Ministry of Defence

de&s

wood.

STRIDE TREGLOWN

Defence Equipment and Support

RAF CAM Relocation to RAF Cranwell

Site Surveys Summary Report

Wood Environment & Infrastructure Solutions UK Limited – February 2021

Report for

Mr Scott Peschel
(DES FsAST 5e)
Defence Equipment and Support
Walnut 3A Mailpoint #1317
MOD Abbeywood
Bristol
BS34 8JH

Main contributors

Cliff Messent

Issued by

.....
Cliff Messent (on behalf of Wood)

Approved by

.....

Wood

Shinfield Park
Shinfield
Reading RG2 9FW
United Kingdom
Tel +44 (0)118 9131234

Doc Ref. 42438-00

document1

Third party disclaimer

This report was prepared by Wood Environment & Infrastructure Solutions UK Limited on behalf of its client, the Ministry of Defence, under a contract PMFTDS-0723-2019 dated 9 January 2020. Wood shall not be liable for any use of this report beyond that for which it was written.

Management systems

This document has been produced by Wood Environment & Infrastructure Solutions UK Limited in full compliance with our management systems, which have been certified to ISO 9001, ISO 14001 and OHSAS 18001 by LRQA.

Document revisions

No.	Details	Date
1	Draft for comment	18th February 2021

Executive summary

RAF Henlow in Bedfordshire has been identified for closure by the UK Government and as a consequence it is planned to relocate the RAF Centre of Aviation Medicine (RAF CAM) from RAF Henlow to a new build facility at RAF Cranwell in Lincolnshire. The RAF has selected a site to the east of Trenchard Hall at RAF Cranwell as the preferred location for this development. See Appendix A for site location plan.

This Site Surveys Summary Report has been prepared by Wood Environment and Infrastructure Solutions UK Ltd (Wood), in conjunction with Stride Treglown Ltd (STL), for and on behalf of Defence Equipment and Support (DE&S). The purpose of this report is to summarise the findings of the following site surveys and reviews undertaken on the East of Trenchard Hall Site at RAF Cranwell:

a) Preliminary Ecological Appraisal;

b) Transport Assessment;

c) Ground Penetrating Radar and Topographical Survey;

d) Phase 1 Land Quality Assessment;

e) Supplementary Phase 2 Ground Investigation;

f) Utilities Survey and Review;

g) Security Assessment.

The findings and recommendations of these surveys are detailed within the body of this report. The general outcome of the surveys is that no significant issues or constraints have been identified that would prevent the RAF CAM development on the site to the East of Trenchard Hall.

A watching brief will be required on the station utility infrastructure to capture any changes in the availability of key services, such as power, and their impact on the RAF CAM development proposals until construction of the RAF CAM facility commences. For example, if the power to RAF Cranwell should require to be upgraded the lead in time for the upgrade can in the order of two years and may be subject to spare capacity being available in the local area network.

Similarly, a watching brief will be required on the ecology of the site to monitor any changes on the site and in particular bats. If the situation changes then mitigation measures will be required prior to construction to manage the situation. These mitigation measures may have to be undertaken within certain times of the year and require appropriate licences to be in place prior to implementation. Thus, further surveys should be undertaken as set out in the Preliminary Ecological Appraisal for the site.

Contents

1. Introduction

1.1 Terms of Reference

Under commission number PMFTDS-0723-2019 Wood Environment and Infrastructure UK Limited has been commissioned by Defence Equipment and Support (DE&S) to undertake the following site surveys and reviews for the proposed RAF CAM development, at RAF Cranwell, on the East of Trenchard Hall site.

a) Preliminary Ecological Appraisal;

b) Transport Assessment;

c) Ground Penetrating Radar and Topographical Survey;

d) Phase 1 Land Quality Assessment;

e) Supplementary Phase 2 Ground Investigation;

f) Utilities Survey and Review;

g) Security Assessment.

1.2 Background

RAF CAM are currently based at RAF Henlow in Bedfordshire which has been identified for closure by the UK Government. In order for the closure of RAF Henlow to proceed RAF CAM must be relocated to an alternative location within the MOD estate.

An Assessment Study was undertaken By GVA (now Avison Young) into the relocation of RAF CAM and considered a number of sites at RAF Cranwell and RAF Wittering. Following publication of the final version of this study in January 2019 the RAF selected a site to the east of Trenchard Hall at RAF Cranwell (Option E) as the preferred location for a new build RAF CAM facility. See Appendix A for the site location.

The GVA Assessment Study included a concept design and indicative site plan. The concept design provides 6,718 sqm (GIA) of floor space in a predominantly single story building. A copy of the site plan is at Appendix B.

In addition to the Assessment Study the Capability User Requirements Document (Version 0.1 dated January 2020) has been prepared by the project Requirements Manager. This document includes an infrastructure annex setting out the office and technical accommodation requirements based on the GVA Assessment Study. This accommodation assessment does not reflect a capability based assessment and may be subject to further development as the project develops.

1.3 Purpose of the Site Surveys

The purpose of the site surveys and reviews was to understand the physical and ecological characteristics and constraints of the proposed development site, to assess the impact of the development on the existing Station infrastructure and make recommendations, if required, for further investigations and/or mitigation measures. A key driver for the surveys and reviews being to reduce uncertainty regarding the development of the East of Trenchard Hall site prior to the project scrutiny and procurement process.

