



Archaeological investigations of the Hollandse Kust (noord) Wind Farm Zone

ROBERT VAN LIL



Periplus *Archeomare*

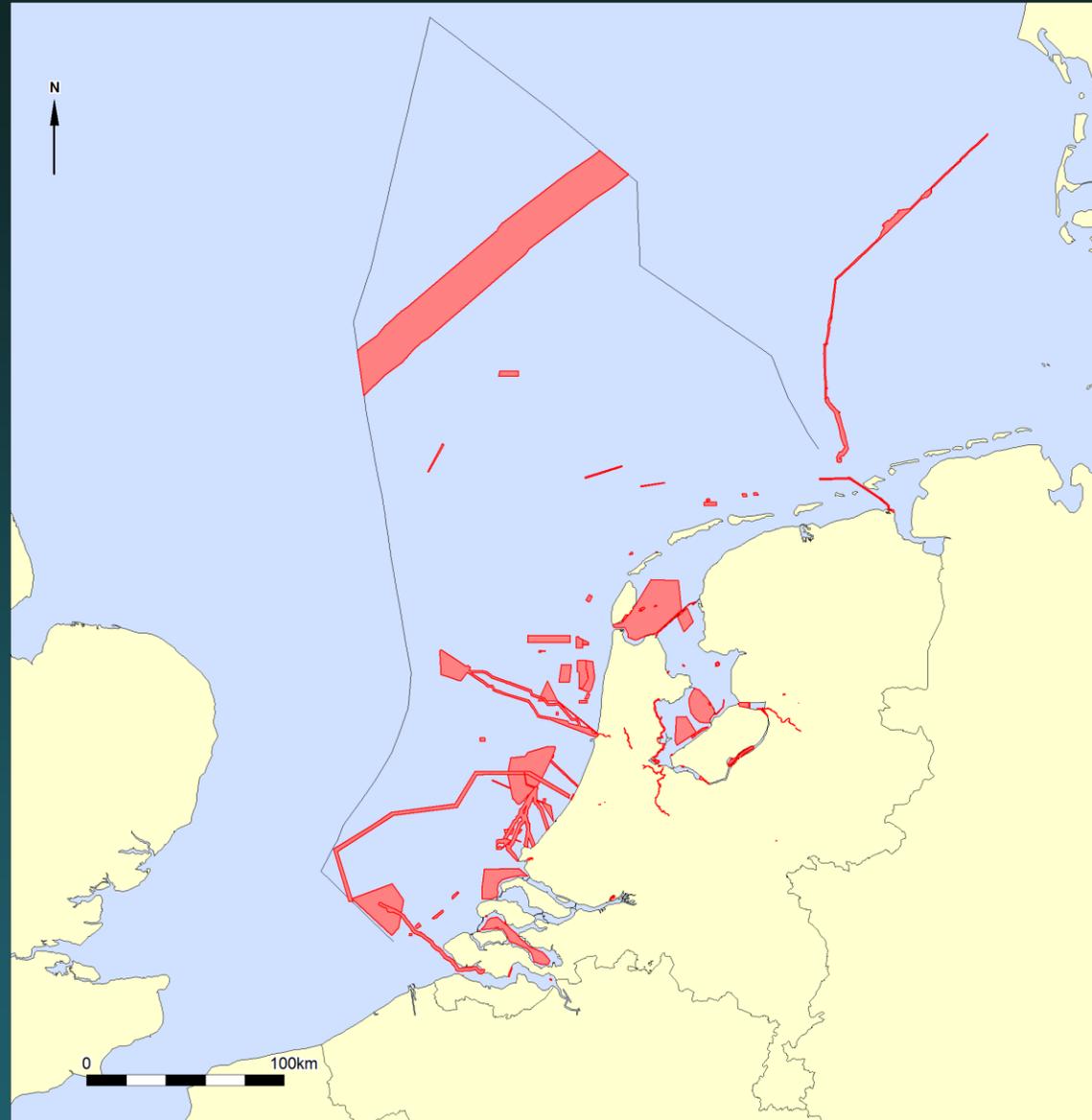
Company profile



Office in Amsterdam

Founded in 2005

> 200 projects



Introduction

- Archaeology and legislation
- Desk study
- Assessment geophysical survey
- Summary and conclusions

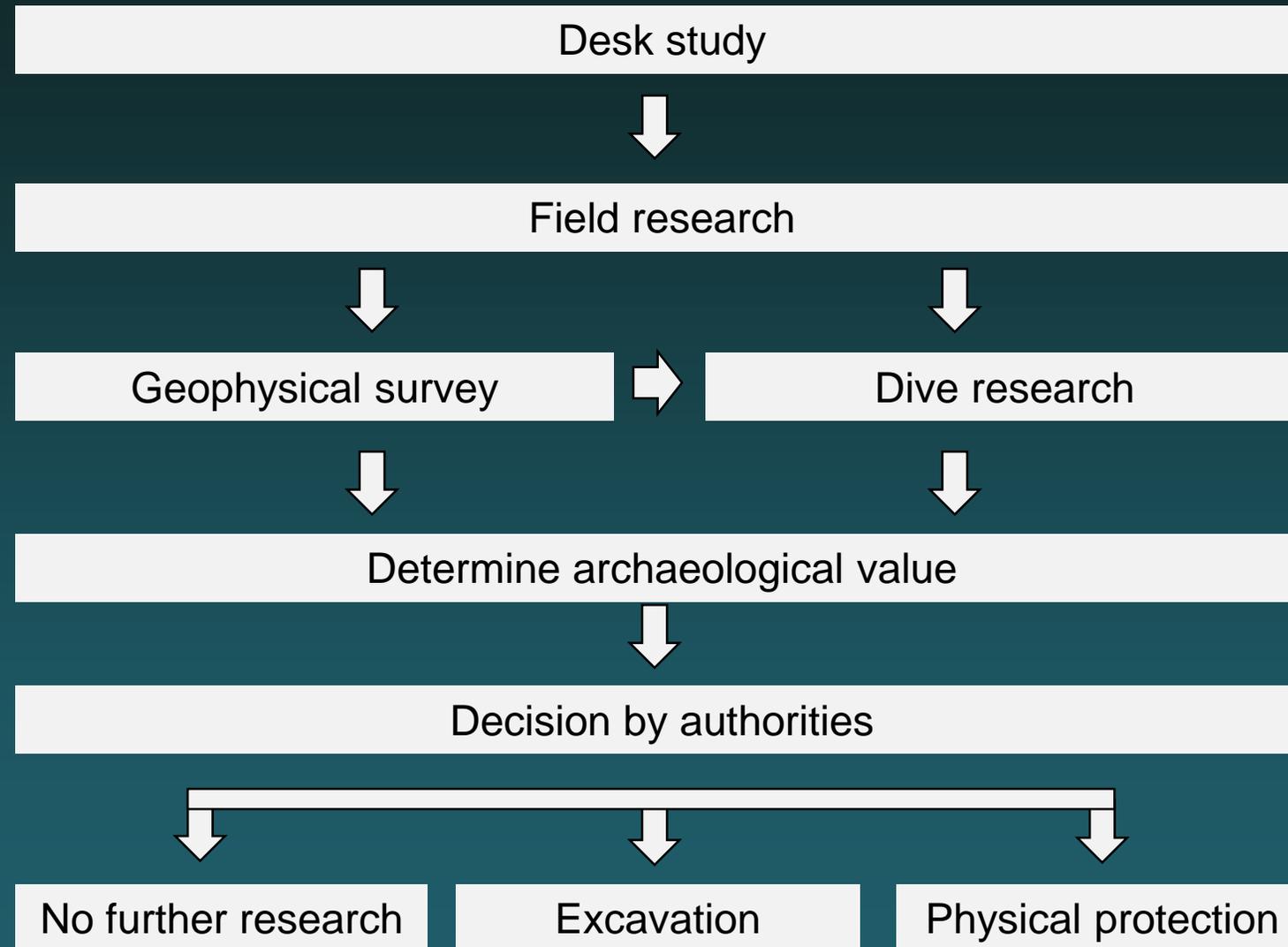
Archaeology and legislation

Dutch legislation - Heritage Act (Erfgoedwet) 2016:

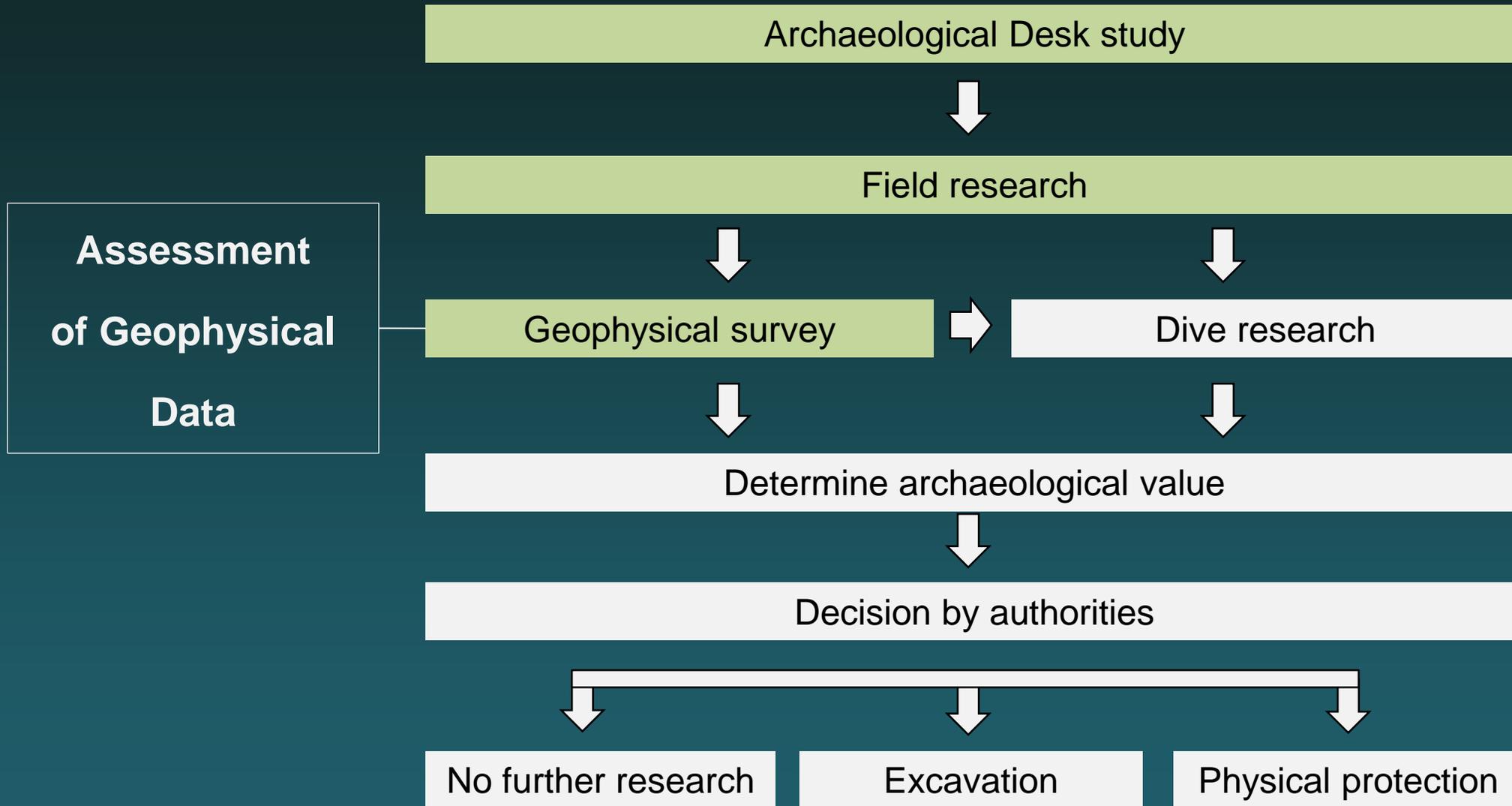
‘... strive to preserve archaeological remains *in situ* ...’

- If (possible) remains could be affected by activities:
avoid locations or obligation to conduct additional
research

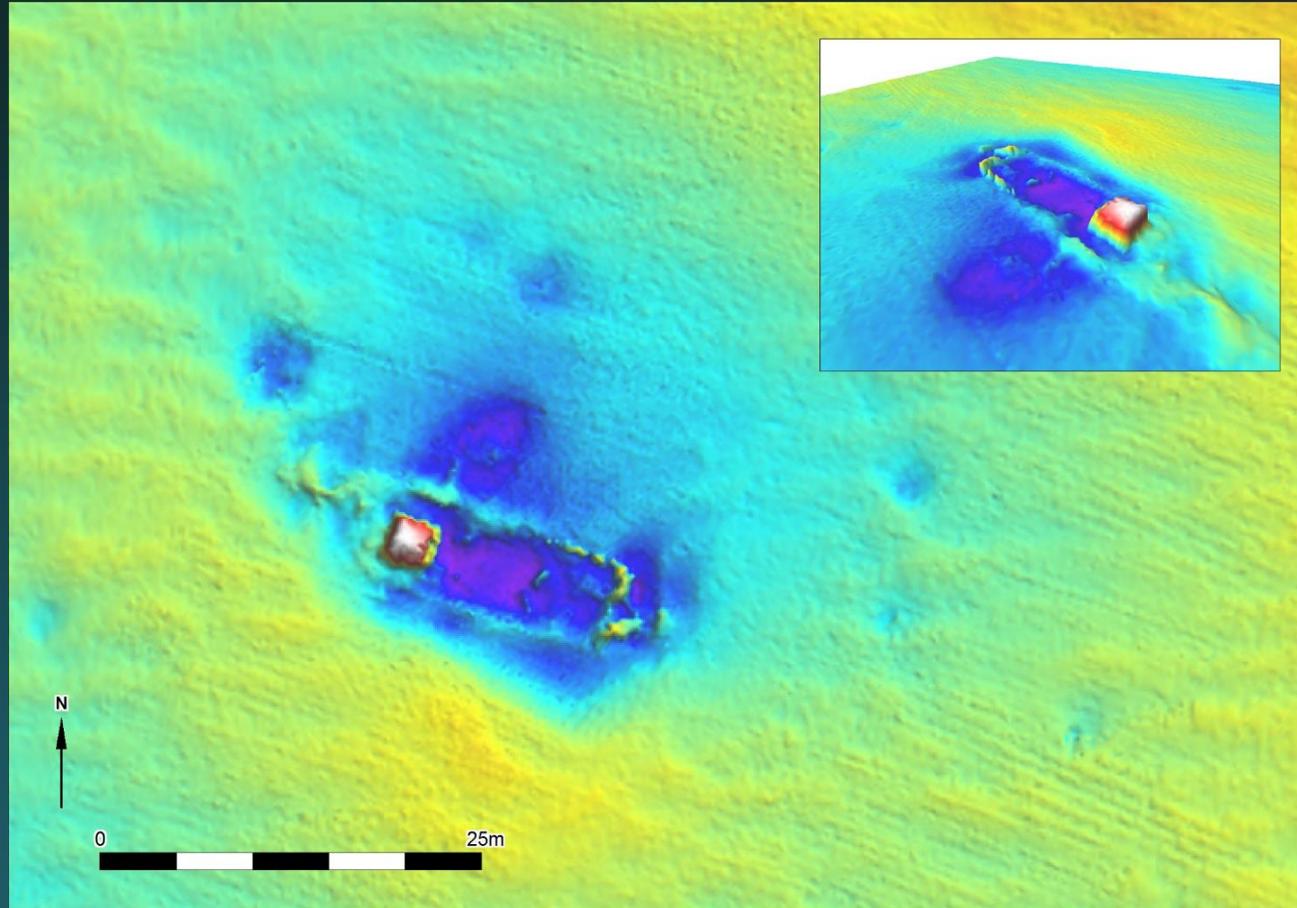
Archaeology and legislation



Archaeology and legislation



General example



Unidentified ship wreck → Assumption: archeological value

General example

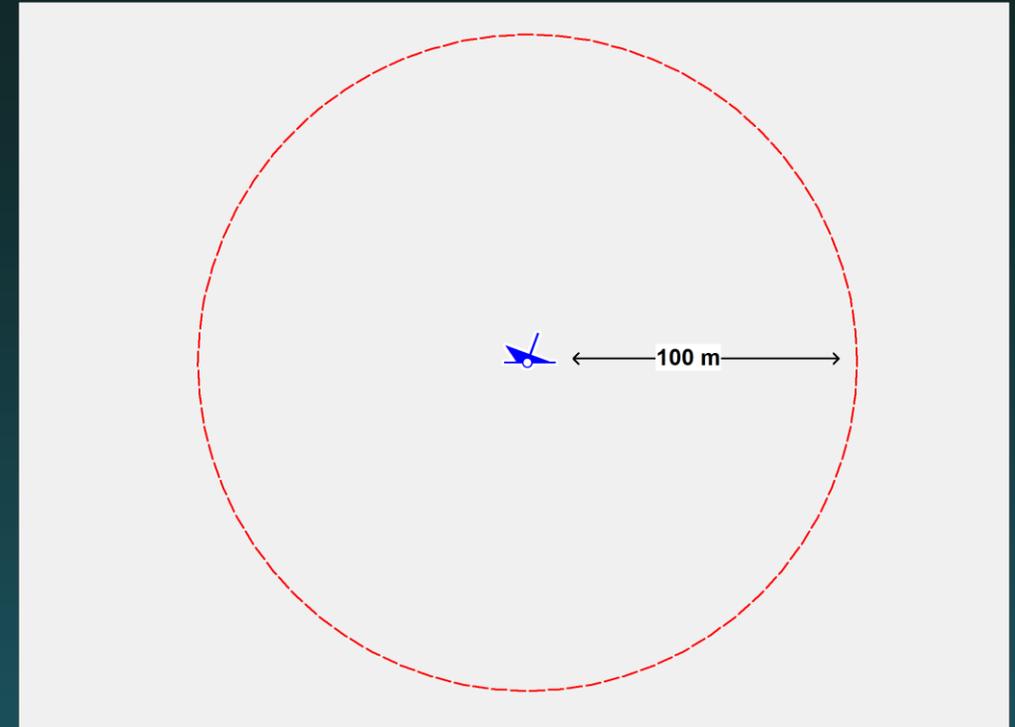
Recommendation:

