Historic England

Geophysics

Reculver Towers Sea Defences, Reculver, Kent, Report on Geophysical Survey, November 2020

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RECULVER TOWERS SEA DEFENCES,

RECULVER, KENT

REPORT ON GEOPHYSICAL SURVEY, NOVEMBER 2020

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SUMMARY

A Ground Penetrating Radar (GPR) survey was conducted over the sea defences protecting the cliff immediately below the site of Reculver Towers, Reculver, Kent. The survey was requested by the English Heritage Trust who manage the site and are in the process of conducting consolidation and repair works to the monument. The aim of the GPR survey (0.001ha) was to assist with the identification of any possible voids within the sea defence that may impair the protection of the cliff from impact of coastal erosion. Results from the survey were compromised by the uneven nature of the ragstone apron surface and restricted access over areas of the site covered by sea weed. Site conditions appear to have deteriorated since an earlier GPR survey in 2008 with much reduced areas of safe access, although there is some limited correlation between anomalous responses between the two data sets.

CONTRIBUTORS
The geophysical fieldwork was conducted by Neil Linford and Andrew Payne.

ACKNOWLEDGEMENTS
The authors are grateful to colleagues from the English Heritage Trust for assisting with access to the site.

ARCHIVE LOCATION
Fort Cumberland, Portsmouth.

DATE OF SURVEY
The fieldwork was conducted between 24th November 2020 and the report completed on 26th February 2021. The cover image (NL) shows a view of the site looking west with the towers of St Mary’s church can be seen at the top of the cliff wand the ragstone sea defence sloping down the cliff to the sea edge. The survey was conducted at low tide over level areas of the sea defence that were not covered by sea weed.

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CONTENTS

INTRODUCTION

A Ground Penetrating Radar (GPR) survey was conducted over the sea defences protecting the cliff immediately below the site of Reculver Towers, Reculver, Kent. The survey was requested by the English Heritage Trust who manage the site and was required to provide information on the sloping masonry sea defences at Reculver Saxon Shore fort to identify any potential damage and significant voiding present that may impair the protection of the cliff from coastal erosion. It was hoped that the survey might also include the area surrounding St Mary's Church and the wider remains of the Roman Fort, but due to the Covid-19 pandemic field work was restricted to the sea defence. The work has been agreed under the Shared Services Agreement and addresses Historic England corporate plan tier three objective "S4A.2 Support the English Heritage Trust in creating new knowledge".

Previous GPR survey conducted in 2008 was able to safely access a larger area of the sea defences, apparently then more free of established sea weed, and it would also appear that the individual ragstone sets forming the apron have become increasingly more uneven over time (Graham 2009). The 2008 survey did suggest a correlation between area of apparent voiding in the GPR response and visual identification of worn or failed concrete grout between the sets.

The sea defence wall is constructed from ragstone, a Cretaceous hard grey limestone found in the Hythe Beds of the Lower Greensand beds, used as a building material throughout Kent. The individual ragstone setts are secured with grout and form a sloping apron from the sea edge, where traversing the stones covered with seaweed was very difficult and hazardous, to a near vertical wall protecting the base of the cliff. Some repairs to the sea defence were evident in places where the original grouting had been replaced by concrete, together with other areas of missing grout and damaged ragstone setts. The weather at the time of the survey was cold but dry with the acquisition conducted at low tide. Due to the highly uneven nature of the ragstone setts a comparative line of data (Line 031) was collected over the level concrete surface immediately to the east of the sea defence.

METHOD

A GSSI 350 HS antenna was used to conduct the survey with instrument control and data logging provided by a field tablet computer mounted on a rugged field cart. Positional control was provided by a Carlson BRx7 Global Navigation Satellite System (GNSS) receiver mounted on the field cart, with real time corrections provided by RTKFnet. Data were collected along the survey lines shown on Figure 1(A) at a 0.01m sample interval through a 90ns two-way travel time window (512 samples per trace at 0.1772ns time interval). The local topography over the sea defence derived from the GNSS data is shown in Figure 1(B). Post-acquisition processing involved, adjustment of time-zero to coincide with the true ground surface, band-pass filtering, background and noise removal, and the application of a suitable gain function to enhance late arrivals.

Representative profiles from the GPR survey data set are shown on Figure 1(D) together with an amplitude time slice between 12.4 and 14.2ns (0.62 to 0.71m) created from the entire data set (e.g. Linford 2004) shown on Figure 1(C). An average sub-surface velocity of 0.108m/ns was assumed following constant velocity tests on the data, and was used as the velocity field for the time to estimated depth conversion.

