



Le réseau
de transport
d'électricité



MINISTÈRE
DE LA TRANSITION
ÉNERGÉTIQUE

*Liberté
Égalité
Fraternité*

Document reference				Issue information	
Project	Package	Issuer	Chrono	Revision	Status
BRE_AO5	PeM	TEC	48	1.1_A	A
Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - AO5 OSS area_1.1_A				
Additional Metadata	Discipline	Document Type	System	Activity	
	GPH-UXO				
	Contract	Acceptance Class	Dossier	Alternative ref.	
	AO4-AO5				
	Confidentiality	Print format	Subcontractor	Contractor ref.	
	Restricted	A4			

Date	Rev	Status	Reason for Revision	Issued by	Checked by	Approved by
08/07/2022	0.0	IFR	Issued	TZ	FL	BMC
29/07/2022	1.0	B	Revision after client's comments	JW	IMA	BMC
23/09/2022	1.1	B	Revision after client's comments	JW	IMA	BMC
29/11/2022	1.1_A	A	Final document (Status A)	JW	IMA	BMC

Change log:

Document uncontrolled when printed/downloaded.
Always check with document control for the latest revision.

**BRE_AO5 AREA
OFFSHORE SUBSTATION
GEOPHYSICAL AND UXO SURVEY**

BRE_PeM_TEC_48_RESULTS
REPORT – GEOPHYSICAL-
UXO SURVEY – AO5 OSS
AREA_1.1_A





PROJECT No.
113401272

RESULTS REPORT

No. OF PAGES
47




1.1_A	29/11/2022	Final document (Status A)	JW	IMA	BMC	FLO	BCO
1.1	23/09/2022	Revision after client's comments	JW	IMA	BMC	FLO	BCO
1.0	29/07/2022	Revision after client's comments	JW	IMA	BMC	FLO	BCO
0.0	08/07/2022	Issued	TZ	FL	BMC	FLO	BCO
REV	DATE	DESCRIPTION	BY	CHK	ENG	PM	CLIENT

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

CONTENTS

1.	INTRODUCTION.....	7
1.1.	PROJECT OVERVIEW.....	7
1.2.	SCOPE OF WORKS.....	11
1.3.	GEODETIC PARAMETERS	11
1.3.1.	Survey datum.....	11
1.3.2.	Vertical datum	12
1.3.3.	Tidal reduction	12
2.	GEOPHYSICAL DATASET	14
2.1.	QA/QC CHECK	14
2.2.	SIT SURVEY	14
3.	DATA ACQUISITION.....	17
3.1.	SURVEY ACQUISITION SCHEME.....	17
3.2.	MULTIBEAM ECHOSOUNDER.....	18
3.3.	SIDE SCAN SONAR – UXO SURVEY.....	21
3.4.	GRADIOMETER – UXO SURVEY.....	26
4.	RESULTS.....	31
4.1.	COVERAGE AREA.....	31
4.2.	ANOMALY PICKING	31
4.2.1.	Magnetic anomalies	31
4.2.2.	MBES and side scan sonar anomalies.....	32
4.3.	DISCRIMINATION OF pUXO TARGETS.....	32
5.	AVOIDANCE DISTANCES	33
6.	CONCLUSION	36

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 1 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_AO5	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - AO5 OSS area_1.1_A				

REFERENCES.....	37
APPENDIX I – LIST OF THE MAGNETIC ANOMALIES DETECTED.....	38
APPENDIX II – LIST OF THE SIDE SCAN CONTACTS DETECTED	40
APPENDIX III – LIST OF THE MBES CONTACTS DETECTED	42
APPENDIX IV – ALARP CERTIFICATE MAP	44

LIST OF FIGURES

Figure 1-1: General view of the UXO box location at the BRE_AO5 Offshore substation (OSS).....	8
Figure 1-2: Detailed view of the UXO box location at the BRE_AO5 Offshore substation (OSS).....	8
Figure 1-3: UXO box dimensions at the BRE_AO5 Offshore Substation area (OSS). 9	
Figure 1-4: UXO box survey line plan at the BRE_AO5 Offshore Substation area (OSS).....	10
Figure 1-5: Qinsy method for accurate height calculation.	13
Figure 2-1: Result from the SIT, Residual field, and Analytic signal at 3m and 6 m altitude.	15
Figure 3-1: UXO data acquisition scheme.	18
Figure 3-2: MBES bathymetry data acquisition with the Qinsy software.	19
Figure 3-3: Processing screen of MBES bathymetry data with the Qimera software.20	
Figure 3-4: 3D image of the MBES bathymetry processing.	20
Figure 3-5: Bathymetric data for BRE_AO5 OSS.	21
Figure 3-6: Navigation editor in SonarWiz 7.	23
Figure 3-7: Bottom tracking processing drawn in blue in the SonarWiz software.	24
Figure 3-8: Side scan sonar data for BRE_AO5 OSS.....	25
Figure 3-9: ROTV with the fixed frame system for MAG acquisition.....	26
Figure 3-10: Processing workflow of magnetometer data.	28
Figure 3-11: Residual field and analytic signal chart examples for BRE_AO5 OSS. 29	
Figure 3-12: Dynamic coverage calculations.	30

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 2 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	


	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

Figure 4-1: Colour scale and threshold used for analysis of magnetic anomalies. ...	31
Figure 5-1: Avoidance distances.	33
Figure 5-2: ALARP validated area in the OSS area.	35
Figure 5-3: Legend of the ALARP maps.	35





LIST OF TABLES

Table 1: Datum parameters table	11
Table 2: Projection parameters table	12
Table 3: Position verification of 10 Kg item.	16
Table 4: Position verification of 25 Kg item.	16
Table 5: Position verification of 72 Kg item.	16
Table 6: UXO data acquisition scheme information	17
Table 7: Magnetometer coverage area (centroid of the GI box).....	31
Table 8: Final ALARP workable areas and GI box location.....	36

ABBREVIATIONS

AAA	Anti-Aircraft Artillery
ADCP	Acoustic Doppler Current Profiler
ALARP	As Low as Reasonable Practicable
cm	Centimetre
CoG	Center of Gravity
DGEC	Direction générale de l'énergie et du climat
DP	Dynamic Positioning
DTM	Digital Terrain Model
EC	Export Cable
EGN	Empirical Gain Normalization
FLO	Fisheries Liaison Officer
GEO	Geophysicist
GI	Borehole location
GIS	Geographic Information System





Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 3 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

ABBREVIATIONS

GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRS	Geodetic Reference System
h	Hour
IGRF	International Geomagnetic Reference Field
INERIS	L'Institut national de l'environnement industriel et des risques
INS	Inertial Navigation System
JSF	EdgeTech Sonar data file format
Kg	Kilogram
KHz	kilohertz
LAT	Low Astronomical Tide
LMA	Luftmine A
LMB	Luftmine B
LSA	Land Service Ammunition
m	Meters
M	Minutes
MAG	Magnetometer
MBES	Multibeam echosounder
mm	Millimetre
MMO	Marine Mammals Observation
MOB	Mobilisation
MRU	Motion Reference Unit
nT	nanoTesla
OSS	Offshore substation
OWF	Offshore windfarm
PC	Party Chief
PEP	Project Execution Plan
POB	Personnel On Board





Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 4 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

ABBREVIATIONS

PPP	Precise Point Positioning
PPS	Pulse Per Second
PPSU	Pulse Power Supply Unit
pUXO	Possible unexploded ordnance
QA	Quality Assurance
QC	Quality Control
QGIS	Quantum GIS (Software)
QHSE	Quality, Health, Safety and Environment
RGB	Red, green, blue
ROTV	Remotely operated towed vehicle
ROV	Remotely Operated Vehicle
RTE	Réseau de Transport d'Electricité
RTK	Real Time Kinematics
s	Second
SHOM	Service hydrographique et océanographique de la Marine
SIT	Surrogate Item Trials
SRF	Ship's Reference Frame
SSS	Side Scan Sonar
SVP	Sound Velocity Profiler
SVS	Sound Velocity Sensor
TBC	To be confirmed
TXT	Standard text document file format
UHR	Ultra-High Resolution
USBL	Ultra-Short Base Line
UTC	Universal Time Coordinated or Coordinated Universal Time
UTM	Universal Transverse Mercator
UXO	Unexploded ordnance
VRF	Vertical Reference Frame

Confidentiality	Diffusion restreinte (restricted)	Pages	Page 5 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

ABBREVIATIONS

VSAT

Very Small Aperture Terminal


WGS84

World Geodetic System 1984

WT

Work time

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 6 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_AO5	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - AO5 OSS area_1.1_A				

1. INTRODUCTION

1.1. PROJECT OVERVIEW


Tecnoambiente carried out a geophysical survey over the proposed BRE_AO5 lot located in Morbihan, in the south of Brittany, close to western coast of Belle-Île-en-Mer and the southern coast of Île de Groix. The site is under consideration for an offshore windfarm and associated offshore substation. This report summarises the survey operations and presents the results of the geophysical UXO survey for the offshore substation area.

The area of interest for this report is approximately 2.50 km x 1.60 km and according to the SHOM bathymetry, the site is in water depths ranging from -81 to -89 m. The spatial surface this area represents is about 3.99 km².

The objective of this report is to present the data obtained in the geophysical/UXO phase of the BRE_AO5 work area, focusing only on the Offshore Substation (OSS).

The location of the UXO box in the offshore substation area of BRE_AO5 has been sited over the previously acquired seismic lines from Phase I. Figure 1-1 and 1-2 show the location of this box.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 7 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_AO5	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - AO5 OSS area_1.1_A				

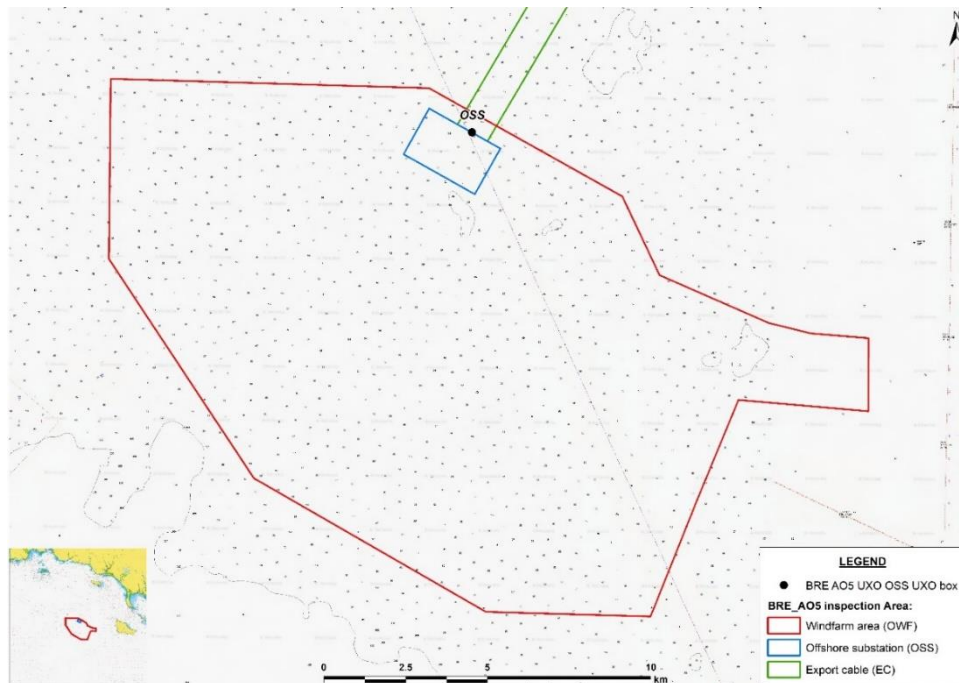


Figure 1-1: General view of the UXO box location at the BRE_AO5 Offshore substation (OSS).

