



St Mary's Harbour Geophysical Survey

**Archaeological Assessment of Sidescan Sonar
& Sub-Bottom Profiling Survey**



**ST MARY'S HARBOUR GEOPHYSICAL SURVEY
ARCHAEOLOGICAL ASSESSMENT**

**ARCHAEOLOGICAL ASSESSMENT OF SIDESCAN SONAR AND
SUB-BOTTOM PROFILING SURVEYS**

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ST MARY'S HARBOUR GEOPHYSICAL SURVEY ARCHAEOLOGICAL ASSESSMENT

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SUMMARY

Wessex Archaeology (WA) was commissioned by Scott Wilson Ltd to undertake an archaeological assessment of geophysical survey data prior to the extension of the quay at Saint Mary's Harbour. The geophysical data was comprised of sidescan sonar, sub-bottom profiler and single beam echosounder data and was reviewed in order to determine the archaeological potential of the survey area.

The survey data was acquired between the 30th October and the 1st November 2004 from the survey vessel *MV Enterprise* by Titan Environmental Surveys Ltd. The survey area was located around the quay at St Mary's Harbour near Rat Island in the Isles of Scilly. The survey area was rectangular, 500m long and 600m wide orientated N-S between 89900E, 11200N and 90500E, 10700N (OSGB).

On the basis of the geophysical data, the marine archaeological potential of the survey area can be summarised as follows:

- Fifteen sidescan sonar anomalies (**WA3001** to **WA3015**), all of which were considered to be of low archaeological potential;
- Four of the sidescan sonar anomalies (**WA3006**, **WA3007**, **WA3014** and **WA3015**) are of apparent anthropogenic origin and should be investigated by an archaeological diving inspection prior to the development;
- Two sidescan sonar anomalies (**WA3008** and **WA3009**) which are also within the proposed development and may be posts or some other anthropogenic structure;
- The near surface geology of the area was composed of granite bedrock overlain by a thin layer of soft sediment which appears to contain no peat horizons or any other features of archaeological potential.

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Titan Environmental Surveys Ltd acquired the geophysical survey data and we are grateful for the assistance of Nick Cramp and Euan McNeil with viewing the data.

Dr Paul Baggaley carried out the archaeological assessment and evaluation of the geophysical survey data and compiled this report. Karen Nichols prepared the illustrations and the project was managed for Wessex Archaeology by Paul Baggaley.

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1. INTRODUCTION

- 1.1.1. Wessex Archaeology (WA) was commissioned by Scott Wilson Ltd to undertake an archaeological assessment of geophysical survey data, in order to assess the archaeological potential of an area around the quay in St Mary's harbour, prior to the extension of the quay. The geophysical survey was undertaken by Titan Environmental Surveys Ltd between the 30th October and the 1st November 2004.
- 1.1.2. This report deals specifically with an assessment of potential archaeological sites as indicated by sidescan sonar and sub-bottom profile data collected for the survey area.
- 1.1.3. The survey area was located around the quay at St Mary's Harbour near Rat Island in the Isles of Scilly (**Figure 1**).

2. AIMS AND OBJECTIVES

- 2.1.1. The aim of the study is to provide an archaeological interpretation of geophysical data over the area of seabed which will be directly affected by the proposed development.
- 2.1.2. The objectives of the study are:
 - To assess high resolution sidescan sonar, sub-bottom profiles and single beam bathymetric data;
 - To interpret the data in order to identify, locate and characterise any marine sites of archaeological potential;
 - To comment on the archaeological character and importance of identified sites.

3. METHODOLOGY

3.1. INTRODUCTION

- 3.1.1. The survey area was rectangular, 500m long and 600m wide as defined by the co-ordinates below:

Table 1: Outline of main survey area

Point	Easting (m)	Northing (m)
NE	90500	11200
NW	89900	11200
SE	90500	10700
SW	89900	10700
<i>Datum: OSGB36 Projection: National Grid</i>		

3.1.2. Two geophysical surveys were conducted as part of this project:

- a sidescan sonar survey;
- a sub-bottom profiler survey.

3.1.3. A single beam echosounder was operated during both geophysical surveys. The surveys were carried out by Titan Environmental Surveys Ltd aboard the survey vessel *MV Enterprise* between the 30th October and the 1st November 2004.