Avoid location (including a bufferzone of 100m)

or

Prove that site has no archaeological value

(additional research)



Legal base:

Policy Rules for Earth Removal in National Waters

(Beleidsregels ontgroningen in rijkswateren)

Heritage Act (Erfgoedwet)

Archaeological Desk Study 2017

Gather information on:

- current use of the area
- historical situation and possible disturbances
- known archaeological features and objects
- geological setting

Result:

- specific archaeological expectation

Archaeological Desk study 2017

HKNWFZ 304 km²
Research Area 391 km²



Bathymetry

Water depth

Min 15.0 m LAT
Max 34.5 m LAT
Avg. 22.6 m LAT

Morphology

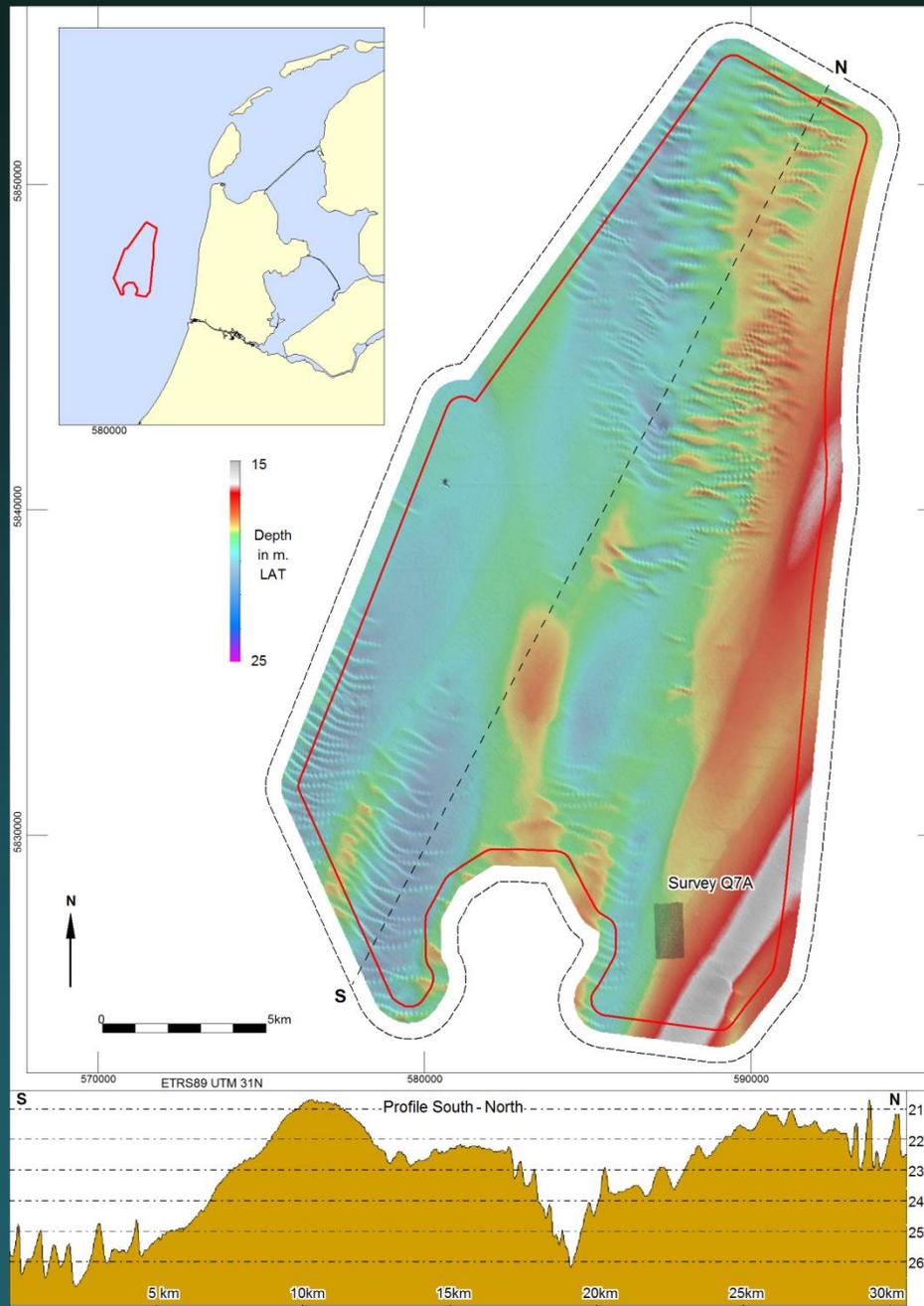
Ridges SSW – NNE

Height: 4m

Sand dunes WNW – ESE

Wavelength 500m; height 3m

Migration 2-4m NE direction



Previous Research



All conducted by
Periplus Archeomare

Known disturbances

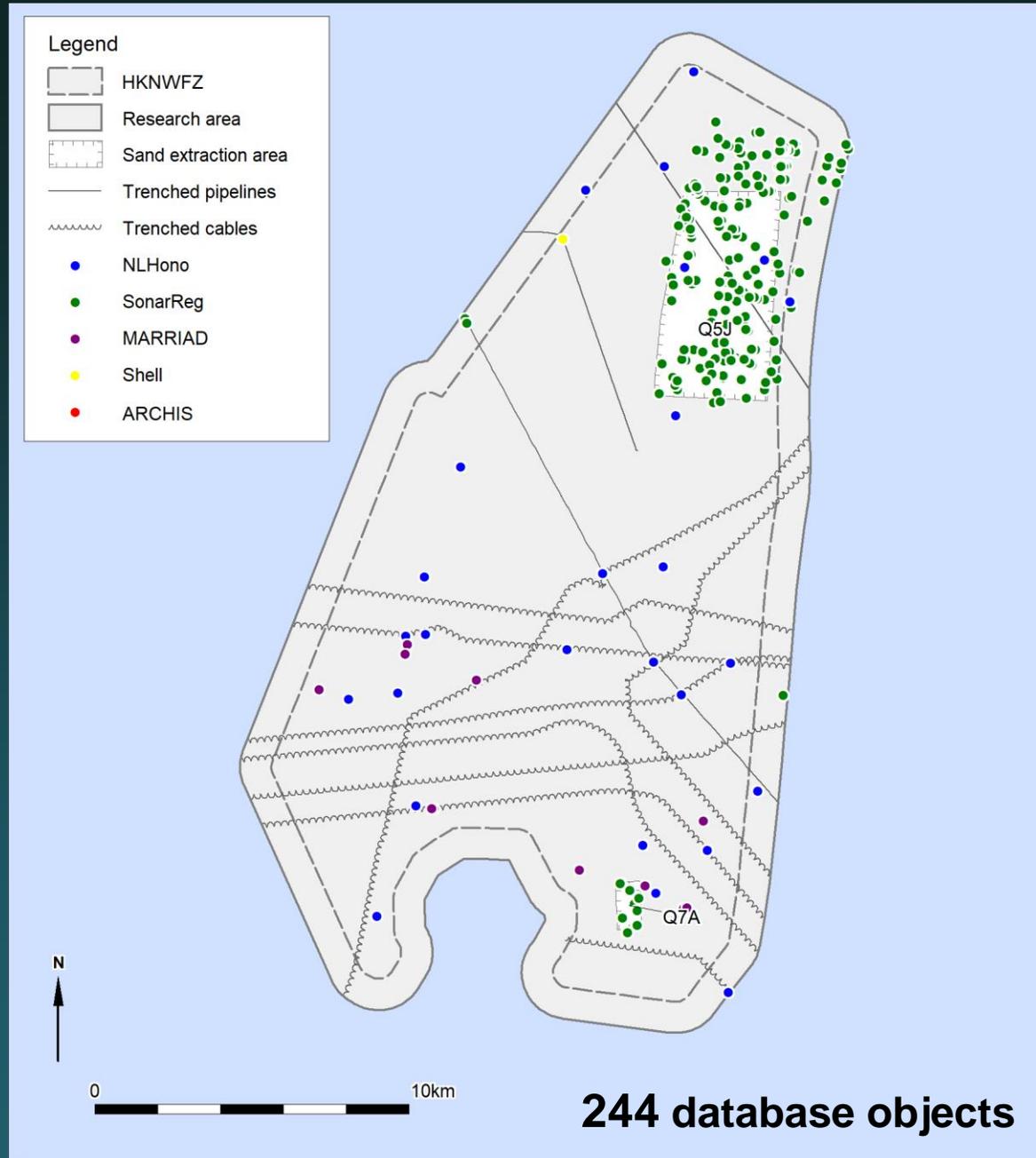
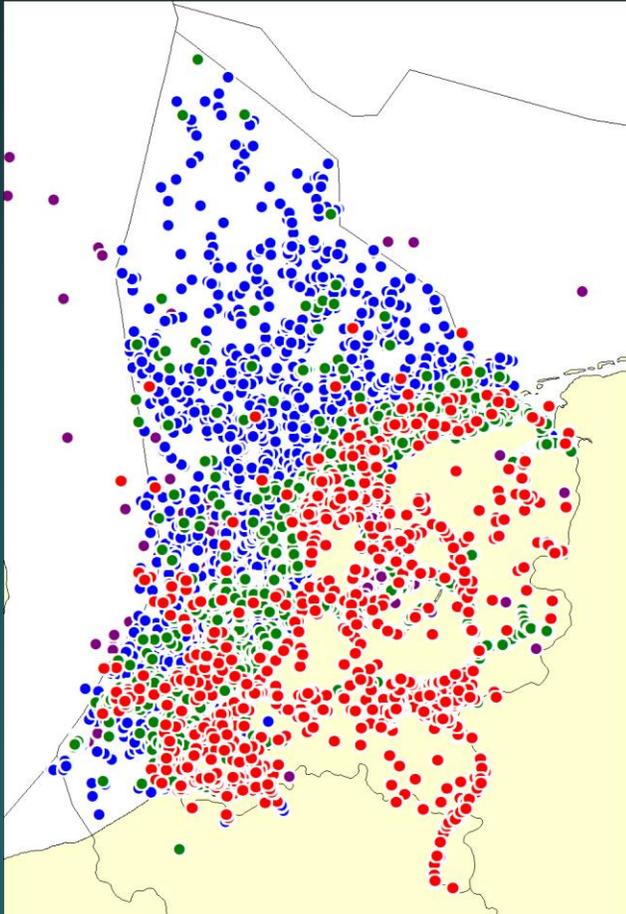


Known wrecks and objects

Sources:

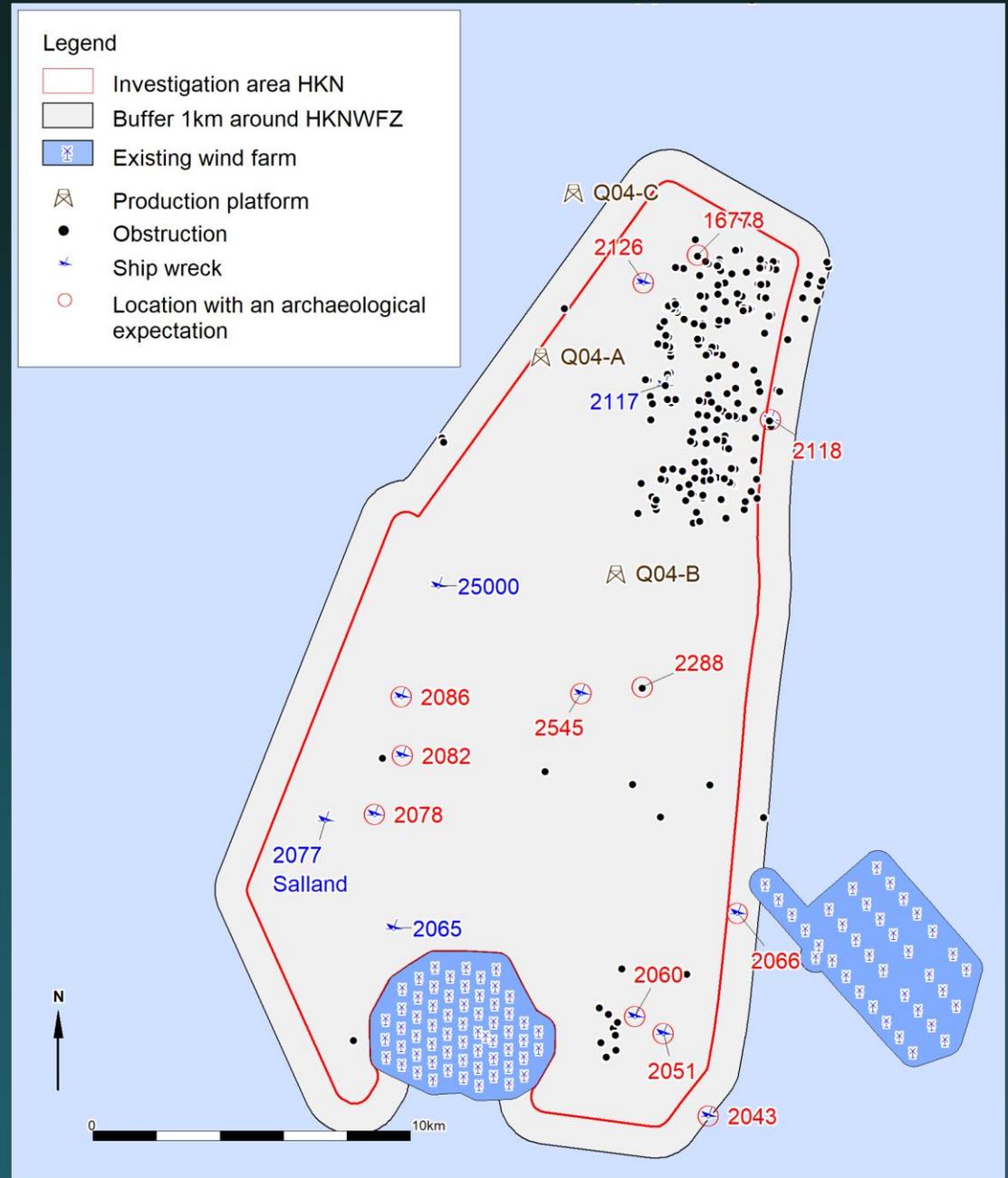
- Ministry of Cultural Heritage: ARCHIS
MARIAD
- Rijkswaterstaat: SonarReg92
- Dutch Hydrographic Service: NLHono
- Periplus Archeomare

