

Barrow Offshore Wind Farm

Post construction Monitoring



Archaeological Assessment of Geophysical Data

Final

BARROW OFFSHORE WIND FARM

POST-CONSTRUCTION MONITORING

Archaeological Assessment of Geophysical Data

Final

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December 2007

Ref: 67670.02

BARROW OFFSHORE WIND FARM

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Summary

Wessex Archaeology (WA) was commissioned by DONG Energy A/S on behalf of Barrow Offshore Wind Ltd (BOW) to conduct an archaeological assessment of geophysical data acquired for post-construction monitoring for the Barrow Offshore Wind Farm, Lancashire centred on 480600 E, 5982550 N (WGS84 UTM zone 30N).

WA has previously completed a desk-based assessment of the potential impact of the scheme on the marine archaeological environment prior to its development and an archaeological protocol for the development stage of the wind farm. The previous archaeological works had defined ten exclusion zones: eight within the wind farm area and two on the cable route.

The post-construction monitoring has confirmed that all the recommended exclusion zones appear to have been observed with geophysical anomalies found within all ten exclusion zones.

Two new sites of high archaeological potential have been identified from the review of the post-construction monitoring survey, both of which are located on the cable route. These sites lie within areas of complex geology and may have natural origins.

No sites of high archaeological potential were identified within the navigation route area.

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Acknowledgements

This investigation was commissioned by DONG Energy A/S on behalf of Barrow Offshore Wind and the help of Helle Hegelund Knudsen is gratefully acknowledged. The assistance of Patrick Clark from Osiris Projects in providing the data is also acknowledged.

Dr Paul Baggaley carried out this assessment and compiled this report with help from Cristina Serra. Kitty Brandon prepared the illustrations and the project was managed for Wessex Archaeology by Paul Baggaley.

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1 BACKGROUND

1.1. PROJECT BACKGROUND

- 1.1.1. Wessex Archaeology (WA) was commissioned by DONG Energy A/S on behalf of Barrow Offshore Wind Ltd (BOW) to conduct an assessment based on the results of a geophysical survey of the Barrow Offshore Wind Farm, Lancashire. The main development area lies 21.8 kilometres off the western coast of Lancashire and it is linked to the coast by a cable route that continues in-shore to a point on the southern edge of the town of Heysham (**Figure 1**).
- 1.1.2. WA has previously completed a desk-based assessment of the potential impact of the scheme on the marine archaeological environment prior to its development. This desk-based assessment was completed in 2002 (WA ref. 50372.02).
- 1.1.3. Further to this WA prepared an archaeological protocol for the development stage of the Barrow-in-Furness Offshore Wind Farm, Lancashire. This archaeological assessment was completed in July 2004 and involved the defining of construction exclusion zones (WA ref. 57010.03).
- 1.1.4. A total of 39 anomalies had been identified by WA during the compilation of the Archaeological Protocol in 2004. Thirty of these corresponded to sidescan anomalies and the rest originated from documentary evidence.
- 1.1.5. Then in 2005 WA were commissioned to re-assess the absence or presence of anomalies detected in previous assessments, and to ascertain their position. This was done by reviewing raw sidescan sonar data provided by Osiris Projects. This archaeological assessment was completed in November 2005 and the construction exclusion zones were consequently redefined as a result of this assessment (WA ref. 60090.02).
- 1.1.6. By re-assessing the data a total of eight known sidescan sonar anomalies were re-identified and two new ones detected; their positions were verified and construction exclusion zones assigned to each one.
- 1.1.7. On the basis of the 2005 data assessment 10 exclusion zones were defined. Eight of these exclusion zones were within the wind farm area with the other two on the cable route.

1.1.8. The navigation route was not reviewed in any of the previous assessments conducted by WA.

1.2. AIMS AND OBJECTIVES

1.2.1. The aim of the post-construction archaeological assessment is to demonstrate that the exclusion zones recommended in previous phases of archaeological works have been observed and to determine whether or not any new sites of archaeological potential could be identified from the data.

1.2.2. The objectives of the review of the geophysical data were as follows:

1.2.3. To confirm the presence of previously located marine sites and to comment on their apparent character;

1.2.4. To comment on the effectiveness of the construction exclusion zones suggested during previous phases of archaeological works;

1.2.5. To identify, locate and characterise previously unrecorded sites.

2 METHODOLOGY

2.1. DATA SOURCES

2.1.1. The geophysical data assessed for this report were assessed for quality and were rated as Good using the following criteria:

Data Quality	Description
Good	Data which are clear and unaffected by weather conditions or sea state. The dataset is suitable for the interpretation of standing and partially buried metal wrecks and their character and associated debris field. These data also provide the highest chance of identifying wooden wrecks and debris..
Average	Data which are affected by weather conditions and sea state to a slight or moderate degree. The dataset is suitable for the identification and partial interpretation of standing and partially buried metal wrecks, and the larger elements of their debris fields. Wooden wrecks may be visible in the data, but their identification as such is likely to be difficult.
Variable	This category contains datasets with the quality of individual lines ranging from good to average to below average. The dataset is suitable for the identification of standing and some partially buried metal wrecks. Detailed interpretation of the wrecks and debris field is likely to be problematic. Wooden wrecks are unlikely to be identified.

Table 1: Criteria for assigning Archaeological Potential Rating

2.2. GEOPHYSICAL DATA - TECHNICAL SPECIFICATIONS

- 2.2.1. The geophysical data assessed for this report consisted of sidescan sonar data acquired by Osiris Projects. The survey data were acquired in two phases. The first phase was conducted between 25th September to 3rd November 2006 at which point the survey was postponed due to bad weather. The survey was then completed with a second phase conducted between 4th to 13th April 2007.
- 2.2.2. Osiris Projects used a Geoacoustics SS941D dual frequency sidescan sonar towfish operating at 410kHz with a 75m range setting throughout the initial phase of the survey. The second phase of the survey was conducted using a Klein 3000 sidescan sonar system which operates at 100kHz and 500kHz simultaneously. The sidescan sonar data were recorded digitally as cod files on a Coda DA200.
- 2.2.3. Primary positioning was provided by a CSI vector Sensor differential GPS system which received corrections from the General lighthouse Authority's permanent base station on Point Lynas on Anglesey. This system normally provides sub-metre accuracy and positioning was noted as good throughout the survey.
- 2.2.4. For this survey all positions were expressed as UTM zone 30 co-ordinates (WGS84 spheroid).