3.2. TECHNICAL SPECIFICATIONS

3.2.1. The sidescan sonar data were collected using an Edgetech DF1000 sidescan sonar towfish. This is a high frequency sidescan sonar system and was operated at 309 kHz on a 50m range. Sidescan sonar survey lines were orientated N-S along the length of the survey area with a 45m line spacing except within the area of the small craft moorings where the line spacing was up to 80m due to obstructions.

3.2.2. The sub-bottom profiler data were collected using an Applied Acoustic surface towed boomer. This boomer seismic source operates at around 1 kHz and provides a high level of penetration into the underlying geology. Survey lines were run concurrently with the sidescan sonar with a 45 metre line spacing.

3.2.3. The single beam echosounder data were collected using an Odom Hydrotrac echosounder. This system was calibrated by means of a bar check before operation. The echosounder was operated concurrently with the other geophysical surveys.

3.2.4. Tidal data was obtained from the using Post Processed Kinematic GPS data from the vessel. This was used to reduce the bathymetry data to the vertical reference datum which was then used to reference the sub-bottom profiler data.

3.2.5. Navigation data for all the surveys was supplied through a Differential Global Positioning System (DGPS) receiver integrated with Trimble HydroPro survey and navigation software. This system operates to a horizontal precision of ± 2 metres.

3.2.6. All the horizontal co-ordinates of the survey were presented in the Ordnance Survey of Great Britain 1936 datum (OSGB36). Chart Datum (CD), which is 2.91m below Ordnance Datum, has been used as the vertical reference frame for this survey.

3.3. DATA PROCESSING AND ANOMALY CHARACTERISATION

3.3.1. The raw bathymetric data were processed by Titan Environmental Surveys Ltd. and this data set provided a vertical reference for the geophysical data.

3.3.2. As the sidescan sonar data was not available in a standard digital format the paper records produced during the survey were reviewed and interpreted by WA staff at the offices of Titan Environmental Surveys Ltd. The data were interpreted for any objects of possible anthropogenic origin; the position and dimensions of any such objects were recorded.

3.3.3. As the sub-bottom profile data was not available in a standard digital format the paper records produced during the survey were reviewed and interpreted by WA staff at the offices of Titan Environmental Surveys Ltd. The data were interpreted by delineating any strong boundaries between different geological layers or features such as palaeo-channels or peat horizons.

3.3.4. Sites of archaeological potential were rated according to their proximity to known wreck sites, extent and character.

3.3.5. Ratings were ascribed as follows:

Table 2: Criteria for Archaeological Potential Rating

High	Ascribed only where the geophysical anomalies appeared to be a wreck site or was near a known wreck site.
Medium	Geophysical anomalies with no directly corroborating data but being of a significant size, shape or amplitude to suggest possible archaeological potential.
Low	Small, isolated, geophysical anomalies of unclear origin.
Very Low	Ascribed to geophysical anomalies interpreted as likely to be modern debris or mooring points.

3.3.6. During the initial phase of data analysis fifteen sidescan sonar anomalies were identified.

3.3.7. It should be emphasised that the identification of a features on the basis of a sidescan sonar or sub-bottom profile survey does not imply that the features is necessarily of archaeological interest. Many of the features so identified may prove to be of modern origin, or to be – for example – geological exposures, features attributable to sediment movement or scars from anchoring or dredging.

3.3.8. The form, size and/or extent of anomalies need not enable easy discrimination; a single small but prominent anomaly may comprise all that is present, or it 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 only a means of prioritising sites in order to inform any subsequent investigations; it does not constitute a definitive interpretation.

