



freyr

SURVEY RESULTS REPORT

UXO Survey

Sand Nourishment Borrow Area S4E

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Survey Results Report

UXO Survey

Sand Nourishment Borrow Area S4E



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1. Introduction

This report and the appended Clearance Certificate only covers the planned dredging activities in the Dutch waters for Sand Nourishment Borrow Area S4E (hereinafter: S4E).

To mitigate the risks imposed to the dredging activities by UXO(s), Van Oord BV (hereafter: Van Oord) contracted Deep BV (hereafter: Deep) to execute a UXO geophysical survey. Van Oord has contracted NjordIC B.V. (hereafter: NjordIC) to act as UXO consultant for the geophysical survey.

The UXO mitigation measures need to be compliant with the Netherlands Explosives Law (CS-000).¹ Consequently, all activities need to be supervised by a CS-000 certified company. It is therefore that Freyr Trade & Services B.V. (hereafter: Freyr) – as a partner company of NjordIC – is involved in this project. Freyr was responsible for the supervision, and where necessary execution of the UXO geophysical survey data QC according to CS-000 requirements.

This report contains the UXO survey results for S4E.

1.1. Objectives to UXO Survey

The objective of the UXO geophysical survey was to:

- Identify all ferrous objects within the survey area that meet the minimum applicable UXO threshold criteria of 50kg ferrous mass to a maximum detection depth below current seabed level.
- Produce a UXO ALARP Clearance Certificate for the survey area with dynamic avoidance polygons around those ferrous objects which are of or above threshold level.

1.2. References

This Survey Results Report is based on the following information:

UXO Historical Desktop Study (DTS):

- Indicatie en Analyseonderzoek Ontploffbare Oorlogsresten Kustlijnverzorging voor het zandwinvak S7-9 (walcheren), reference 21S073-VO-01 (S7-9), version 1, dated July 28 2021.

Project Risk Analysis:

- Projectgebonden Risico Analyse Zandwinvakken S4E en S7AC, NjordIC, reference 2022.02.292/UPO-492, dated October, 28 2022.

Project documentation of Deep:

- Project Execution Plan, Deep, reference P4108_S4E_UXO_PEP_R01, draft, dated February 13, 2023.
- HSE Manual, Deep, reference DEEP_HSE_MAN_R14.
- Surrogate Item Trial Report, reference P4108_S4E_UXO_SIT_R00, final, dated February 22, 2023.

1.3. Area of Investigation

The UXO Survey area is located on the North Sea off the Dutch coast Northwest of Walcheren. The location of the UXO Survey area is shown in Figure 1.

¹ CS-000: Netherlands Certification Scheme – Detection and Clearance of Explosive Remnants of War.

