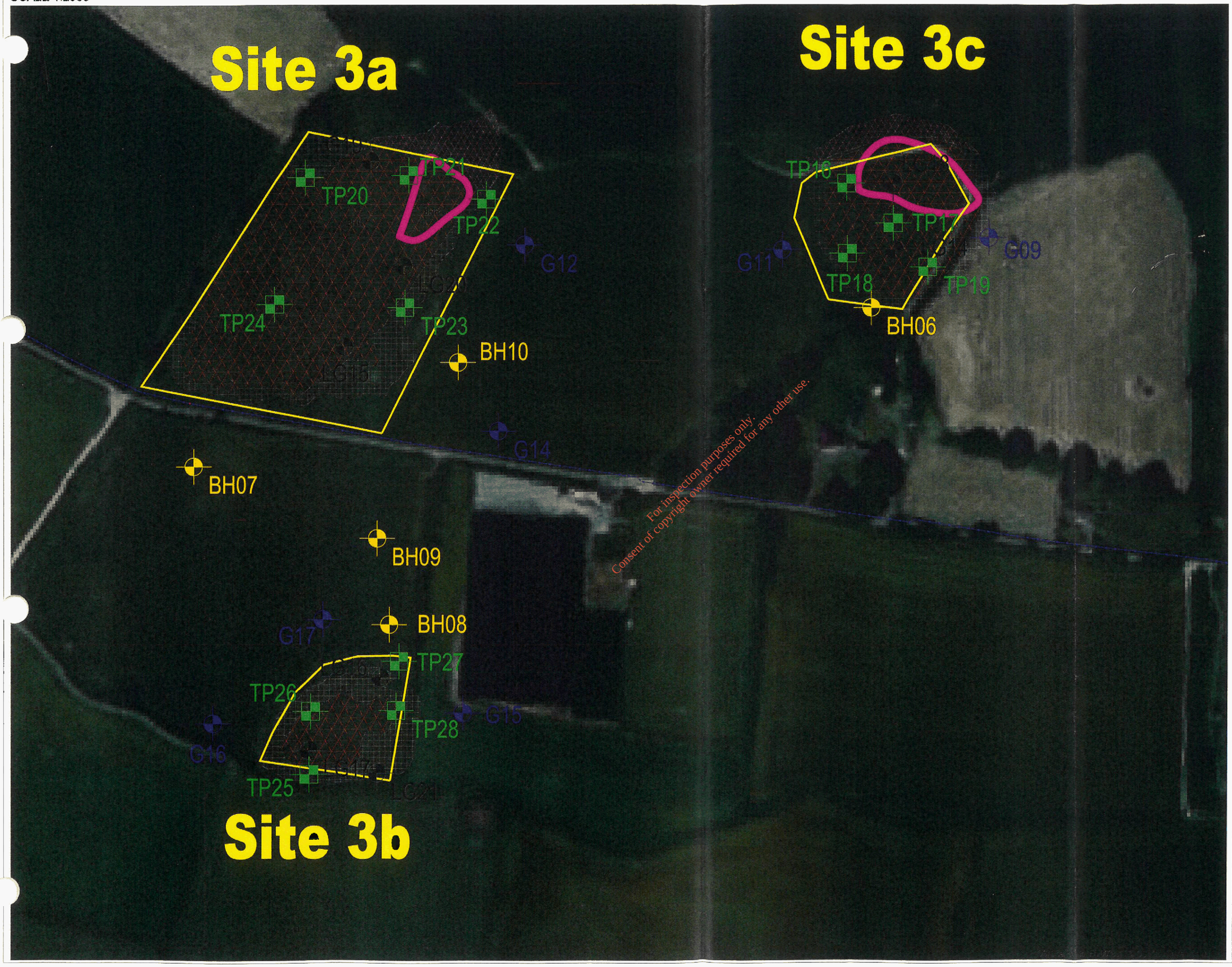
PROJECT:	FASSAROE UNAUTHORISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
CLIENT:	RPS CONSULTING
DRAWING NO:	AGL15302_05
SCALE:	AS INDICATED @ A3
DATE:	20th April 2016

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	AT
02	09/05/2016	YOC	

FIGURE 1: SUMMARY MAP - Sites 3a, 3b & 3c

SCALE 1:2000



INDEX MAP:

LEGEND:

- Extent of Waste with high Organic & Metallic content
- Extent of Waste with lower Organic & Metallic content Or Waste mixed with silty clayey SAND/GRAVEL
- Landslide and/or potential leachate
- Zone of high levels of leachate beneath waste body