2.3. GEOPHYSICAL DATA - PROCESSING

- 2.3.1. The sidescan sonar data were processed by WA using Coda Geosurvey software. This allowed the data to be replayed with various gain settings in order to optimise the quality of the images. The data were initially scanned to give an understanding of the geological nature of the area and were then interpreted for any objects of possible anthropogenic origin: the position and dimensions of any such objects were recorded into a gazetteer and an image of each anomaly acquired.
- 2.3.2. During this stage of the interpretation the sidescan sonar anomalies were ascribed an archaeological flag in order to record the geophysicists' initial assessment of the sidescan sonar anomaly. These flags were ascribed as follows in table 2:

High	Ascribed only where the geophysical anomalies clearly represent a wreck site or were very near to a previously known site.
Medium	Geophysical anomalies with no directly corroborating data but being of a size, shape or amplitude such as to suggest that they possibly relate to archaeological sites or features.
Low	Small, isolated, geophysical anomalies of uncertain origin, which are likely to be 'artefacts' in the data or natural features.
Very Low	Anomalies that are known or are highly likely to be of modern origin, and which are not archaeologically interesting (e.g. moorings, etc)

Table 2: Criteria for assigning Archaeological Potential Rating

- 2.3.3. The form, size and/or extent of anomalies is a guide to its potential. A single small but prominent anomaly may be part of a much more extensive feature that is largely buried. Similarly, a scatter of minor anomalies may define the edges of a buried but intact feature, or it may be all that remains as a result of past impacts from, for example, dredging or fishing. The application of a ratings system is therefore a means of prioritising sites in order to inform further stages of the interpretation process and on its own is not definitive.

3 RESULTS

3.1. INTRODUCTION

- 3.1.1. The results of this assessment are collated and detailed in **Appendix I**. A total of 179 sidescan sonar anomalies were identified in the data and each was rated to provide an archaeological potential as shown in the table below.

Archaeological Potential	Number of Anomalies
High	4
Medium	51
Low	124
Total	179

Table 3: Archaeological Potential Rating

3.2. WIND FARM AREA

- 3.2.1. The data reviewed for this report were similar to that reviewed in previous phases of archaeological assessment in that it showed a general scatter of small anomalies described as debris. A total of 53 sidescan sonar anomalies were identified within the wind farm area (**Figure 2**).
- 3.2.2. All eight of the sites with exclusion zones defined in 2005 were re-identified. The association between the site numbers given in 2005 and the anomalies identified in this report is shown below in table 4.

2005 sites	2007 anomalies
6000	3023, 3092
6001	3131, 3137, 3141
5006	3125
5007	3094, 3143
5008	3127, 3133, 3136
5010	3108
5012	3001, 3134
5013	3002, 3135, 3139

Table 4: Relationship between 2005 sites and 2007 sidescan sonar anomalies

- 3.2.3. Only site **WA6000** was clearly identifiable as a wreck site. The data reviewed for this report suggested that the site had not been impacted by the development of the wind farm. Sidescan sonar anomalies **3023** and **3092** were the only sites of high archaeological potential identified in the wind farm area (**Figure 3**).
- 3.2.4. The remaining 36 sidescan sonar anomalies in the wind farm area were all interpreted as being of medium or low archaeological potential and therefore were not considered to be of significant archaeological potential.
- 3.2.5. Sites **WA1101**, **WA1103** and **WA1104** were all listed as charted obstructions during the desk-based assessment however these sites were not found during the 2005 assessment and could still not be identified during the assessment described in this report.

3.3. CABLE ROUTE AREA

- 3.3.1. A total of 47 sidescan sonar anomalies were identified within the cable route area (**Figure 4**). The route surveyed appears to differ slightly from the area surveyed for the 2005 assessment and so site **5020** does not appear to have been covered by the most recent survey.
- 3.3.2. The association between the site numbers given in 2005 and the anomalies identified in this report is shown below in table 5.

2005 sites	2007 anomalies
5020	3189
6002	3215

Table 5: Relationship between 2005 sites and 2007 sidescan sonar anomalies

- 3.3.3. Of the two sites with exclusion zones defined in 2005, **WA6002** was re-identified and does not appear to have been disturbed.
- 3.3.4. Site **WA5020** was previously identified as a wooden wreck but this could not be confidently discerned from the sidescan sonar data reviewed for this report. An anomaly was found within 100m of site **WA5020**. However it may be that anomaly **3189** is not actually site **WA5020** but an unrelated piece of debris. The cable route appears to have been moved slightly to the north to ensure that this site was not disturbed.

- 3.3.5. Anomalies **3207** and **3214** were both interpreted as being of high archaeological potential and interpreted as being possible wreck sites due to their size and possible evidence of structure (**Figure 5**). However, both anomalies were in areas of complex seafloor sediments and may have a geological origin. Anomaly **3207** covers an area of approximately 20m x 13m while anomaly **3214** is 22m x 20m.
- 3.3.6. The remaining 43 sidescan sonar anomalies along the cable route were all interpreted as being of medium or low archaeological potential and therefore were considered not to be of significant archaeological potential.

3.4. NAVIGATION ROUTE AREA

- 3.4.1. A total of 79 sidescan sonar anomalies were identified within the navigation route area (**Figure 6**). All of these sites were of medium or low archaeological potential and are thought likely to be modern debris.
- 3.4.2. There has been no archaeological assessment of the navigation route area and therefore no exclusion zones or desk-based information exists with which to compare the sidescan sonar anomalies identified during this assessment.

4 POST-CONSTRUCTION ASSESSMENT

4.1. INTRODUCTION

- 4.1.1. The report has assessed sidescan sonar data for archaeological anomalies and compared the results against previous phases of archaeological works for the Barrow offshore windfarm development
- 4.1.2. The 2007 data reviewed for this report has found geophysical anomalies within all ten of the construction exclusion zones previously recommended by WA. This confirms the need for the exclusions zones and also suggests that they have been effective in protecting sites of potential archaeological importance.
- 4.1.3. Only two new sites of high archaeological potential have been identified from the review of the post-construction monitoring survey, both of which are located on the cable route. These sites lie within areas of complex geology and may have natural origins.
- 4.1.4. No sites of high archaeological potential were identified within the navigation route area.

5 REFERENCES

Wessex Archaeology, 2002, Barrow-in-Furness Offshore Wind Farm Environmental Assessment Technical Report: Archaeology, Unpublished report ref: 50372.02.

Wessex Archaeology, 2004, Barrow-in-Furness Offshore Wind Farm Archaeological Protocol, Unpublished report ref: 57010.03.

Wessex Archaeology, 2005, Barrow-in-Furness Offshore Wind Farm Pre-construction monitoring: Preliminary review of additional geophysical results, Unpublished report ref: 60090.02.