1.4 Purpose of the Site Surveys Summary Report

The purpose of this report is to summarise the findings and recommendations of the detailed individual site surveys and reviews undertaken on the East of Trenchard Hall Site at RAF Cranwell into a single document.

2. Preliminary Ecological Appraisal (PEA)

2.1 Introduction

A Preliminary Environmental Appraisal (PEA) was undertaken comprising a desk study and an extended Phase 1 habitat survey. The approach adopted for the survey followed the *Guidelines for Preliminary Ecological Appraisal* with the standard Phase 1 habitat survey methodology extended to identify the presences, or potential presence, of legally protected species, and habitats and species that are of importance for biodiversity conservation as detailed in the *Guidelines for Baseline Ecological Assessment*.

A Phase 1 habitat survey of the East of Trenchard Hall site was undertaken in February 2020. Full details of the PEA methodology, results and conclusions are detailed in the RAF CAM Relocation to RAF Cranwell, Preliminary Ecological Appraisal report (ref 42438-WOOD-XX-XX-RP-OE-0001_S2_P02.1) provided under separate cover.

The purpose of the PEA is to inform the proposed RAF CAM development at RAF Cranwell and its intent is to enable the early identification of potential ecological constraints; inform additional survey or mitigation requirements;, and to establish the ecological baseline of the development site.

2.2 PEA Conclusions and Recommendations

2.2.1 Designated sites

There are no statutory biodiversity sites of international importance within 10km of the Site. There are however, one statutory biodiversity site of national importance within 5km (High Dyke SSSI, 1.8km west) and two non-statutory biodiversity sites of local importance within 2km of the Site. The closest of these is Lodge Paddock RAF Cranwell LWS, located 0.7km west of the Site. Due to the nature of the proposed development, and the distance from the designated sites it is unlikely that the development will result in any adverse effects on these designations and therefore the sites do not pose a constraint to the proposed RAF CAM development.

Recommendation

The proposed development should incorporate standard pollution prevention measures20 during both the construction and operational phases. The implementation of standard best practice construction measures to minimise dust pollution on the Site will further reduce any likelihood of adverse effects such that no further work is deemed to be necessary in respect of designated sites.

2.2.2 Habitats

The habitats present on-site are generally common and widespread both locally and nationally, and are of limited conservation value, albeit the collective cover of semi-mature trees and semi-improved grassland provide some habitat that is likely to be used by birds and other fauna. The hedgerow towards the south east of the survey area is isolated in nature, albeit hedgerows are a priority habitat at both national and local levels.

Recommendation

Where possible semi-mature trees should be retained within the scheme design and protected from damage during the construction works. Furthermore, the planting of trees and scrub comprising native species of

local provenance, should be included within any landscape proposals. The hedgerow is unlikely to be impacted by the works as it is located off-site, such that no further measures are required.

2.2.3 Species

Badger

There was no evidence of badger on Site or within 30m of the Site.

Recommendations

Badgers are a mobile species and frequently dig new setts. In view of this, should a period of six months elapse between the time of the survey and the onset of construction work, a pre-development check of the Site and land within 30m its boundary for any new setts would be required, carried out sufficiently far in advance of construction, mindful of the timing constraints associated with works which may disturb badgers or damage or destroy their setts.

Bats - commuting / foraging

The Site provides a limited amount of habitat for bats, namely the semi-mature trees, shrubs and semi-improved grassland that offers foraging and commuting opportunities. The habitats are within an area that is lit by streetlights to the north and west which although may attract insect prey of bats, studies have shown even light tolerant bats species (such as Pipistrellus spp.) may avoid these areas. Thus, reducing the Sites suitability for foraging and/ or commuting bats.

Furthermore, the habitat onsite is connected to intensively managed grassland (airfield) and the RAF base comprising residential and office buildings. The wider area however has small pockets of woodland and is very rural in nature such that bats roosting on or in the vicinity of the Site are likely to disperse to darker habitats to forage. The habitats present on-site do provide a limited foraging resource and the habitats onsite are connected to offsite areas via the trees along Cranwell Avenue. However, the trees are lit by streetlights thus reducing their suitability as a dispersal and/or foraging corridor. Therefore, the Site meets the criteria for 'Low' suitability for bats.

Recommendations

Best practice guidelines specify that activity surveys are required where development proposals are likely to impact on habitats suitable for commuting and foraging bats. Low suitability sites require further surveys comprising one activity survey for bats in each season (Spring, Summer and Autumn). In addition to the above, it is recommended that lighting incorporated within the proposals should be designed to adhere to principles set out in Bats and artificial lighting in the UK (Bat Conservation Trust and Institution of Lighting Professionals, 2018) in order to minimise or prevent additional illumination of any retained habitat features (tree line to the north along Cranwell Avenue and semi-mature trees retained within the Site) that may be used by bats and other nocturnal wildlife.

Bats – roosting

Two structures are present within the survey area, but offsite, both of which offer negligible potential for bats to roost, and therefore no further survey is required. Additionally, surrounding buildings such as Trenchard

Hall to the west and residential dwellings to the north of the Site are considered to offer low to moderate potential for bats to roost.

