rose geophysics

SPECIALISTS IN ARCHAEOLOGICAL SURVEY

GEOPHYSICAL SURVEY REPORT

GALSON CEMETERY

RGC19336/GCL

Commissioned by: Galson Cemetery Committee

December 2019

ROSE GEOPHYSICAL CONSULTANTS LLP
5 Petticoat Lane | Orphir | Orkney KW17 2RP | Telephone: 01856 811783
Email: Susan@rosegeophysics.co.uk | www.rosegeophysics.co.uk

REGISTERED IN SCOTLAND NO: SO304077 | VAT REGISTRATION NO: 141 7787 93

NON-TECHNICAL SUMMARY

Rose Geophysical Consultants was commissioned by the Galson Cemetery Committee to carry out a geophysical survey over the modern graveyard surrounding Teampull Nan Cro' Naomh at South Galson, Isle of Lewis. A Ground Penetrating Radar (GPR) survey was undertaken to provide a detailed plan of the cemetery grounds showing the location of past burials to assist with management of the cemetery.

The GPR survey has successfully mapped numerous burials across the site. Anomalies indicative of burials have been identified which appear to correspond with headstones and grave markers. Additional responses clearly suggestive of burials have been identified which do not appear to correspond to any headstones and grave markers.

Throughout the survey area several areas of increased response have also been noted. These are anomalies which cannot be clearly identified as burials and some may simply be due to natural variations in the subsoil. However, it is likely that the bands of high amplitude response in the west of the area may well be associated with burials. While some clearly defined burials have been noted within these bands of high amplitude response, the results are confusing and several grave markers do not have a clearly associated burial response. Given that this is the oldest portion of the cemetery the complexity of the data is not surprising given the potential for a high density of burials.

Elsewhere some grave markers have not produced a clear response indicative of a burial. While in some cases there is high confidence that the marker is marking an unused plot and not a burial, most are ambiguous.

Survey:	Galson Cemetery
Client:	Galson Cemetery Committee
Date of Fieldwork:	4th – 7th November 2019
Survey Personnel:	Dr S M Ovenden and A S Wilson
Report Author:	Dr S M Ovenden
Report Illustrations:	Dr S M Ovenden
Date of Issue:	10th December 2019

TABLE OF CONTENTS

LIST OF FIGURES

1 INTRODUCTION

1.1 Rose Geophysical Consultants LLP (RGC) was commissioned by the Galson Cemetery Committee to carry out a geophysical survey over the modern graveyard surrounding Teampull Nan Cro' Naomh at South Galson, Isle of Lewis.

1.2 A Ground Penetrating Radar (GPR) survey was undertaken to provide a detailed plan of the cemetery grounds indicating the location of past burials to assist with management of the cemetery.

2 SITE LOCATION, GEOLOGY & DESCRIPTION

2.1 Galson Old Graveyard, on the Isle of Lewis, is located on the coast near the village of South Galson, 19 miles north of Stornoway.

2.2 The site lies on machair adjacent to the coast.

2.3 The survey covered an area of approximately 0.4ha within a pasture field which had been cut prior to survey.

3 ARCHAEOLOGICAL BACKGROUND

3.1 Galson Cemetery surrounds Teampull nan Cro' Naomh, a possible 13th century chapel and associated older graveyard which is visible in the field as a pronounced mound immediately to the north and west of the survey area. The chapel is a Scheduled Ancient Monument and therefore the survey did not encroach on this scheduled area.

3.2 Two ruins lie to the south of the chapel, and mark the northern limit of the survey area in the west of the area. These are of unknown date (Post Medieval - 1540 AD to 1900 AD) and have the appearance of mausoleums.

4 SURVEY AIMS AND OBJECTIVES

4.1 The aim of the geophysical survey was to map burials within the cemetery grounds.

4.2 Specifically the objectives of the survey were:

- to provide a detailed plan of the cemetery grounds indicating the location of past burials.
- to produce a comprehensive report and data archive.

5 METHODOLOGY

5.1 SURVEY TECHNIQUES USED

5.1.1 A 500MHz GPR surveys was carried out over the area of the current graveyard as indicated on Figure 1, at scale of 1:500.