Known objects



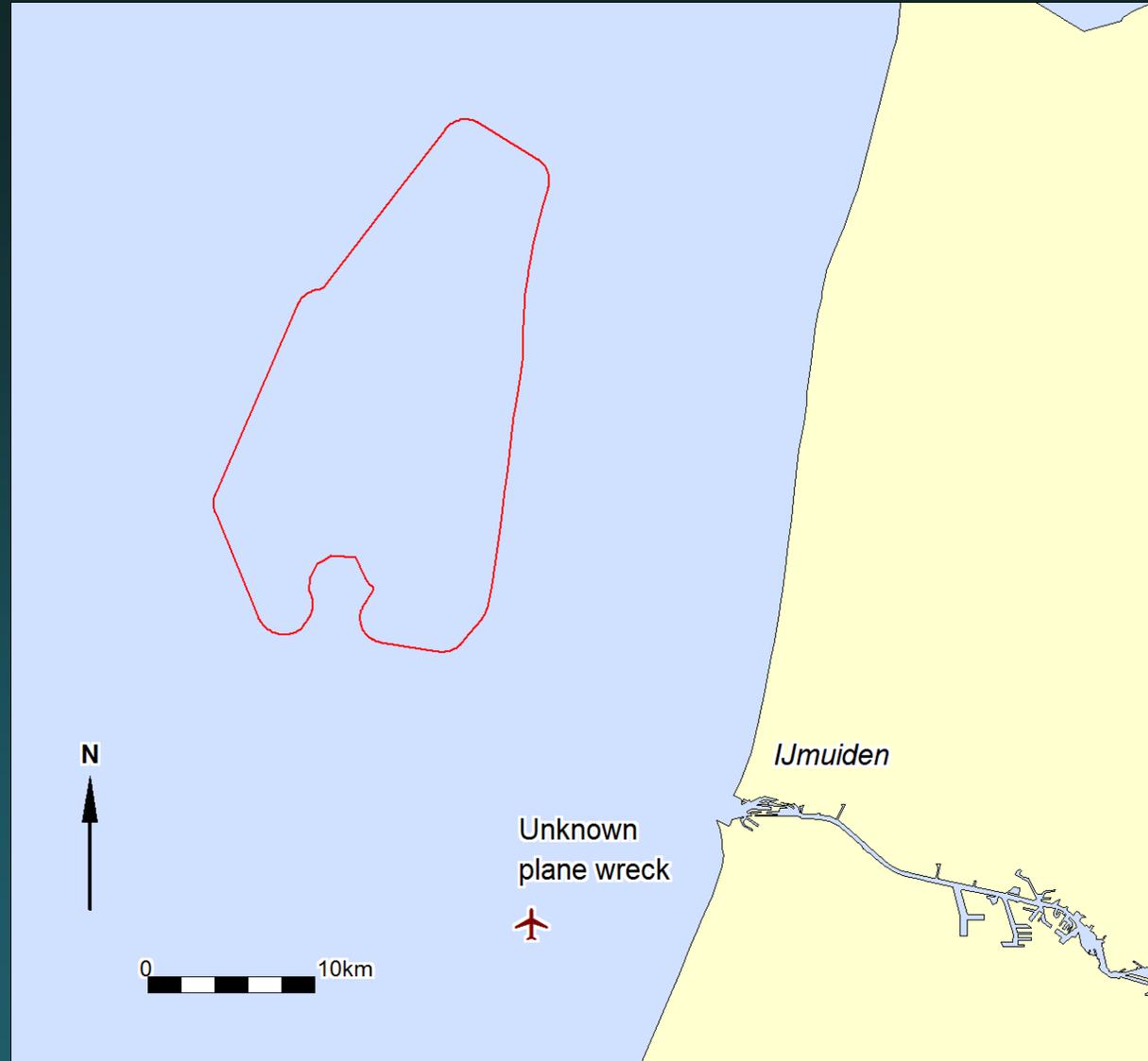
Desk study results

Database		Potential archaeological wreck sites	
Type	Number	No	Yes
Wrecks	14	4	10
Other	230	228	2
Total	244	232	12

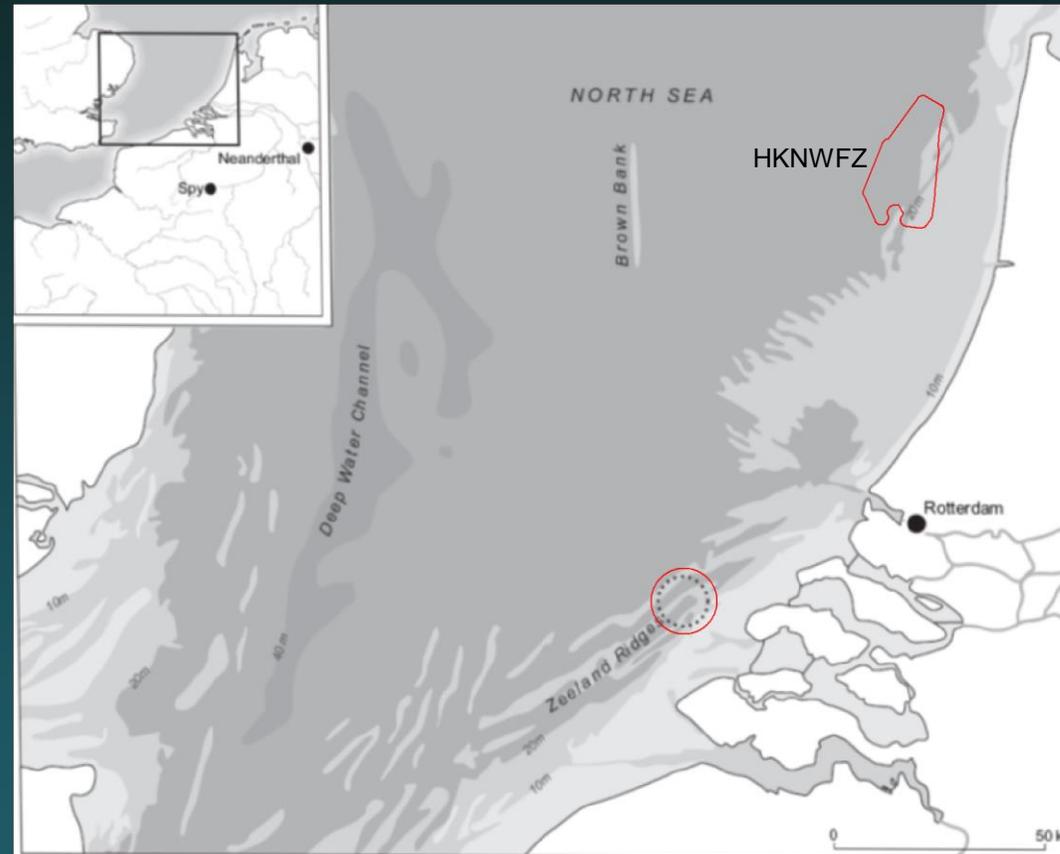


Plane wrecks WOII

More than 200 planes
still missing

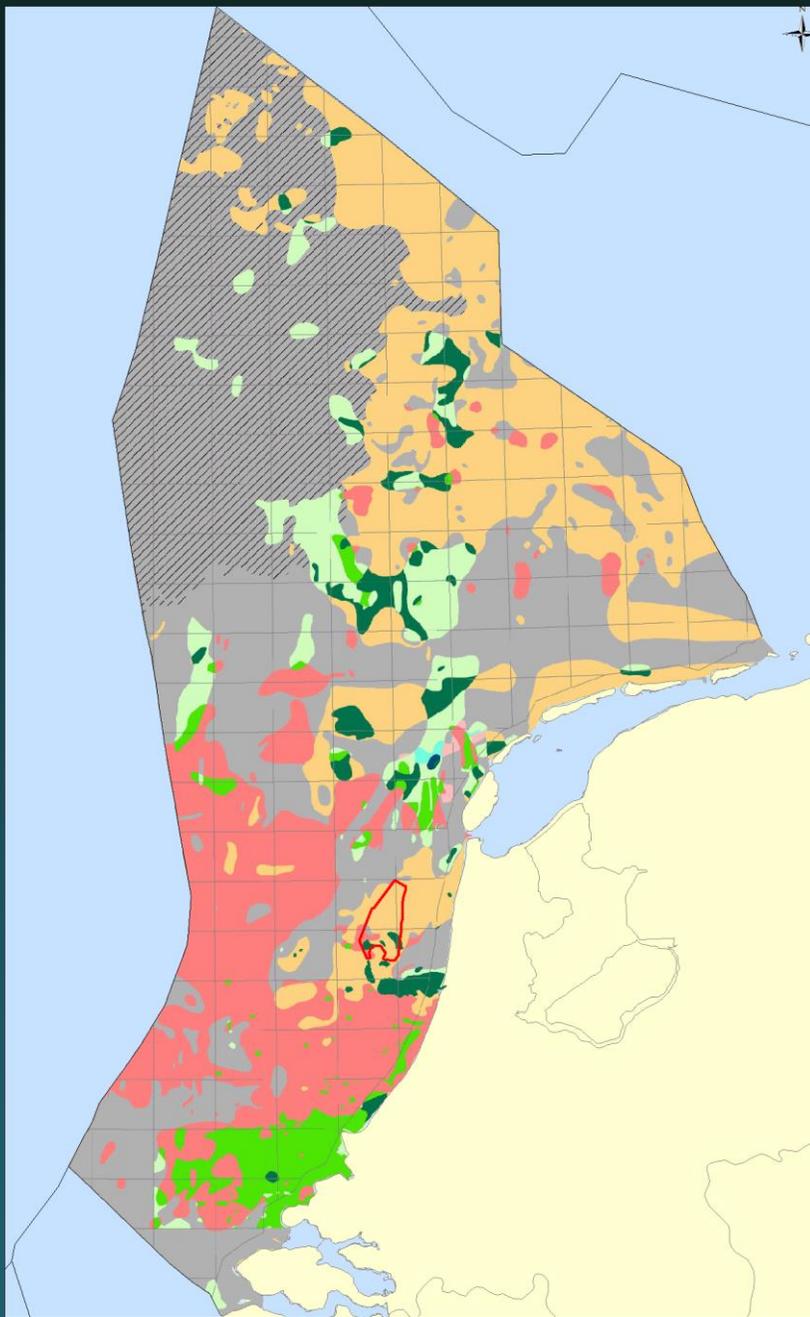


Drowned prehistoric landscapes



2009: The Zeeland Ridges Neandertal

Archaeological potential



Legend

 Research area

Expectancy prehistoric remains

 No prehistoric remains intact

 Mesolithicum + Late Paleolithicum

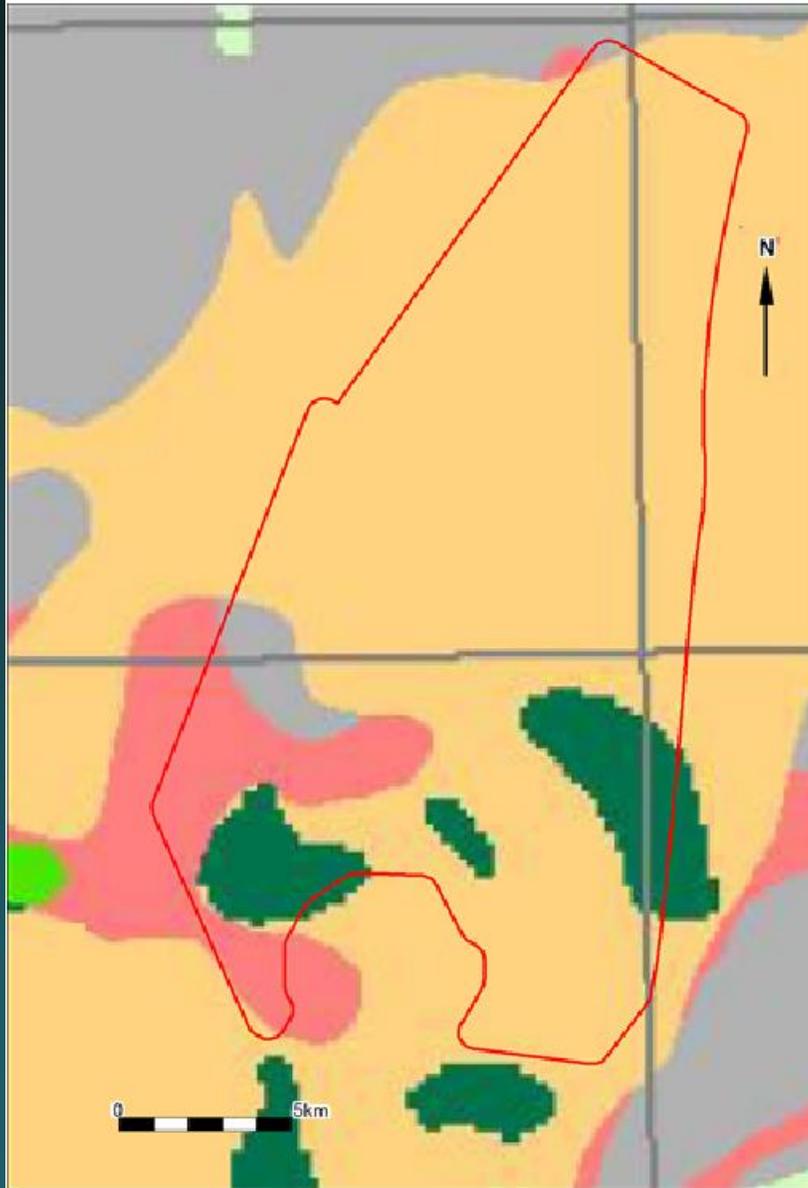
 Mesolithicum + Middle Paleolithicum

 Residual Mesolithicum + Late Paleolithicum

 Middle Paleolithicum

Source: Indicative model of archaeological potential of the North Sea. Deltares 2016

Archaeological potential



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 Middle Paleolithicum

Source: Indicative model of archaeological potential of the North Sea. Deltares 2016