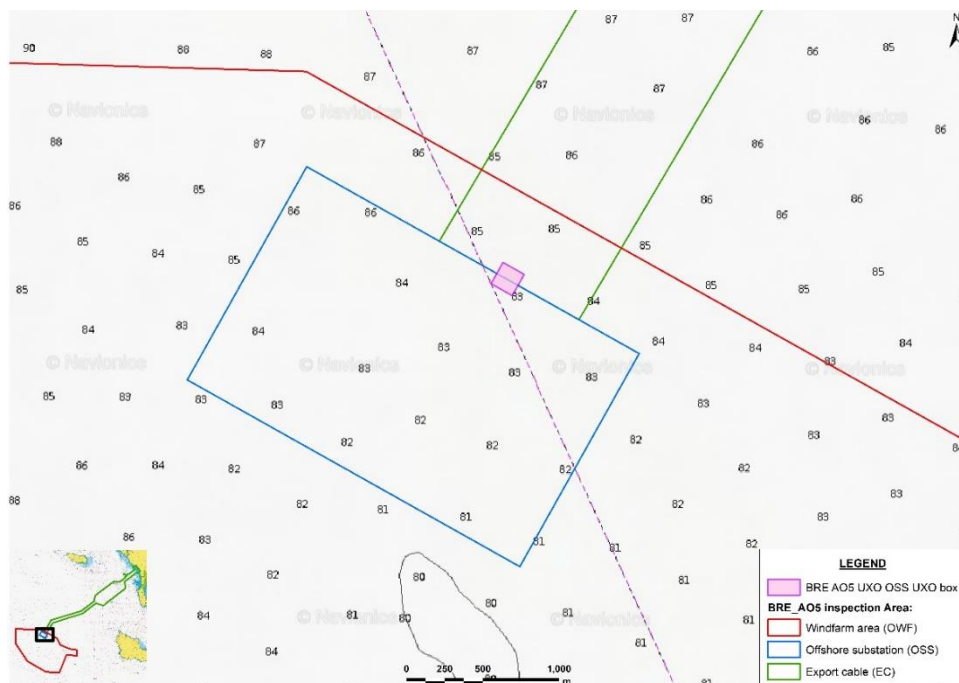



Figure 1-2: Detailed view of the UXO box location at the BRE_AO5 Offshore substation (OSS).

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 8 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_AO5	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - AO5 OSS area_1.1_A				

The UXO box size comprises a total area of 25600 m² (160 m x 160 m), with a run in / run out length of 1000 metres utilised to optimise the acquisition of the magnetometer data. Figure 1-3 provides an example of the UXO box, and Figure 1-4, illustrates the survey line plan layout at 6 m separation.

The BRE_AO5 OSS UXO box central point coordinates (*WGS84 Zone 30N*) are as follows:

- **UTM X:** 452993.33
- **UTM Y:** 5247700.33

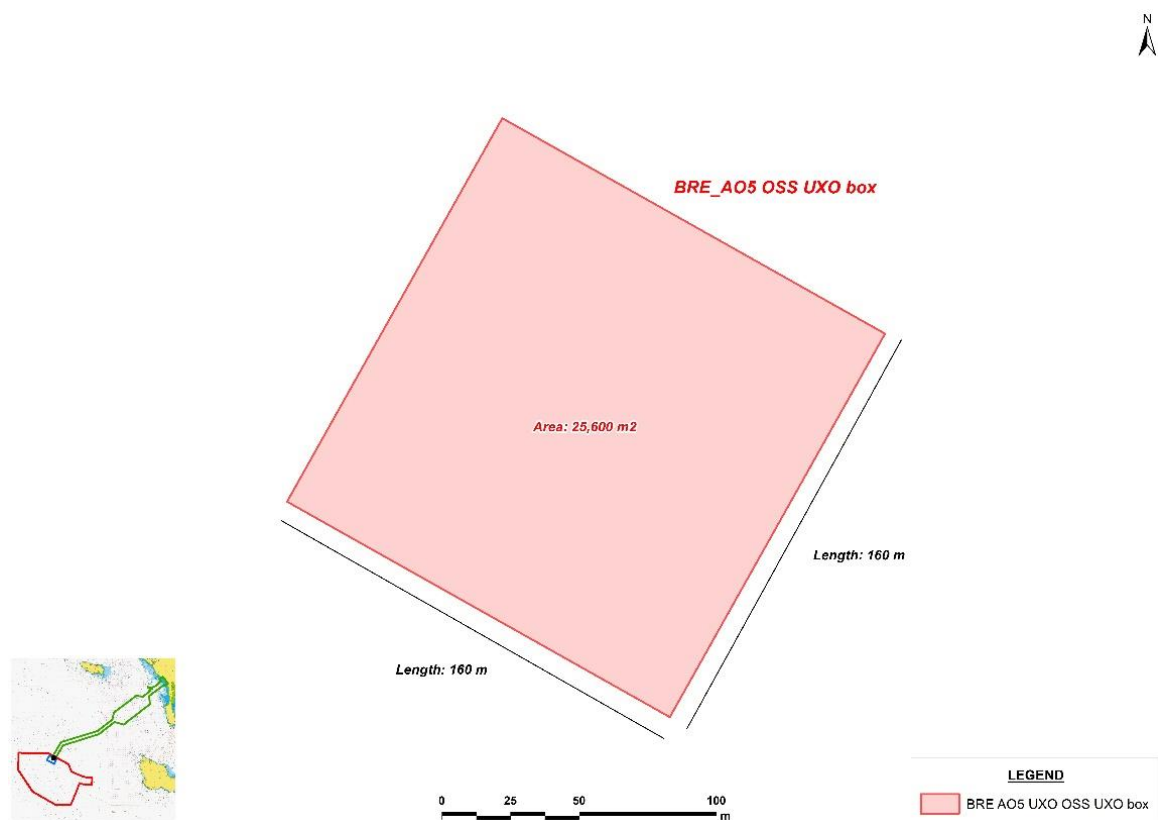


Figure 1-3: UXO box dimensions at the BRE_AO5 Offshore Substation area (OSS).

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 9 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	






	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				



Figure 1-4: UXO box survey line plan at the BRE_A05 Offshore Substation area (OSS).

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 10 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_AO5	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - AO5 OSS area_1.1_A				

1.2. SCOPE OF WORKS

The objective of the site survey was to perform a geophysical and UXO survey over the proposed GI point (Borehole location) on the OSS site, comprising MBES, SSS and MAG datasets. The purpose of this was to:

- To define the final location of the GI points on the proposed box
- To detect magnetometer anomalies, and side scan and MBES contacts
- To review proposed borehole locations for geohazards

The main purpose of the study was to provide an ALARP certificate for intrusive geotechnical sampling over the BRE_AO5 OSS area.

1.3. GEODETIC PARAMETERS

1.3.1. Survey datum

These parameters are detailed below.

Table 1: Datum parameters table

DATUM	
Survey Datum:	WGS 84
Spheroid	GRS 1980
Semi-Major Axis (a)	6,378,137.000
Semi-Minor Axis (b)	6,356,752.31424
Inverse Flattening (1/f)	1/298.257223563

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 11 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	


	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

Table 2: Projection parameters table.

PROJECTION	
Projection	UTM
False Easting	500000
False Northing	0
Latitude of Origin	0°00'00.000000"
Central Meridian	3°00'00.000000"
UTM Zone	30 N
Scale Factor on CM	0.9996
Units:	Meters


1.3.2. Vertical datum

Vertical datum used by the Qinsy software is LAT Bathyelli v2 geoid published by the SHOM in December 2013. The Bathyelli LAT (SHOM 2013) is a surface based on the GRS 1980 spheroid. The same geoid model was used for the A05 area during the 2021 survey.

1.3.3. Tidal reduction

To carry out the survey as accurately as possible, Tecnoambiente utilised MarineStar PPP corrections via satellite signal. When using an accurate GNSS system (RTK correction), the tidal corrections are carried out in real-time through Qinsy computations, as shown in Figure 1-5.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 12 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

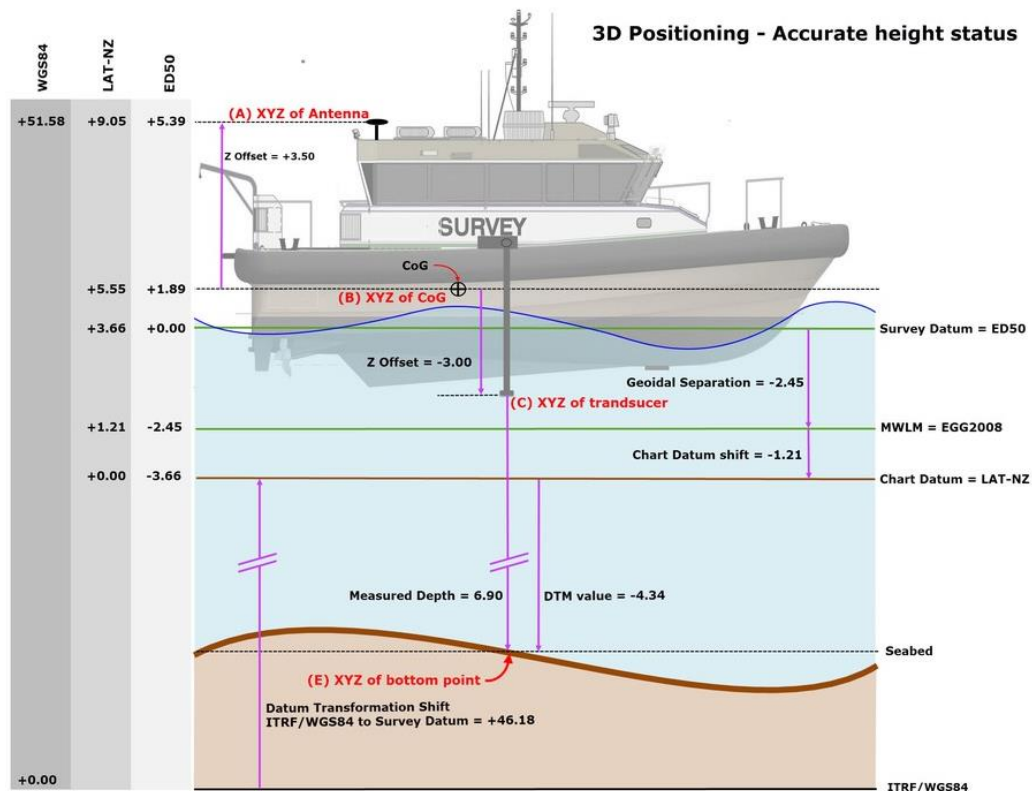






Figure 1-5: Qinsy method for accurate height calculation.