5.1.2 GPR is the most appropriate geophysical technique for mapping burials due to the nature of the technique and its depth of investigation.

5.1.3 It must be remembered that no geophysical technique can date features detected. However, a possible era can be suggested by the form of a response and it may be possible to distinguish different phases of activity. However, this is not always possible and as a result the data can sometimes be ambiguous with responses from features of different dates being interpreted as a single feature.

5.1.4 All geophysical survey work was carried out in accordance with recommended good practice specified in guideline documents published by Historic England (David et al. 2008), European Archaeological Council (Schmidt et al. 2016) and the Chartered Institute for Archaeologists (CIfA, 2014).

5.1.5 Data processing, storage and documentation have been carried out in accordance with the good practice specifications detailed in the guidelines issued by the Archaeology Data Service (Schmidt, 2009).

5.2 ESTABLISHMENT OF SURVEY GRID

5.2.1 Prior to data collection a series of 20m grids were set out and georeferenced using a Trimble R8 RTK GPS system using the VRS network with correction via mobile data connection. The grid was established to an accuracy of +/ - 2.5cm.

5.2.2 The data plots and interpretations have been positioned on a georeferenced digital map created by RGC using a Trimble R8 RTK GPS system using the VRS network with correction via mobile data connection.

5.2.3 Geo-referencing information is provided within Appendix I of this report and the accompanying CAD files.

5.3 DATA COLLECTION

5.3.1 Survey was carried out using a MALA X3M GPR system with a 500MHz antenna.

5.3.2 Data was collected at 0.02m intervals along parallel traverses 0.25m apart using 'zig-zag' data collection.

5.3.3 Data was collected in a southeast - northwest alignment i.e. parallel to the alignment of headstones. The GPR system was synchronised with the GPS system to enable 'live' georeferencing of the GPR data and to record topographic changes.

5.3.4 The data were downloaded at lunchtime and at the end of the day to check data quality and to back-up the data.

5.4 Data Processing

5.4.1 Following data download, the traverses were imported and assembled into blocks in their correct relative location using Geophysical Archaeometry Laboratory GPR Slice. The data were processed using a range of standard processing algorithms appropriate for GPR data. The data had the following editing and processing steps applied:

- Set Time Zero - edit all radargrams to adjust for correct time zero (start point)
- Gain & Wobble Correction - application of a gain appropriate to the data set
- Background Filter - removes banding noise within the data
- Bandpass – Clips the data to remove high and low frequency noise

5.5 Data Presentation

5.5.1 A location plan showing the area investigated is provided in Figure 1 at a scale of 1:500.

5.5.2 The data plots have been exported from Geophysical Archaeometry Laboratory GPR Slice and have been attached to CAD base mapping created by RGC.

5.5.3 The data are displayed as a series of depth slices, with accompanying digitised interpretation diagrams, in Figures 3 to 12, all at 1:500. Depth slices display the data as a series of successive plan views of the variation of reflector energy. The variation in amplitude is represented using a grey scale with black indicating high amplitude and white indicating low amplitude responses. Low amplitude is generally typical of 'cut features' like ditches, pit-like features and grave cuts, while high amplitude are generally indicative of 'hard features' such as voids, structures, surfaces and burials.

5.5.4 A summary interpretation is provided in Figure 2 at a scale of 1:400. This provides a combined plan of all the potential burials detected within the different depth slices. Separate copies of this Figure at 1:100 have been provided as folded plans.

6 SITE CONDITIONS / GENERAL CONSIDERATIONS

6.1 The weather at the time of the survey was unsettled with heavy rain at times.

6.2 Conditions on site were good with the survey area being under short grass.

6.3 Graves of any age can be difficult targets and are best mapped by GPR. Different elements of burials produce different anomalies. These can include:

- Surface trends indicating the edges of a grave cut. At shallow depths the grave itself does not always produce a strong response because there is little contrast between the grave fill and the surrounding soil.
- A strong response at the top of the burial, normally 0.40m – 0.60m beneath the surface. This produces a strong response because there is more contrast between the burial, which may include a void, and the surrounding soil.
- A strong response at the base of the grave cut, normally 1.20m and 1.60m beneath the surafce in modern single burials, due to the undisturbed natural at the base of the grave.