4. RESULTS

- 4.1.1. The depth of seabed within the survey area ranged from 3.2m above CD south of Rat Island to 7.4m below CD in the north-west of the survey area.
- 4.1.2. The sidescan sonar data was mosaiced by Titan Environmental Surveys Ltd to produce a single sidescan sonar image for the survey area with the principle aim of showing they had achieved complete coverage for the area. However due to intermittent noise in the sidescan sonar data set there were a few small areas which do not appear to have been ensonified.
- 4.1.3. As outlined above (3.3.5 - 3.3.8) the sidescan sonar anomalies were assessed to produce a list of fifteen features within the survey area (**WA3001** to **WA3015**) with levels of archaeological interest. The resulting list is set out in **Appendix I** and their distribution is illustrated in **Figure 2**.
- 4.1.4. The list in **Appendix I** includes the rating ascribed to the possible archaeological potential of each feature. The features have been rated as follows:

Table 3: Archaeological Potential Rating of sidescan sonar features within the survey area

Archaeological Potential	Number within Survey Area
High	0
Medium	0
Low	15
Very Low	0

- 4.1.5. The sub-bottom profiles showed that the geology of the area consisted of bedrock characterised by sub-horizontal, linear reflectors overlain by a layer of sediment. There were no buried palaeo-channels or other features of archaeological interest in the sub-bottom data.
- 4.1.6. Features which are small, isolated anomalies, the origin of which can not be confidently identified have been considered to have low archaeological potential. Some of these features may be geological in origin.
- 4.1.7. All the features identified by the sidescan sonar survey (**WA3001** to **WA3015**) were considered to be in of low archaeological potential as they were not clearly identifiable as being of modern origin, nor were the anomalies of sufficient size, or located near any known wreck sites, to be considered of higher importance.

- 4.1.8. Four of the fifteen sidescan sonar anomalies (**WA3006, WA3007, WA3014** and **WA3015**) were located in a group to the north west of the quay (**Figure 3**). These objects are of apparent anthropogenic origin but it was not possible to conclusively identify them from the geophysics data.
- 4.1.9. A further two sidescan sonar anomalies (**WA3008** and **WA3009**) were located within the limits of the proposed development. These two anomalies are small dark reflectors with large shadows indicating that they are standing up from the seafloor and may be posts or some other anthropogenic structure.
- 4.1.10. The distribution of the geophysical anomalies within the survey area shows some concentration of anomalies around the area to the north west of the quay.
- 4.1.11. The sub-bottom profiles showed that the geology of the area consists of granite bedrock with no palaeo-channels, peat horizons or other features of archaeological interest. There was a layer of sandy gravel / gravely sand overlying the granite bedrock but this would appear to be an accumulation of modern sediment and therefore would have a low archaeological potential.
- 4.1.12. The lack of a desk based assessment for this area means that no comment can be made on the overall archaeological character of the area. It is possible that there may be archaeological material within the sediments in the form of small buried objects, which could not be resolved during a geophysical survey.
- 4.1.13. The local harbourmaster has informed Scott Wilson that there may be the remains of a WWII aircraft engine within the harbour although the position for this is not known, and no anomalies could be confidently identified as an aircraft engine. However it is possible that the sidescan sonar anomalies to the north west of the quay (**WA3006, WA3007, WA3014** and **WA3015**) could be the aircraft engine.

5. CONCLUSIONS

- 5.1.1. This study has reviewed the sidescan sonar and sub-bottom profile data collected over the area around St Mary's Harbour shown in **Figure 1**. This data was of sufficient quality and resolution to allow an assessment of the area's archaeological potential. However a large area to the west of the quay was covered in Kelp and Sea Grass which may obscure objects of potential archaeological interest.
- 5.1.2. In summary, the archaeological interest of the survey area, as identified during this assessment, comprises:
- Fifteen sidescan sonar anomalies (**WA3001** to **WA3015**), all of which were considered to be of low archaeological potential;
 - Four of the sidescan sonar anomalies (**WA3006, WA3007, WA3014** and **WA3015**) are within the area of the proposed development and are of apparent anthropogenic origin;

- Two sidescan sonar anomalies (**WA3008** and **WA3009**) which are also within the proposed development and may be posts or some other anthropogenic structure;
- The near surface geology of the area was composed of granite bedrock overlain by a thin layer of soft sediment which appears to contain no peat horizons or any other features of archaeological potential.