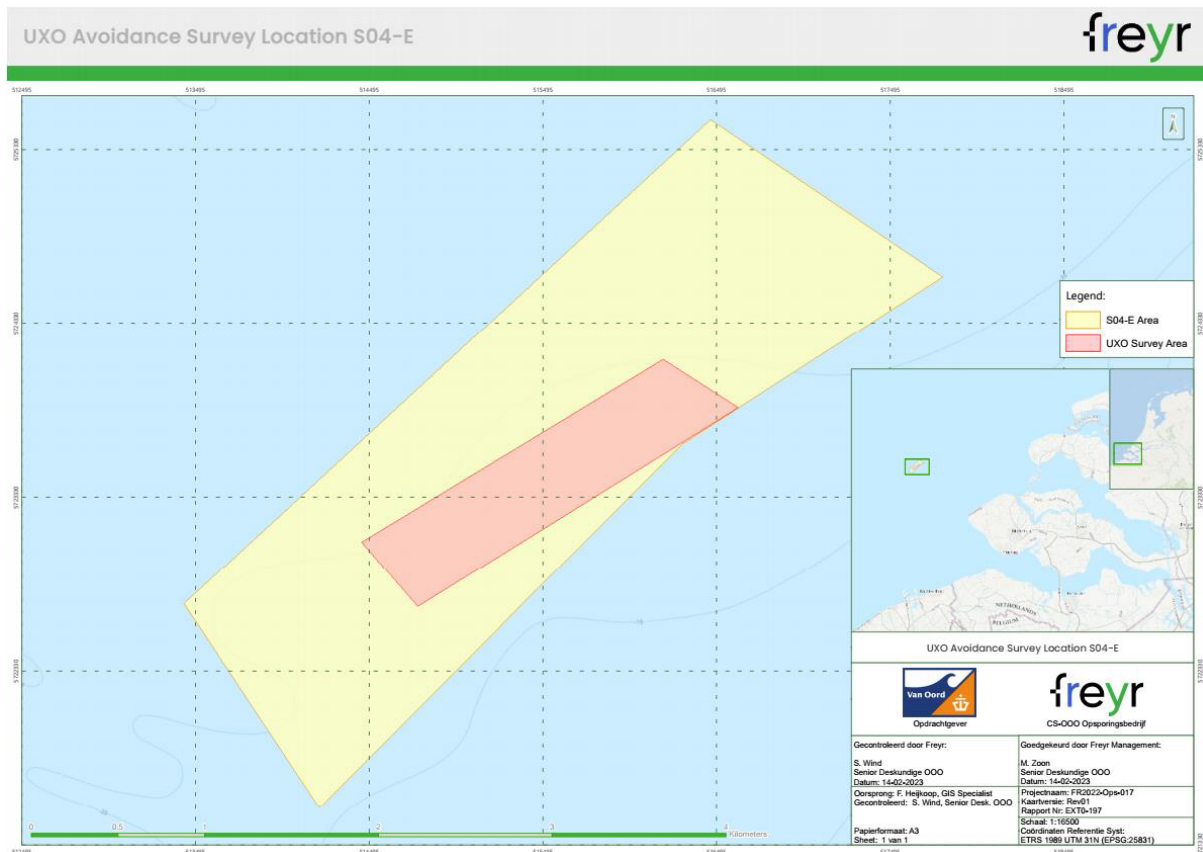


Figure 1 General location of the UXO Survey Area (source: Van Oord)

1.4. UXO Threshold and Detection Depth

In the case of a UXO explosion due to dredging activities, the effects pose an unacceptable risk to the safety of the staff involved. Mitigation measures are required to reduce the risk to a level that is considered As low As Reasonably Practicable (ALARP).

To prevent an uncontrolled explosion, the S4E location was surveyed with the aim to identify all objects that meet the applicable ferrous threshold criterium (potential UXO, or pUXO) that shall be avoided.

In the UXO Risk Assessment the minimum threshold was assessed to be:

- Water depth: >10m LAT
- Threshold: 50 kg ferrous mass
- Smallest threat item: Allied 250lbs air dropped bomb

The threshold is applied for the design of the UXO geophysical survey and the evaluation of the survey data. The detection depth was set at the maximum detection range of the survey equipment based on the Surrogate Item Trials (see paragraph 1.6).

1.5. Horizontal and Vertical Reference

The horizontal and vertical reference for the survey is detailed below:

- Datum: ETRS89 (UTM Coordinates)
- Ellipsoid: International 1924
- Projection: Universal Transverse Mercator zone 31N (UTM 31N)
- Vertical reference: LAT

All geographical and projection coordinates used during the operational work, reporting and charting are based on local datum ETRS89. Projection coordinates are expressed in Universal Transverse Mercator (UTM) grid, Zone 31, Northern Hemisphere (EPSG code: 25831).

The primary satellite navigation and positioning system will be operating with RTK corrections (i.e. 06-GPS). A secondary GNSS receiver is available with separate RTK corrections for redundancy and comparison to the primary computation.

The vertical datum for all depth and/or height measurements is Lowest Astronomical Tide (LAT).

1.6. Surrogate Items Trial

The CS-000 requires proof/demonstration of the functionality of the equipment/sensors, detectability of ferrous mass, accuracy of positioning and the quality of the survey data. For this a Surrogate Items Trial (SIT) was conducted prior to the project by Deep. Based on this trial, several key survey parameters were calculated, such as the maximum detection range, the optimal survey line spacing, and maximum gap allowance.

The SIT was performed onboard the Breaker on February 22nd, 2023. The results of the SIT (for data and report see: SIT report Volans, version 0.0, reference P4108_S4E_UXO_SIT_R00, date April 20, 2022) were used by Freyr for data QC of the operational UXO survey data.

The results of the SIT showed the observed signal values of all magnetometer measurements in the vicinity of the SIT object in relation of their distance to it.