6.4 The success of any geophysical survey in identifying remains is dependent on several factors including geology and soils, field conditions and the nature of the buried archaeological features / deposits. In addition, all geophysical data can be ambiguous and while every effort has been made to ensure that the interpretations contained within this report represent an accurate record of burials across the site, it is a subjective analysis of the data. There are several instances were a burial may not be detected. These include:

- Insufficient contrast between the burial and the surrounding soil. This can occur in older or clandestine burials.
- The burial being too deep to be detected i.e. deeper 2m
- Data being confused by multiple interments in one grave. This can be hard to detect as the multiple excavations of the grave will have ‘eroded’ the edges of the grave cut.
- Data being confused by a very high density of graves within an area and / or graves of different ages overlapping each other.

6.5 As a result a geophysical survey may only reveal certain features and not produce a complete plan of all of the archaeological remains, in this case burials, within a survey area and can only confidently predict a presence, not an absence.

7 SUMMARY OF RESULTS (Figure 2)

The anomaly letters referred to below are shown on the summary interpretation.

7.1 Extant headstones / grave markers have been mapped and are displayed on the interpretations. They are stylised and do not reflect the size or foot print of the headstone / marker. The rectangles represent a clear headstone or grave / plot marker, while the circles indicate a headstone stump and / or large cobble possibly marking a grave.

7.2 The following interpretation categories have been used:

- Recent Burial: These are strong responses from recent burials still visible on the surface that do not yet have a headstone.
- Burial with Grave Marker: A clear response indicative of a burial and associated with a grave marker.
- Burial with No Grave Marker: A clear response indicative of a burial with no visible grave marker.
- Grave Cut Trend: A linear trend very likely to be associated with a grave cut. In some cases these are the only anomalies associated with a possible burial that have been detected.
- High Amplitude Response: These have an unknown origin. In some cases they may indicate a cluster of closely spaced burials. These are discussed more fully in detail in Section 8.

7.3 The summary plan is a combined interpretation based on the individual depth slices which are discussed in more detail in the following section and displayed in Figures 3 to 12.

7.4 Below is a summarised discussion of the results of the survey. It is strongly advised that the full discussion of the result is consulted, Section 8.

7.5 Four very strong anomalies have been recorded and appear to correspond with recent burials which do not yet have headstones. These are also visible on the surface and are indicated on the plan by a solid red block.

7.6 Across the survey area numerous responses clearly suggestive of burials have been identified which appear to correspond with headstones and grave markers. These are indicated on the plans by a blue cross hatched rectangle.

7.7 Across the survey area numerous responses clearly suggestive of burials have been identified which do not appear to correspond to any headstones and grave markers. These are indicated on the plans by a red cross hatched rectangle.

7.8 Throughout the survey area several areas of increased response have been noted. These are anomalies which cannot be clearly identified as burials and some may simply be due to natural variations in the subsoil.

7.9 However, it is likely that the bands of high amplitude response (A) in the west of the area may well be associated with burials. While some clearly defined burials have been noted within these bands of high amplitude response, the results are confusing. In addition, several grave markers in this area do not have a clearly associated burial response. Given that this is the oldest portion of the cemetery the complexity of the data is not surprising. As stated above, data can be confused in an area with a very high density of burials, particularly if they overlap each other.

7.10 Elsewhere across the site small areas of high amplitude response (B) have been noted. These appear to be associated with clear responses indicative of discrete burials and as such may indicate additional burials. As a result, even though no clear burials have been detected in these areas, they should be avoided for future burials.

7.11 The high amplitude response (C) in the west of the area coincides with a rougher area of ground. There are no clear suggestions of burials within this area.

7.12 Some additional coherent areas of high amplitude response (D) have been noted. These do not appear to be associated with burials, although it cannot be dismissed, and are discussed in more detail in detail in Section 8.