The separation between the WGS84 ellipsoid (GRS80) and the vertical datum is a model called Bathymelli v2. This comprises a set of surfaces, each of which defines the separation of one vertical datum from the WGS84 ellipsoid. If corrections drop out, they can be applied during post processing.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 13 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

2. GEOPHYSICAL DATASET

2.1. QA/QC CHECK

The processed values obtained from the onboard processing team during the survey are checked before the ALARP certificate phase. This quality control check of the input data validates the quality of the processing method. Here is the QA/QC for the measurements made:

- QC0: check of the geophysical value
- QC1: Check of the sensor position
- QC2: Check of the altitude of sensor and dynamic coverage
- QC3: Check of the noise
- QC4: Check of the speed and sampling frequency

2.2. SIT SURVEY


The calibration test (SIT) was carried out using ferrous surrogates, weighing 10 kg, 25 kg and 50 kg, in order to be consistent with historical data (Ref 01). This test makes it possible to estimate the precision of the survey positioning, the amplitude of the signal to be sought and the detectability distance.

After mapping an area to make sure it was clear of potential targets, the surrogates were immersed. Several altitudes were utilised to undertake the calibration test above the surrogate: 3 m, 5 m, and 6 m (Figure 2-1). Each of the three surrogates were detectable at all altitudes (Ref 05); however, the amplitude of the signal at the 6 m altitude for the 10kg weight was found to be only 0.8 nT/m, well under the used cut-off of 2 nT/m.

From these SIT data, it was possible to estimate:

- The positional uncertainty of the survey at 2.5 m average (Table 3, 4 and 5)
- A detection range of 6 m for a ferrous mass greater than 25 kg
- A detection range of 4 m for a ferrous mass of about 10 kg

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 14 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

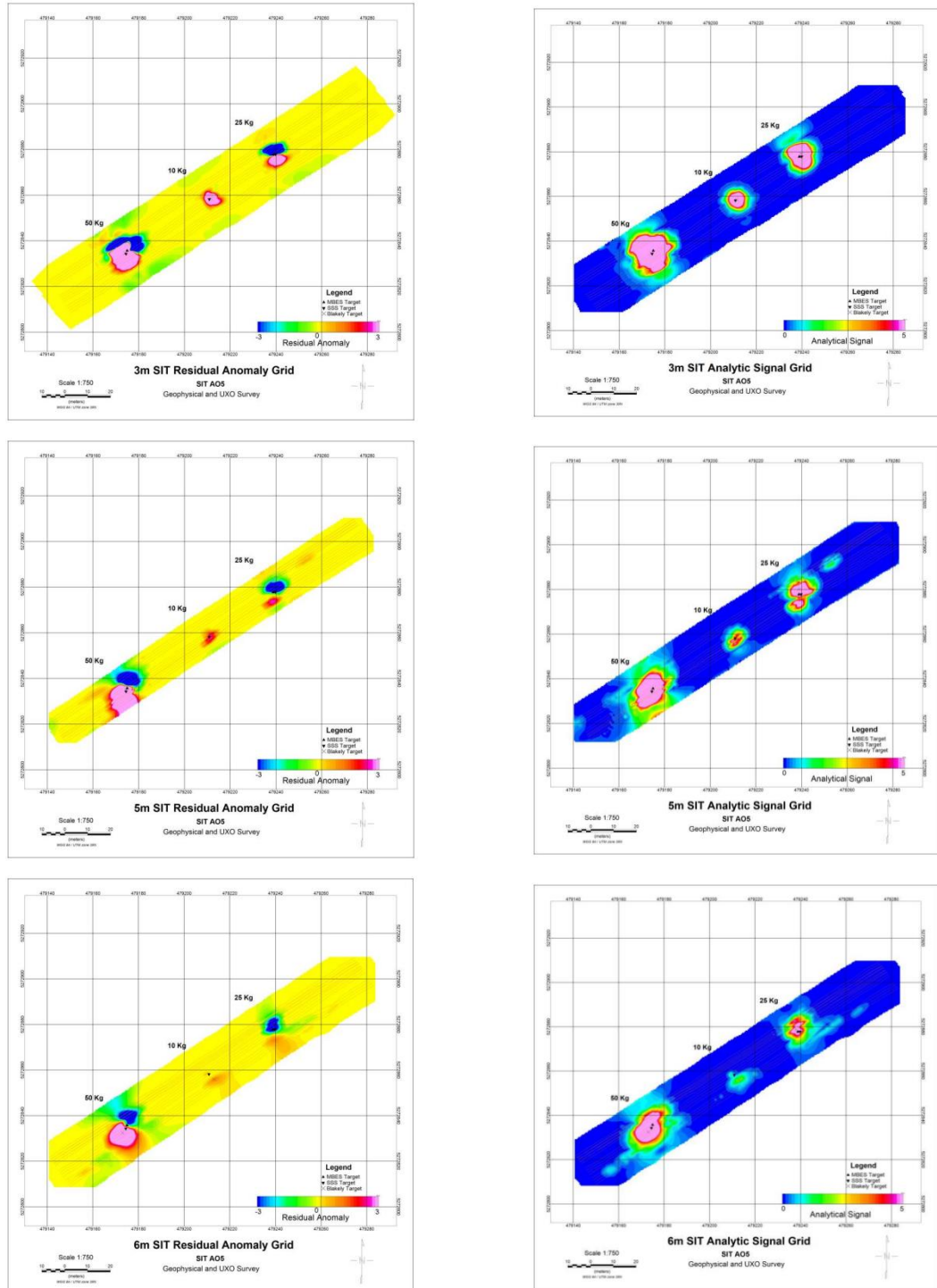


Figure 2-1: Result from the SIT, Residual field, and Analytic signal at 3m and 6 m altitude.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 15 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	





   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

Table 3: Position verification of 10 Kg item.

	Source	Easting (m)	Northing (m)	Δ Easting (m)	Δ Northing (m)	Total Deviation (m)
10 Kg Surrogate Item	SSS position	479210.87	5272858.14	N/A	N/A	N/A
	Blakely test @ 3m	479211.5	5272859.0	0.63	0.87	1.08m
	Blakely test @ 5.0m	479212.50	5272857.50	1.64	0.64	1.72
	Blakely test @ 6.0m	479213.00	5272856.00	2.13	2.14	3.01


Table 4: Position verification of 25 Kg item.

	Source	Easting (m)	Northing (m)	Δ Easting (m)	Δ Northing (m)	Total Deviation (m)
25 Kg Surrogate Item	SSS position	479239.83	5272877.72	N/A	N/A	N/A
	Blakely test @ 3.0m	479239.5	5272879.00	-0.33	1.28	1.32
	Blakely test @ 5.0m	479239.00	5272880.00	0.81	2.27	2.41
	Blakely test @ 6.0m	479238.00	5272878.50	1.83	0.76	1.99

Table 5: Position verification of 72 Kg item.

	Source	Easting (m)	Northing (m)	Δ Easting (m)	Δ Northing (m)	Total Deviation (m)
50 Kg Surrogate Item	SSS position	479174.40	5272834.28	N/A	N/A	N/A
	Blakely test @ 3.0m	479174.00	5272835.00	0.40	0.26	0.47
	Blakely test @ 5.0m	479174.50	5515635.50	0.1	0.72	0.81
	Blakely test @ 6.0m	479173.00	5272832.50	1.40	1.78	2.24

Confidentiality	Diffusion restreinte (restricted)	Pages	Page 16 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

3. DATA ACQUISITION

3.1. SURVEY ACQUISITION SCHEME


To ensure full coverage of the UXO box within the study area of the A05 offshore substation area, data acquisition during the survey was carried out as follows:

Table 6: UXO data acquisition scheme information

Methodology	Survey lines	Range
Multibeam echosounder system (MBES)	6 m	75 m
Side Scan Sonar (SSS)		100 m
Gradiometer (MAG)		8 m

The following figure shows the basic data acquisition scheme for the UXO phase.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 17 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

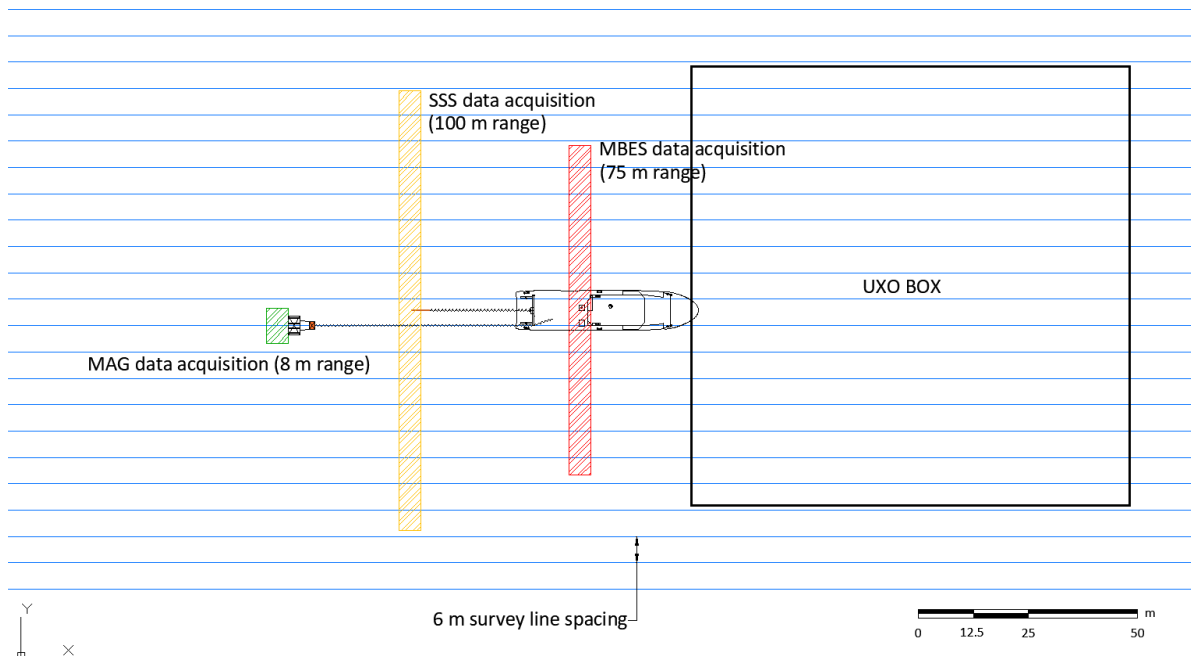


Figure 3-1: UXO data acquisition scheme.