6 APPENDIX I: SIDESCAN SONAR ANOMALIES

WA ID	Anomaly Type	Easting	Northing	Length (m)	Width (m)	Height (m)	Description	Archaeological Potential
3001	Object with shadow	479347	5982803	3.2	2.5	0.4	Debris	Low
3002	Object with shadow	479377	5982819	5.5	4.2	0.4	Debris	Medium
3004	Object	478968	5983311	4.6	1	0	Dark reflector: Elongated object	Low
3005	Object	479045	5983271	3.2	3.1	0	Dark reflector: Object with scour but no shadow	Low
3006	Object	478993	5983337	2.7	1.5	0	Dark reflector	Low
3007	Object with shadow	479247	5983690	2.8	1.8	0.2	Debris	Low
3008	Object with shadow	480181	5982245	11.7	7	0.2	Patch of debris	Medium
3010	Object	481250	5981217	7.4	0.5	0	Dark reflector	Medium
3023	Object	481030	5982838	21.5	12.1	0	Wreck: Elongated patch of dark reflectors	High
3024	Object	480966	5982908	3.8	3.3	0	Dark reflector: Angular object	Low
3033	Object	481198	5982812	3.3	1.5	0	Dark reflector	Low
3038	Object with shadow	478155	5983250	1.9	1.3	0.9	Debris	Low
3039	Object	478249	5983214	2.5	0.3	0	Dark reflector: Object in a patch of darker seafloor	Low
3040	Object	480941	5980736	4	1.2	0	Dark reflector: Elongated object by turbine	Low
3041	Object with shadow	481650	5981762	2.2	2.2	1.2	Debris	Low
3073	Object	479940	5983558	3.8	2.4	0	Dark reflector: Elongated object	Low
3074	Object	479937	5983562	4.5	1.9	0	Dark reflector: Elongated object	Low
3075	Object	479926	5983568	5.4	1.4	0	Dark reflector	Medium
3076	Object with shadow	479572	5983641	6	3.2	0.3	Debris	Medium
3092	Object with shadow	481034	5982836	22.5	8.1	0.3	Wreck: Elongated patch of dark reflectors and debris with linear and angular features	High
3093	Object	481029	5982820	2.2	1.5	0	Dark reflector: Debris associated with nearby seafloor disturbance. Object with scour	Medium
3094	Object with shadow	481459	5981358	4.7	1.3	0.4	Debris	Low
3095	Object	480288	5982367	10.2	17	0	Debris: Patch of debris	Medium
3108	Object with shadow	482208	5982710	2.9	2.3	0.7	Debris	Low
3108	Object with shadow	482208	5982710	2.9	2.3	0.7	Debris	Low
3114	Object with shadow	481350	5981504	8.6	4.6	0.9	Debris	Medium
3115	Object with shadow	480998	5982168	6.4	6.1	0.4	Debris	Medium

WA ID	Anomaly Type	Easting	Northing	Length (m)	Width (m)	Height (m)	Description	Archaeological Potential
3123	Object with shadow	480576	5982685	4.2	2.1	0.2	Debris	Low
3125	Object	478608	5983102	22.5	4.8	0	Dark reflector	Medium
3126	Object with shadow	480267	5981934	3.2	1.5	0.3	Debris	Low
3127	Object with shadow	479915	5982206	3	2.5	0.4	Debris	Low
3129	Object with shadow	478594	5983110	3.4	0.9	0.4	Debris	Low
3130	Object	478714	5982974	8	2.4	0	Dark reflector	Medium
3131	Object with shadow	481151	5981175	3	2	0.4	Debris	Low
3133	Object with shadow	479909	5982213	3.4	1.4	0.2	Debris	Low
3134	Object with shadow	479340	5982804	3	0.9	0.5	Debris	Low
3135	Object	479369	5982819	7.2	1.6	0	Dark reflector	Medium
3136	Object with shadow	479910	5982219	1.8	1.2	0.5	Debris	Low
3137	Object with shadow	481160	5981176	2.2	0.9	0.4	Debris: block and linear feature	Low
3138	Object	481008	5981678	3.4	1.7	0	Dark reflector	Low
3139	Object with shadow	479373	5982810	3.9	1.1	0.3	Debris	Low
3140	Object	479870	5982364	11.4	2.3	0	Dark reflector	Medium
3141	Object with shadow	481159	5981169	4	0.6	0.3	Debris	Low
3143	Object with shadow	481457	5981362	2.6	1.4	0.5	Debris	Low
3145	Object with shadow	481897	5981385	9.5	1.5	0.6	Debris	Medium
3146	Object with shadow	481641	5981770	7	3.5	1.4	Debris	Medium
3159	Object	479596	5984390	3.8	1.6	0	Dark reflector	Low
3163	Object with shadow	480176	5984308	6.1	2.3	0.3	Debris	Medium
3164	Object	480062	5984356	5.4	5	0	Seafloor disturbance: Debris	Medium
3165	Object	480078	5984354	3.4	1.2	0	Debris	Low
3166	Object with shadow	480720	5983836	2.4	1	0.2		Low
3167	Object	480002	5984613	5.6	5.2	0	Dark reflector: debris	Medium
3168	Object	479983	5984595	2.6	2.2	0	Dark reflector: debris	Low
3169	Object	483985	5981797	8.9	5.6	0	Dark reflector: curved feature possibly partially buried	Medium
3170	Object	485205	5981573	7.8	2.5	0	Dark reflector: linear object	Medium
3179	Object with shadow	488668	5980608	2.7	0.8	0.5	Debris	Low
3180	Object with shadow	488675	5980578	8.9	0.9	0.7	Debris	Medium
3182	Object with shadow	491087	5979682	3.1	0.8	0.4	Debris	Low

WA ID	Anomaly Type	Easting	Northing	Length (m)	Width (m)	Height (m)	Description	Archaeological Potential
3183	Object	493831	5979146	1.8	1.5	0	Dark reflector: circular object	Low
3184	Object	494248	5979200	2.1	0.7	0	Dark reflector: object in sand waves	Low
3185	Object	494402	5979289	2.1	1.6	0	Bright reflector: object in sand waves	Low
3186	Object	495477	5979769	2.3	0.8	0	Debris: object in sand waves	Low
3187	Object	495977	5979938	1.2	1.4	0	Dark reflector: square object	Low
3188	Object	496548	5980292	5.4	0.8	0	Dark reflector: linear object	Medium
3189	Object with shadow	496670	5980219	4.6	0.5	0.2	Debris: linear object	Low
3190	Object with shadow	497323	5980388	4.5	0.5	0.3	Debris: linear object	Low
3191	Object with shadow	499453	5981225	4.4	0.4	0.3	Debris: linear object	Low
3192	Object with shadow	499946	5981726	8.3	7.5	1.4	Debris: possible wreck	Medium
3193	Object	501910	5983584	10.7	0.8	0	Debris: linear object	Medium
3194	Object	500932	5982934	5.5	2.2	0	Dark reflector	Medium
3195	Object with shadow	500927	5982888	3.9	1.3	0.3	Debris: possibly with small scour	Low
3196	Object with shadow	500848	5982827	9.2	1.8	1	Debris	Medium
3197	Object with shadow	500858	5982763	42.3	1.3	0.5	Debris: large linear object	Medium
3198	Object with shadow	492770	5979230	1.2	0.7	0.4	Debris	Low
3199	Object with shadow	493100	5979207	1.9	1.1	0.5	Debris	Low
3200	Object with shadow	493101	5979230	1.2	0.4	0.5	Debris	Low
3201	Object with shadow	493123	5979226	0.9	0.3	0.6	Debris	Low
3202	Object with shadow	493126	5979238	1.2	0.4	0.2	Debris	Low
3203	Object	494171	5979254	3	0.9	0	Debris: hard reflector lying in sandwaves	Low
3204	Object with shadow	495064	5979616	2.8	0.7	0.6	Debris: object in sandwaves	Low
3205	Object	495223	5979695	20.7	3.9	0	Dark reflector: object lying partially buried in sand waves	Medium
3206	Object	496532	5980283	3	1.6	0	Dark reflector: object with scour	Low
3207	Object	499359	5981240	19.9	13.5	0	Possible wreck in area of complex geology	High
3208	Object	499903	5981720	6.8	1.2	0	Bright reflector: linear object	Medium
3209	Object with shadow	499950	5981727	6.3	7.3	1.2	Seafloor disturbance: large object but little sign of structure	Medium
3210	Object with shadow	499915	5981803	7.3	1.5	0.3	Debris	Medium
3211	Object	502238	5983873	7.6	2.4	0	Dark reflector: linear	Medium
3212	Object with shadow	500860	5982828	3.1	1.4	1	Debris: partially buried object with structure	Medium