Two trees were identified as having rot holes, albeit these appeared to only extend back a few centimetres. One tree (TN6) supports a small (c.5cm) diameter rot hole on the northern aspect of the tree c.3m above

ground level (AGL), the tree is located within the semi-improved grassland and is situated away from streetlights and is considered to have 'low' potential for bats to roost. The other tree (TN8) supports a larger (c.10cm) diameter hole on the southern aspect c.2m AGL albeit it is situated along Cranwell Avenue close to streetlights. The feature itself is considered to offer moderate potential for bats to roost, however, its location reduces the likelihood given the lighting surrounding this feature.

Recommendations

The surrounding buildings offer low to moderate potential for bats to roost. However, the development is limited in nature; restricted to the semi-improved grassland and will comprise a structure that will not encroach on the surrounding buildings, furthermore, the development will be located in an already lit area. Therefore, no further surveys of the surrounding buildings are recommended at this point, however if the scheme design changes such that impacts are likely on the surrounding buildings this recommendation may need to be reviewed.

Best practice guidelines state that trees considered to only offer low potential for bats to roost are not required to have further surveys. However, moderate potential trees are required to have two further surveys. Therefore, it is recommended that the rot hole on the southern aspect of TN8 is inspected during the first activity survey to further investigate its potential for bats and to look for evidence of use by bats (i.e. droppings). The hole is c.2m AGL and could be reached by ladders to inspect the feature. If the feature is confirmed as being of moderate potential a second survey will be required which can be carried out concurrently with the activity surveys described above. The second inspection survey (if required) will also look for evidence of use by bats such that this inspection should constitute the second survey required by the guidelines. This method of thoroughly inspecting the features present will negate the need for further dusk emergence or dawn re-entry surveys, although this will need to be determined following the initial inspection.

Reptiles

The area of the Site to be developed comprises largely of semi-improved grassland which provides some suitable areas of reptile habitat that could support reptile species such as adder, grass snake, common lizard and slow worm. However, the Site is relatively isolated given the intensively managed grassland surrounding the Site and gardens associated with the residential dwelling to the north are separated by Cranwell Avenue. Therefore, although a few individuals may be present, the likelihood of the Site supporting an important population is deemed to be low enough to not warrant further survey work.

Recommendations

In view of the above, due to the low likelihood of reptiles being present, it would be possible to carry out the Site preparation works by adopting precautionary avoidance measures. The measures in this instance given the managed grassland present would be to have a suitably qualified ecologist carry out a fingertip search of the Site prior to clearance works. Once the Site is deemed free of reptiles, works can continue without further supervision.

Birds

The Site offers suitable habitats (semi-mature trees) to support individuals or breeding pairs of common and widespread bird species as well as some more important species such as skylark. Furthermore, several nests

were identified within one of the roadside trees to the north. However, the Site comprises a limited area and type of habitat available for these species and therefore this reduces the likelihood that the Site would support more than very small numbers.

Recommendation

The nests and eggs of all wild birds (with certain exceptions) are protected and therefore any vegetation clearance (removal of trees) should avoid the nesting bird season (March – August inclusive). If this is not possible then a nesting bird check should be undertaken by a suitably qualified ecologist immediately in advance of vegetation removal. Should an active nest be found, this would need to be retained and safeguarded until the young have fledged.

Invasive / notifiable weeds

Cotoneaster is present within the areas of introduced shrub off-site.

Recommendation

The works are restricted to the semi-improved grassland and it is not anticipated that any of the introduced shrub beds will be impacted by the works. However, if the cotoneaster present needs to be disturbed during the proposed works, it should be either burned on-site or taken to a landfill that is able to accept Schedule 9 species in order to prevent its spread. If the plant is not going to be disturbed it can be left in situ and no further measures will be required.

Other species

The Site is suitable to support species listed under S41 of the NERC Act 2006, such as hedgehog and common toad, albeit neither of these species were recorded during the Site survey.

Recommendations

Although no further work is deemed to be necessary with regard to S41 species, where possible, consideration should be given to implementing biodiversity enhancement measures as outlined in 2.2.4 below.

2.2.4 Biodiversity enhancement measures

The National Planning Policy Framework states that planning policies and decisions should contribute to and enhance the natural and local environment by "minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures". As such, it is recommended that a number of enhancement measures are incorporated within any future scheme design. Although the proposals are of a limited nature the following enhancement measures should be included where possible:

- improvement of the grassland surrounding the development to include an appropriate mowing regime to encourage the growth of calcareous grassland species;
- enhancement of the eastern boundary of the Site by planting shrubs or scrub in between retained trees. Plants should be fruiting and/ flowering species that are native and of local provenance. This will increase the nectar resource for invertebrates and will provide valuable foraging for bats and birds;

- five bat boxes should be installed on retained trees along the eastern boundary of the Site away from the streetlights along Cranwell Avenue to increase the provision of available roosting and nesting habitat; and
- log piles and artificial hibernacula could also be created and interspersed throughout any areas of retained habitat along the northern and eastern boundaries of the Site. The aim of this measure would be to increase the structural diversity of the habitat for invertebrates and other species. These log piles could be created using timber from any on-site felling or arboricultural work.