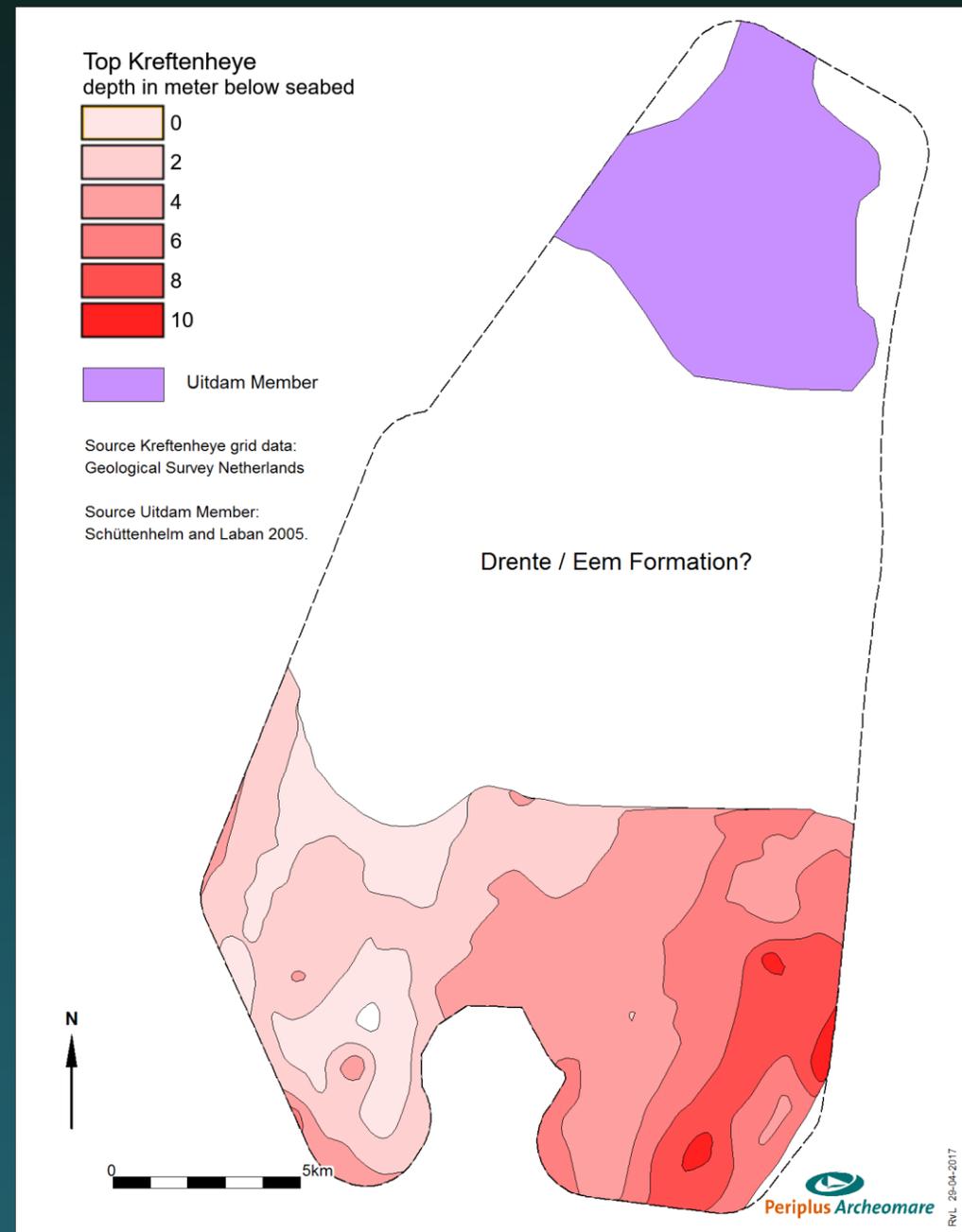
Geological units

Archaeology - Landscape – Geology

PLEISTOCENE UNITS

Kreftenheye Formation

- braided river system



Geological units

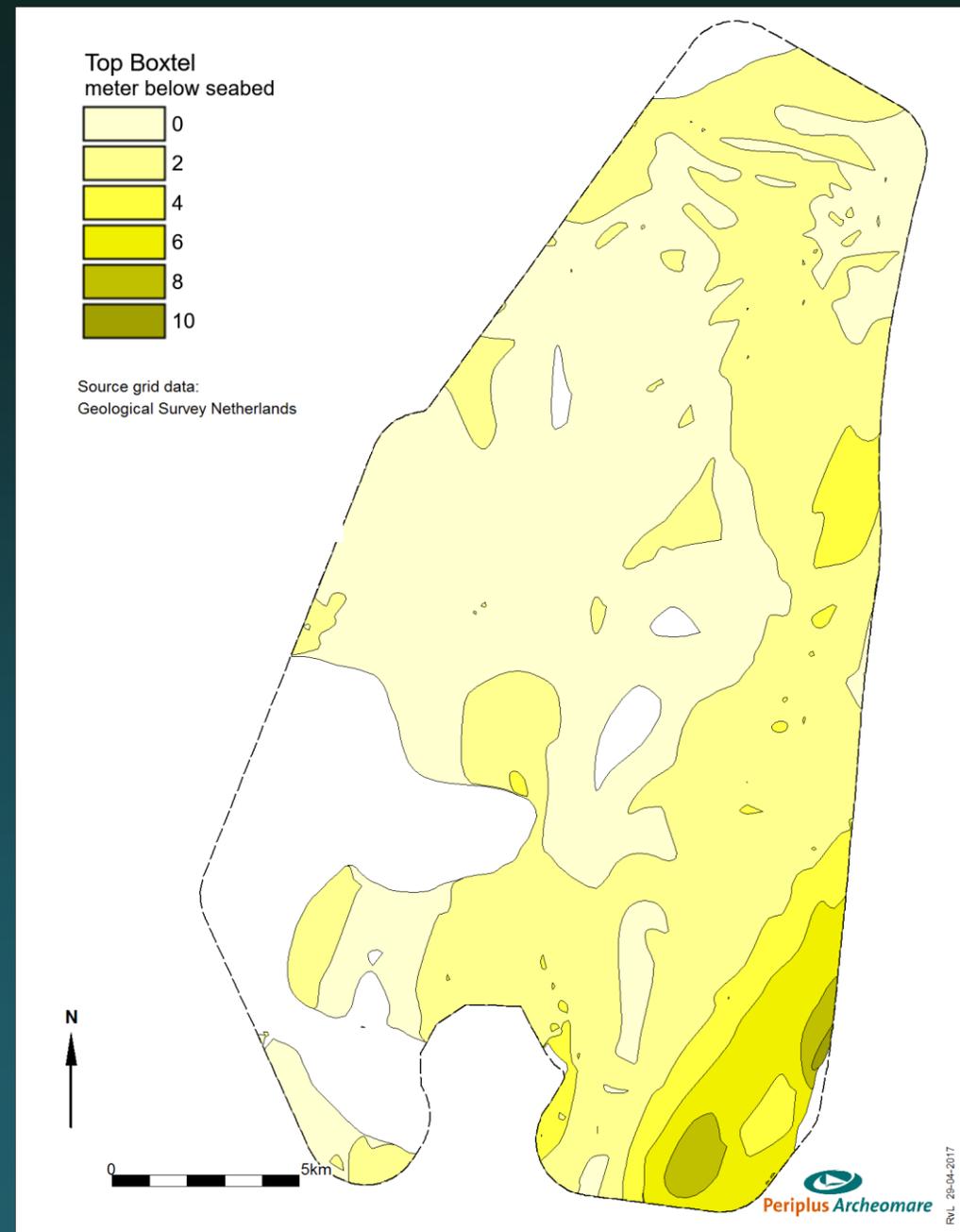
Archaeology - Landscape – Geology

PLEISTOCENE UNITS

Boxtel Formation

- cover sand landscape with dunes, ridges and beak valleys; vegetated in Early Holocene

NOTE:
known level for remains of prehistoric settlements onshore



Geological units

Archaeology - Landscape – Geology

HOLOCENE UNITS (12.000BP – NOW)

Basal Peat Bed

- peat

Naaldwijk Formation

- tidal flat

including Velsen Bed

- humic clay



Archaeological levels

Unit	Depth	Archaeological remains
Bligh Bank Member	0	reworked flint and bone artifacts
Velsen Bed	0 - 8	lost objects, dumps
Basal Peat Bed	0 - 10	lost objects, dumps
Boxtel Formation - Wierden Member - Delwijnen Member	0 - 10	camps sites of hunters and gatherers; flint and bone artifacts; burnt nuts and seeds; charcoal; hunting gear
Kreftenheye Formation	6 - 10	reworked flint and bone artifacts lost objects, dumps; possible camp sites
Eem Formation - Brown Bank Member	?	reworked flint and bone artifacts camps sites Neanderthaler; flint artifacts
Drente Formation - Gieten Member - Uitdam Member	?	camps sites Neanderthaler; flint artifacts

Conclusions desk study

Facts:

- 12 known wreck sites of possible archeological interest
- Late Pleistocene landscape covered by Holocene deposits
- Integrity of Pleistocene landscape and possible prehistoric remains is unknown

Expected remains:

- Undiscovered ship wrecks and WWII aircraft
- *In situ* buried prehistoric remains

Recommendations: geophysical survey

In order to map wrecks and confirm known locations:

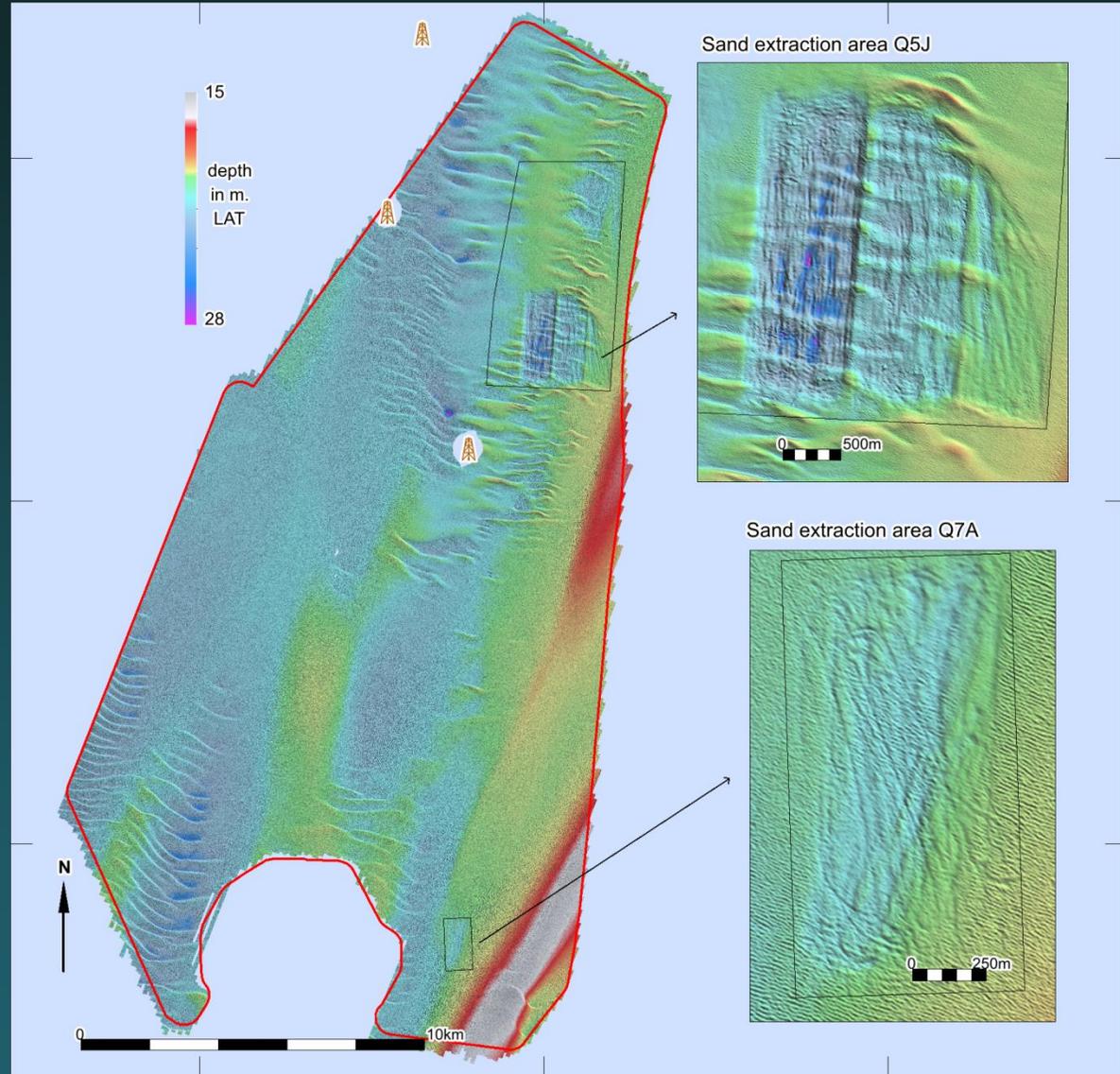
- **Side scan sonar and magnetometer survey**

In order to map the prehistoric landscape:

- **Subbottom profiling**

Geophysical survey Fugro 2017

- side scan sonar
- single beam echo sounder
- magnetometer
- multibeam echo sounder
- sub-bottom profiler; pinger
- ultra high resolution seismic



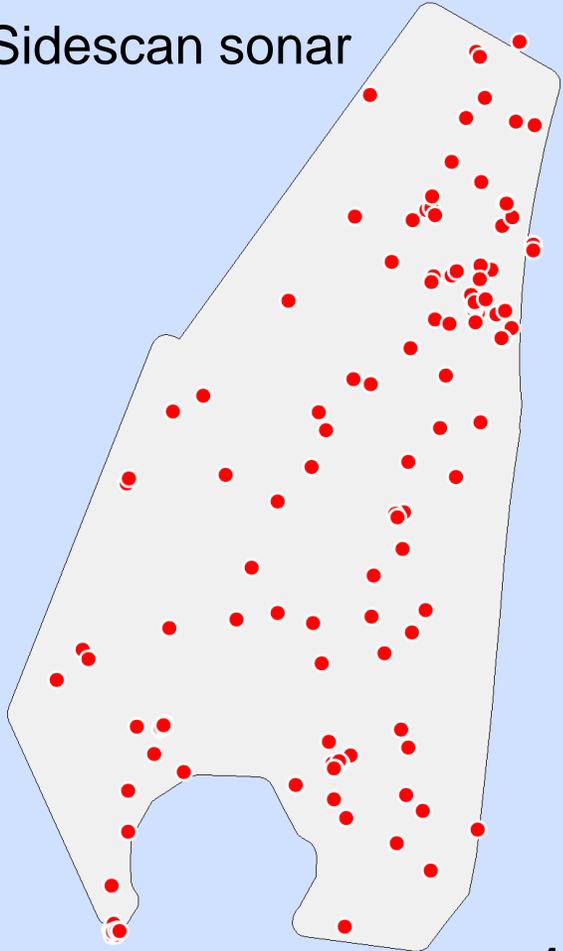
Assessment geophysical survey data

The goals set for this assessment were:

- Validate the locations of known wrecks and objects
- Assess the possible value of newly found contacts
- Assess the prehistoric landscape based on the seismic data