3.2. MULTIBEAM ECHOSOUNDER

The objective of this phase of data acquisition is the detection of possible MBES targets lying on the seabed. Due to the coverage requirements of gradiometer data acquisition, this required total coverage of the seabed within the UXO box, and hence a survey line spacing of 6 metres was utilised.

During data acquisition, the vessel's master must follow previously programmed routes along the project lines, shown on the computer screen (Helmsmann indicator). If the actual course deviates from the programmed route by more than a specified amount, or when there is a problem with a peripheral, such as a loss of GPS corrections, the vessel master is warned by the use of visual and audible alarms.

While the master follows the navigation lines, the acquisition module of the hydrography program captures all of the position data sent by the GPS, the raw values of the movement reference unit (Hydrins III) and the heading of the equipment; to correct the location of the

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 18 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

soundings sent by the multibeam echosounder. This correction is made for each transmission pulse in real-time.

Parallel to data entry, data acquired by the equipment and peripherals are synchronized. This process is carried out by Qinsy, and is complemented by the input of the time and the pulse per second (PPS) provided by the MRU, so that all data is time synchronised.

The guidelines followed by Tecnoambiente during the surveying for MBES data acquisition are:

- IT-CM-36 SVP Deployment Recovery, Rev1.0
- IT-CM-01. Guidelines for Hydrography Project management, 5
- IT-CM-04. Bathymetric survey, 1
- IT-CM-14 Survey Basics Guidance, 1
- IT-CM-15 Online Surveying procedure, 3

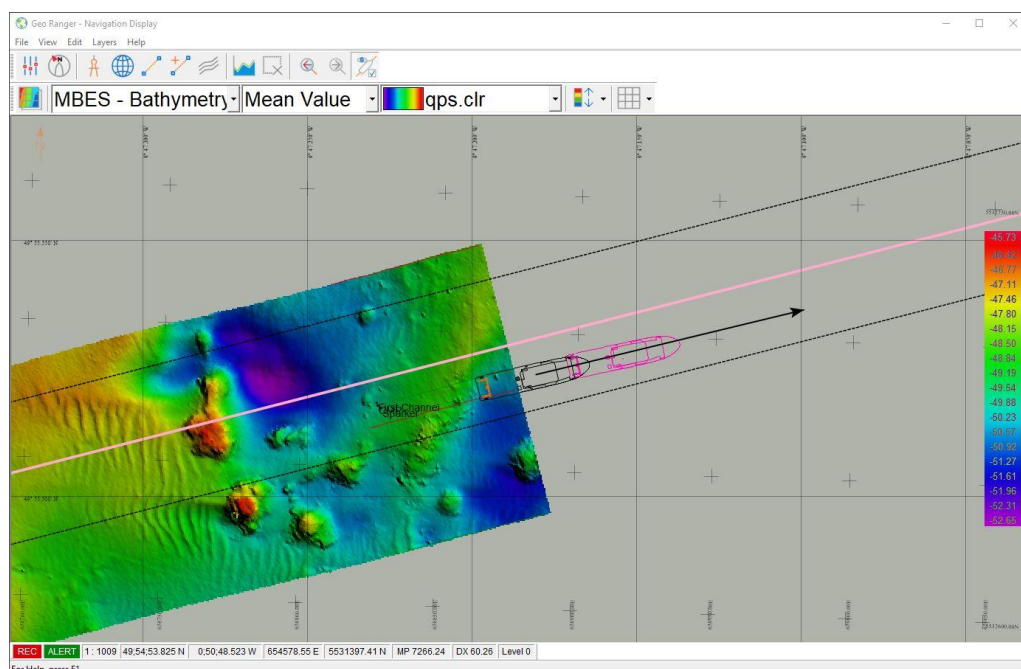



Figure 3-2: MBES bathymetry data acquisition with the Qinsy software.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 19 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

During data acquisition, limits were applied to reduce soundings noise. These limits in the recording correspond to static gates of the equipment software that reduce the acquired registers noise, in accordance with statistical calculations of vertical uncertainty.

During the processing phase of acquired data, the lines on the screen are processed, in order to manually correct any noise that appears in the records. Noise is produced by multiple factors such as, multipath in position, air bubbles, cetaceans, motor interference from the vessel, etc., in the digital register of soundings. To make certain of the complete removal of any noise in the soundings, spike filters and spline filters were applied.

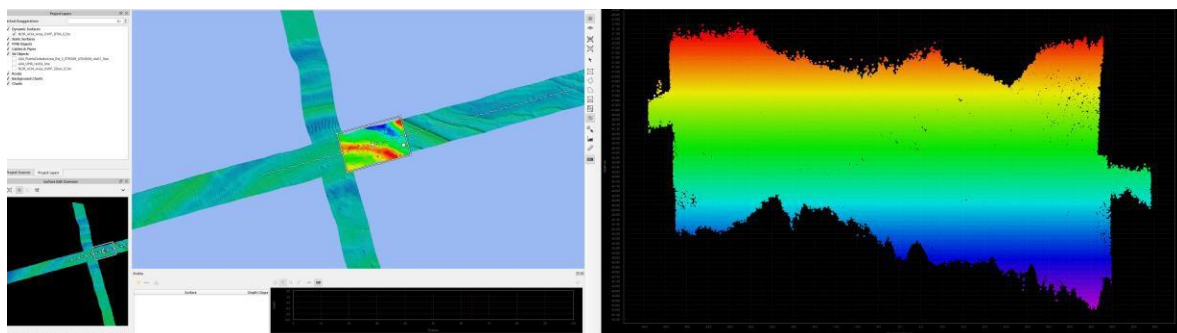


Figure 3-3: Processing screen of MBES bathymetry data with the Qimera software.

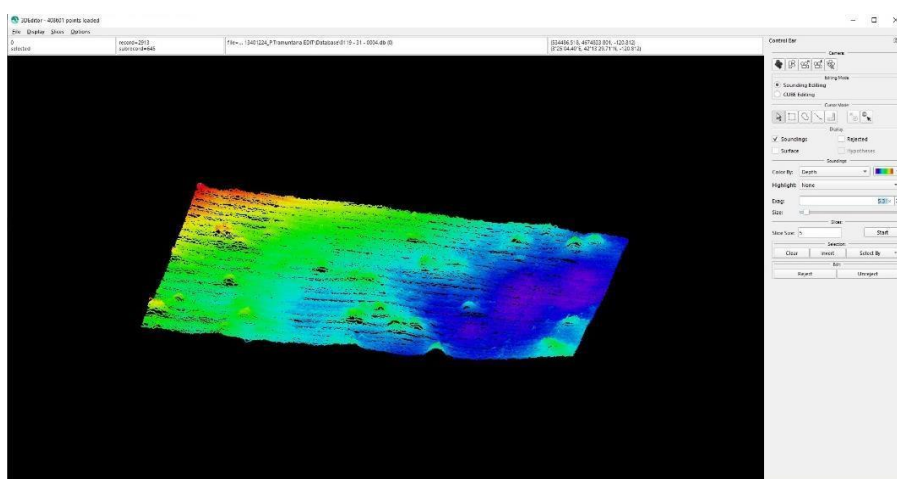



Figure 3-4: 3D image of the MBES bathymetry processing.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 20 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

Once any possible existing errors in the records were deleted, a digital model of the terrain with 0.25 x 0.25 m grid size was produced, with a minimum cell size to obtain the maximum resolution of the seabed.

Digital terrain models (DTM) are created in Qimera. Once done, the DTM's are exported as 32bits RGB Geotiff, for the UXO box (Figure 3-5).

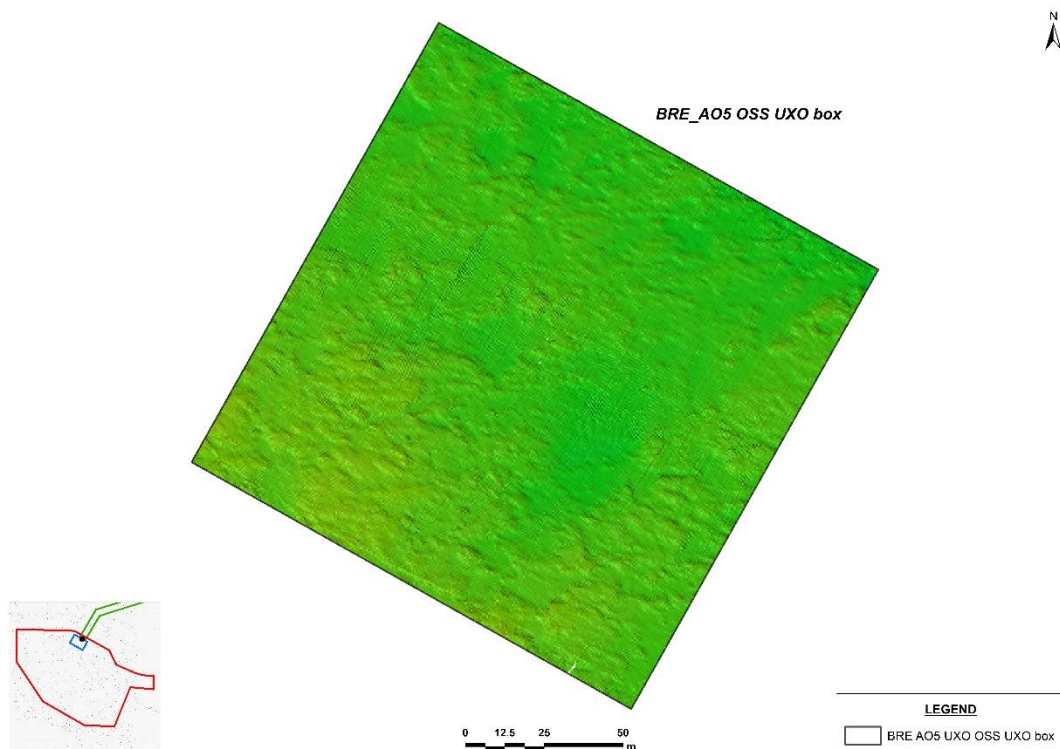



Figure 3-5: Bathymetric data for BRE_A05 OSS.