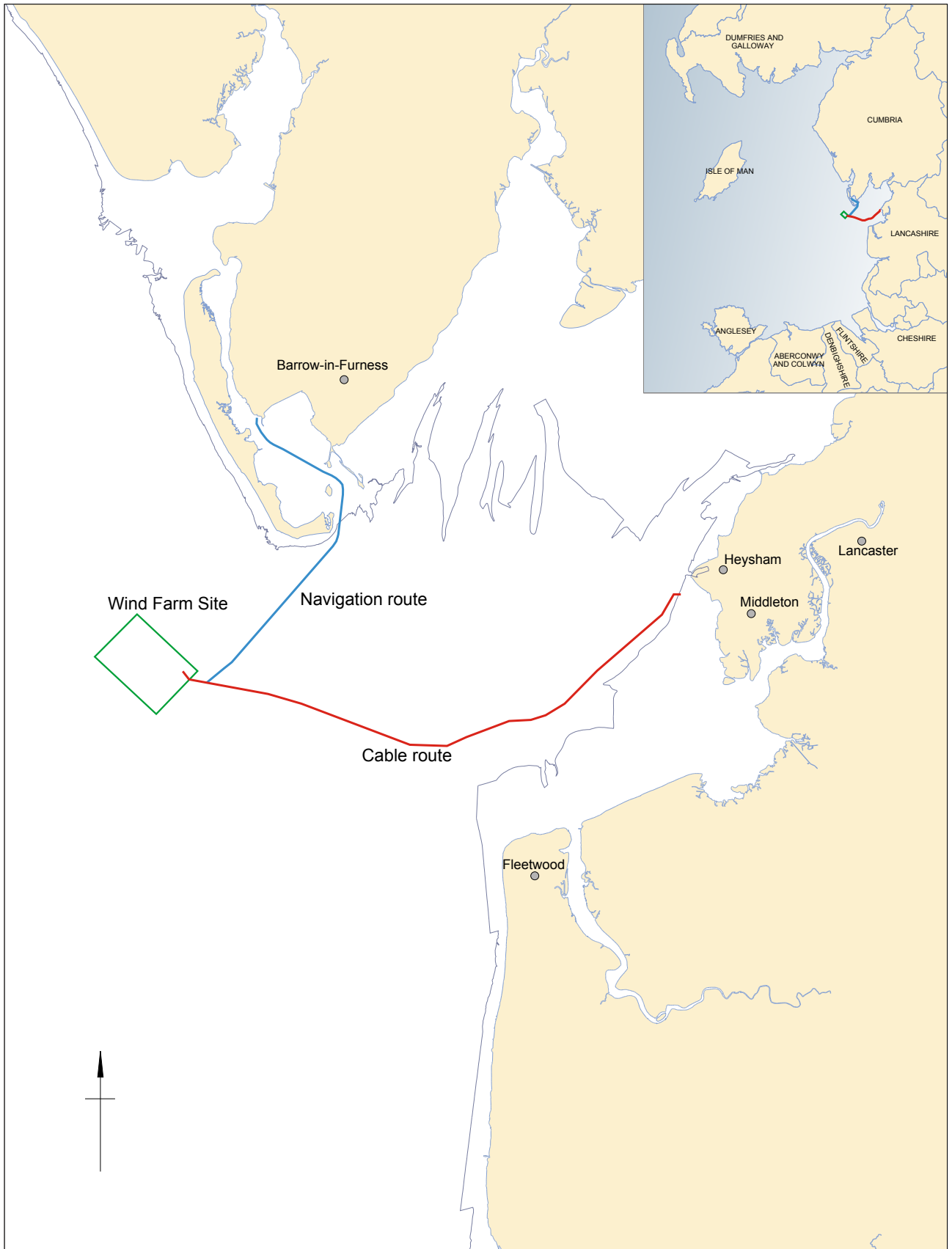
WA ID	Anomaly Type	Easting	Northing	Length (m)	Width (m)	Height (m)	Description	Archaeological Potential
3213	Object	500665	5982685	25.8	11.6	0	Seafloor disturbance: rope attached/snagged	Medium
3214	Object	499349	5981242	22.4	20.1	0	Wreck: large dark reflector with some signs of structure	High
3215	Object with shadow	487364	5981059	2.8	1.9	0.4	Dark reflector: square object	Low
3216	Object with shadow	482176	5982364	2.7	2.1	0.7	Debris: rectilinear object, with smaller items nearby	Low
3217	Object with shadow	494078	5979232	2.2	0.6	0.3	Debris: object in sandwaves	Low
3218	Object	490081	5980148	2.8	0.4	0	Debris: linear object	Low
3219	Object	502235	5983873	13.7	3.7	0	Debris: linear dark and bright reflectors	Medium
3220	Object	503924	5985882	8.7	3.7	0	Dark reflector	Medium
3221	Object	503087	5984776	7	7	0	Debris: bright linear reflectors	Medium
3222	Object	502300	5984075	5	0.7	0	Debris: linear object	Medium
3223	Object with shadow	502162	5984046	0.2	0.6	0.1	Debris: rope attached. may be bouy mooring	Low
3224	Object	502205	5983865	2.9	0.9	0	Debris: linear dark and bright reflectors	Medium
3500	Object with height	485031	5983785	4.2	2.3	1.1	Debris	Low
3501	Object with height	485031	5983784	4.7	2.6	0.3	Debris	Low
3502	Object	484977	5983766	3.6	2.2	0	Dark reflector	Low
3506	Object with height	485497	5984491	3.5	1	1.3	Debris	Low
3507	Object	484765	5983634	4.1	1.6	0	Dark reflector	Low
3508	Object	484680	5983554	3.6	2.2	0	Dark reflector: Debris	Low
3509	Object with height	484767	5983488	1.9	1.6	0.3	Debris	Low
3511	Object with height	484547	5983362	3.2	0.9	0.3	Debris	Low
3512	Object	484414	5983253	6	2.8	0	Dark reflector: Debris	Medium
3513	Object with height	487360	5986557	10	1.4	0.4	Debris	Medium
3514	Object with height	486265	5985151	2.7	1.3	0.7	Debris	Low
3515	Object with height	484736	5983346	16.7	1	0.5	Debris: Linear and slightly curved feature	Medium
3516	Linear	484533	5983203	23.9	0.2	0	Debris: Linear and curved feature	Medium
3517	Object with height	483669	5982305	4.5	2.5	0.2	Debris	Low
3522	Object with height	483783	5982545	3.6	1.4	0.3	Debris	Low
3525	Object	483795	5982410	4.9	2.1	0	Dark reflector	Low
3528	Object with height	484920	5983618	2.8	1.3	0.6	Debris	Low
3529	Object with height	483312	5982010	3.4	2.9	0.4	Debris	Low