7.13 For grave markers that have not produced a clear response indicative of a burial the grave markers have been colour coded on the summary plan. A magenta grave marker advises caution as there are ephemeral responses which may be related to burials. A green grave marker indicates a lack of any response suggestive of a burial. However, as stated above, this is a subjective analysis of the data. It is possible that comparing the plan with the grave markers while on site may enable further clarification.

7.14 The data does suggest apparent clear areas (E) were very little response has been recorded and should be suitable for future burials.

8 DETAILED RESULTS AND INTERPRETATION

The anomaly numbers referred to below are shown on the interpretation diagrams.

8.1 The data from the GPR survey are displayed as a series of depth slice maps. These are 25cm thick spits through the ground which provide maps of buried features at different depths. The depth slices have been constructed parallel to the modern ground surface with overlapping near surface depth slices. Additional images of the data have been consulted during interpretation but are not included in this report.

8.2 0.00m – 0.25m Depth Slice (Figure 3)

8.2.1 This shallow depth slice shows weak responses caused by changes in the surface.

8.2.2 A broad area of high amplitude response (1) has been recorded in the west of the area. This is not a very strong response, but it is coherent. The shape and location of the anomaly suggests it may be associated with the mound to the north. However, whether this increased response is suggesting an extension of the older graveyard or is due to landscaping of the current graveyard is not clear.

8.2.3 Discrete areas of high amplitude response (2) and short trends (3) have been noted throughout the area and are likely to be associated with grave cuts. However, in some cases no deeper burial has been recorded beneath the surface responses (2) and as a result they may be due to surface changes and not associated with burials, but their form needs to be taken into account.

8.2.4 The linear trend (4) in the north of the survey area is an old fence line.

8.3 0.25m – 0.50m Depth Slice (Figure 4)

8.3.1 Linear trends (3) suggestive of grave cuts are clear across this depth slice.

8.3.2 Weak, but well-defined, high amplitude responses (4) have been detected across the site and are likely to be associated with burial.

8.3.3 In the southwest of the area broad bands of high amplitude response (5) are apparent. It is thought that this elevated response may be due to a high density of burials.

8.4 0.50m – 0.75m & 0.63m – 0.88m Depth Slices (Figures 5 & 6)

8.4.1 Within these overlapping depth slices some weak trends (3) are still apparent.

8.4.2 Four very strong anomalies (6) have been recorded and appear to correspond with recent burials which do not yet have headstones. These are also visible on the surface and are indicated on the plan by a solid red block.

8.4.3 Across the survey area numerous responses clearly suggestive of burials (7) have been identified which appear to correspond with headstones and grave markers. These are indicated on the plans by a blue cross hatched rectangle.

8.4.4 Across the survey area numerous responses clearly suggestive of burials (8) have been identified which do not appear to correspond to any headstones and grave markers. These are indicated on the plans by a red cross hatched rectangle.

8.4.5 A very strong broad linear response (9) has been detected in the southwest of the survey area. The origin of this is unclear although it could be associated with a line of closely spaced burials. Similar well defined responses (10) have been recorded to the east. As with (9) it is possible that these responses (10) could simply be associated with grave cuts. However, it is possible that these anomalies are associated with the remnants of former mausoleum type structures / enclosed burial plots, or perhaps a former boundary wall.

8.4.6 Additional discrete high amplitude responses have been noted throughout the area. Most of these are associated with burials that are stronger in the deeper depth slices.

8.5 0.75m – 1.00m & 0.88m – 1.13m Depth Slices (Figures 7 & 8)

8.5.1 Within these overlapping depth slices the responses (6) from the presumed recent burials are still apparent.

8.5.2 At these depths additional burials associated with grave markers (7) and unmarked burials (8) are clear.

8.5.3 The strong responses of unknown origin, (9) and (10), along the southern limits of the survey are still clear in these depth slices. However, at these depths is appears that (10) could be a concentration of unmarked burials.

8.6 1.00m – 1.25m & 1.25m – 1.50m Depth Slices (Figures 9 & 10)

8.6.1 Numerous marked (7) and unmarked burials (8) are still apparent within these depth slices.

8.6.2 The responses (9) and (10) in the south of the area are still evident. While the form of (9) is consistent with depth, (10) is not which suggest that (10) is not simply associated with burials.

