RADIATION WALKOVER SURVEY AT DAEDALUS

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1 Introduction

Aurora Health Physics Services Limited (Aurora) was commissioned by Campbell Reith to carry out a gamma radiation walkover survey of an area of land on the site of the former MoD establishment HMS Daedalus, Lee on Solent Hampshire. The survey was carried out on the 19th and 20th April 2017.

Radioactive contamination has previously been identified on the site (ref. 1) from the use of radium luminised materials and these may still be present.

2 Health, Safety & Security

Copies of the following Aurora documents were submitted to Campbell Reith prior to commencing work:

- Aurora Survey Risk Assessment & Method Statement – AHP/RPA/RAMS/CMB/17/01

3 Radiological Survey

All instruments used during the work are listed in Table 1 below.

Table 1. Instruments Used for Survey.

Instrument	Used for monitoring	Aurora Asset Number	Calibration Date	Background reading on site
RadSurvey 3" NaI GPS system	Ground gamma contamination	AHP0203/204	8th Feb 2017	150 – 250 counts per second (cps)
Exploranium GR135 NaI probe	Ground gamma contamination	AHP0052	7th Feb 2017	80 – 100 cps
Mini 1000	Gamma dose rate	AHP0191	2nd Aug 2016	0.1 µSv/hr
Electra ratemeter BP19 probe	Surface beta contamination	AHP0224	27th Mar 2017	20 cps
Electra ratemeter DP6 probe	Surface alpha and beta contamination	AHP0273	24th Mar 2017	alpha 0.5 cps beta 12 cps

3.1 Ground Survey

The survey was undertaken using Aurora's 'RadSurvey' System (RadSurvey), as shown in Figure 1 below. The RadSurvey instrument consists of a sensitive gamma radiation detection system linked to a Global Positioning System (GPS) enabling accurate gamma radiation contour mapping of the site. The data collected during the survey is used to accurately demonstrate and validate the radiological status of the identified areas.

The survey system is configured using real time differentially corrected GPS to provide continual spatial reference information allowing the survey unit to be operated at sub-metre accuracy. Radiation and positional information is displayed and collected autonomously in the data logger.

Figure 1. Aurora's RadSurvey system in use.

3.1.1 RadSurvey Detector and Ratemeter

The survey unit is configured with a 75 mm by 75 mm high-sensitivity sodium iodide detector mounted in a protective case carried at a height of approximately 0.2 m above ground level.

The detector is connected to a multi-channel analyser (MCA) which is configured to provide gross gamma counts per second, every second, to the data logger. The RadSurvey system is capable of detecting material of regulatory interest to a depth of approximately 0.3 m in soil. Therefore, at soil

depths significantly greater than 0.3 m, or where the surface covering is not soil, i.e. concrete or tarmac, it is possible that radioactive contamination may not be identified.

3.1.2 RadSurvey Methodology

The survey methodology involved traversing the site in nominal 1 m wide lanes using the survey equipment. Data was accumulated at the rate of one reading per second and recorded in the data logger, resulting in one radiation reading per 1 m^2 of the accessible areas of the site. Global Positioning System (GPS) information is automatically linked to the radiological data for ease of interpretation.

In areas of the site where the ground is populated with trees or shrubs, GPS coverage is not always 100 percent and gaps in the displayed data are possible. Where this occurs, detector data is still collected and reviewed to check if any high-count rates are observed in any areas that aren't covered by the GPS.

3.1.3 Background Readings

Typical background readings for the RadSurvey detector varied from 100 counts per second (cps) to 300 cps. All organic materials contain some level of radioactivity. Naturally occurring radionuclides include the uranium (^{238}U and ^{235}U) and thorium (^{232}Th) decay chains commonly found in soils and rock and radioactive potassium (^{40}K) commonly found in wood, clay and brick. These background levels vary between different materials (e.g. rock and soil) and in different areas of the UK. Background readings were taken for each instrument during equipment set up and function testing.

3.1.4 RadSurvey Results

Using a Geographical Information System (GIS) the gathered data is displayed in map form. Interpolation was carried out on the data to provide a display of the radiation contours of the site as a surface picture. The area of the survey was confirmed with Campbell Reith at the site to ensure that the survey area was consistent with the intended development. This area is bounded approximately by the red line shown in Figure 2 below.

Figure 2. Plan view of the area surveyed within red line boundary.

The survey collected 34,586 data points ranging between 92 and 434 counts per second (cps). The average reading on the site was 241 cps with a standard deviation of 50 cps. There were no areas of the site with statistically significant elevated count rates. The results of the RadSurvey can be seen as a surface picture in Figure 3.