2.2.5 PEA Summary

The PEA identified the presence/potential presence of the following ecological receptors:

- one statutory biodiversity site within 5km;
- two non-statutory biodiversity sites within 2km;
- cumulative cover of mature standard trees;
- provision of a limited amount of potential foraging habitat for badger;
- potential bat roosting habitat (within two trees) and foraging habitat (albeit of low quality);
- a small amount of potential foraging habitat and refuge that could support a small number of reptiles; and
- an assemblage of nesting birds that are common to the local area.

It should be noted that there are no water bodies within 500m of the Site, such that the potential presence of species such as great crested newt, water vole, otter and white-clawed crayfish can be disregarded.

3. Transport Assessment (TA)

3.1 Introduction

A Transport Assessment (TA) has been undertaken to assess the impact of the RAF CAM development on RAF Cranwell and the local highways network. The TA is required to support the planning application for the development to take into account the increased personnel numbers and additional traffic movements and car parking.

The TA has been developed in consultation with the planning and highways officers within Lincolnshire County Council (LCC). The extent of the study area was determined in scoping discussions with LCC and extends form the RAF CAM site to the Cranwell Avenue (B1429)/A17 junction to the west; to the Sleaford Road (B1429)/A15 junction to the east; and to the main Street/A17 junction to the south. Figure 3.1 (at Appendix C) shoes the key transportation routes considered as part of the study area.

Proposed Scheme

An indicative masterplan of the proposed development is shown at Appendix A. The proposals include a single storey (6,718sqm Gross Internal Area) building with 192 car parking spaces. The proposed building will consist of management and administration offices, training areas plus equipment and maintenance areas. The proposed parking facility consists of 192 cars spaces (including 10 disabled), 10 motorbike spaces, 44 cycle parking spaces and a pickup/drop off lay-by for 4 vehicles.

It is anticipated that vehicular access to the Site will be achieved from the existing Cranwell Avenue (B1429) access via Central Drive (a private road) and Nursery Road (a private road). Therefore, for a robust assessment, it is assumed that all development traffic will use Central Drive to access the public highway, the B1429 Cranwell Avenue.

Following a sustainable transport mode review, it is considered that the Site is accessible by all modes of transport and walking and cycling are a viable alternative to car use within the Cranwell base as everything is within a 2km radius.

Car Parking

The car parking demand has been calculated based on 3,000 students per year and on average 14 courses running per week. The MoD have advised that at any one time, there could be up to 259 personnel within the RAF CAM facility, comprising 143 staff and 116 trainees. 37% of trainees would live in the Single Living Accommodation located within the walking distance and 30% of trainees would car share or take alternative transport modes.

Consequently, the peak parking demand would be 181 vehicles on site. Providing a car parking with 192 spaces allows an extra 11 parking spaces for extraordinary events.

The quantity of parking provided on Site has been carefully calculated by MoD to take account of the worst case scenario because there is little opportunity to provide overflow parking as on-street parking is not allowed in the vicinity of the Cranwell base for security reasons.

Transport Assessment Report

The transport assessment and survey was undertaken in March 2020. Full details of the TA methodology, results and conclusions are detailed in the RAF CAM Relocation to RAF Cranwell, Transport Assessment report (ref 42438-WOOD-XX-XX-RP-OT-0001_S3_P02) provided under separate cover.

3.2 TA Conclusions and Recommendations

3.2.1 Introduction

The aim of the TA was to assess and demonstrate that the development proposals can be accommodated within the existing transport network to a standard that is accepted by LCC the highway authority.

This section summarises these proposals and the outcome of the operational assessment.

3.2.2 Summary of Location and Development Proposals

The proposed Site is situated within the RAF Cranwell base, south of Lincoln and surrounded by A17, B1429, Central Drive (a private road), Main Street and A15. The proposals include a single storey (6718sqm Gross Internal Area) building with 192 car parking spaces. The proposed building will consist of management and administration offices, training areas plus equipment and maintenance areas.

It is anticipated that vehicular access to the site will be achieved from the existing Cranwell Avenue (B1429) access via Central Drive (a private road) and Nursery Road (a private road).

3.2.3 Summary of Assessments

Once trainees attending the proposed development have arrived, the vast majority of their activity and that of the staff will be restricted to the RAF Cranwell base where the transport network is suitable for pedestrians and cyclists. Therefore, improvement schemes to the wider pedestrian and cycle networks are not considered necessary.

In discussion with LCC, it was agreed that the following junctions should be considered to assess the capacity to understand if mitigation is required.

- Junction 1 - A17/Cranwell Avenue (B1429);
- Junction 2 - Cranwell Avenue (B1429)/Central Drive;
- Junction 3 - Cranwell Avenue (B1429)/College Road (B1429)/Main Street;
- Junction 4 – A15/Sleaford Road (B1429)/Unnamed Road; and
- Junction 5 – A17/Main Street.

Table 3.1 presents a summary of the model analysis for each junction, each time period and each scenario and also identifies whether mitigation is required or not.