WA ID	Anomaly Type	Easting	Northing	Length (m)	Width (m)	Height (m)	Description	Archaeological Potential
3530	Object with height	483273	5982026	2.6	0.9	0.2	Debris	Low
3532	Object with height	483670	5982309	4.1	1.2	0.3	Debris: Group of objects	Low
3535	Object with height	483982	5982513	2.1	0.9	0.6	Debris	Low
3536	Object with height	484008	5982494	3.5	1.9	0.2	Debris: Angular object	Low
3537	Object with height	484012	5982481	3.1	0.9	0.2	Debris	Low
3538	Object with height	484009	5982487	2.8	0.7	0.2	Debris	Low
3539	Object	484615	5983088	3.7	2.1	0	Dark reflector: Debris	Low
3542	Object	484751	5983398	13.2	1.4	0	Dark reflector: Broad linear object	Medium
3543	Object	484739	5983351	19.2	0.9	0	Dark reflector: Broad linear object	Medium
3544	Object	484782	5983312	6.2	1.5	0	Dark reflector: Row of small objects	Medium
3546	Object	485269	5984001	8.4	3.3	0	Dark reflector: Elongated object	Medium
3547	Object	485281	5983998	1.9	1.1	0	Dark reflector: Associated with object id 3546	Medium
3551	Object	485913	5984587	7.6	1.5	0	Dark reflector: Linear object	Medium
3560	Object	483788	5982397	6.1	1.1	0	Dark reflector: Debris	Medium
3567	Object with height	485269	5984039	3.9	1.3	0.5	Debris	Low
3568	Object with height	485231	5983996	4.3	1.2	0.4	Debris	Low
3569	Object with height	484917	5983618	4.6	1.8	0.4	Debris	Low
3570	Object with height	485157	5983963	5.9	0.8	0.2	Debris	Medium
3571	Object with height	485380	5984168	2.8	1.4	0.7	Debris	Low
3572	Object with height	485421	5984223	3.7	0.8	0.7	Debris	Low
3573	Object with height	485430	5984201	4.6	0.9	0.3	Debris	Low
3576	Object	487075	5986159	3.8	1.8	0	Dark reflector	Low
3577	Object	487310	5986396	4.9	3.6	0	Dark reflector	Low
3578	Object	487336	5986441	3.3	1.1	0	Dark reflector	Low
3579	Object	485234	5993809	8.5	4	0	Bright reflector	Medium
3580	Object	485187	5993786	1.2	1.1	0	Dark reflector	Low
3588	Object with height	488647	5991280	7.8	0.6	2	Debris	Medium
3589	Object	488894	5991050	2.5	1.4	0	Dark reflector	Low
3590	Object with height	489060	5990996	1.3	0.5	0.3	Debris	Low
3591	Object with height	489086	5990970	1.3	0.8	0.3	Debris	Low
3592	Object	489162	5990718	5.4	5.2	0	Dark reflector: Patch of small objects	Medium
3593	Object	489076	5989376	2.6	2.6	0	Dark reflector	Low

WA ID	Anomaly Type	Easting	Northing	Length (m)	Width (m)	Height (m)	Description	Archaeological Potential
3594	Object	489050	5989379	2.7	1.9	0	Bright reflector	Low
3595	Object	488721	5988225	3.6	3.1	0	Bright reflector	Low
3596	Object	487361	5986555	5.1	3.8	0	Dark reflector	Medium
3597	Object with height	487092	5986318	2.5	0.6	0.5	Debris	Low
3599	Object	486608	5985674	2.4	0.5	0	Dark reflector: Angular object	Low
3600	Object	486227	5985269	12.4	9.3	0	Seafloor disturbance :Patch of material	Medium
3601	Object with height	486241	5985273	1.9	0.6	0.4	Debris	Low
3602	Object	486239	5985267	5.3	1.5	0	Dark reflector	Medium
3603	Object with height	486177	5985265	1.3	1	1.1	Debris	Low
3604	Object with height	486178	5985254	1.6	0.7	0.9	Debris	Low
3605	Object	486000	5984684	4.4	3.2	0	Dark reflector	Low
3606	Object	486209	5985067	2.5	1.8	0	Dark reflector	Low
3607	Object	486178	5985030	10.6	0.9	0	Dark reflector: Row of three objects	Medium
3608	Object	486160	5985020	1.8	1.3	0	Dark reflector	Low
3609	Object	486170	5985021	0.9	0.8	0	Dark reflector	Low
3610	Object	486264	5985152	4.2	4	0	Dark reflector	Low
3611	Object with height	487108	5986146	1.6	1.1	0.3	Debris	Low
3612	Object with height	487123	5986156	3.3	1.6	0.4	Debris	Low
3620	Object	487799	5991902	3.1	2.1	0	Bright reflector	Low
3623	Object	486595	5992593	3.3	2.6	0	Dark reflector	Low
3626	Object	489243	5990470	4.8	4.1	0	Bright reflector	Low
3627	Object	489145	5989295	4.3	1.7	0	Bright reflector: Angular object	Medium
3628	Object	489127	5989205	2.6	0.7	0	Bright reflector	Low
3629	Object	489125	5989198	5.8	1.1	0	Bright reflector	Medium
3631	Object	489128	5989203	12.3	2.9	0	Bright reflector	Medium
3632	Object	489224	5990634	10.4	7.7	0	Bright reflector	Medium
3633	Object	489193	5990632	9.5	7.2	0	Dark reflector	Medium
3634	Object	487101	5992077	4.7	4.6	0	Dark reflector	Low
3635	Object	485509	5993139	9.7	3.2	0	Dark reflector	Medium