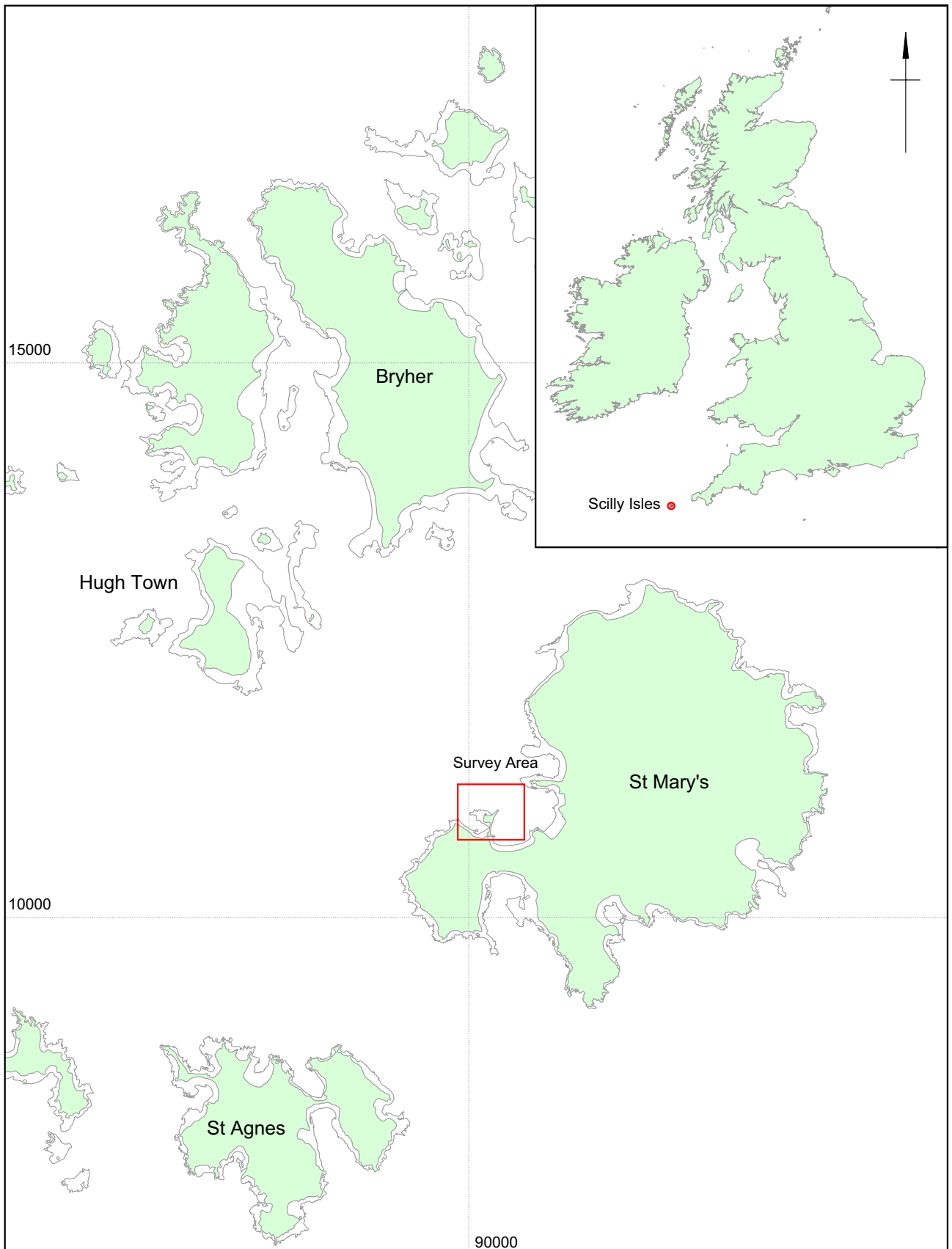
6. RECOMMENDATIONS FOR FURTHER INVESTIGATION


- 6.1.1. Due to the low archaeological potential ascribed to all fifteen geophysical anomalies (**WA3001** to **WA3015**) and the absence of any features of archaeological interest in the sub-bottom profile data, the area covered by the geophysical survey data is assessed as having an overall low archaeological potential.
- 6.1.2. There were no sites identified within the survey area from the geophysical data which need to be specifically avoided during the construction or vibrocoring.
- 6.1.3. It is recommended that a sample of the features with low archaeological potential within the survey area are selected for ground truthing to verify the interpretation methodology. In particular the sidescan sonar anomalies to the north west of the quay should be investigated by archaeological diving inspection as these sites will be affected by the proposed development.
- 6.1.4. In view of the possible presence of small buried objects of archaeological interest, not capable of being resolved by geophysical survey, it is further recommended that provision be made for obtaining prompt archaeological advice in the event that archaeological finds are made in the course of dredging.