8.6.3 Bands of increased response (11) have been noted in the west of the survey area. It is likely that these are associated with high concentrations of burials even though distinct responses from graves are not clear in the data. Given this is the oldest section of the graveyard these confused responses are not surprising.

8.7 1.50m – 1.75m & 1.75m – 2.00m Depth Slices (Figures 11& 12)

8.7.1 At these depths some responses from burials (7) are still apparent together with bands of high amplitude (11) which are thought to be associated with burials. However, the data on the whole is much quieter which is to be expected given the depth.

9 CONCLUSION

9.1 The GPR survey has successfully mapped numerous burials across the site. Anomalies indicative of burials have been identified which appear to correspond with headstones and grave markers. Additional responses clearly suggestive of burials have been identified which do not appear to correspond to any headstones and grave markers.

9.2 Throughout the survey area several areas of increased response have also been noted. These are anomalies which cannot be clearly identified as burials and some may simply be due to natural variations in the subsoil. However, it is likely that the bands of high amplitude response in the west of the area may well be associated with burials. While some clearly defined burials have been noted within these bands of high amplitude response, the results are confusing and several grave markers do not have a clearly associated burial response. Given that this is the oldest portion of the cemetery the complexity of the data is not surprising given the potential for a high density of burials.

9.3 Elsewhere some grave markers have not produced a clear response indicative of a burial. While in some cases there is high confidence that the marker is marking an unused plot and not a burial, most are more ambiguous.

10 STATEMENT OF INDEMNITY

10.1 Geophysical data can be ambiguous and while every effort has been made to ensure that the interpretations contained within this report represent an accurate record of potential surviving archaeological deposits, it is a subjective analysis of the data.

10.2 The success of a geophysical survey in identifying archaeological remains is dependent on several factors including geology and soils, time of year for some techniques, field conditions and the nature of the buried archaeological features / deposits. As a result a geophysical survey may only reveal certain archaeological features and not produce a complete plan of all of the archaeological remains within a survey area and can only confidently predict a presence of archaeology, not an absence.

REFERENCES

ClfA, 2014, *Standards and Guidance for Archaeological Geophysical Survey*

David, A. Linford, N. Linford, P., 2008, English Heritage (Historic England): *Geophysical Survey in Archaeological Field Evaluation*, Swindon.

Schmidt, A. and Ernenwein, E., 2009, *Archaeology Data Service: Geophysical Data in Archaeology: A Guide to Good Practice*

Schmidt, A. Linford, P., Linford, N. David, A. Gaffney, C. Sarris, A. Fassbinder, J., 2016, *EAC Guidelines for the use of Geophysics in Archaeology.* European Archaeological Council.

APPENDIX I: METADATA

RGC Project Name	Galson Cemetery		
RGC Project Number	RGC19336/GCL		
Client	Galson Cemetery Committee		
Date of Survey	4th – 7th November 2019		
Personnel	Susan Ovenden & Alistair Wilson		
Date OF Report	10th December 2019		
Report Author	Susan Ovenden		
Local Authority	Western Isles		
Parish	Barvas		
Site / Monument Type	Cemetery (Post Medieval - 1540 AD to 1900 AD)		
Site Number	4346 (Teampull Nan Cro' Naomh – Chapel to northwest of survey area)		
Canmore ID	NB45NW 1 (Teampull Nan Cro' Naomh – Chapel to northwest of survey area)		
NGR	NB 43345 59319		
DES Entry	Yes		
Ground Cover	Short grass		
Weather Conditions	Wet		
Survey Techniques Area Data Interval	500MHz GPR survey 0.4ha; Data collected @ 0.02m by 0.25m		
Geo-reference details			
GPR Survey Depth Slices	JPEGs on Local Grid	BL 0m, 0m	TR 75m, 100m
	Georeferenced (OSTN15)	BL 143260.57, 959264.08	TR 143345.25, 959355.65
GPR Survey Radargrams	GPR files contain embedded GPS data in UTM format		

ARCHIVE DETAILS			
GPR Survey	Working Files (Mala X3M)	Preservation Files (SEGY)	JPEG Images
Radargrams	Yes	Yes	No