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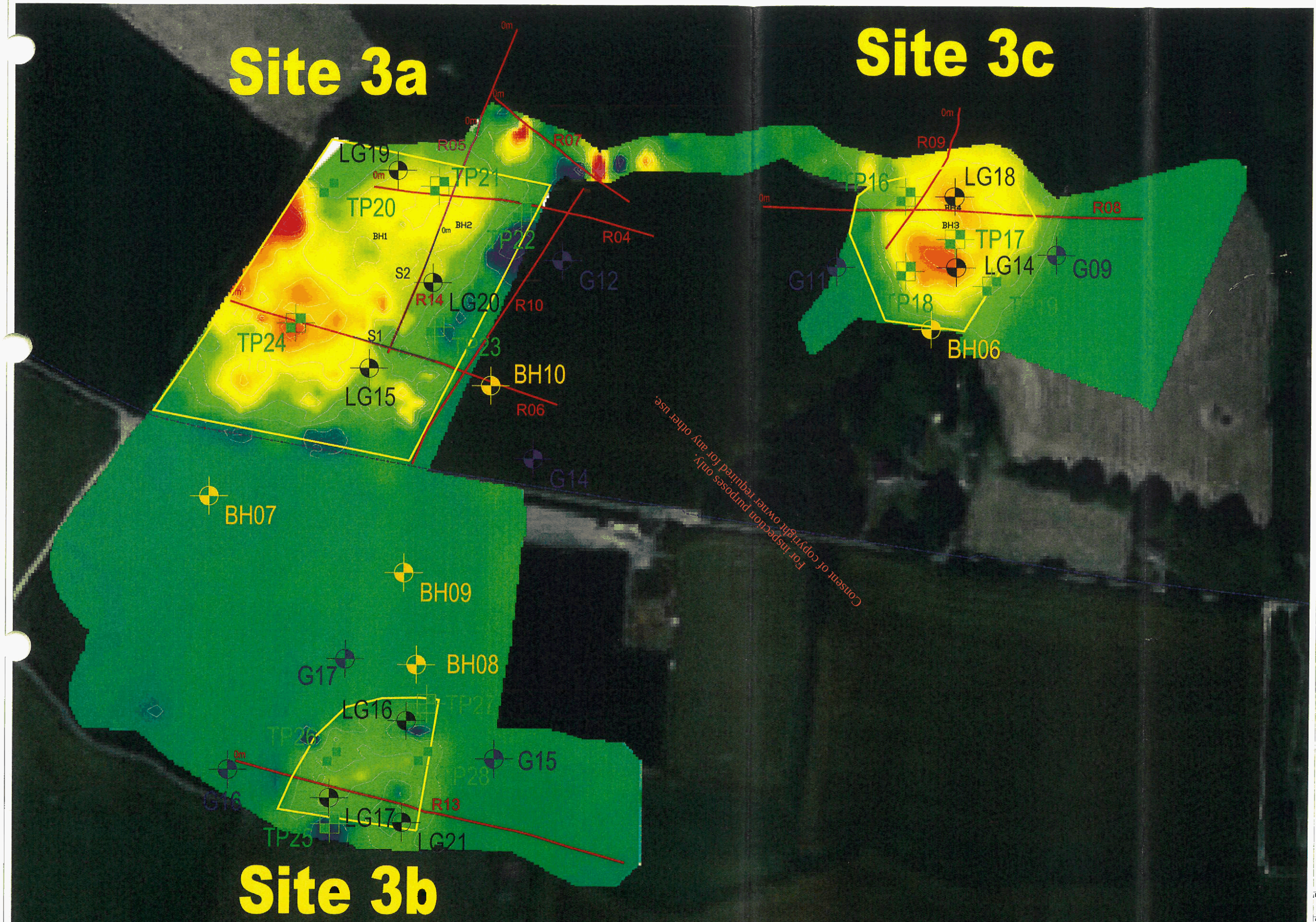
PROJECT:	FASSAROE UNAUTHORISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
CLIENT:	RPS CONSULTING
DRAWING NO:	AGL15302_07
SCALE:	AS INDICATED @ A3
DATE:	20th April 2016

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	AT
02	09/05/2016	YOC	

FIGURE 1: INPHASE CONTOURS

SCALE 1:2000



INDEX MAP:

LEGEND:

- Site boundary
- R1 — ERT profile
- S1 — Seismic refraction profile

Inphase Values: 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, -1, -2, -3, -4, -5, -6

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PROJECT:	FASSAROE UNAUTHORISED LANDFILL SITES GEOPHYSICAL INVESTIGATION
CLIENT:	RPS CONSULTING
DRAWING NO:	AGL15302_06
SCALE:	AS INDICATED @ A3
DATE:	20th April 2016

Version:	Date:	Drawn By:	Checked:
01	20/04/2016	YOC	AT
02	09/05/2016	YOC	