Table 3.1: A Summary of the Junction Model Results

Junction	2020 Baseline		2024 Future Base		2024+Development		Outcome
	AM	PM	AM	PM	AM	PM	
A17/Cranwell Avenue (B1429)	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	No capacity mitigation required
Cranwell Avenue (B1429)/Central Drive	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	No capacity mitigation required
Cranwell Avenue (B1429)/College Road (B1429)/Main Street	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	No capacity mitigation required
A15/Sleaford Road (B1429)/Unnamed Road	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	No capacity mitigation required
A17/Main Street	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	No capacity mitigation required

Table 3.1 shows that none of the junctions within the assessment area requires mitigation as all junctions have ample capacity to accommodate the development traffic. Furthermore, a sensitivity test was undertaken which established that even if all traffic flows were increased by 21.8%, the junctions would still operate within capacity and therefore not require mitigation.

3.2.4 Conclusions

After considering existing conditions, road safety and assessing the capacity of the existing junctions, it is concluded that the impact of the development traffic can be accommodate on the existing transport network without impacting on the local environment.

4. Ground Penetrating Radar (GPR) and Topographical Survey

4.1 Introduction

A Ground Penetrating Radar (GPR) and topographical survey of the proposed RAF CAM development site to the east of Trenchard Hall was undertaken in March 2020.

The topographical survey was a full 3D 1:200 survey of the RAF CAM site and includes as appropriate building footprints, site boundary nature and extents , kerb lines, pathways and surfaces, street furniture, overhead cables and general grid levels throughout the site at 10 to 15m intervals. The survey includes individual free standing or small groups of trees over 200mm in trunk diameter together with the extents of any wooded and heavily vegetated areas.

In addition to the topographical survey a ground penetrating radar (GPR) survey of the site was undertaken to identify underground features including:

- Underground services including the depth of service below ground level;
- Location, extent and depth of underground features including air raid shelters and drainage pumping chambers.

The results of these surveys were presented in the form of a dwg format drawing, 12 No pdf format sheets covering the site, and a GPR survey interpretative report.

4.2 Topographical Survey Results

The survey showed an undulating site varying in height Above Ordnance Datum (AOD) from about 50.8m to 56.5m. The approximate levels at the four corners of the site are:

- North west 56.5m
- North east 52.2m
- South west 55.5m
- South east 55.5m

For full details of the survey and levels the dwg format drawing should be examined which has been provided under separate cover. A copy of the combined topographical and GPR survey out put is lodged at Appendix D.

The survey identifies surface features including the three air raid shelters at the south west corner of the site and the foul water pumping station. The seven air raid shelters that were located centrally east to west across the site are not identified as they have been removed and there are no identifiable surface features remaining to survey.

4.3 Ground Penetrating Radar Survey

Warner Surveys undertook a GPR survey at the site in February 2020 to update the understanding of the sub-surface obstructions and anomalies across the site, with particular emphasis on the location and identification of former air raid shelters. An Impulse Radar Raptor High Density Array GPR antenna was

utilised for the survey, where terrain allowed for this. The GPR achieved penetration of around 1.5-1.8m bgl across the site.

The GPR survey identified underground features, services and anomalies and a full interpretation is provided in Warner Surveys report titled Ground Penetrating Survey Report, RAF Cranwell dated March 2020. A copy of this report has been provided under separate cover.

The linear features identified are underground services. A number of these services correlate with known services recorded on the Station site services plan. Marked up drawings showing this correlation are lodged at Appendix D.

In addition, the survey identifies a number of potential underground services not identified on the site services plan. These services are considered to be from the previous development of the site. The Status of these services has not been determined at this stage and may include live as well as redundant/disconnected services.

The Supplementary Phase II Ground Investigation undertaken in August 2020, see Section 6, investigated a number of the anomalies identified by the GPR survey and confirmed that the unknown linear features encountered by the investigation were redundant drainage services. This investigation only sampled a number of features and further investigation will be required to verify the status of these linear features and anomalies.

4.4 Summary and Recommendations

The results of the Topographical Survey are factual and record the surface features and levels within the designated RAD CAM site area.

The GPR Survey identifies a number of underground features including known and unknown services. A number of these features were investigated as part of the Supplementary Phase II Ground Investigation and further information is provided in Section 6 of this report.

There are limitations on the features that the GPR survey can identify and further investigation will need to be undertaken by the RAF CAM infrastructure contractor prior to construction commencing to identify the presence of underground features within the footprint of the construction area.

5. Phase 1 Land Quality Assessment

5.1 Introduction

A Phase One Land Quality Assessment (LQA) was undertaken, for the RAF CAM development site, in April 2020. Full details of the LQA methodology results and conclusions are detailed in the RAF Cranwell "Site 07" Land to the East of Trenchard Hall Phase 1 Land Quality Assessment report (ref 42438-WOOD-XX-XX-RP-OG-0001_S2_P01.1) provided under separate cover.

The LQA study reviewed the existing ground investigation information for suitability to identify any data gaps which required additional ground investigation. A key output from this report was recommendation and cost estimates for a Supplementary Phase II Ground Investigation, see Section 6.

The Land Statement output from the LQA Phase 1 study is set out below.

5.2 Land Quality Statement

5.2.1 Site Description

The site, located within RAF Cranwell, is centred on National Grid Reference (NGR) 501440, 349680, near Sleaford, Lincolnshire, NG34 8HB. The study area for the LQA 1 is a parcel of land to the east of Trenchard Hall known as Site 07.