RESULTS

A graphical summary of the significant GPR anomalies superimposed on the base OS map data is provided in Figure 1(C) together with the location of voids interpreted from the 2008 survey.

Possible areas of voiding have been identified from the individual data profiles and superimposed over a representative amplitude time slice in Figure 1(C). There is little correlation between voids identified in the 2008 and the current survey, partly due to more restricted access towards the sea edge and, perhaps, due to subsequent repairs made to the sea defences. Comparison with the GPR profile collected over the adjacent level concrete surface demonstrates the influence of the uneven ragstone sea defence on the data quality (Figure 1(D), Line 031). There is a discernible response from the base of the concrete at ~1m and strong, diffracted responses ringing through the profile corresponding with visible joints in the concrete.

CONCLUSIONS

The uneven surface of the ragstone sea defence has influenced the data quality and it is difficult to be entirely confident that GPR is able to provide reliable information to detect voids at the site. It seems possible that surface conditions have deteriorated since the 2008 survey and that the seaweed has also encroached further to restrict safe access over sea defence apron. Repeat survey in the future could, perhaps, use an Uncrewed Aerial Vehicle mounted GPR to gain more complete access and, potentially, overcome decoupling of the antenna over the uneven ragstone setts, depending on the degree of diffraction from the rough surface.

LIST OF ENCLOSED FIGURES

REFERENCES

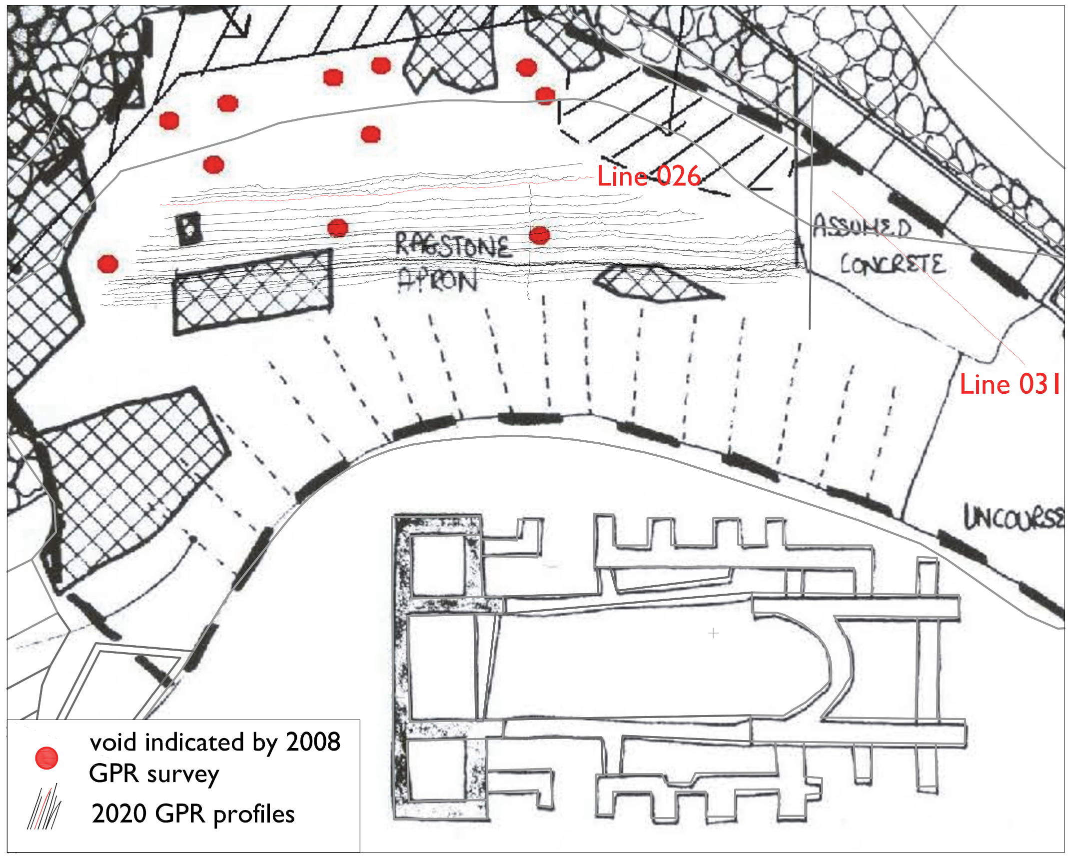
Graham, B 2009 *'Radar Survey of Reculver Towers'*. ERA Technology ERA Report 2008-0036.