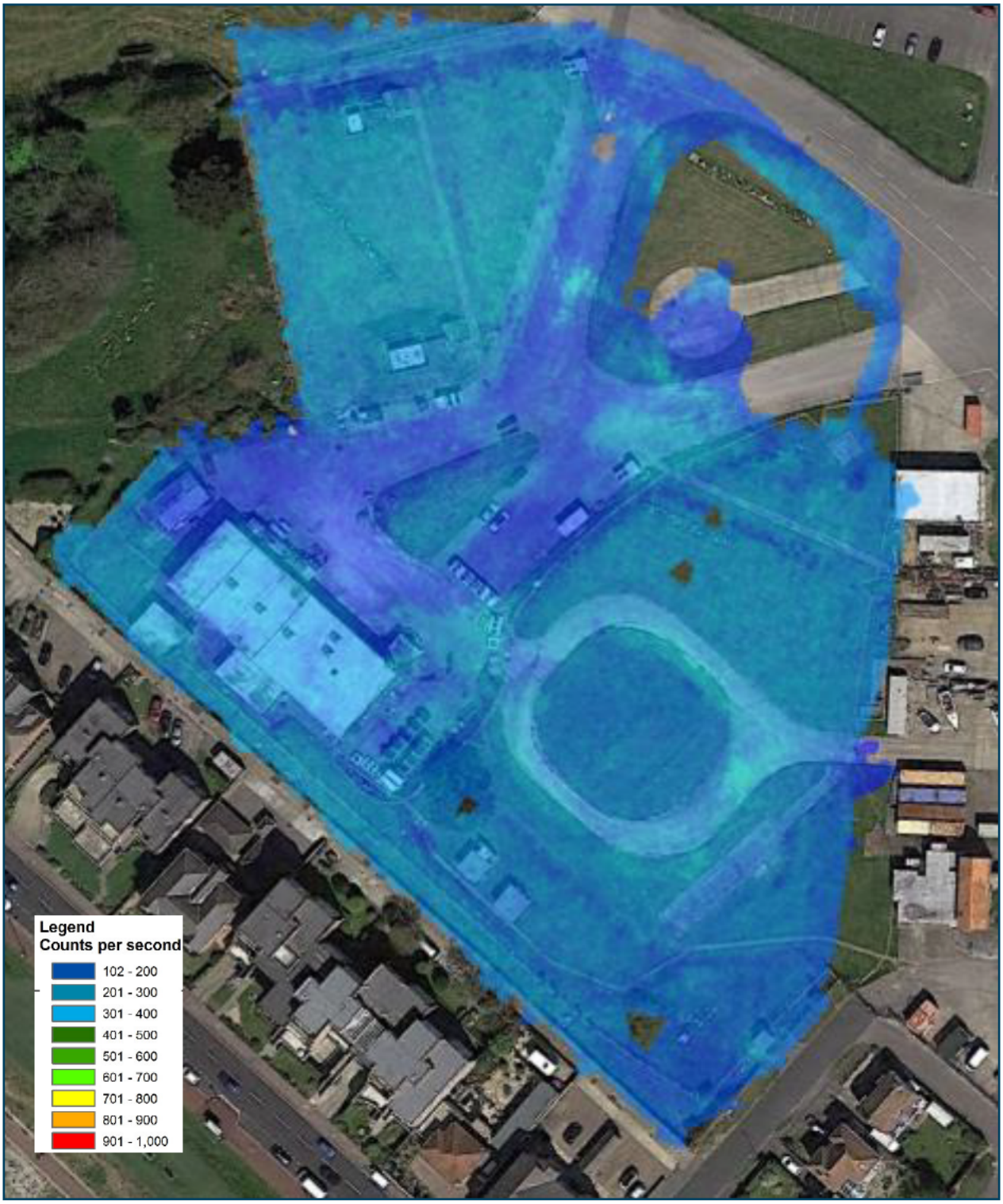

Figure 3. RadSurvey results showing levels in counts per second.

The site generally showed readings commensurate with those expected from natural background, taking into account variations dues to different surface materials.

There are several areas in Figure 3 that are missing GPS data points (marked with no colouring). These are locations where either tree cover or site works prevented acquisition of a GPS signal or where a surface structure prevented access for monitoring. Where tree coverage prevents a GPS

signal being recorded the data is reviewed by the operator to confirm that no elevated reading are present in the data. The areas of missed coverage can be seen in Figure 4 below.

In addition, there was a section to the West side of the site that was composed of ‘made ground’ with up to approximately 50 cm additional depth of material (see Figure 4). Therefore, the surface measurements in this area are not representative of the material that is below the original ground.