The site is roughly square in shape, bounded by tarmacadam roads on all sides, and covers an area of approximately 5 hectares. The RAF Cranwell site is accessed via the main Guardroom on Cranwell Avenue.

5.2.2 Environmental Setting

Superficial deposits are generally absent within the area, however small pockets of Head deposits exist nearby, the closest of these lies <50 m north east of the site. These comprise clay, silt, sand and gravel. Geological mapping indicates that the site is underlain by bedrock of the Upper Lincolnshire Limestone Member Formation. This, in turn, overlies the Northampton Sands and Upper Lias Clays formation.

The site is of high sensitivity with respect to groundwater. The Lincolnshire Limestone Formation is a Principal Aquifer and the small areas of Head Deposits are classed as a Secondary Undifferentiated Aquifer. The site lies within a total catchment (Zone 3) source protection zone (SPZ). The nearest active groundwater abstraction well is located 1.8 km east of the site and is used for general farming and domestic water supply.

The site is of very low sensitivity with respect to surface water. There is no named river within 1km of the site and the nearest surface water feature to the site is a small pond located 700 m north east of the site, close to the sewage treatment works.

The site of low sensitivity with respect to ecology. The nearest designated site is the High Dyke Site of Special Scientific Interest (SSSI), which is located 2.3 km west of the site.

5.2.3 Site History

The site remained green fields until it was developed sometime prior to 1947 when rows of military accommodation were constructed. A number of underground air raid shelter are also present on and in the vicinity of the site. By 1958, the site has been largely cleared of buildings and a BFI has been constructed just beyond the eastern boundary.

The site was cleared of all remaining buildings with just ten air raid shelters remaining, seven in the central section and three in the southwest corner along with a Severn Trent pumping station. Sometime between April 2005 and December 2006 the seven central air raid shelters were demolished and backfilled. The three shelters in the southwest corner remain on site have not been infilled.

5.2.4 Potential Sources of Contamination

A number of potential sources of contamination have been identified at the site, although based on the conceptual model only the source of made ground associated with air raid shelters has been considered for risk assessment as there are no plausible pollutant linkages associated with the other potential sources.

Potential Source Number	Potential Source	Associated Contaminants	Considered for risk assessment?
S1	Made ground in and around old and infilled air raid shelters	TPH, BTEX, PAHs, heavy metals, cyanides (total), VOCs, asbestos Made ground is locally thicker. CGL investigation found no exceedences of GACs for commercial industrial use and one sample with asbestos (crocidolite) below detection limit 0.001%	Yes - asbestos
S2	General Made Ground beneath former accommodation buildings	TPH, BTEX, PAHs, heavy metals, cyanides (total), VOCs, asbestos Made ground is absent across the majority of the site. CGL investigation found limited presence of made ground across the site with no exceedences of GACs for commercial industrial use	No
S3	Off-site RAF base activities - fuel storage	Hydrocarbons and BTEX	No
S4	Off-site historical infilled pit	Soil gas	No
S5	Off-site RAF base activities - nearby fire section	TPH, BTEX, PAHs, Perfluorooctanesulfonic acid (PFOS). Wood investigation found no exceedences of GACs for commercial industrial use. However, PFOS concentrations were found in Made Ground and groundwater samples. Made Ground sample was below GAC. Groundwater samples exceeded DWS for wholesomeness	No

5.2.5 Potential Risks Identified at the Site

Potential risks to sensitive receptors have been identified at the site and the table below summarise the risk assessment, which has been completed based on future commercial/industrial use.

Potential Source	Potential Pollutant	Potential Receptors	Risk
S1 Made Ground in and around infilled and old air raid shelters	Asbestos	Commercial/industrial site users under future use (R1)	Moderate Risk may be reduced depending on layout of future design. If the source location is beneath hardstanding likelihood will be reduced

5.2.6 Geotechnical Assessment

The Geotechnical Assessment was carried out by reviewing the findings of 3 previous investigations, a Land Quality Assessment for the entire RAF Cranwell site prepared by Wood in 2017, a ground investigation interpretative report prepared by CGL in 2018, and a GPR survey carried out by Warner Surveys in 2020. The investigations confirmed the presence of weathered Limestone at shallow depth, overlain by topsoil and localised Made Ground. The CGL investigation included the excavation of six trial trenches in the area of the infilled air raid shelters. This proved the existence of 6 of the 7 backfilled air raid shelters in the centre of the site, with the backfill material comprising granular rubble (sand, gravel, brick, concrete etc.) to depths of 2.60 to 2.85m bgl. A concrete floor slab of unknown thickness was found at the base of each investigated shelter. The extent of Made Ground was not fully delineated, and one of the air raid shelters was not investigated. It is not clear why this was the case.

The investigation did not cover the other 3 shelters located on the southwest corner of the site. Review of the historical data indicated that these 3 underground air raid shelters have not been filled.

The weathered Limestone comprised an upper layer of completely weathered material, recovered as stiff to very stiff clay, or variable loose to dense sandy gravel or sand and gravel. This was underlain by more competent weathered Limestone.

5.2.7 Conclusions

One potential source of contamination has been identified at the site, namely asbestos (crocidolite) in the made ground associated with the former air raid shelters in the central part of the site. This source has been identified to pose a moderate risk to future commercial / industrial site users. The risks to future site users from this source may be reduced depending on the future layout of the development by reducing the likelihood of the contaminant linkage being realised if the source is beneath hardstanding.