3.3. SIDE SCAN SONAR – UXO SURVEY

The objective of this phase of data acquisition is the detection of possible sonar targets lying on the seabed. Due to the coverage requirements of gradiometer data acquisition, this required total coverage of the seabed within the OSS box, and hence a survey line spacing of 6 metres was utilised.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 21 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

A side scan sonar system comprises a processing unit connected through a cable to a wet unit that transmits and receives acoustic energy. Side scan sonar can determine seabed morphology and configuration by means of acoustic signals. It can also determine its composition, identifying different seabed strata as hard (rocky or consolidated), soft or sedimentary, as well as identifying areas of seagrass.

Side scan sonar systems can work in different frequency ranges: systems working in high frequencies, (between 500 kHz and 900kHz) offer higher resolution but lower ranges, with systems working in low frequencies (100 kHz), offer lower resolution but higher ranges. For this survey, a frequency of 900kHz was utilised. The reflection of the signal coming from the seabed is detected by the same transducers, amplified, and transmitted to the control unit, and recorded and displayed on the computer screen, providing an acoustic map. With this data, it is possible to identify different seabed morphologies, together with the visualization of any seabed objects.


When the vessel is underway, the winch operator can start deploying cable until the fish gets to the desired working depth of about 6 m above the seabed.

The guidelines followed by Tecnoambiente during the surveying for SSS data acquisition are:

- IT-CM-01. SBL-SSS,1
- IT-CM-21. SSS Launch and Recovery, 0
- IT-CM-13. Geophysical Data Acquisition. General Procedure, 2
- IT-CM-14. Survey Basics Guidance, 0
- IT-CM-15. Online Surveying procedure, 3
- IT-CM-18. USBL Pole Deployment, 1

Once the SSS data were acquired and then exported into JSF format, the files are imported into the SonarWiz 7 software. Channels 3 and 4 were used for recording the high frequency data.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 22 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

After data importation into the SonarWiz 7 software, an initial navigation correction was made for each imported file, applying smoothing filters to avoid errors in the heading of the tow fish. The track position was smoothed using a mean value of 300 pings.

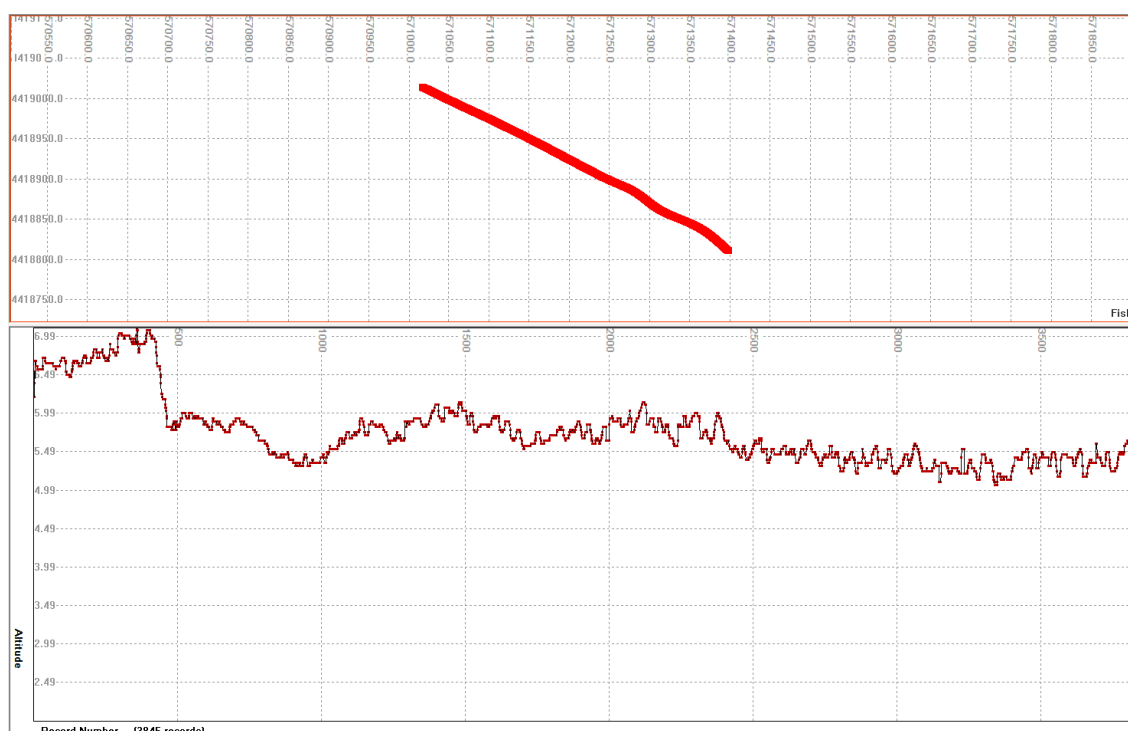



Figure 3-6: Navigation editor in SonarWiz 7.

After the aforementioned corrections were implemented, the water column for each file was eliminated, by applying the bottom-tracking acquired during the survey, as shown in Figure 3-7. If bottom-tracking of the tow fish failed during the survey, it was done automatically by applying filters or by drawing the seabed manually during post-processing. This enables slant range corrections for the digital data to be as accurate as possible.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 23 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

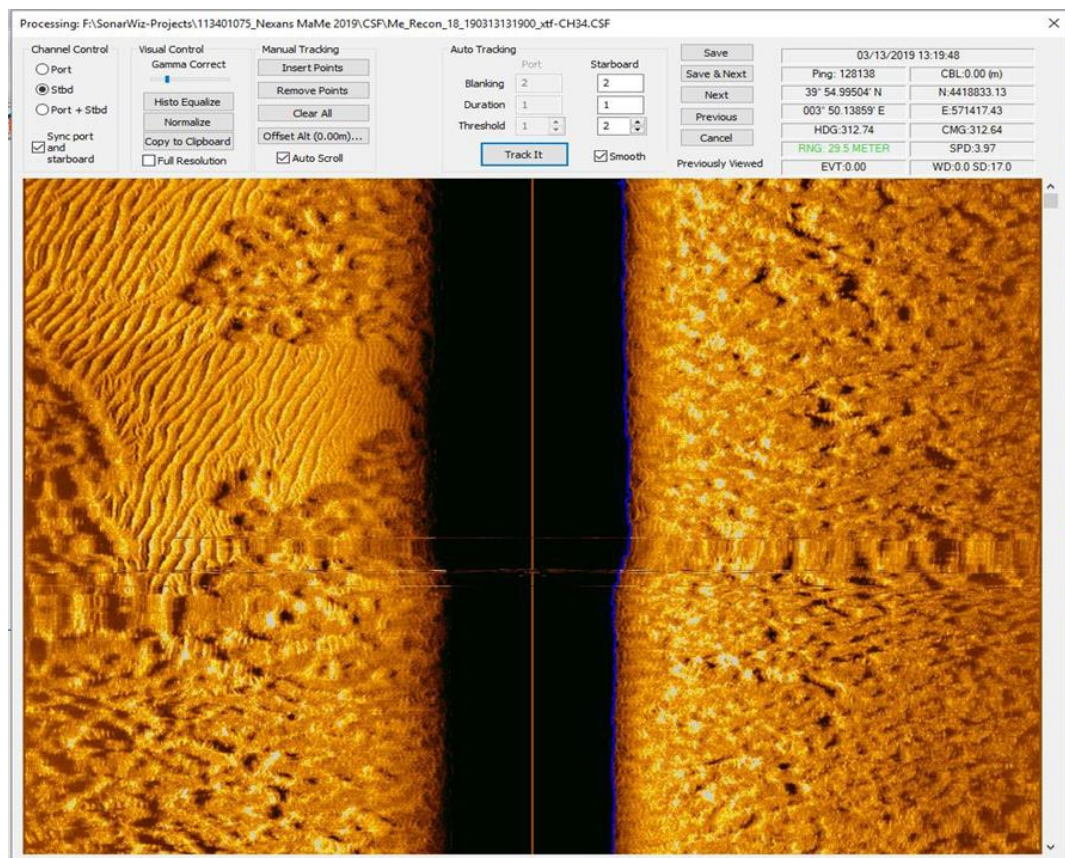



Figure 3-7: Bottom tracking processing drawn in blue in the SonarWiz software.

The following steps during SSS processing in the SonarWiz 7 software are the application and enabling of the EGN filter, and the enabling of the de-stripe filter.

At this point during data processing, a processed MBES geotiff is imported into the project. Using the MBES information, rotations to the SSS file are applied, in order to match feature orientations seen in the MBES data. Where necessary, a move offset can be applied to the SSS file, in order to match features within the MBES data.

Any observable contact within the area of interest is picked and its dimensions are measured.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 24 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

The final processing step is the export of the sonar files into a GIS software package, where all of the information is integrated, and a sonar mosaic is generated. This is carried out by converting the JSF files into 32bits RGB Geotiff images, to obtain georeferenced images of the processed data, with a resolution of 0.1 m (Figure 3-8).