Co-ordinates are in UTM zone 30, WGS84

Positional accuracy estimated $\pm 10\text{m}$



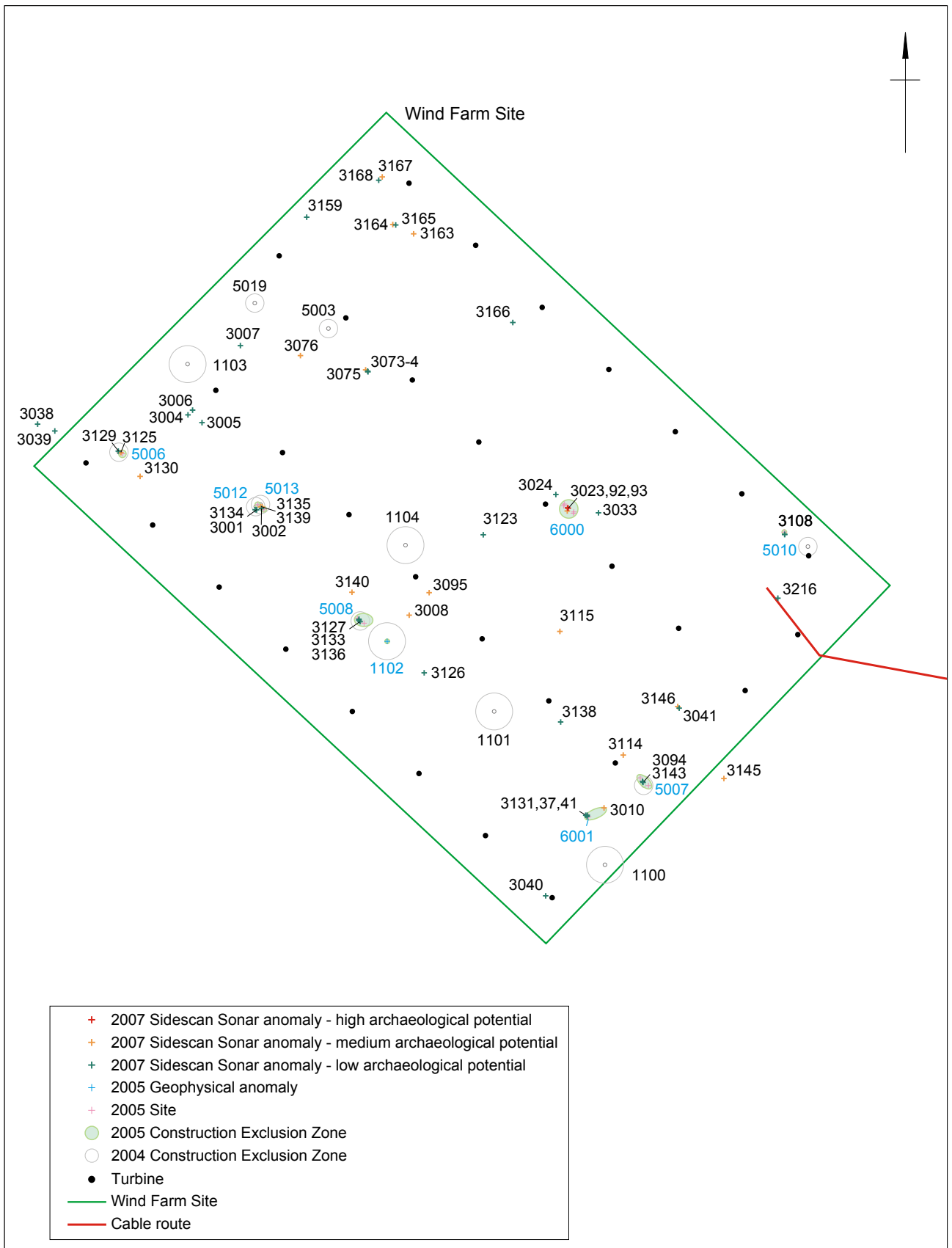
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Site location plan

Figure 1



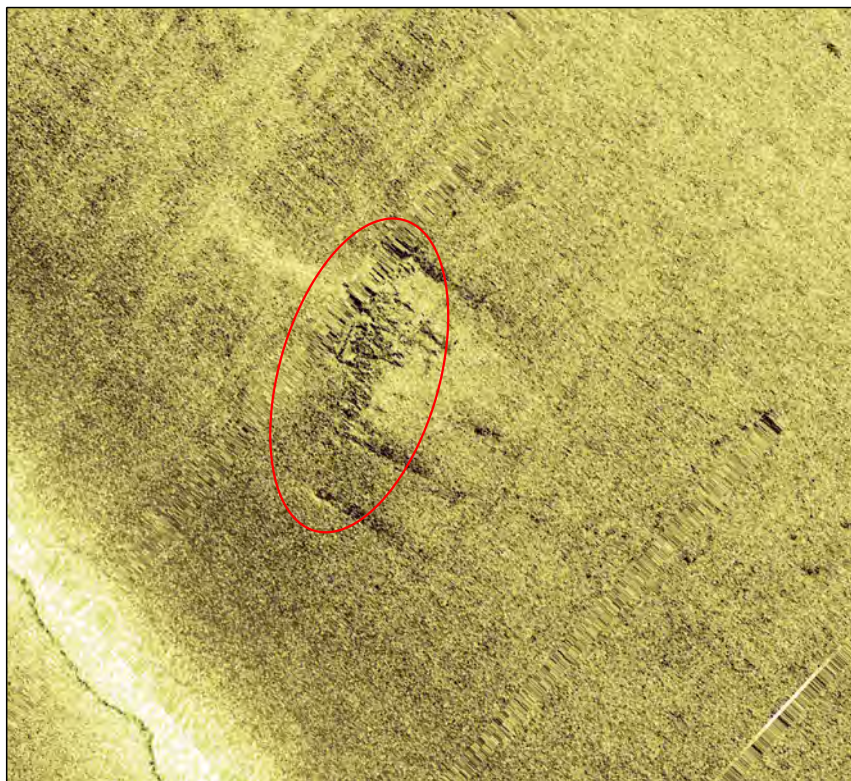
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Construction Exclusion Zones and Sidescan Sonar Anomalies within the Wind Farm Area

Figure 2



Sidescan sonar anomaly 3023: Wreck identified as an elongated patch of dark reflectors (21.5m x 12.1m)



Sidescan sonar anomaly 3092: Wreck identified as a sea floor disturbance with linear and angular objects (22.5m x 8.1m x 0.3)