Other potential constraints to the proposed development have been identified on site, namely:

- Naturally occurring radon – Intermediate probability radon area (5 to 10% of homes are estimated to be at or above the Action Level);
- Deep deposits of backfill material in the former air raid shelters that have been filled;
- Remnant floor slabs at between 2.60 and 2.85 m bgl from the air raid shelters across the central part of the site;
- Potential for buried relic foundations related to former site use, identified as anomalies in GPR survey;
- Potential for deep backfill material in location of historical stone pit on northern boundary;
- Three existing underground air raid shelters i.e. voids of unknown depth and extent, in the south western corner of the site. The extent of surrounding Made Ground associated with their construction is not known; and
- It is currently unknown what is planned for the existing pumping station in the centre of the site. If this is to be removed, then there may be remnant underground structures / voids associated with this.
- Potential presence of UXO with varying risk categorisations from low to high;

5.2.8 Recommendations

- The full extent of the made ground associated with the construction and subsequent filling of the former air raid shelters in the central part of the site is unknown. GCL (2018) identified six of the air raid shelters but did not investigate the seventh and did not delineate the extent of Made Ground adjacent to them. Additionally, the extent to which asbestos contamination is present in the material is unknown. Further ground investigation is therefore recommended in this area;
- The geometry of the remaining air raid shelters should be surveyed;
- Investigation of the area surrounding the remaining air raid shelters is recommended, to delineate any surrounding made ground;
- Further investigation, intrusive (trial pitting / trenching) and non-intrusive is required to investigate possible relic foundations and obstruction (other than the shelters' base slabs identified in the GPR Survey), including the shelters side walls;
- Further intrusive investigation to confirm ground conditions affecting the proposed development and aid in the design of foundations, floor slabs, swimming pool excavation etc;
- Site-specific contamination data obtained from all site investigations, including UXO studies, should be included in the pre-construction information for any below ground works; and
- Mitigation measures to address the risks to UXO and radon should be adopted during design and construction of the development.

5.3 Summary

The above recommendations formed the basis for the Supplementary Phase II Ground Investigation undertaken in August 2020, see Section 6 for details.

6. Supplementary Phase II Ground Investigation.

6.1 Introduction

Further to the Phase One Land Quality Assessment (LQA), summarised in Section 5 of this report, a Supplementary Phase II Ground Investigation was undertaken in August 2020 based on the findings and recommendations of the Phase 1 LQA.

The aim of the Supplementary Phase II Ground Investigation was to investigate contamination constraints present at the site identified in the Phase One LQA and to update the preliminary environmental risk assessment for military end-use (assessed as a commercial/ industrial use). This information was used to refine the conceptual model.

The scope of works for the Phase Two LQA comprised:

- Undertake a targeted Phase Two site investigation to determine the presence/absence of contamination arising from the targeted potential contamination sources identified in the Phase One LQA.
- Undertake a generic quantitative risk assessment and refine the conceptual site model to assess human health and environmental risks posed by any contamination identified.
- Preparation of a report to summarise the risks associated with the potential future land uses.

The purpose of this Phase 2 report was to assess the land quality of the site to support the proposed relocation of the RAF CAM. The report considered future military (assessed as commercial/ industrial) land use but did not consider detailed design of any future development. The findings of this report are based on the information made available to Wood by DE&S, and the findings of the ground investigation.

Full details of the phase II Ground Investigation methodology, results and conclusions are detailed in the RAF Cranwell "Site 07" Land to the East of Trenchard Hall Supplementary Phase II Ground Investigation report (ref 806174-WOOD-XX-XX-RP-OC-0001_A_P01.1) provided under separate cover.

The results, conclusions and recommendations from the Phase II Ground Investigation are set out in the following sections and update the Land Quality Statement details outlined in Section 5 of this report for the Phase One LQA.

6.2 Land Quality Statement

6.2.1 Environmental Setting

Superficial deposits are generally absent within the area, however small pockets of Head deposits exist nearby, close to the north east of the site. These are variable and may comprise clay, silt, sand and gravel. Geological mapping indicates that the site is underlain by bedrock of the Upper Lincolnshire Limestone Member Formation.

The site is of **high** sensitivity with respect to groundwater. The Lincolnshire Limestone Formation is a Principal Aquifer and the small areas of Head Deposits are classed as a Secondary Undifferentiated Aquifer. The site lies within a total catchment (Zone 3) source protection zone (SPZ). The nearest active groundwater abstraction well is located 1.8 km east of the site and is used for general farming and domestic water supply.

The site is of very **low** sensitivity with respect to surface water. There is no named river within 1km of the site and the nearest surface water feature to the site is a small pond located 700 m north east of the site, close to the RAF Cranwell sewage treatment works.

The site of **low** sensitivity with respect to ecology. There are no designated ecological sites within 2km of the site. The nearest designated site is the High Dyke Site of Special Scientific Interest (SSSI), located 2.3 km west of the site.