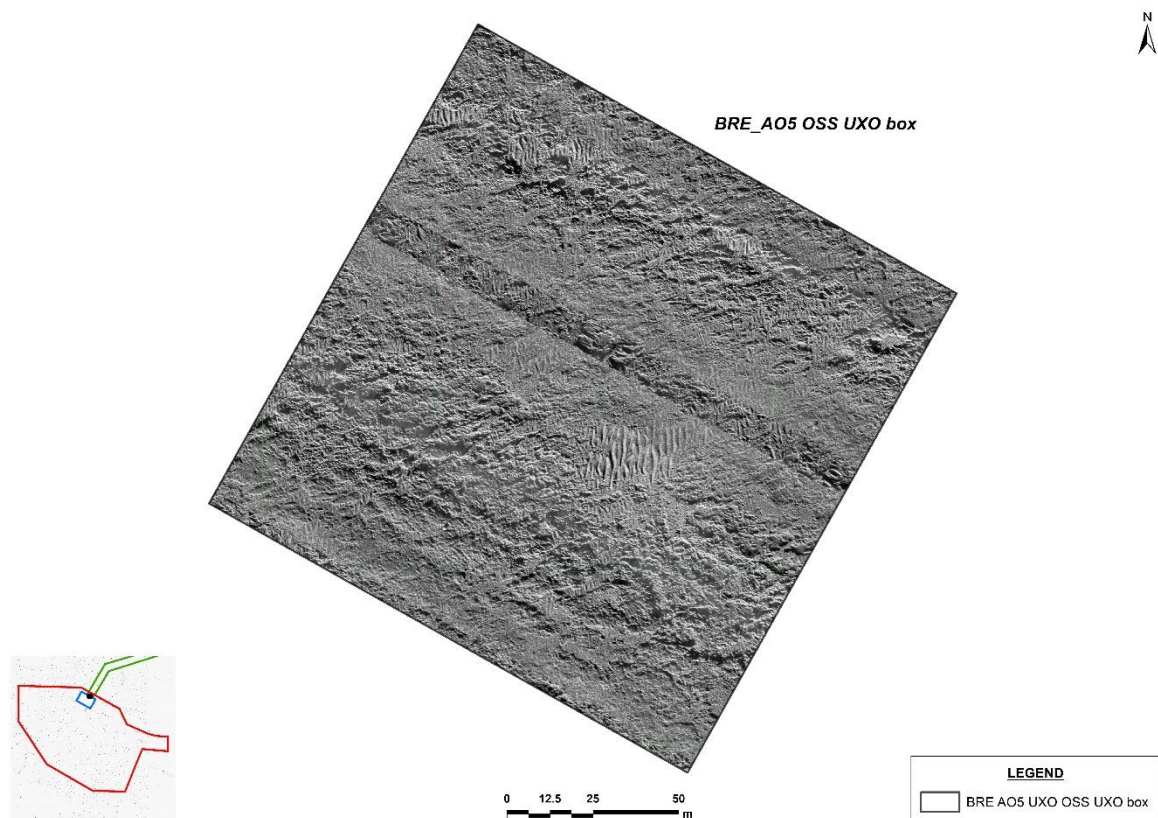



Figure 3-8: Side scan sonar data for BRE_A05 OSS.

The guidelines followed by Tecnoambiente during the surveying for SSS data processing are:

- IT-CM-01. SBL-SSS,1
- IT-CM-27. SSS Processing procedure, 0

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 25 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

3.4. GRADIOMETER – UXO SURVEY

Magnetometer data were recorded using four Geometrics G-882 magnetometers fitted in a custom frame and spaced 1.1 metres apart, horizontally. Survey line spacing was set at 6 metres. The frame has an automated bottom tracking function, allowing it to keep a fixed height above the seabed. After merging in Qinsy, all raw data were timestamped and output as .txt files were recorded for each magnetometer (Mag 1, Mag 2, Mag 3, and Mag 4).



Figure 3-9: ROTV with the fixed frame system for MAG acquisition.


The guidelines followed by Tecnoambiente during the surveying for MAG-UXO data acquisition are:

- IT-CM-25. UXO Mooring Procedures,0
- IT-CM-18. USBL Pole Deployment, 1
- IT-CM-26. UXO Scanfish Launch and Recovery, 0

Data was processed using UXO Marine Mag module from OASIS software.

Positioning and altitude data were corrected to eliminate outliers (despiked), then filtered, and smoothed. Incorrect positions were removed and the positions were filtered using a non-linear filter. All altitudes greater than 4 m were removed from the database.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 26 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	


	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

The magnetometer data were corrected to eliminate aberrant values (“despiking”). They were also interpolated, but were also slightly smoothed, so as not to lose the weaker components of the signal.

The magnetometer values were then processed, in order to compensate for variations in the altitude of the fish (increase in the signal when the magnetometer approaches the seabed). The magnetometer values were recalculated at a constant virtual altitude of 3 m above the seabed. The altitudes were smoothed, using a B-Spline filter. Processed positions and altitudes were then exported, to calculate dynamic coverage.

Finally, the long-wavelength component of the Earth's magnetic field was calculated using several successive non-linear filters. This long wavelength component includes diurnal variations, geological variations, and noise, as well as the International Geomagnetic Reference Field (IGRF). This was then eliminated from the data set, resulting in a residual component, comprising primarily anthropogenic magnetic anomalies.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 27 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

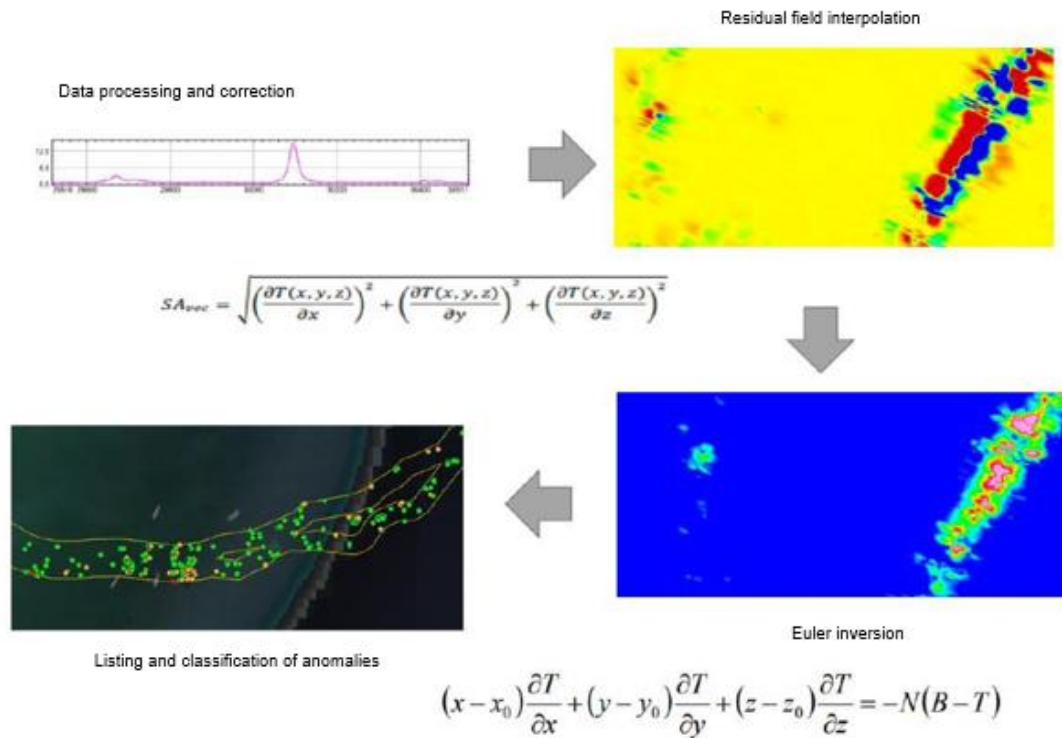



Figure 3-10: Processing workflow of magnetometer data.

A 2D map of the magnetic anomalies within the survey area was produced by interpolating these data, using a 0.25 m grid and 5 m blanking distance. The amplitude of the analytic signal was calculated using a 3D grid. The analytic signal is utilized for the mapping of structures and for the more precise positioning of any targets.

The results of the magnetometer measurements are included as two maps:

- A map of the residual magnetic field (in nT)
- A map of the analytical signal (in nT/m)

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 28 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_AO5	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - AO5 OSS area_1.1_A				

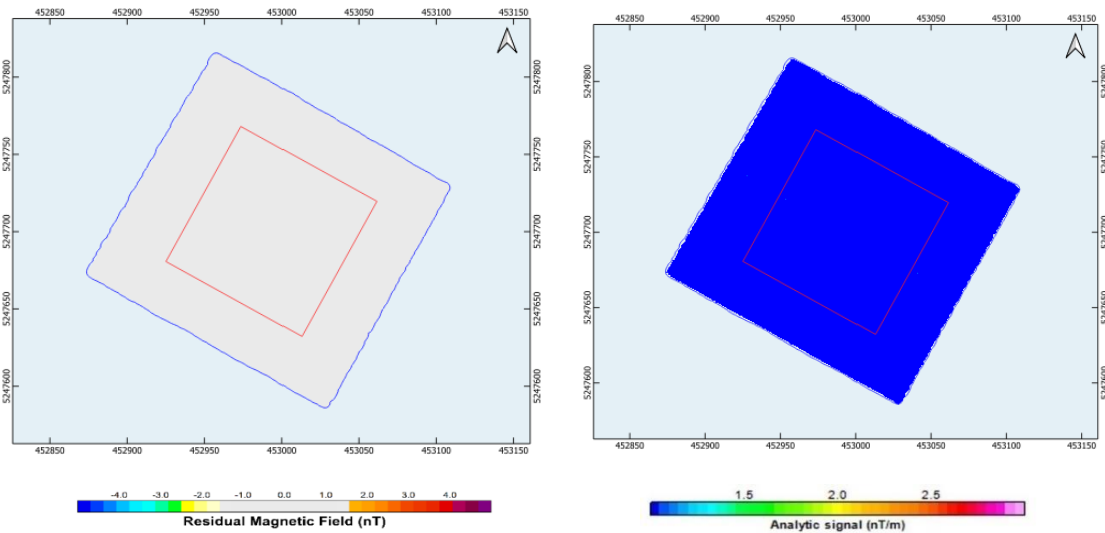


Figure 3-11: Residual field and analytic signal chart examples for BRE_AO5 OSS.


The magnetometer coverage depended on the spacing width of the surveyed lines and the height above seabed of the measuring device, making it possible to ensure the detection of an object at any point, by knowing the distance between the measuring sensor and the object. The requirements of the Scope of Work were met throughout the surveyed areas, i.e. detection of a 25 kg ferrous mass at a depth of 2 m and a maximum detection distance of 6 m (*Penella 1982*).

The dynamic coverage was calculated for a detection range (Δ) determined by the mass of the smallest object we were looking for and the depth below seabed of the soil intrusive activity.