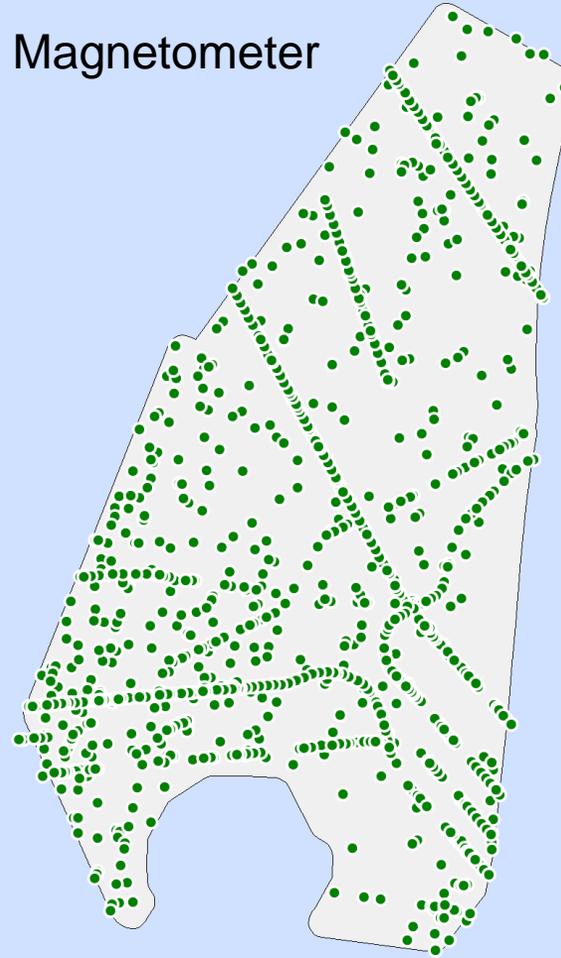
Results sonar & magnetometer

Sidescan sonar



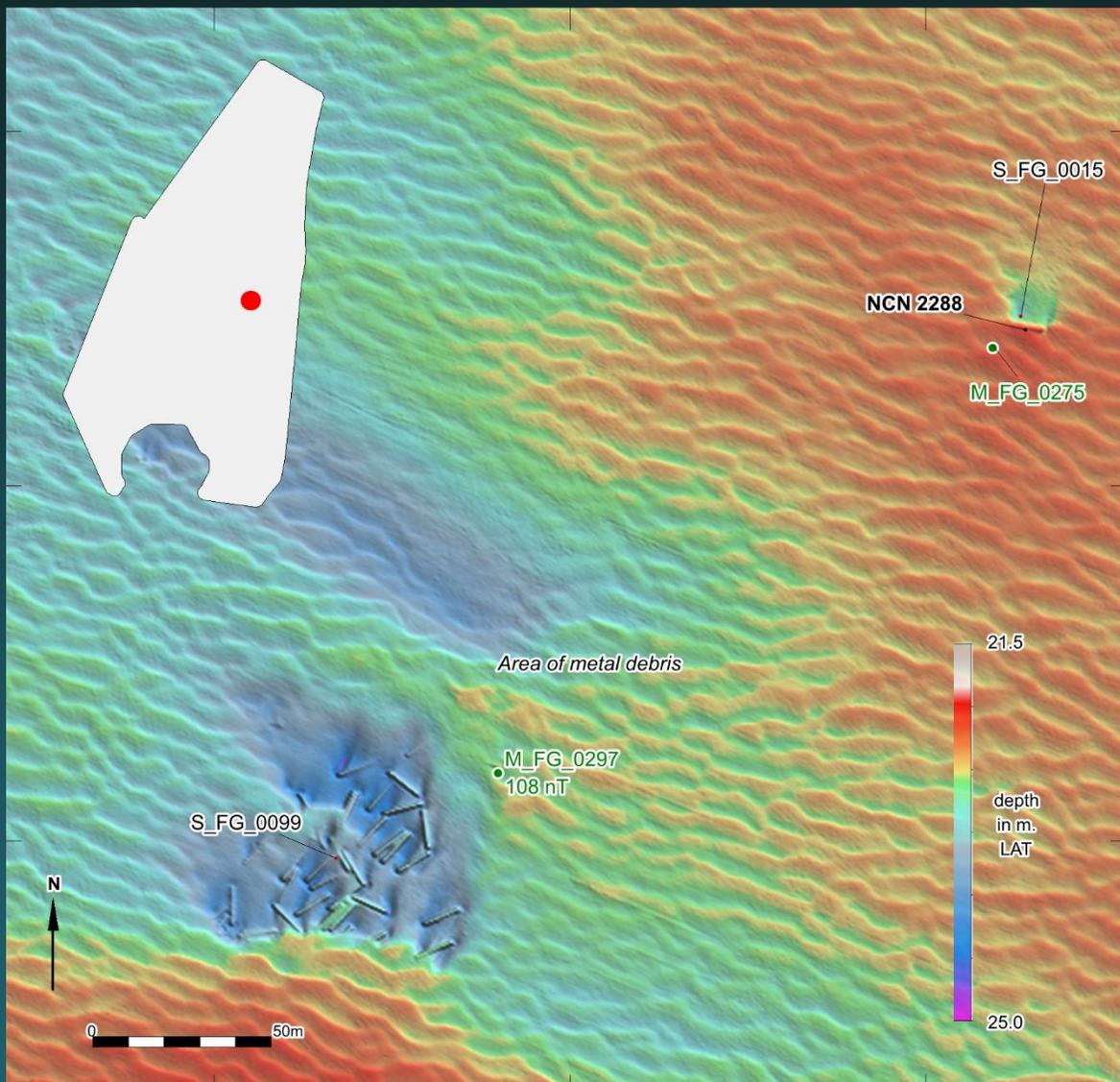
131 contacts

Magnetometer



1035 anomalies

Verification known objects

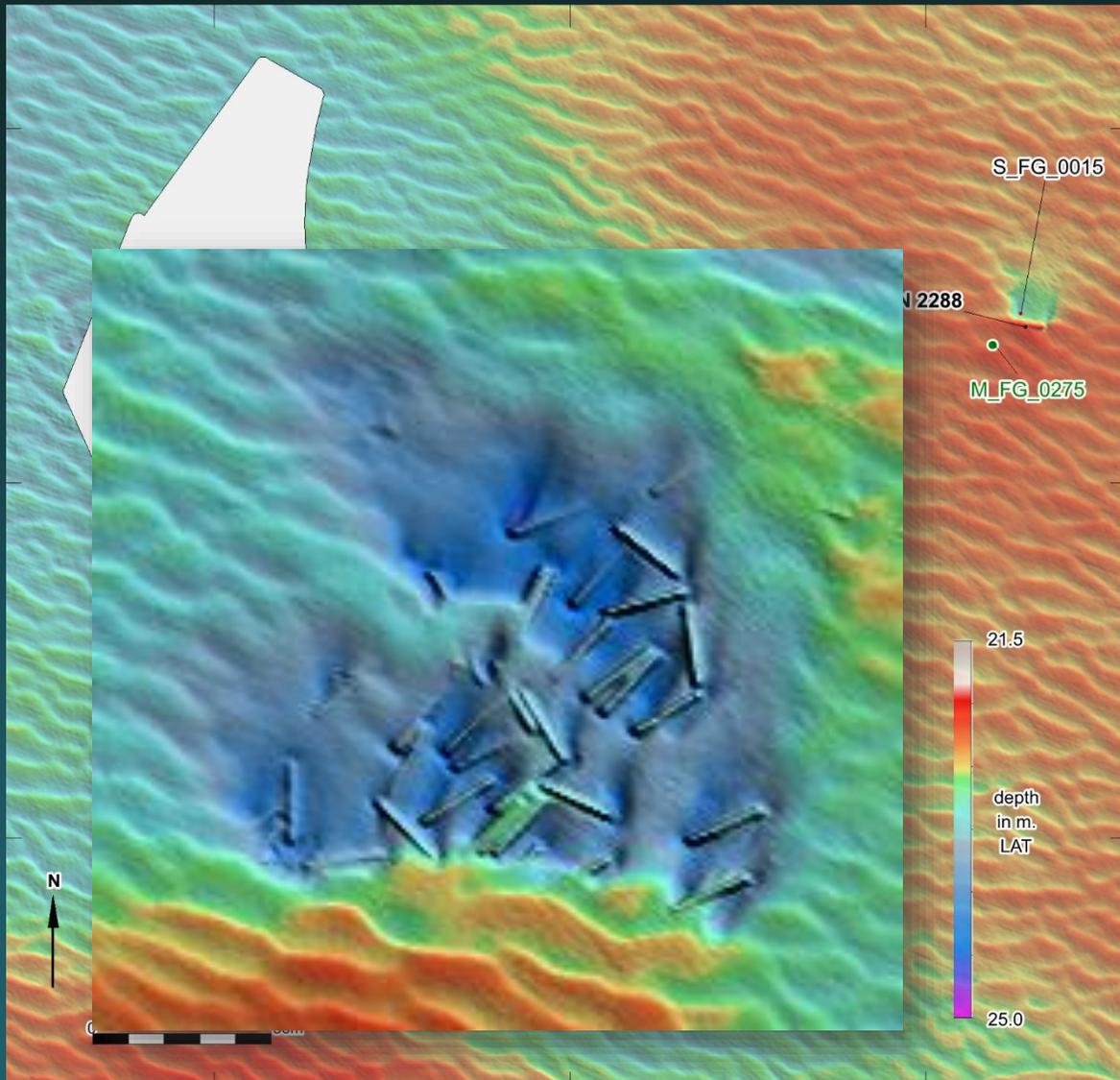


NCN 2288

Database description:

“An obstruction with wreck remains ca 300 x 100m”

Verification known objects

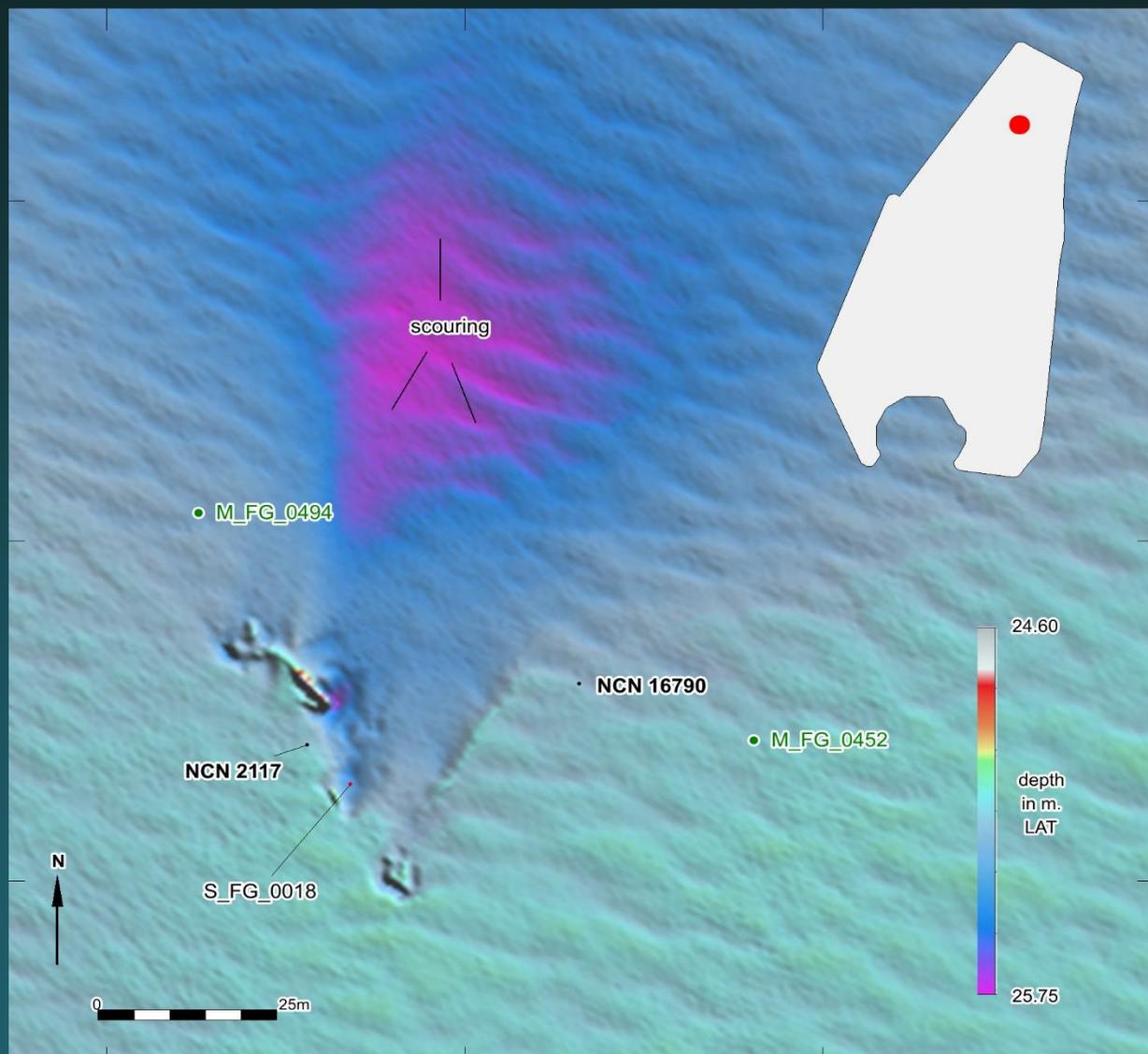


NCN 2288

Database description:

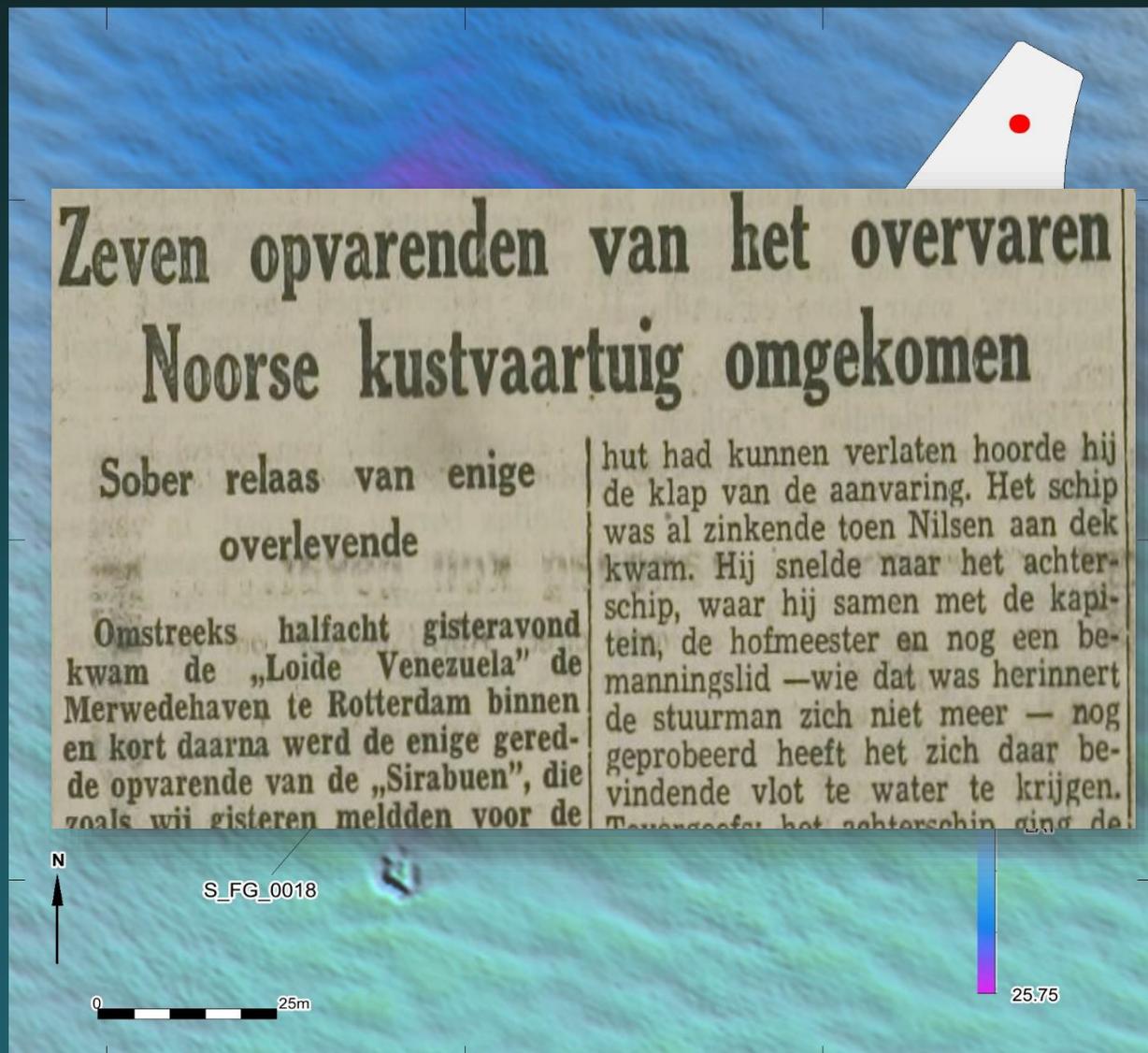
“An obstruction with wreck remains ca 300 x 100m”

Verification known objects



NCN 2117 and NCN 16790 represent the wreck of the Norwegian cargo vessel Sirabuen, sunk in January 10, 1956

Verification known objects



NCN 2117 and NCN 16790 represent the wreck of the Norwegian cargo vessel Sirabuen, sunk in January 10, 1956

Geophysical Survey

Outcome of the archaeological desk study:

Known Objects: 244

Of which:

Wrecks: 14



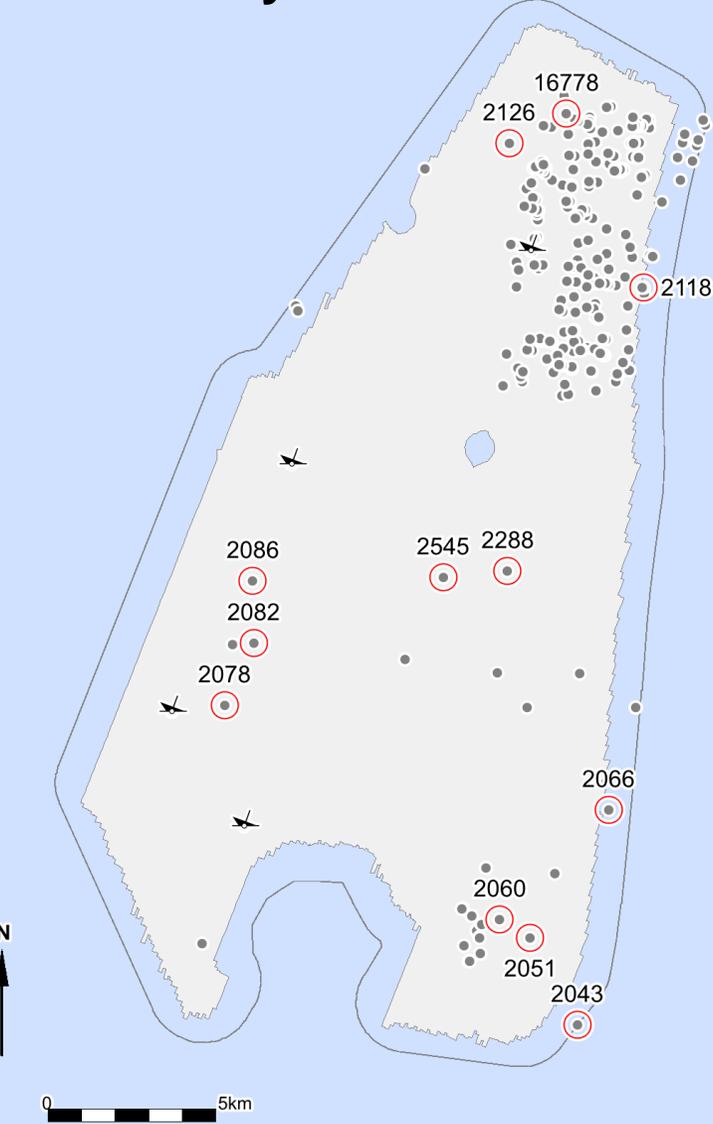
Geophysical Survey

Outcome of the archaeological desk study:

Known Wrecks

Possible Archaeological	12
Non-archaeological	4
Total	16

Desk Study



Geophysical Survey

Known Wrecks

Possible Archeological (12 Known):

FOUND 2

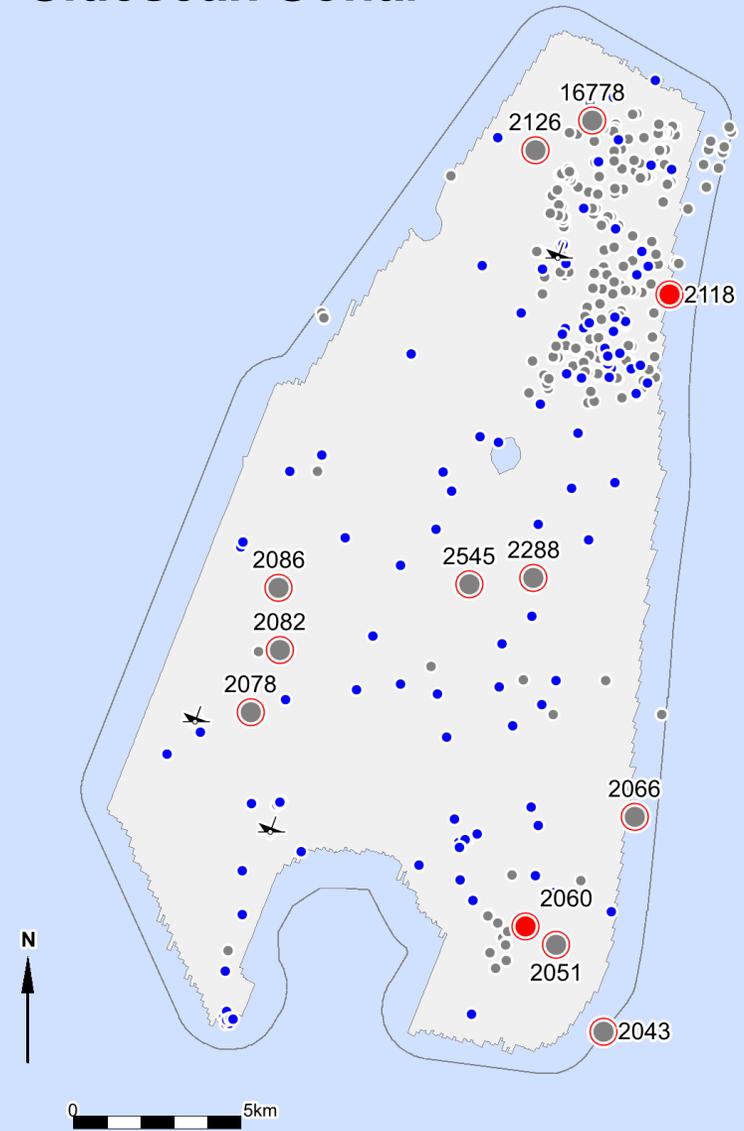
NOT Found 10

Non-archaeological (4 Known):