APPENDIX I: LIST OF SIDESCAN SONAR ANOMALY SITES

WA ID No.	Tag Name	OSGB E	OSGB N	Length (m)	Width (m)	Height (m)	Description	Archaeological Potential
3001	Object with shadow	89954.1	11038.0	0.3	0.3	0.3	Dark reflector – probably geological	Low
3002	Object with shadow	89951.4	11032.6	0.3	0.3	0.3	Dark reflector – probably geological	Low
3003	Object	90069.8	11170.7	0.3	0.3	-	Dark reflector – probably geological	Low
3004	Object with shadow	90088.4	11035.8	1	1	0.6	Probably geological - boulder	Low
3005	Object	90112.2	11198.0	0.3	0.3	-	Dark reflector – probably geological	Low
3006	Object with shadow	90246.8	10974.6	4	1	0.6	Object – possibly of anthropogenic origin	Low
3007	Object with shadow	90262.8	10974.7	0.5	0.3	0.3	Object – possibly of anthropogenic origin	Low
3008	Object with shadow	90215.9	10947.1	1	0.5	0.5	Small dark reflector with shadow	Low
3009	Object with shadow	90222.8	10946.9	1	0.5	1.8	Small dark reflector with shadow – possibly a post	Low
3010	Object with shadow	90246.5	10989.5	1.5	0.5	0.3	Mound with shadow – possibly geological in origin	Low
3011	Object with shadow	90240.3	10986.1	1	0.5	0.3	Mound with shadow – possibly geological in origin	Low
3012	Object	90472.8	10835.2	0.5	0.5	-	Possible cobbles	Low
3013	Object with shadow	90141.7	10774.4	0.4	0.4	1	Dark reflector – probably geological	Low
3014	Object with shadow	90240.6	10971.2	3.23	0.5	0.3	Object – possibly of anthropogenic origin	Low
3015	Object with shadow	90255.1	10972.3	0.3	0.3	0.3	Object – possibly of anthropogenic origin	Low

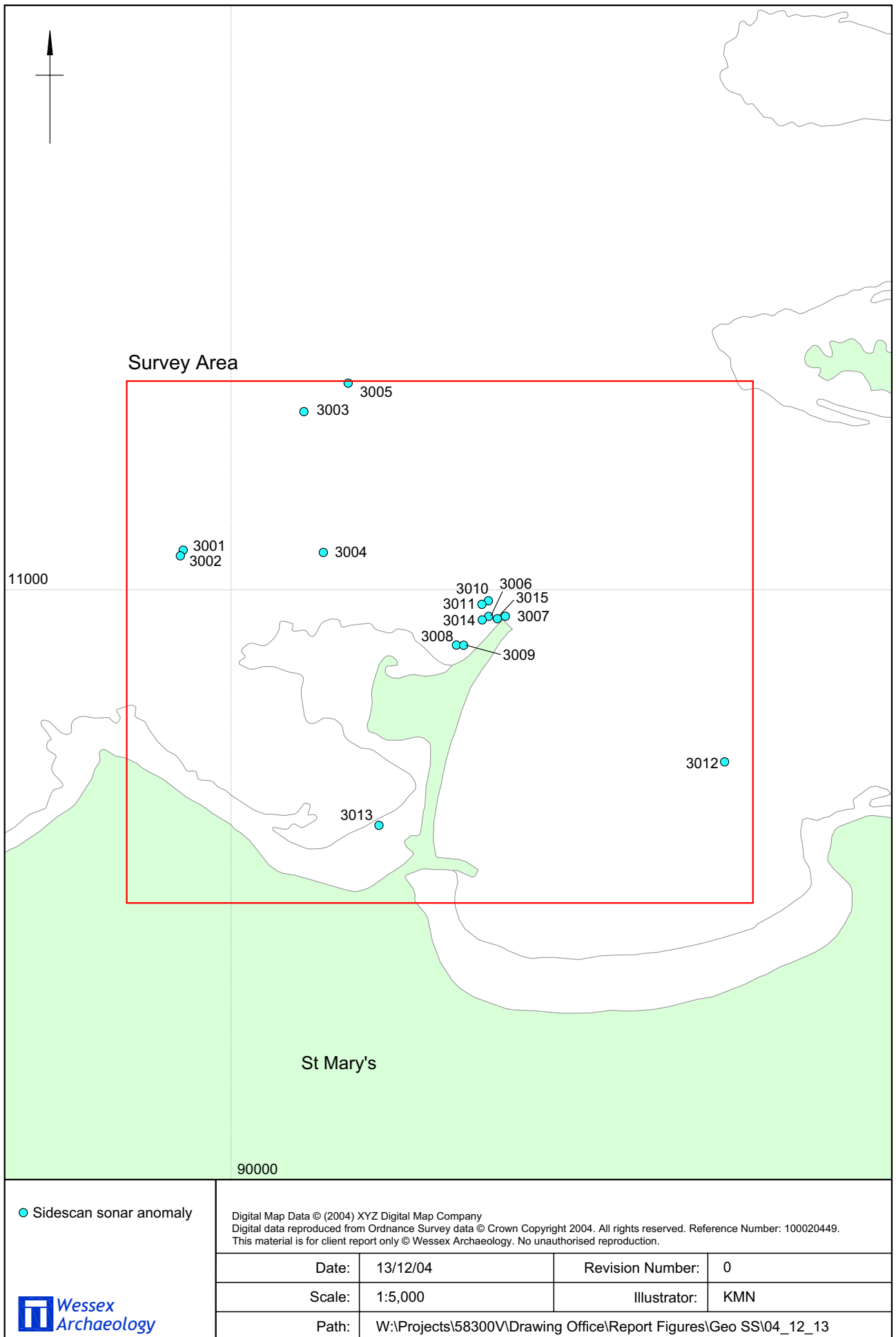
1. All co-ordinates in OSGB36, National Grid.
2. The dimensions of the sidescan sonar anomalies are a guide only.