The detection radius (d) under sensor was then calculated for each point with the formula:

$$d = \sqrt{\Delta^2 - (alt + DBSF)^2}$$

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	Page 29 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

Where:

Δ = Detection range

DBSF= Depth below seafloor

alt= Altitude of sensor

For the detection range of 6 m and depth of 2 m defined for this survey, the formula is defined as follows:

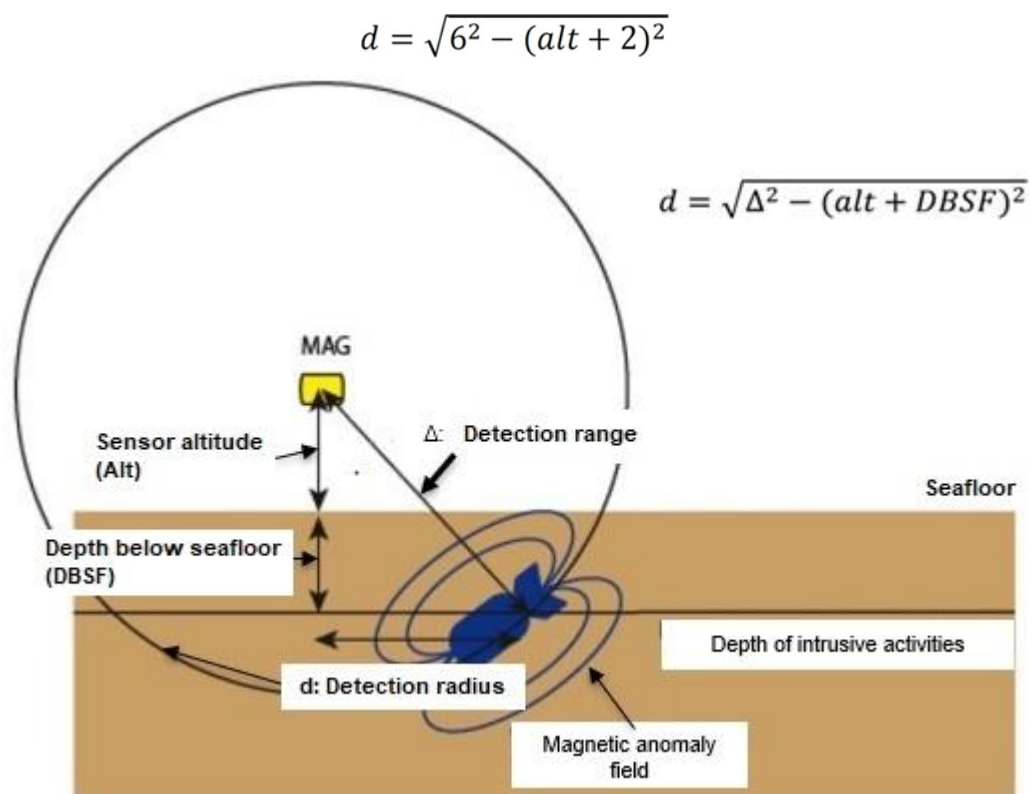



Figure 3-12:.Dynamic coverage calculations.

This means that for each point of data, a circle of detection with radius d is drawn around this point. The data were opened within a GIS software package (QGIS). Drawing these circles in the GIS software, using a buffer of detection ranges, enables us to map the detection coverage and identify any data gaps.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 30 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

4. RESULTS

4.1. COVERAGE AREA

The survey took place over the OSS GI box for a magnetometer coverage of 10000 m².

Table 7: Magnetometer coverage area (centroid of the GI box).

BOX	MAGNETOMETER SURVEY AREA WITH 100% DYNAMIC COVERAGE (m ²)
BRE_A05 OSS	10000
TOTAL	10000

4.2. ANOMALY PICKING

4.2.1. Magnetic anomalies

Visualization of the residual field map (in nT) makes it possible to locate any dipole anomalies present. The map analysis threshold (sensitivity of the display via the adjustment of the colour scale) is very important to validate the interpretation. By gradually decreasing the analysis threshold, it is possible to image anomalies of lower intensity. After analysis of the data, anomalies were manually picked, using the colour scale presented in Figure 4-1.

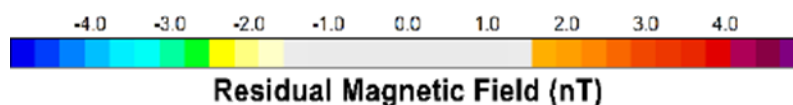






Figure 4-1: Colour scale and threshold used for analysis of magnetic anomalies.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 31 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

Anomalies are also detected automatically from the analytical signal grid, with a 1.0 nT/m threshold (grid value cut-off of 1nT/m).

No magnetic anomalies were detected within the survey area.

4.2.2. MBES and side scan sonar anomalies

No MBES or side scan sonar anomalies were detected within the survey area.

4.3. DISCRIMINATION OF pUXO TARGETS


Magnetic anomalies indicate the presence of ferrous elements at or below the seabed. This is true for most types of unexploded ordnance (UXO).

Any magnetic anomaly can therefore correspond to a potential UXO

Therefore:

- Any side scan sonar or MBES contact with a magnetic signature is considered as pUXO.
- The shapes and lengths of side scan sonar and MBES contacts were analysed carefully for discrimination as non-UXO.
- Side scan sonar and MBES contacts without magnetic signatures and without any corresponding shape and length criteria are considered as non-UXO. But as these contacts correspond to potential obstructions on the seabed, they were mapped without any avoidance area indicated on the ALARP certificate maps.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 32 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

5. AVOIDANCE DISTANCES

Following the analysis, we are looking for as low as reasonably practicable (ALARP), areas that can be considered clear of any pUXO. The avoidance criteria have been defined following the UXO threat and risk assessment, with geotechnical investigation risk mitigation strategy recognised and the desktop studies (**Ref. 01**):

Thus, the avoidance distance can be calculated as follows (Figure 5-1):

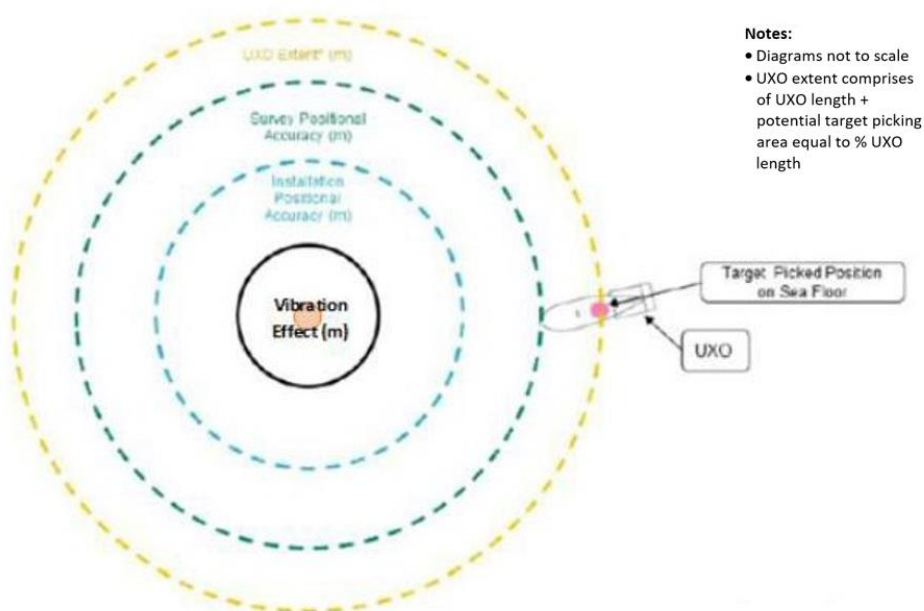



Figure 5-1: Avoidance distances.

$$\text{Avoidance distance} = \text{Geotechnical tool width} + \text{Vibration effect distance} + \text{Geotechnical tool positioning accuracy} + \text{UXO survey accuracy} + \text{Ammunition length}$$

The effect of the generation of seismic waves during vibro-driving or pile driving has to be taken into account in the case of geotechnical drilling or pile driving. These machines generate a wide variety of seismic waves (pressure, Rayleigh, shear) (Study report DRS17-

Confidentiality	Diffusion restreinte (restricted)	Pages	Page 33 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

164706-11171B, INERIS) that can trigger UXO detonation. This effect need not be considered for other geotechnical work, such as jack up or anchor installation.

For the OSS area, the 15 m buffer was applied as avoidance distance, in accordance with the document delivered by 6 Alpha Associates Limited (Ref. 01).


A safety buffer of 15 m is to be employed from any isolated magnetic anomaly.

This was achieved through geospatial processing by QGIS software.

Firstly, the areas that could not be considered as clear of any pUXO are mapped, grouping the pUXO targets (magnetic anomalies and/or sonar and MBES contacts) and potential saturated areas. Afterwards, the “avoidance areas” were mapped with an avoidance zone of 15 metres (a 15 m safety buffer around the anomaly) away from all the potential UXO (pUXO) anomalies, or any saturated or excluded areas. This avoidance area was also applied from the edge of the dataset inwards, towards the centre of the survey area.

The free space between these avoidance areas and the detection surface and the survey limits was then mapped, and a workable area was obtained. This defined the outline of the ALARP certificate (Figure 5-2).

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 34 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

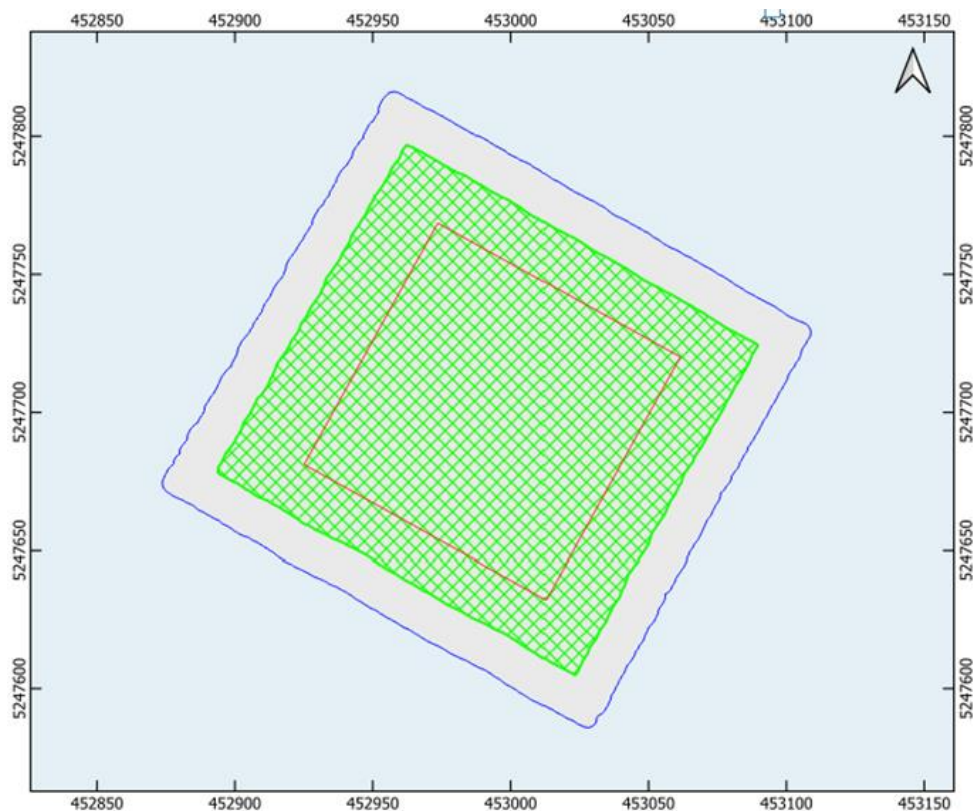






Figure 5-2: ALARP validated area in the OSS area.