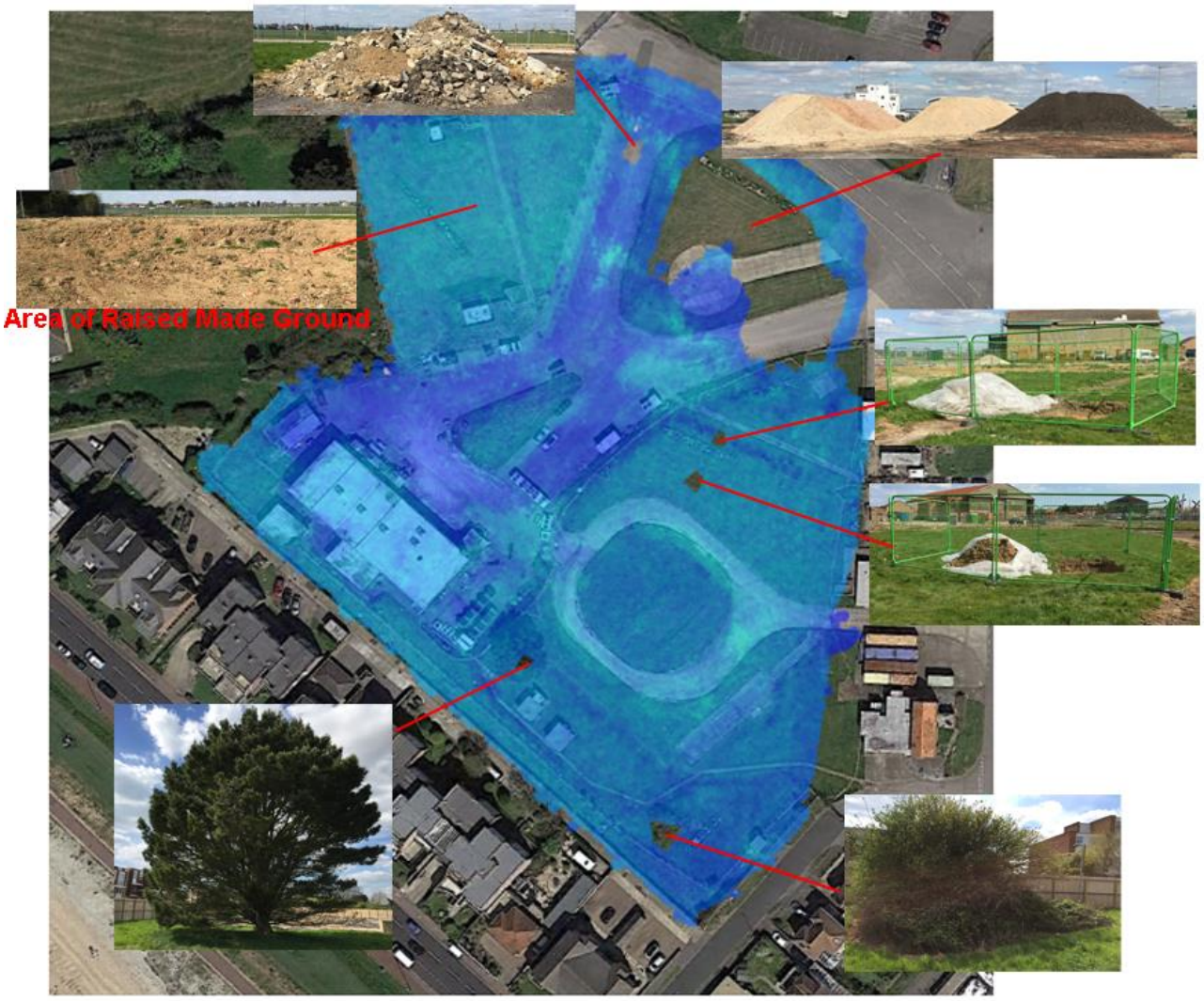

Figure 4. RadSurvey map showing locations that could not be surveyed

4 Risk assessment for future use

No evidence of contamination was found during the external ground survey. There is therefore no radiation exposure pathway for future occupants of the surveyed areas of the site. Not all areas could be accessed.

5 Conclusions & Recommendations

A gamma radiation walkover survey has been conducted of an area of ground formerly occupied by the Ministry of Defence within the confines of HMS Daedalus.

The survey indicates that most of the site had measurements commensurate with natural background and no areas with significant elevated radiation readings were identified during the survey.

Whilst the majority of the site area was subject to a RadSurvey, some areas could not be surveyed due to the presence of piles of excavated material as indicated in Figure 4. If these areas are cleared, then these locations could be surveyed to provide comprehensive coverage and information on their radiological status.

6 References

1 Entec HMS Daedalus Land Quality Assessment Radiological survey Report Project 05002 31 May 2007