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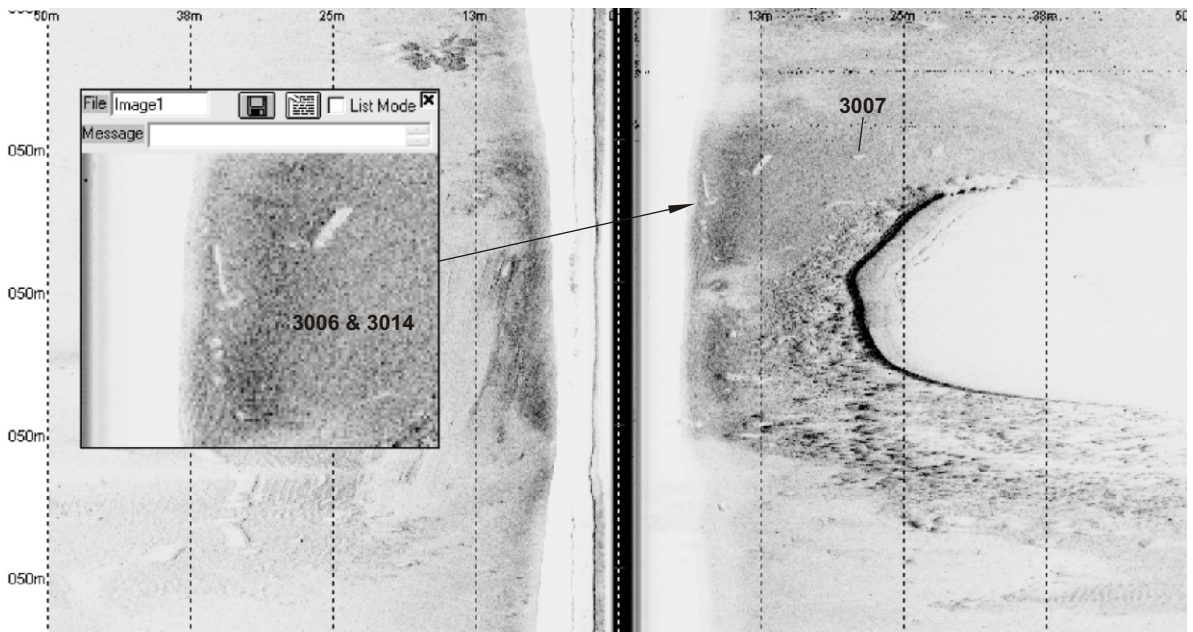
Site location