Linford, N 2004 'From Hypocaust to Hyperbola: Ground Penetrating Radar surveys over mainly Roman remains in the U.K.'. *Archaeological Prospection*, 11 (4), 237-246.

Figure 1

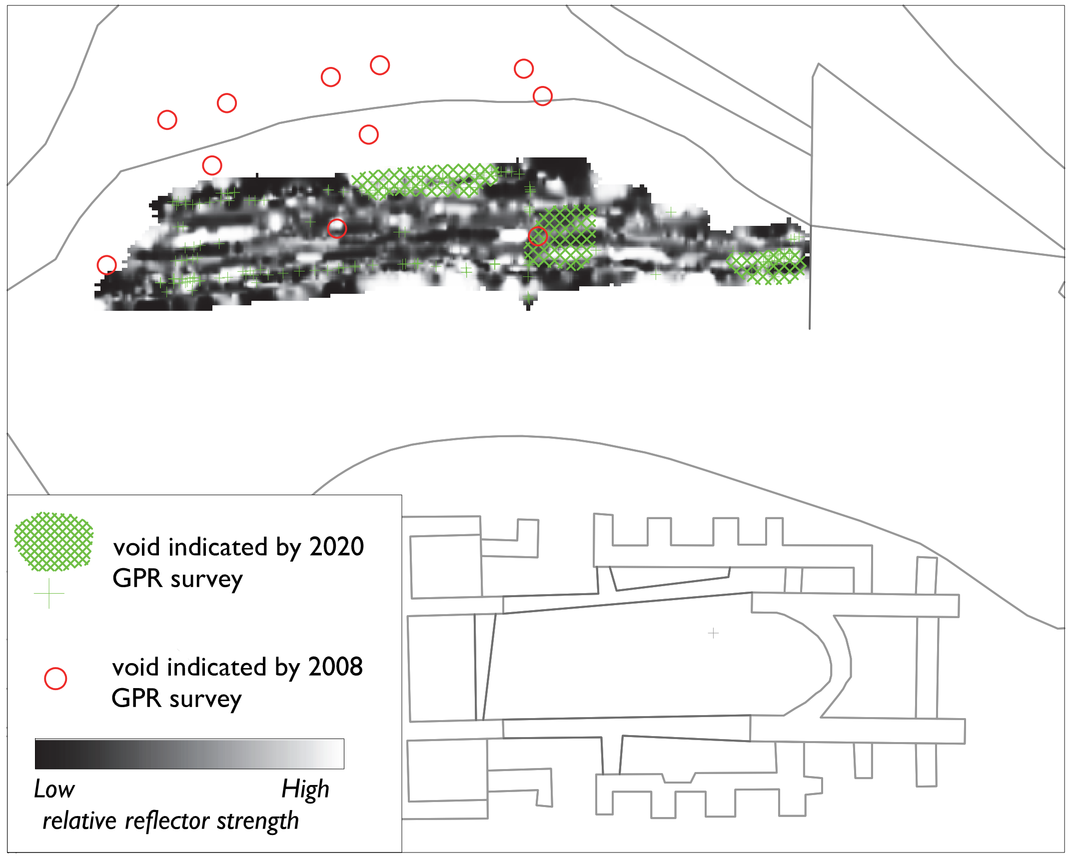
RECULVER TOWERS SEA DEFENCES, RECULVER, KENT
Ground Penetrating Radar survey, November 2020