FOUND 3

NOT Found 1 (Removed)

Sidescan Sonar

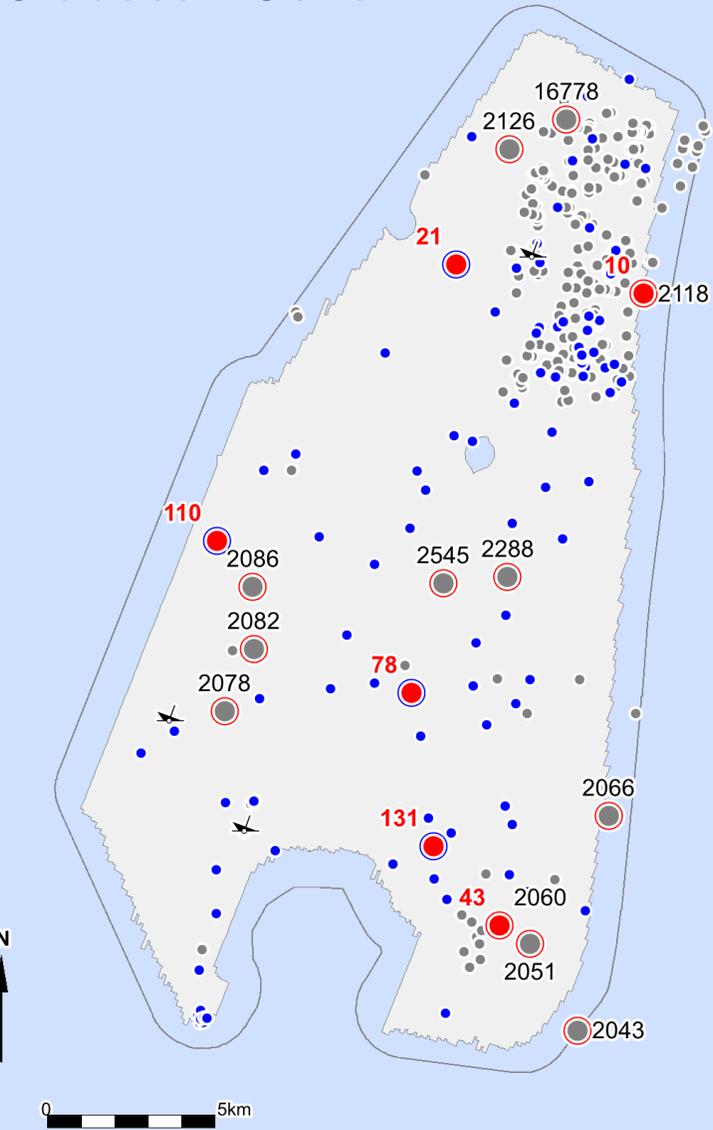


Geophysical Survey

Possible Archaeological Wrecks **FOUND**:

Known wrecks	2
New wrecks	4
Total	6

Sidescan Sonar



Geophysical Survey

Wrecks within the Wind Farm Site:

FOUND:

Possible Archaeological (Known wrecks) 0

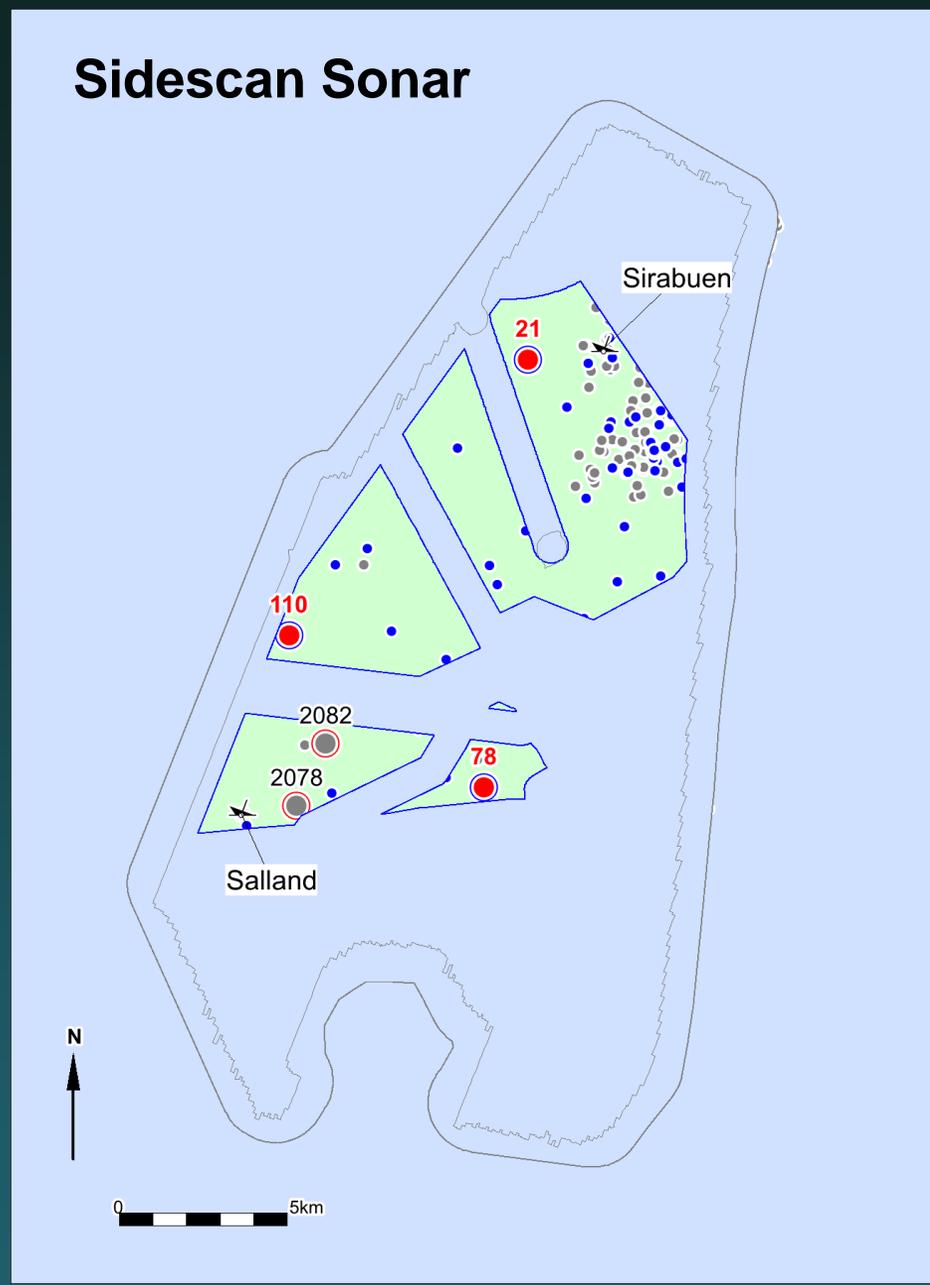
Possible Archaeological (New wrecks) 3

Non-archaeological (Known wrecks) 2

Total FOUND: 5

NOT FOUND:

Possible Archaeological (Known wrecks) 2



Geophysical Survey

Within the Wind Farm Site:

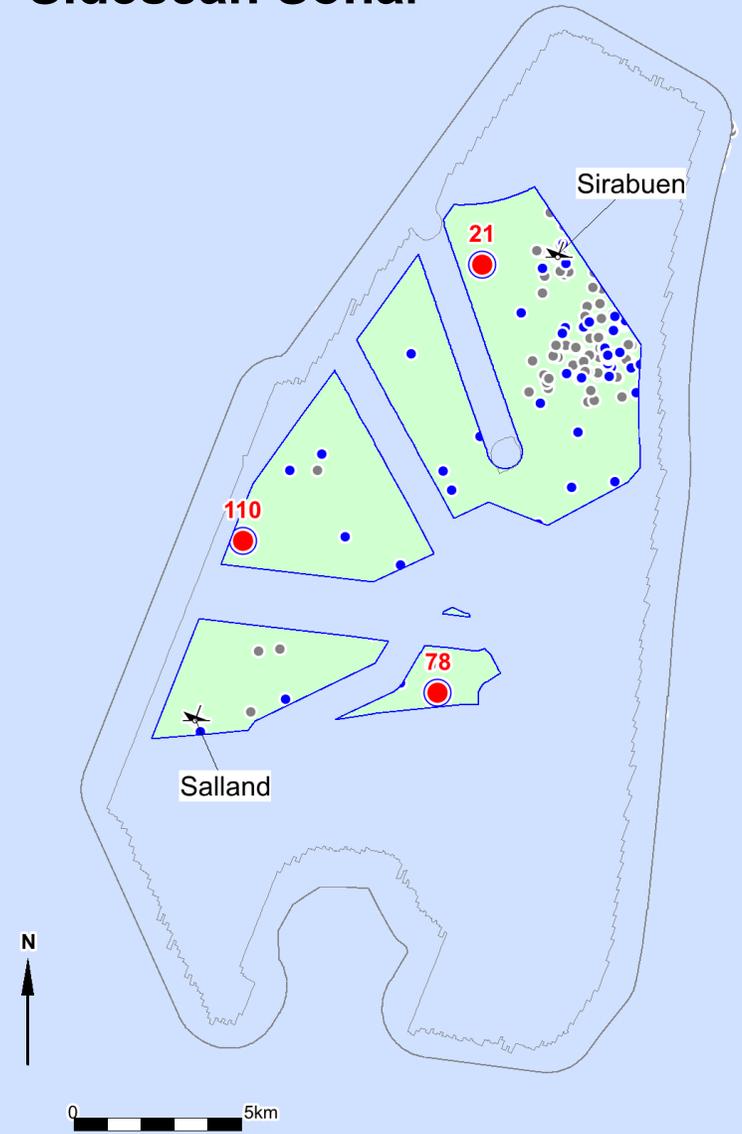
NOT FOUND:

Possible Archaeological Known wrecks 2

BUT:

Accuracy of wrecks positions less than 1000m,
therefore the locations of the wrecks is very uncertain
and could even lie outside the Wind Farm Site.

Sidescan Sonar

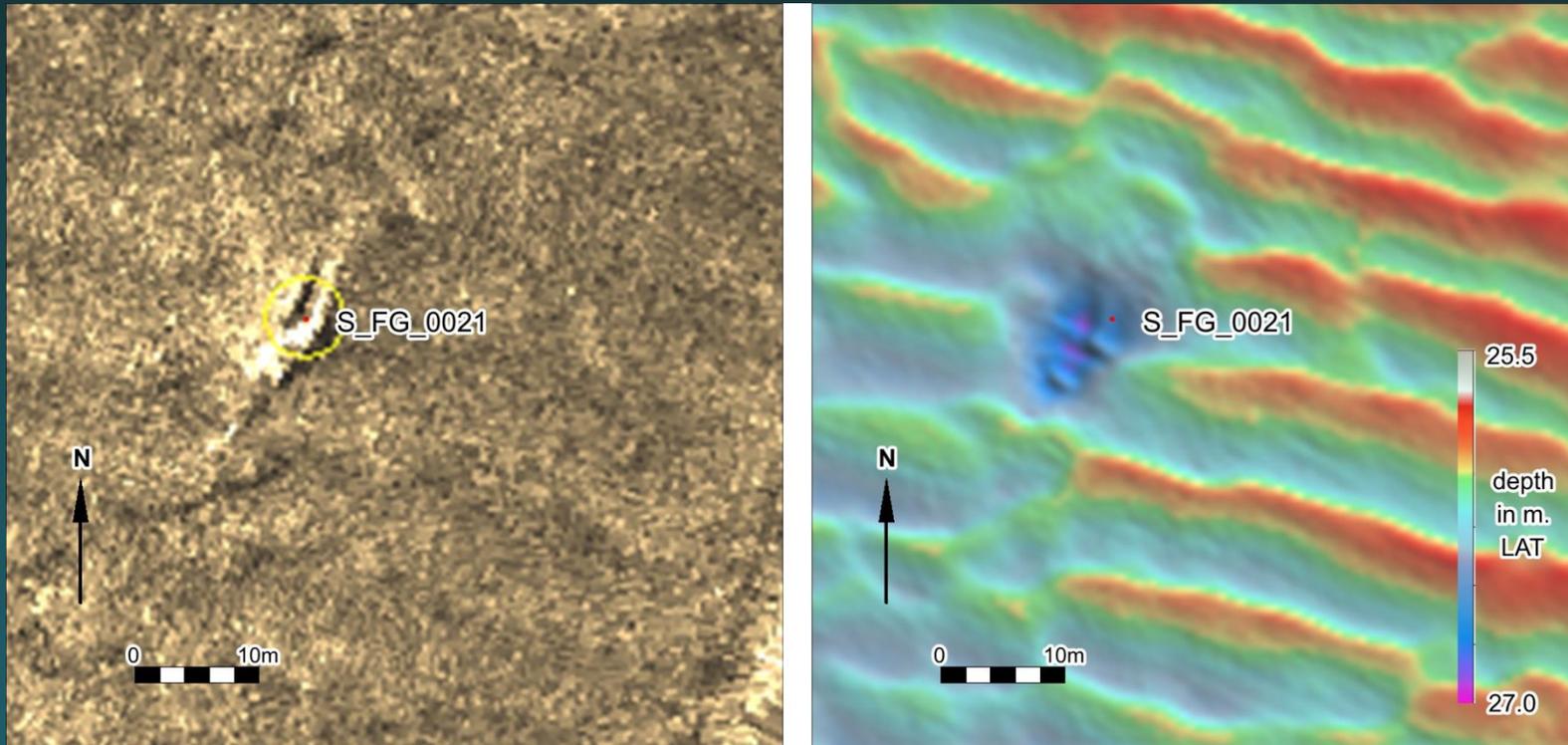


New objects

Example

Sonar contact S_FG_0021

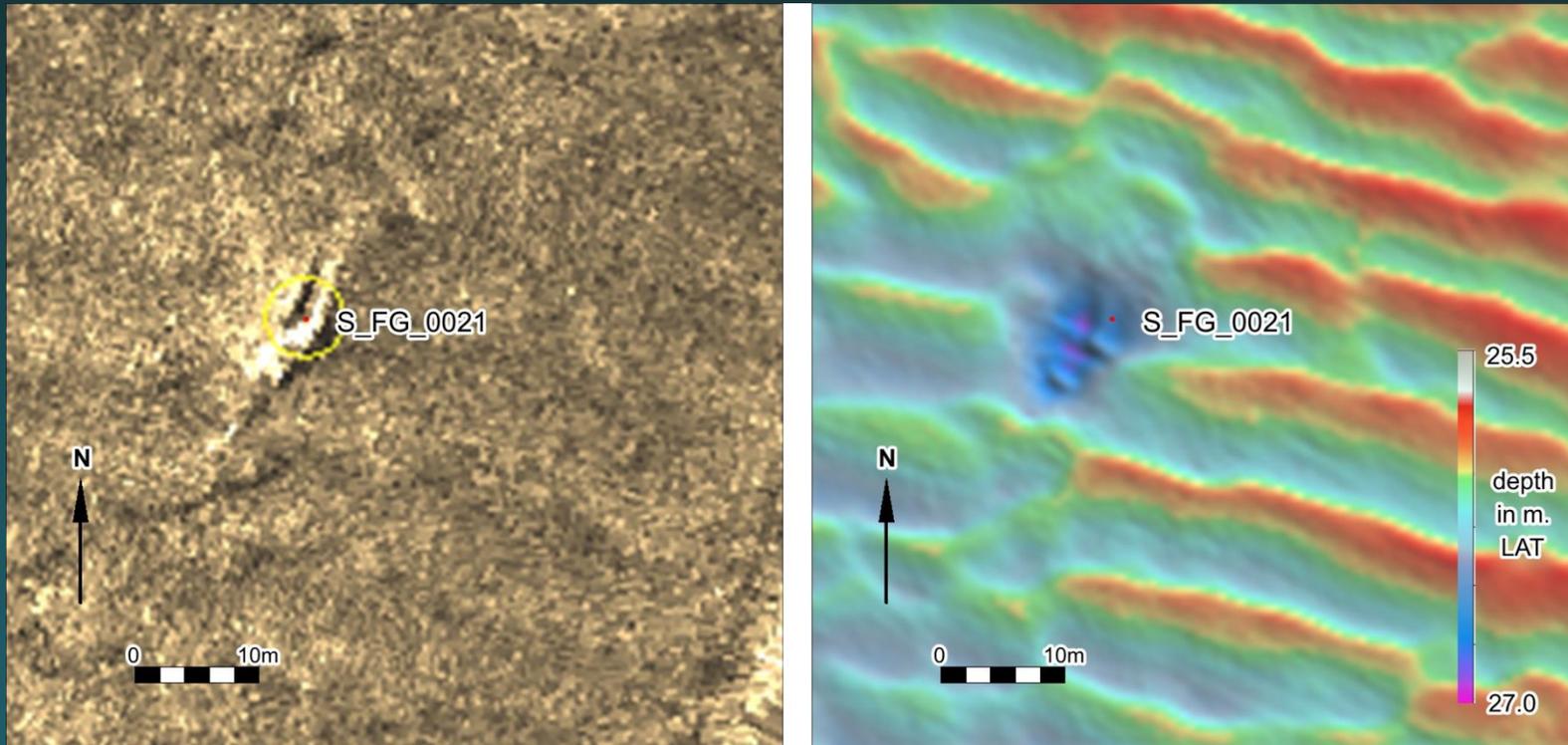
“strong contact with shadow - DEBRIS”