Figure 1

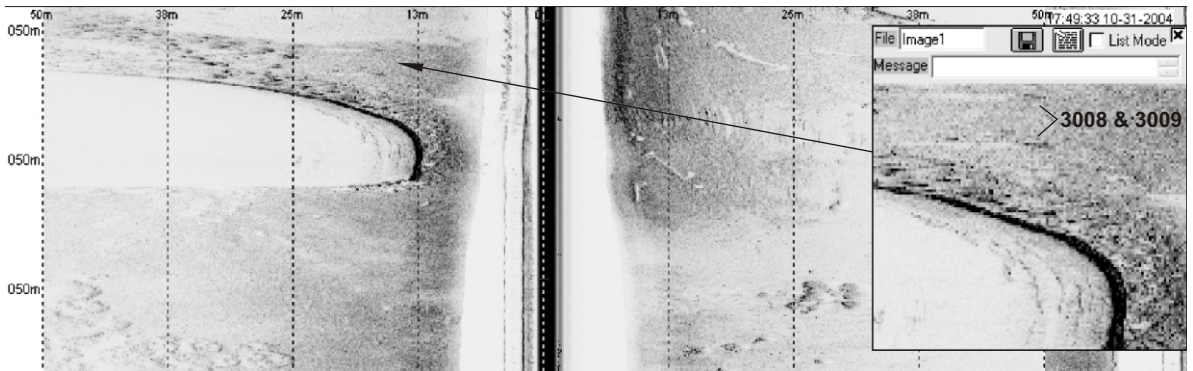


Locations of sidescan sonar anomalies

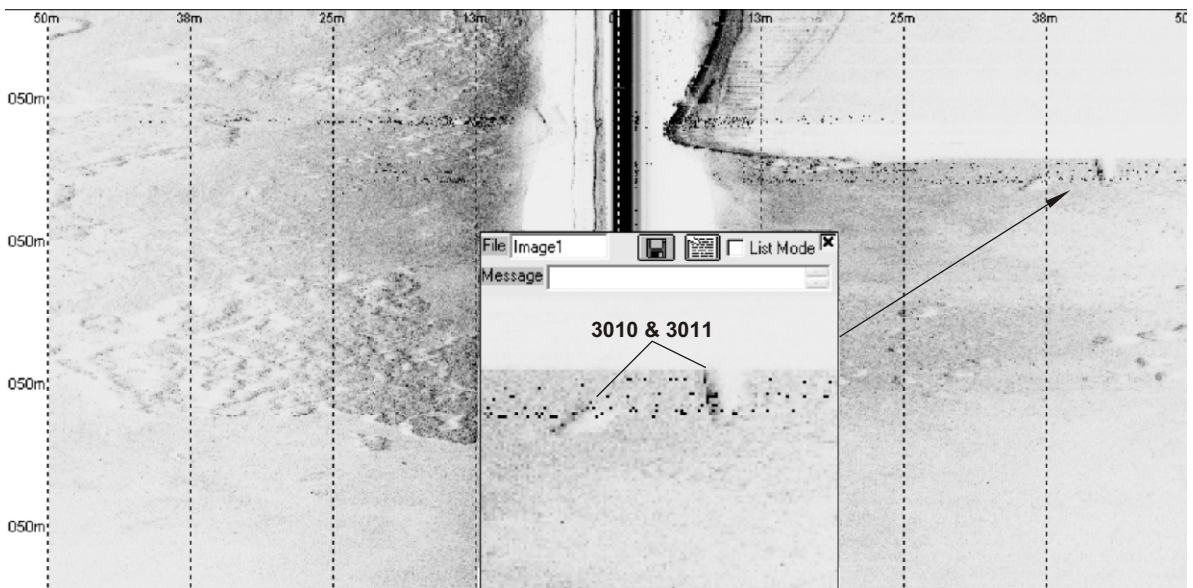
Figure 2



Targets 3006, 3007 and 3014



Targets 3008 and 3009



Targets 3010 and 3011



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