(A) Location of GPR profiles



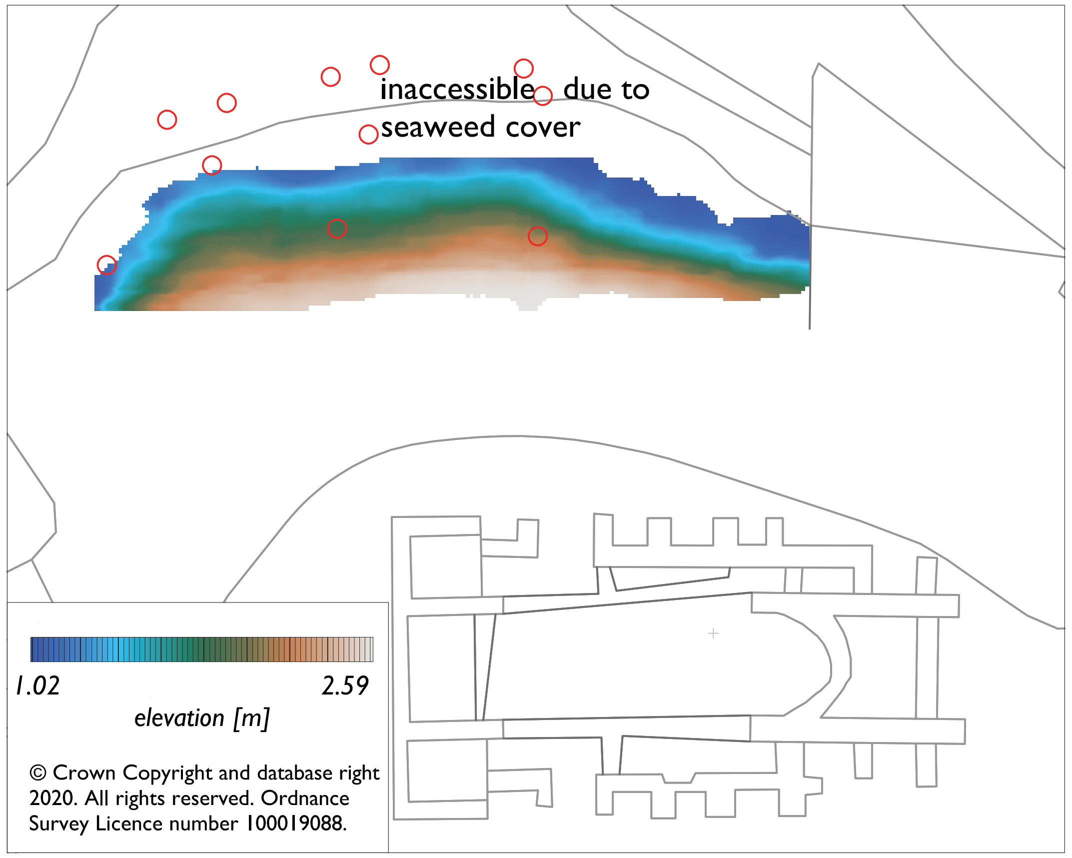
(C) GPR amplitude time slice between 12.4 and 14.2ns (0.62 to 0.71m)

N

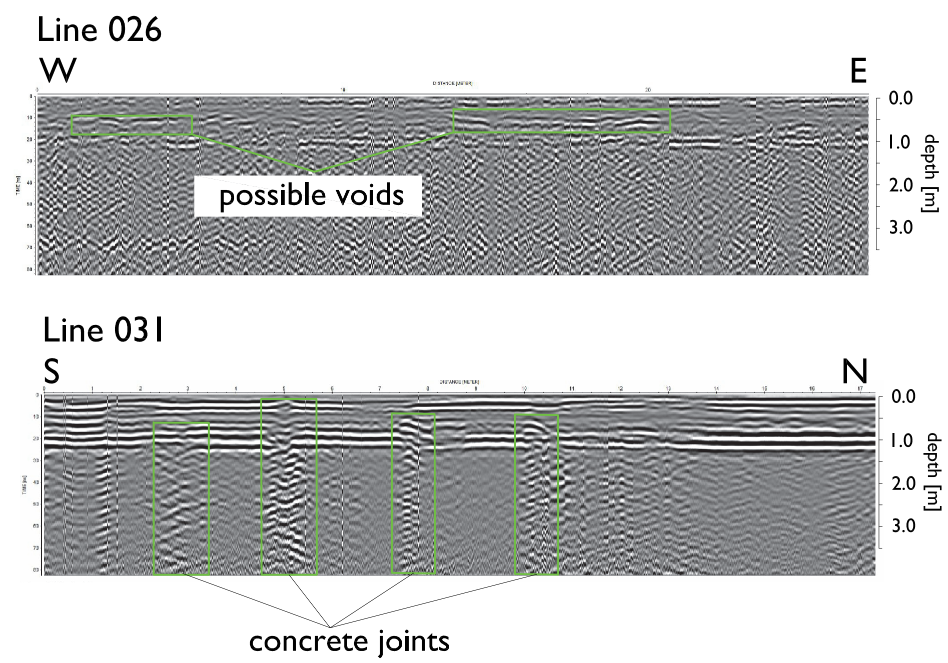


(B) Local topography

TR2269



(D) Selected GPR profiles



0 30m
1:500

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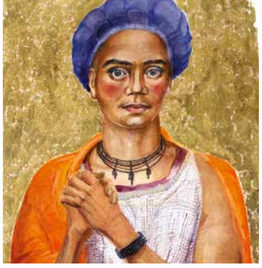



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