0 50m

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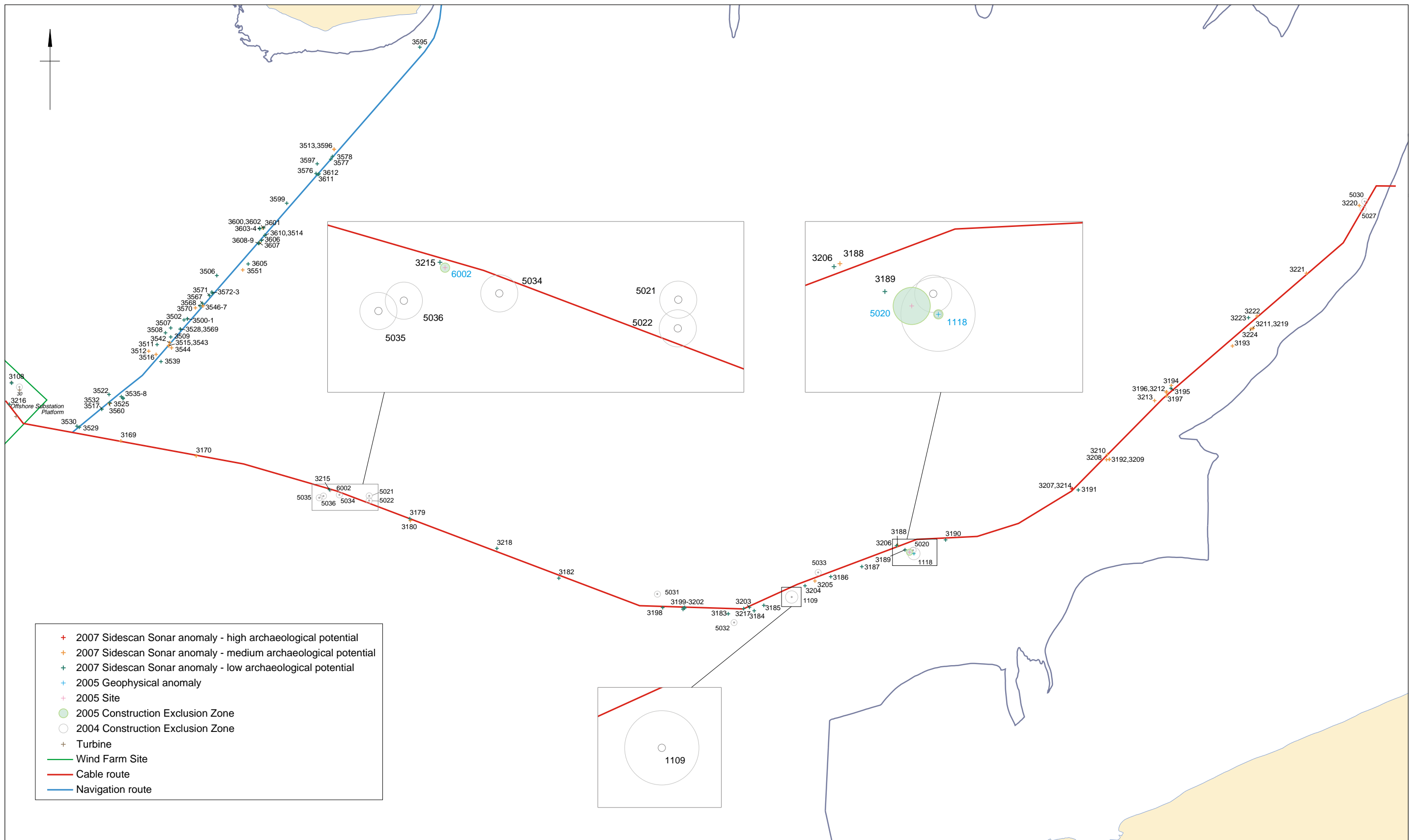
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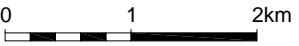
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- + 2007 Sidescan Sonar anomaly - high archaeological potential
- + 2007 Sidescan Sonar anomaly - medium archaeological potential
- + 2007 Sidescan Sonar anomaly - low archaeological potential
- + 2005 Geophysical anomaly
- + 2005 Site
- 2005 Construction Exclusion Zone
- 2004 Construction Exclusion Zone
- + Turbine
- Wind Farm Site
- Cable route
- Navigation route