From the SIT Trial the maximum detection range was estimated to be 6.25m for 50kg ferrous mass

2. Results

In this chapter the results of the UXO survey are described. The UXO survey was executed by Deep under UXO supervision of Freyr to assure compliancy to the CS-OOO. The UXO survey operations have been executed by the vessel 'Deep Volans' operated by Deep.

2.1. Execution of UXO Survey

The survey of the S4E location commenced using the survey parameters derived from the SIT. The survey, which was executed in a 12/7 regime, started on February 22, 2023 and was completed on April 5, 2023.

The detection results were evaluated by NjordIC's geophysicists using the Oasis Montaj processing software. The evaluated results were then presented to a NjordIC UXO consultant and a Freyr Senior Expert OOO. They subsequently checked the survey data (QA / QC). Upon acceptance of the data, the Senior Expert produced the UXO ALARP certificates for the project location S4E.

2.2. UXO ALARP Clearance Certification

The UXO survey results were used to produce UXO ALARP Clearance Certificates for the project location (see Appendix A). The issued UXO ALARP Clearance Certificate will be used by Van Oord for further planning and execution of dredging activities.

The UXO ALARP Clearance Certificates as per Appendix A of this report are valid for the duration of 1 year.

Human activities or intervention can cause change in the horizontal positions of UXO. Trawling for example may cause UXO exposed on the seabed to be picked up and dropped elsewhere. This risk cannot be quantified and is part of the baseline residual risk. Therefore, the risk of UXO unintentionally being moved by human intervention is excluded in the UXO ALARP Certificates.

2.3. Results

The results of the UXO avoidance survey for the project location consists of 4 UXO ALARP Clearance Certificates: UXO ALARP Clearance Certificates clarifying the safe dredging areas for dredging depths up to 1m, 2m, 3m and 4m respectively.

Areas within the survey area which present with at or above threshold anomalies values have dynamic avoidance polygons applied within the box. These are coloured blue and red within the UXO ALARP Clearance Chart of Freyr and have been supplied in GIS Shapefile format also. These dynamic avoidance polygons are to be avoided during dredging activities. The dynamic avoidance polygons are based on the following parameters:

- The masking zone of the pUXO MAG anomaly is based on a threshold of 5nT.
- A 5m buffer is included to counter positioning errors during UXO Survey and dredging works.
- Exclusion zones are determined based on a 1:4 slope with a maximum dredging depth of 4m.

A UXO ALARP area has been identified as sufficient for the required sand collecting scope and this area is deemed free from threshold anomalies to the detection maximum depth as stated in the Deep Surrogate Item Trial Report S4E: P4108_S4E_UXO_SIT_R00 dated February 22, 2023 and deemed UXO ALARP Clearance safe for dredging works.

The required dynamic clearance is given for the planned dredging works below the level of current seabed as detailed in the MBES bathymetrical data. This vertical clearance is required for conducting safe operations. MAG Survey achieved detection to the maximum assessed detection as detailed in

the SIT report for the relevant threshold target. Vertical ALARP UXO Clearance is given for dredging operations within the defined box on the UXO ALARP certificate.

The UXO ALARP Certificates are appended as Appendix A.

Appendix A: UXO ALARP Certificate

Copies of the UXO ALARP Certificates are attached loose leaf, see file:

- EXT0_220_N04_E_UXO_ALARP_Clearance_Certificate_1m_v1.0
- EXT0_220_N04_E_UXO_ALARP_Clearance_Certificate_2m_v1.0
- EXT0_220_N04_E_UXO_ALARP_Clearance_Certificate_3m_v1.0
- EXT0_220_N04_E_UXO_ALARP_Clearance_Certificate_4m_v1.0

Appendix B: FMTL

Copies of the FMTL are attached loose leaf, see file:

FR2023_Ops_017 - EXT0-220 CS-OOO Survey Results Report Sand Nourishment Borrow Area S4E
Appendix B FMTL.

Appendix C: GIS-Deliverables

GIS files are attached separately, see file:

EXT0_220_S4E_UXO_ALARP_Certificate_GIS_Package_v1.0.

Appendix D: Signed Cover

Copies of the signed cover are attached loose leaf, see file:

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Appendix D Signed Frontpage