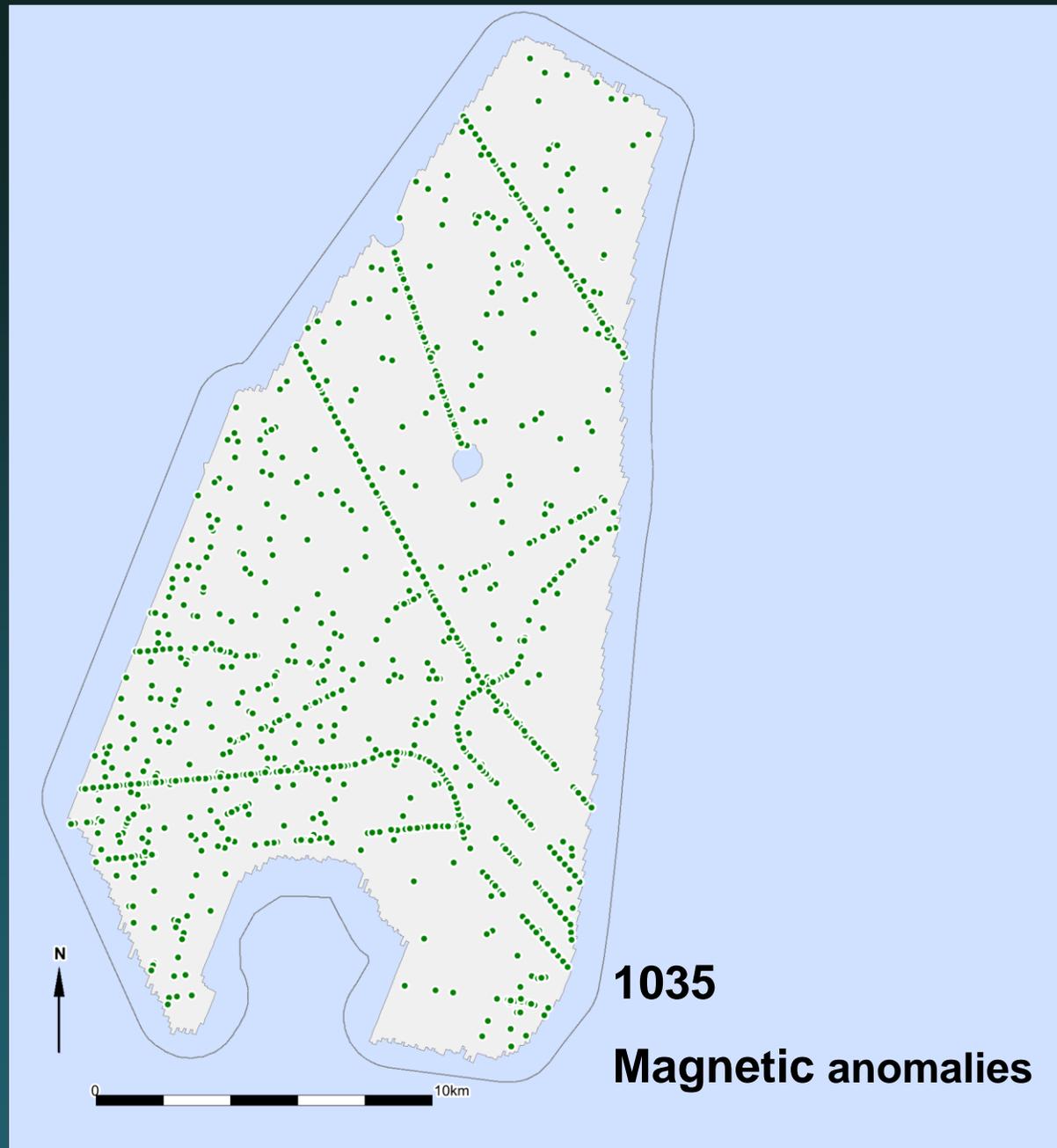
New objects

Interpretation:

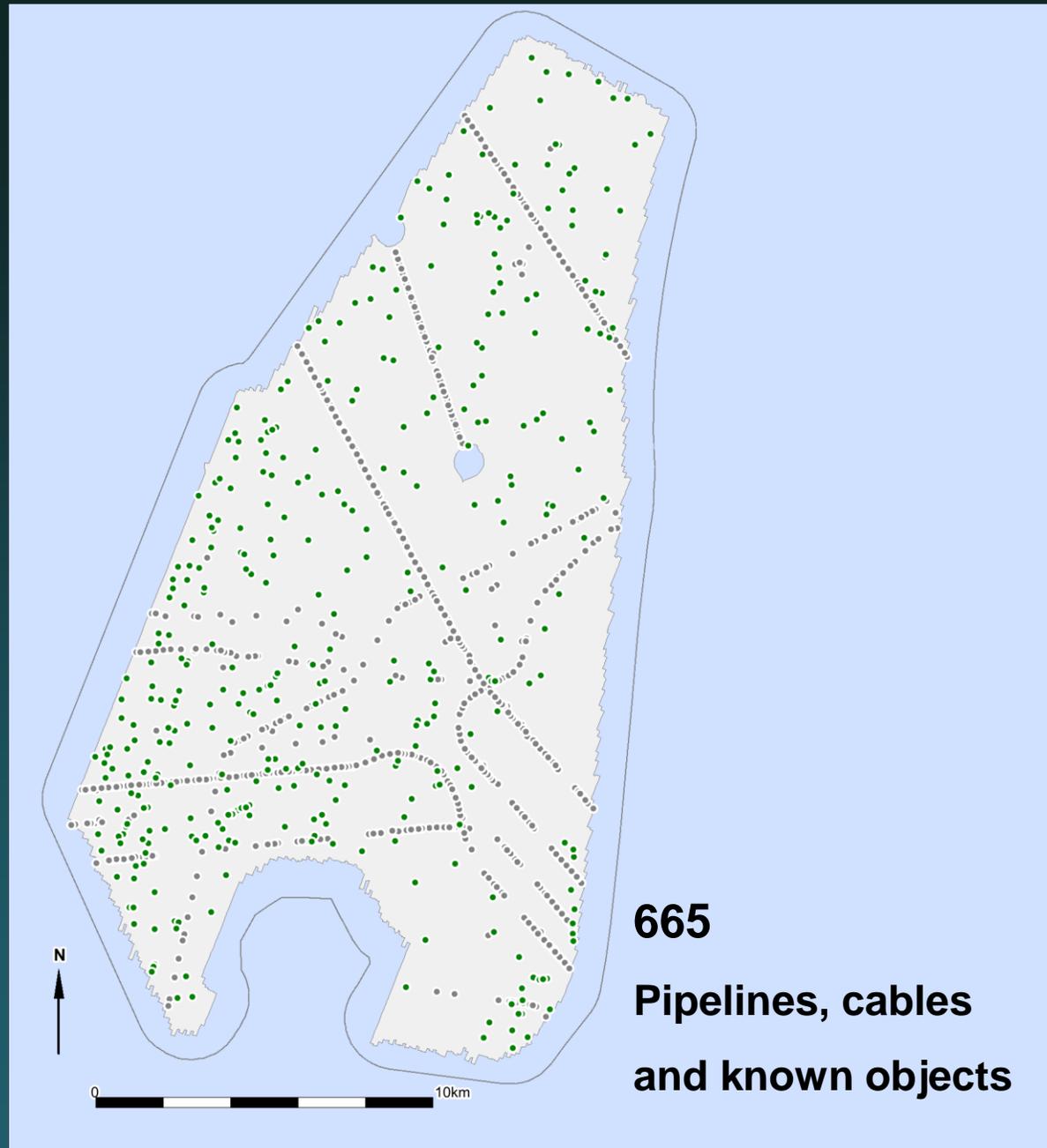
POSSIBLE WRECK REMAINS



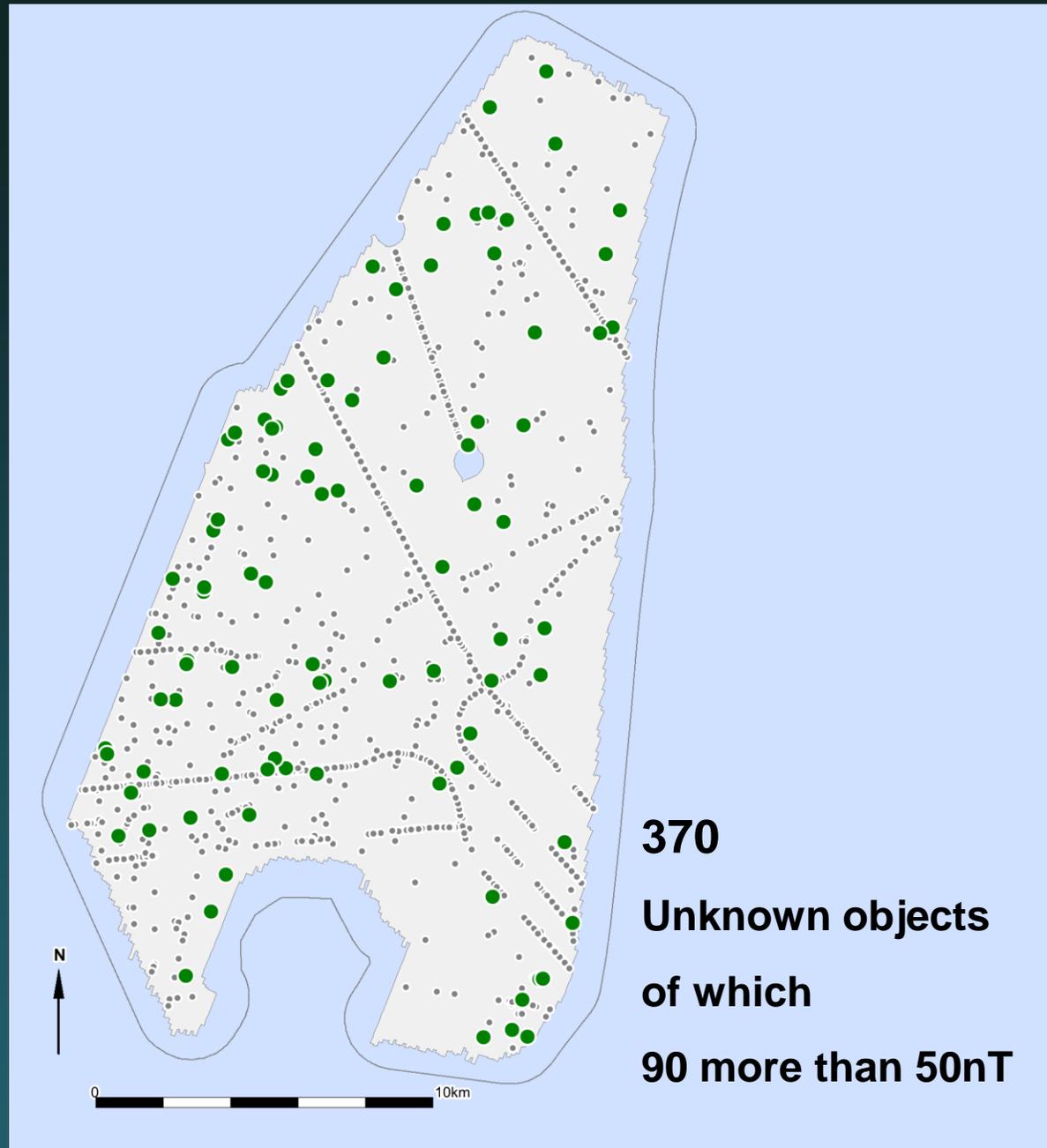
Magnetic Anomalies



Magnetic Anomalies



Magnetic Anomalies

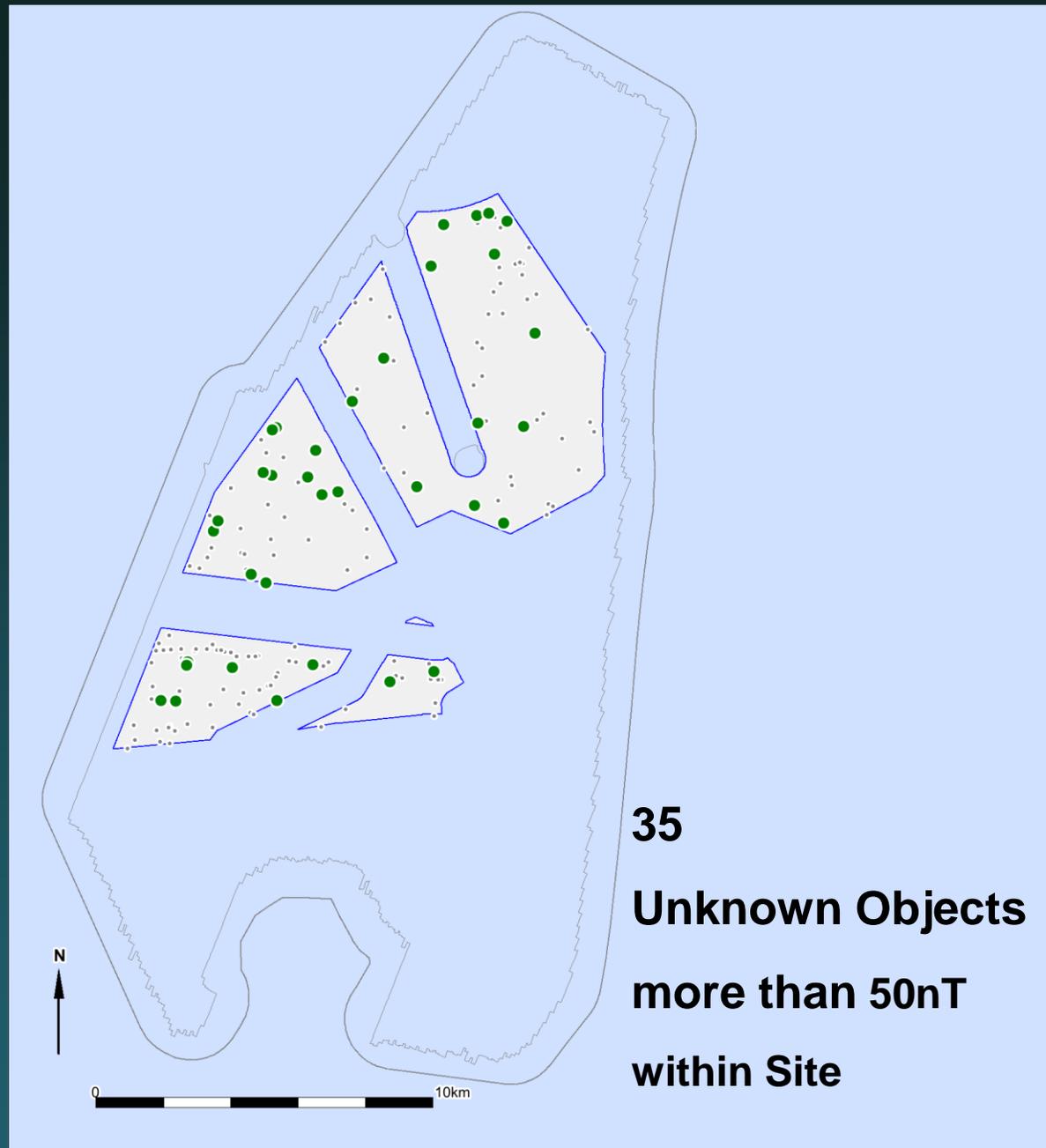


Magnetic Anomalies

More than 50nT

=

Object of Possible
Archaeological Interest



Objects with an archaeological expectation

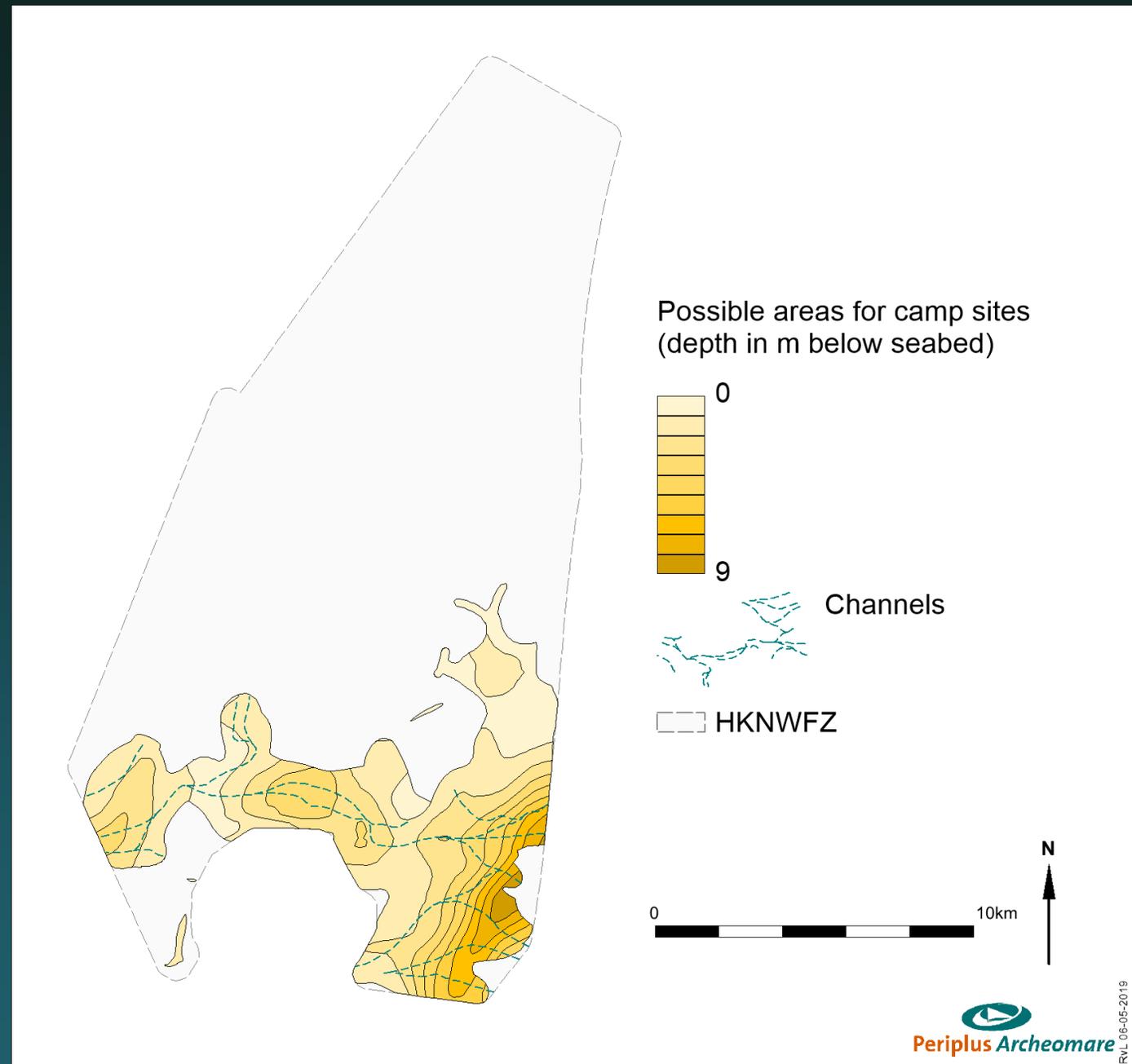
Potential Archaeological objects	TOTAL AREA			SITE		
	NOT FOUND	FOUND		NOT FOUND	FOUND	
		Known	New		Known	New
Exposed (sidescan sonar)	10*	2	4	2*	0	3
Covered (magnetometer)	0	0	90	0	0	35
Total	10	2	94	10	0	38

* The uncertainty of the locations of 5 known possible archaeological wrecks including 2 within Site is very UNCERTAIN (Accuracy = less than 1000m)

Prehistory

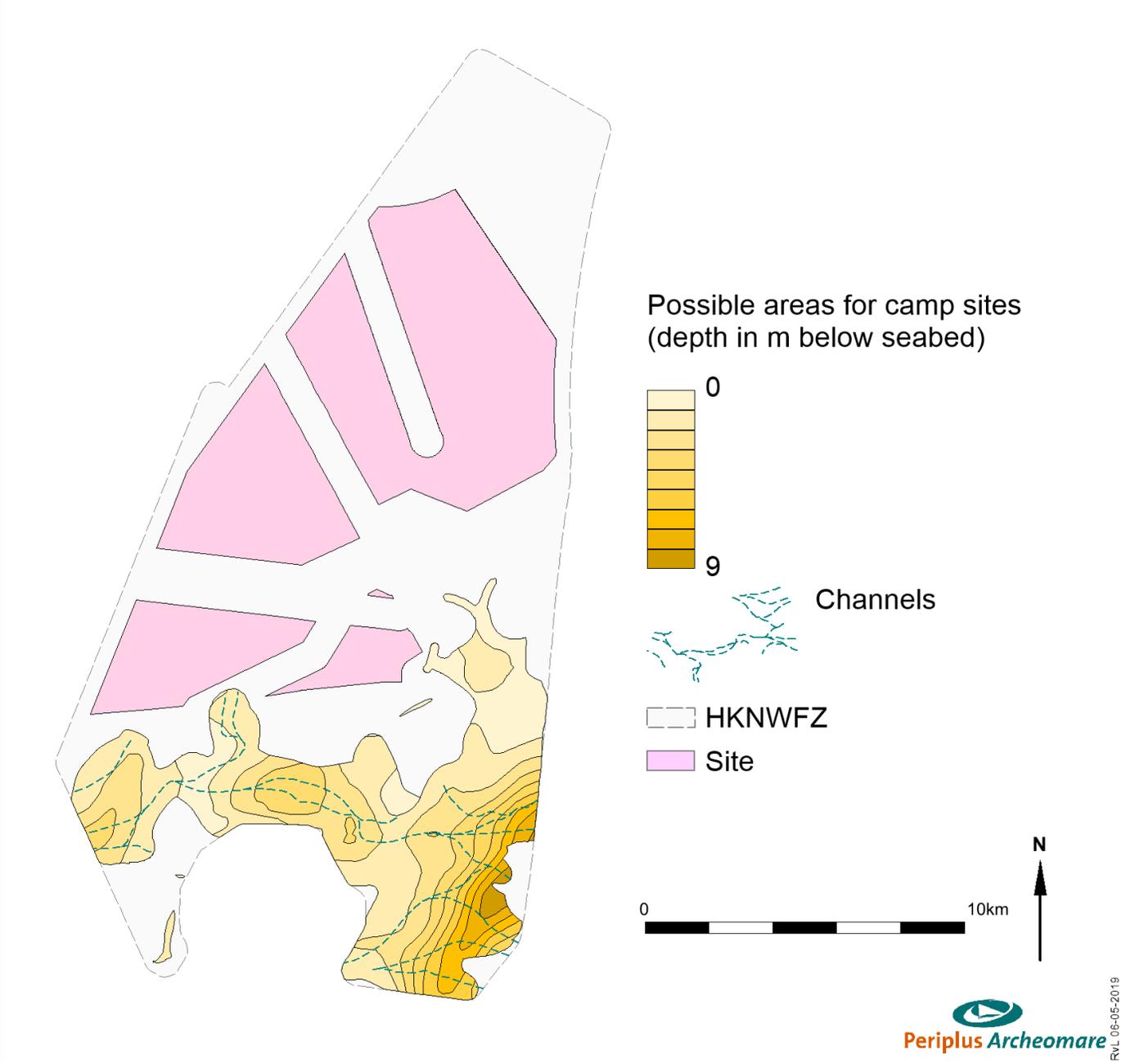
Late Paleolithic & Mesolithic camp sites related to:

- River Valley
- Late Pleistocene – Early Holocene
- Boxtel Formation
- Vegetated Landscape with sand dunes, ridges and streams
- covered by peat and clay

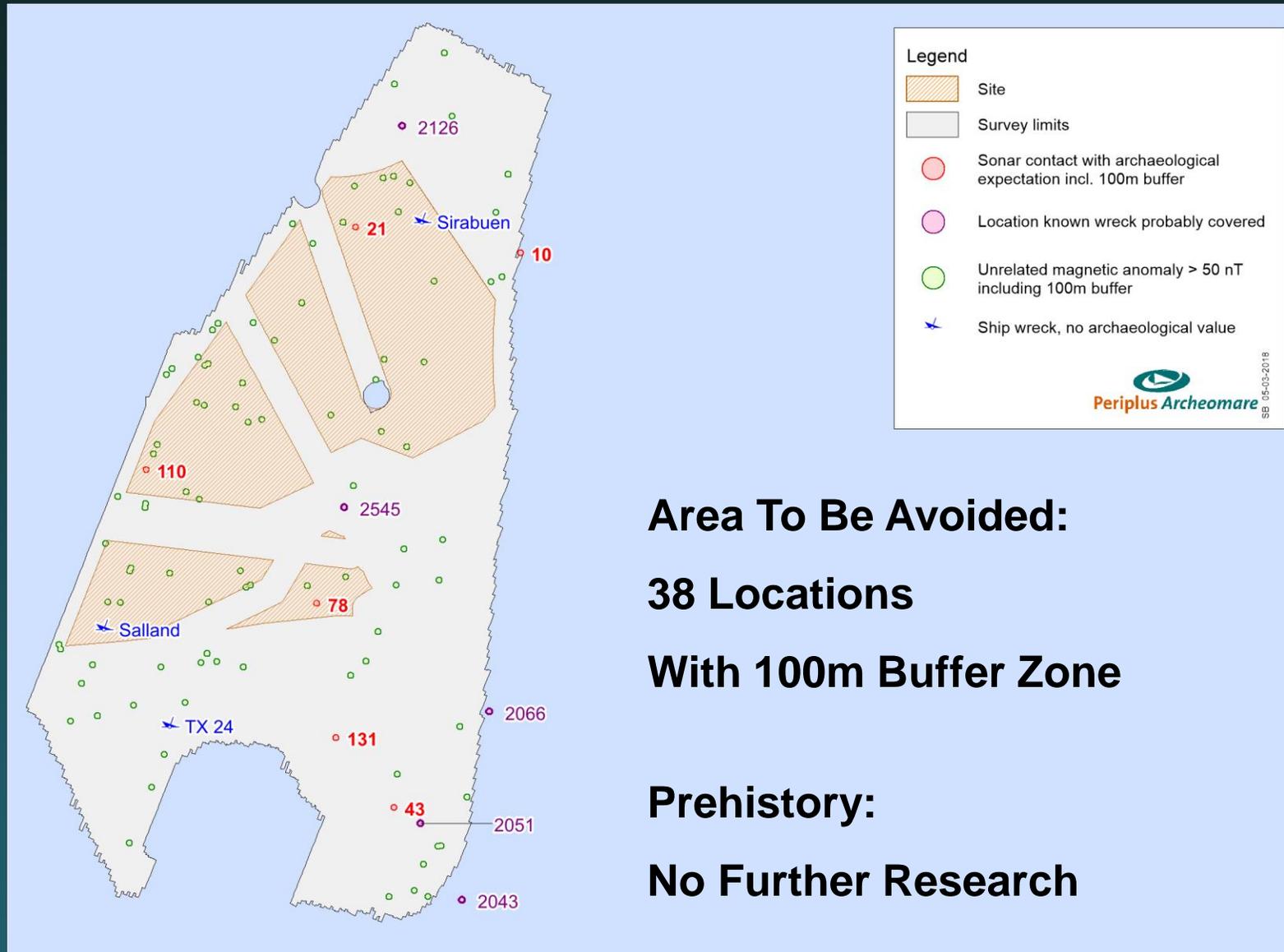


Prehistory

Prehistoric landscape and prehistoric remains herein will not be affected by HKNWFZ development



Summary



**Area To Be Avoided:
38 Locations
With 100m Buffer Zone**

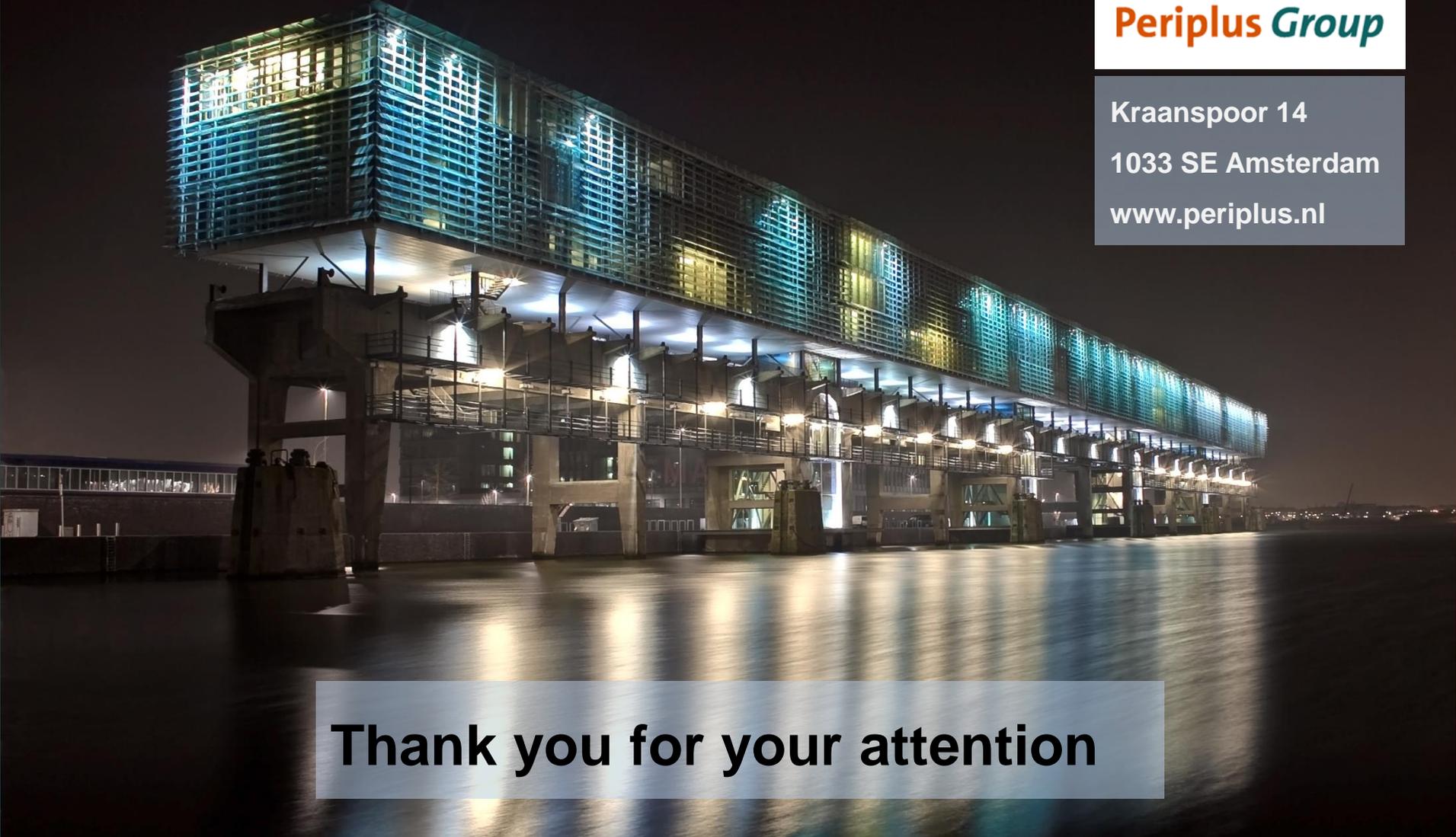
**Prehistory:
No Further Research**

Recommendations

Avoid possible archeological locations (including a buffer zone of 100 meters)

Not feasible? → Additional research required

During construction: Unexpected find? → Report to the authorities



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Thank you for your attention