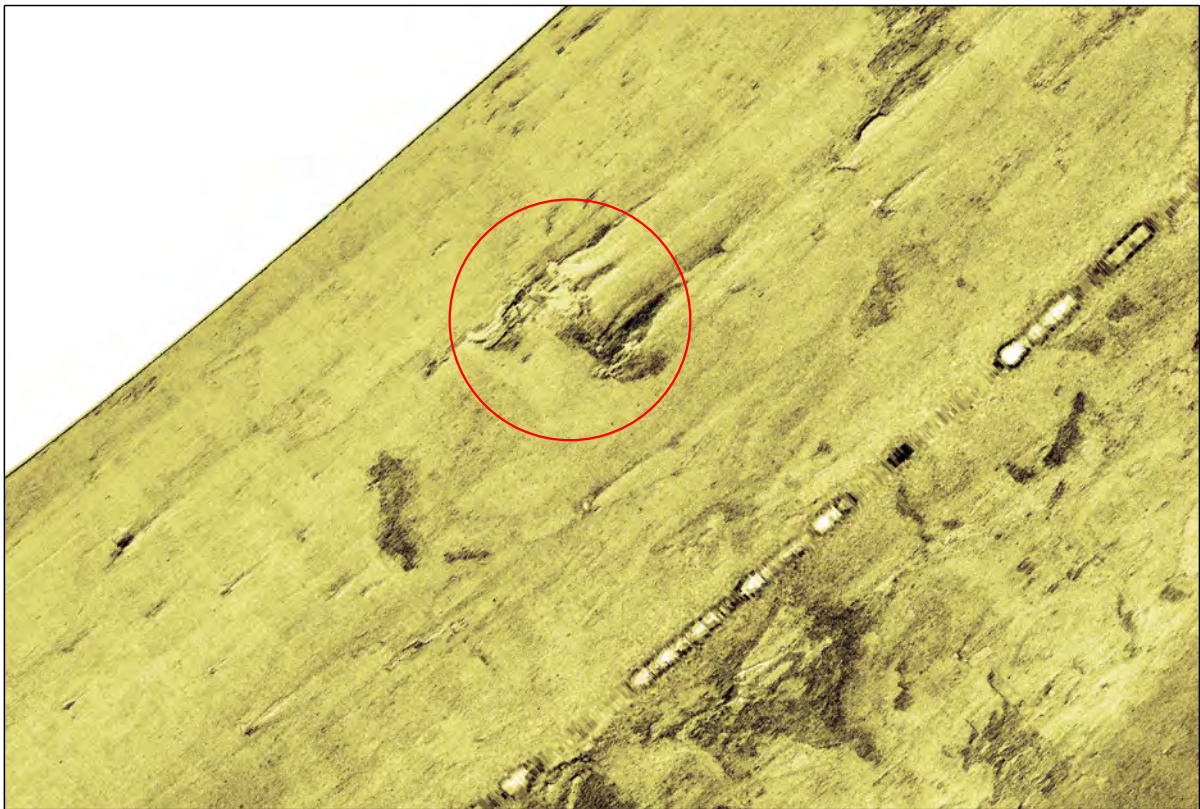


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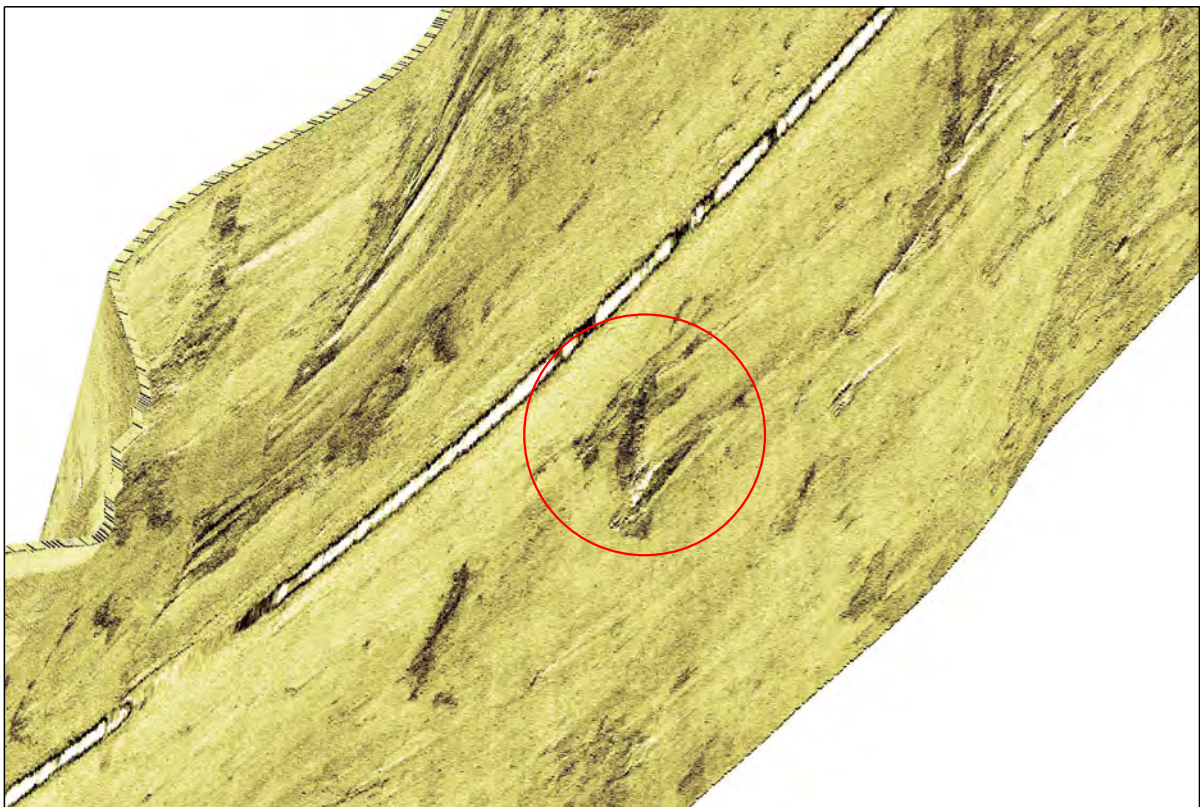
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Construction Exclusion Zones and Sidescan Sonar Anomalies along the line of the Marine Cable Route

Figure 4



Sidescan sonar anomaly 3207: Wreck identified in an area of complex geology (19.9m x 13.5m)



Sidescan sonar anomaly 3214: Wreck identified as a large dark reflector with some signs of structure (22.4m x 20.1m)

0 50m



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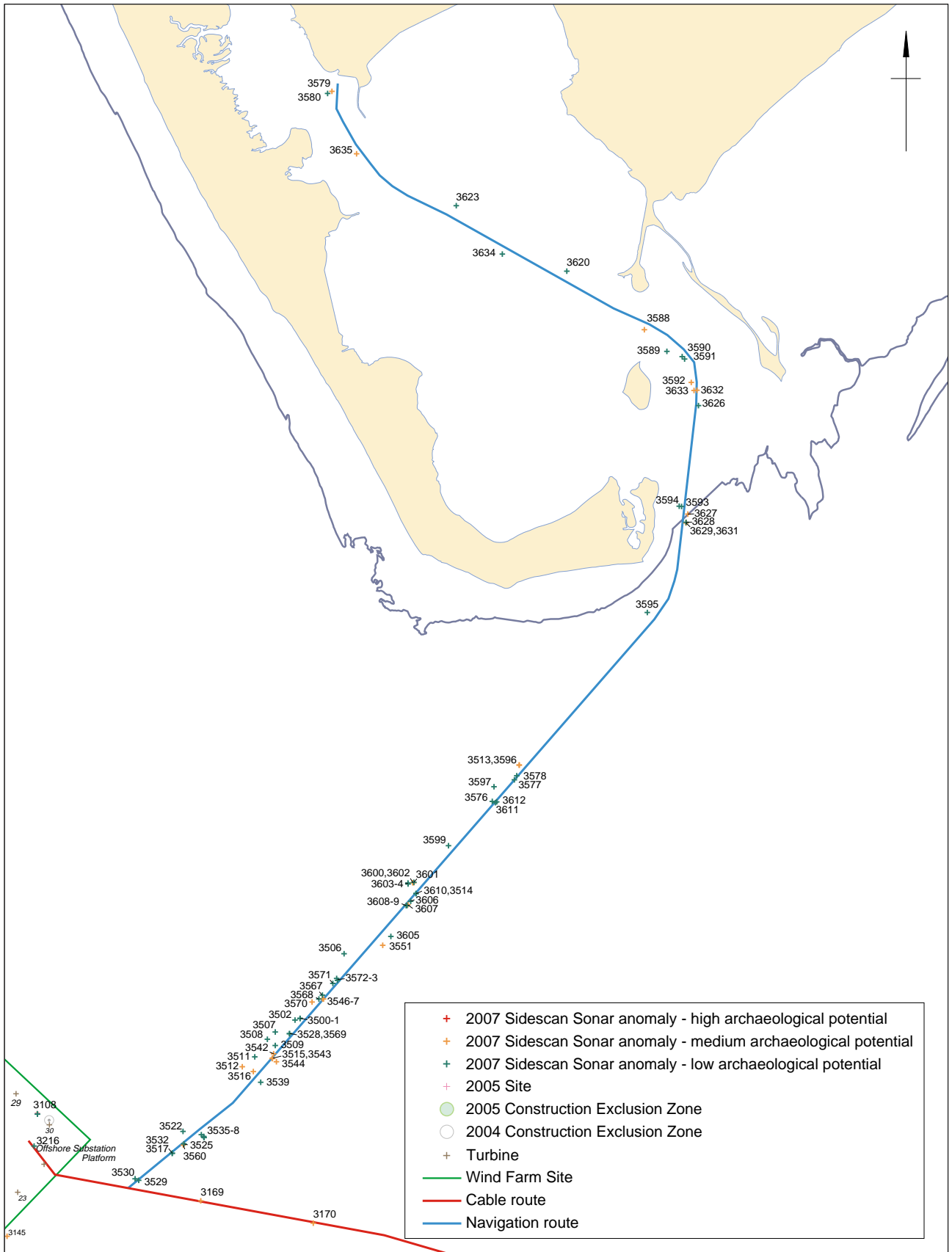
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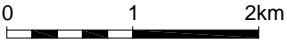

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Sidescan Sonar Anomalies identified along the line of the Navigation Route

Figure 6



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