Geotechnical location		▲	AO5 pUXO magnetic anomalies
□	AO5 GI Original location	■	AO5 avoidance distance
■	AO5 GI Alternative Location	▤	ALARP validated area
□	Geotechnical Boxes	Obstructions	
ALARP		⊕	Obstructions SSS
□	Dynamic coverage	⊗	Obstructions MBES

Figure 5-3: Legend of the ALARP maps.

Confidentiality	Diffusion restreinte (restricted)	Pages	Page 35 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_AO5	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - AO5 OSS area_1.1_A				


6. CONCLUSION

An ALARP area of 10,000 m² was identified for the AO5 OSS area (Table 8).

Table 8: Final ALARP workable areas and GI box location.

ID	Name GI	Easting UTM30N	Northing UTM30N	Workable area (m ²)
1	BRE_AO5 OSS	452993.33	5247700.33	10000
Total				10000

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 36 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

	Project	Package	Issuer	Chrono	Revision	Status
	BRE_AO5	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - AO5 OSS area_1.1_A				

REFERENCES

In accordance with:

- Letter the “*Inspection des poudres et explosifs*” of the French Ministry of Defence and the “*Direction générale du Travail*” of the French Ministry of Labour of September 18th, 2013, relating to pyrotechnic clearance carried out on civil land.
- Decree No. 2014-381 of March 28, 2014, regulatory part Art. R.733-1 to 16 and legislative part Art. L. 733-1 to 3.

In reference to:

- Decree No. 2005-1325 of October 26, 2005, amended from the Ministry of Defence relating to the safety rules applicable during work in the context of a pyrotechnic clearance site and the two implementing decrees.

Ref.01. Unexploded Ordnance Threat and Risk Assessment with Risk Mitigation Strategy: *8811_UXOTARA_with_RMS_AO5 Brittany_DNVGL_Client Draft_V1.0*

Ref.02. Project AO5 De-risk Surveys Scope Of Work: *SOS-01 - Scope Of Service AO5*

Ref.03. Employer’s Requirements Marine Operations: *SVY-ERS-03 – Survey Specification*

Ref.04. Specification for UXO Survey Verification Test RTE Export Cables: *ERS-03-A – SVT Specification*





Ref.05. UXO Surrogate Items report: *SIT report – AO4 and AO5 geophysical and UXO survey*

Ref.06. BRE_AO5 Area - Geophysical and UXO survey - Mobilization Report: *BRE_TEC_21_Mob report - AO5 survey 2022_1.2*

Pennella 1982 Magnetometer techniques in the detection of projectiles Final Report, TR239, Naval explosive ordnance technology center





Rapport d’étude DRS 17-164706-11171-B, Impact des vibrations sur la stabilité des carrières souterraines, INERIS, 2017.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 37 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

 Le réseau de transport d'électricité  MINISTÈRE DE LA TRANSITION ÉNERGÉTIQUE  TECNOAMBIENTE  GEOQUIP HABITE	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

APPENDIX I – LIST OF THE MAGNETIC ANOMALIES DETECTED





Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 38 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

None. Intentionally left blank.





For more information see section 4.2.1 of this report.

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 39 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				





APPENDIX II – LIST OF THE SIDE SCAN CONTACTS DETECTED

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 40 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				





None. Intentionally left blank

Confidentiality	Diffusion restreinte (restricted)	Pages	Page 41 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				





APPENDIX III – LIST OF THE MBES CONTACTS DETECTED

Confidentiality	<i>Diffusion restreinte (restricted)</i>	Pages	<i>Page 42 of 45</i>
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

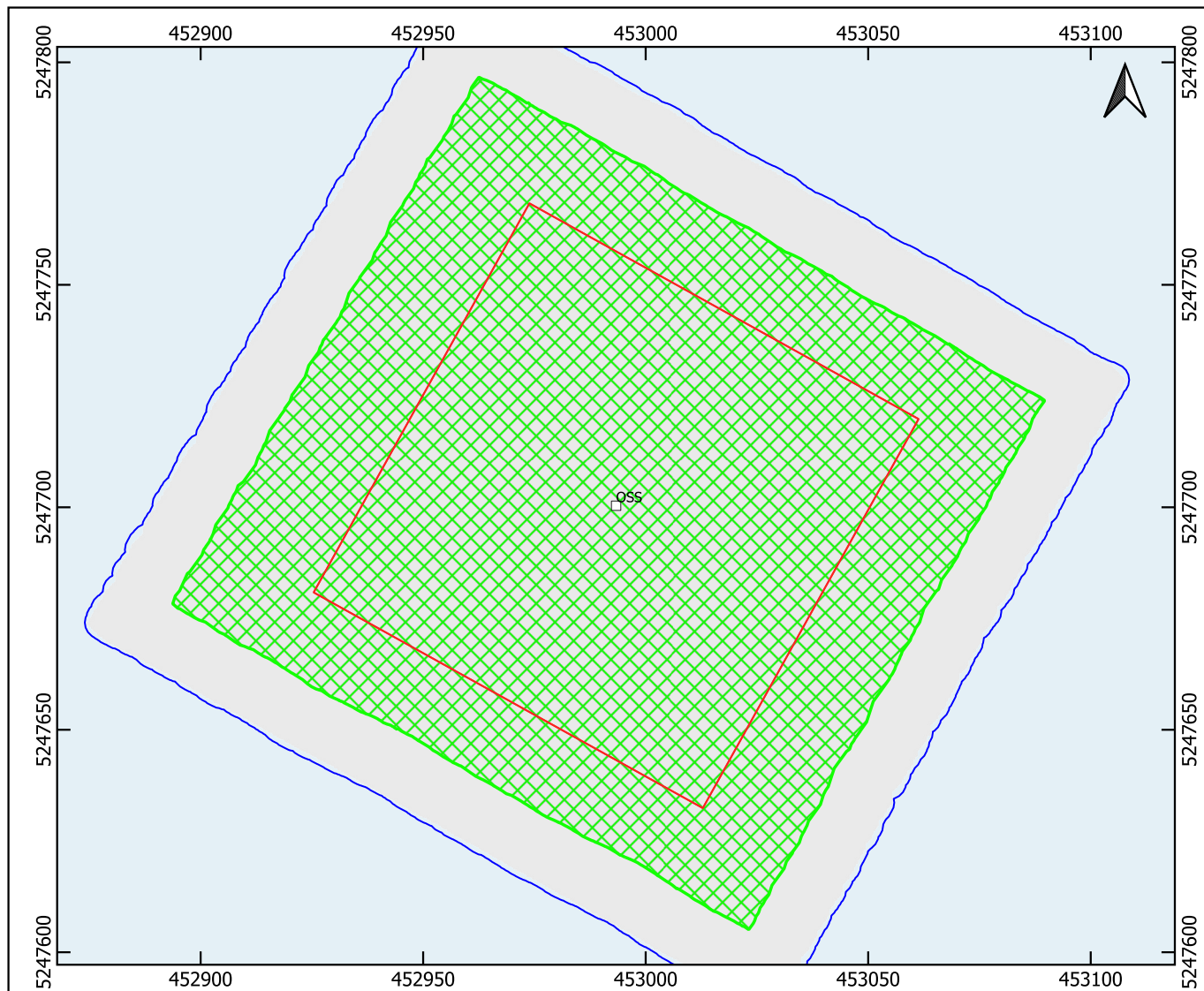
None. Intentionally left blank

Confidentiality	Diffusion restreinte (restricted)	Pages	Page 43 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	

   	Project	Package	Issuer	Chrono	Revision	Status
	BRE_A05	GPH-UXO	TEC	18	1.1_A	A
	Title	BRE_PeM_TEC_48_Results report - Geophysical-UXO survey - A05 OSS area_1.1_A				

APPENDIX IV – ALARP CERTIFICATE MAP

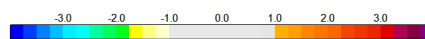
Confidentiality	Diffusion restreinte (restricted)	Pages	Page 44 of 45
Issue date	29/11/2022	Document uncontrolled when printed/downloaded	



- Concession**
- AO5 OWF
- Geotechnical location**
- AO5 GI Original location
 - AO5 GI Alternative Location
- ALARP**
- Dynamic coverage
- Obstructions**
- Obstructions SSS
 - Obstructions MBES
- AO5 pUXO magnetic anomalies**
- AO5 avoidance distance
 - ALARP validated area
- Geotechnical Boxes**

ALARP area: 10007 square meter

Easting:452993.33, Northing: 5247700.33



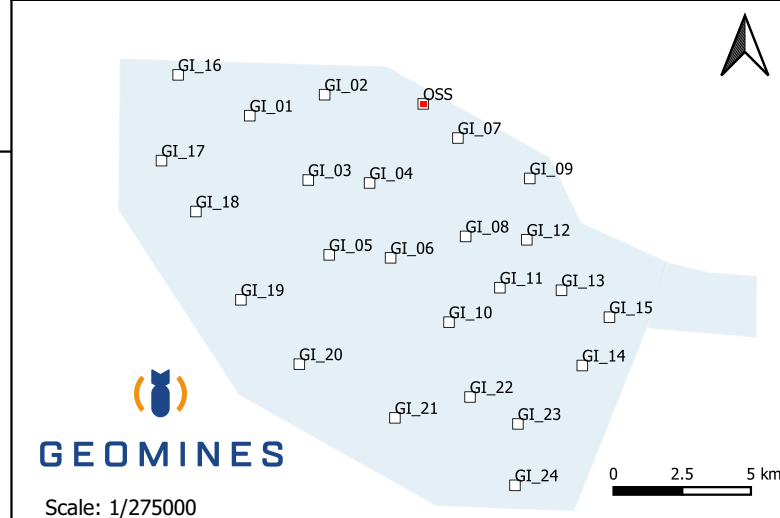
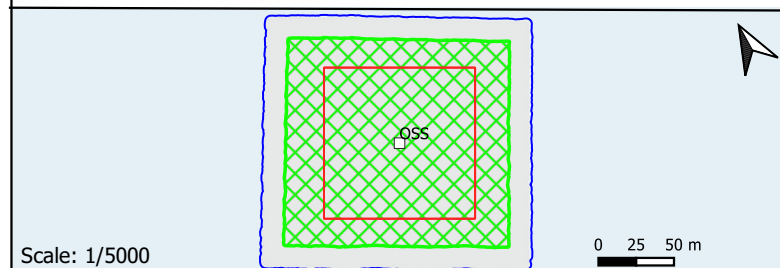
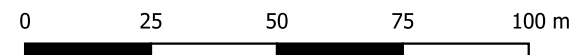
Residual total magnetic field
(nT)



ANNEXE A: AO5 - GI_OSS ALARP CERTIFICATE GIS

Scale: 1/1500
Geodesy : WGS 84 - UTM 30N

Date: 2022-05-24
Version: V1



Scale: 1/275000