6.2.2 Potential Sources of Contamination

The Phase 1 Land Quality Assessment (LQA) and ground investigations indicated that there are potential sources of contamination at the site. In addition, non-intrusive geophysical survey of the site using ground penetrating radar (GPR) had identified widespread anomalies at the site. Based on the conceptual model developed in the Phase 1 LQA, made ground primarily associated with air raid shelters had been assessed as presenting potential risks to development at the site.

6.2.3 Intrusive Investigation

Intrusive investigations were undertaken in August 2020, and targeted the infilled air raid shelters, existing air raid shelters, and shallow made ground at the site. The trial pits also targeted anomalies detected during previous non-intrusive geophysical survey at the site.

A specialist utilities detection contractor undertook a services clearance survey of the exploratory hole locations prior to ground disturbance. Intrusive investigations were supervised by a geoenvironmental engineer and an unexploded ordnance (UXO) specialist. The investigation comprised 22 machine-dug trial pits to a maximum of 3 m below ground level (bgl) plus five hand-dug pits to a maximum of 0.1 m bgl. Soil samples were obtained from each machine-dug trial pit and selected samples were analysed for a suite of potential contaminants, and soil samples from the hand-dug pits were analysed for the presence of asbestos.

6.2.4 Summary of Findings

The findings of the ground investigation provided additional data to supplement the data acquired in previous investigations.

The ground investigations encountered a sequence of topsoil, made ground, superficial deposits of orangish brown clayey sand/ gravel and weathered Upper Lincolnshire Limestone Member. Ground investigations identified made ground at the locations of the infilled air raid shelters to typical depths of 2.7-2.8m bgl, with a concrete base typically 0.2m in thickness penetrated at the locations of the shelters. Beneath the structures was weathered Upper Lincolnshire Limestone.

The existing air raid shelters are constructed with arches of interlocking corrugated sheet metal, overlain with made ground comprising backfilled locally derived reworked natural soils. The dimensions of the existing air raid shelters are approximately 2.0m width by 5m in length.

Geophysical anomalies previously identified at the site were also investigated, and trial pits at these locations typically encountered topsoil overlying made ground with gravel, limestone boulders and locally concrete.

Contaminant concentrations were less than the generic assessment criteria for the proposed end use scenario (assessed as commercial/ industrial end use). No asbestos fibres were detected in any of the soil samples; however, two small fragments of cement-bound tile were identified and recovered from TP12 and TP20 during the trial pitting and analysed for the presence of asbestos. Asbestos (chrysotile) was reported by the laboratory in these tile samples. The soils recovered from these locations were also analysed for the presence of asbestos fibres, and no asbestos fibres were detected.

6.2.5 Summary of Risk Assessment

The risk assessment for the site has been revised based on the results of the ground investigations. The revised risk assessment concluded that the risks to future site users for the proposed redevelopment end use are assessed as Low.

6.2.6 Conclusions

The site investigations have encountered a sequence topsoil, made ground overlying natural soils and weathered Upper Lincolnshire Limestone. The former air raid shelters have been backfilled with heterogenous materials comprising locally derived soils, and anthropogenic materials including ash, clinker, concrete and metal fragments. Rare fragments of asbestos containing materials (ACMs) were encountered locally, but these were not frequently or widely dispersed in backfill materials. Asbestos fibres were not detected in soil samples recovered from the site. No evidence of unexploded ordnance or artefacts was encountered during the intrusive works.

On the basis of the ground investigation findings, the risks to future site users are assessed as low, and the site is assessed as suitable for its proposed end use, and no further risk mitigation/ remediation is required with respect to site contamination levels.

However, the presence of heterogeneous and unconsolidated backfill to the seven demolished former air raid shelters, as well as other below-ground relics of former site use (e.g. foundation slabs, redundant services etc.) are likely to represent local geotechnical constraints to the proposed development.

6.3 Recommendations

Further mitigation of risks with respect to ground contamination are not considered necessary at this site. However, there is potential for encountering hitherto unidentified contamination in soils at the site, and a watching brief should be maintained during ground disturbance activities.

Further investigations may be required for the purposes of foundation design for the proposed development. It is likely that some form of geotechnical mitigation will be required in respect of the former and extant air raid shelters, which may include excavation of the unconsolidated material and replacement with engineered backfill. However, detailed recommendations with respect to geotechnical constraints are outside the scope of this report.

7. Utilities Survey and Review.

7.1 Introduction

A review of the services and utility requirements was undertaken, for the RAF CAM development site, in July 2020. Full details of this assessment of the services and utilities are detailed in the RAF CAM Relocation to RAF Cranwell, Utilities Survey and Review provided under separate cover.

The purpose of this Utilities and Survey Review report was to:

a) Review and assess the services utility requirements for the RAF CAM relocation development;

b) Assess the impact of these additional requirements on the existing Station infrastructure;

c) Identify suitable connection points to the existing Station infrastructure and any upgrade works required to support the RAF CAM development;

d) Identify any further investigations required at the detailed design stage.

The following services and utilities were considered by the assessment:

- Power
- Gas
- Water (potable and firefighting)
- Storm and foul drainage
- Communications and Information Systems (CIS) including remoted alarms and Station tannoy.

The utilities and services review was based on the following:

a) RAF CAM concept design prepared by GVA as part of the January 2019 Assessment Study titled RAF Centre of aviation Medicine;

b) East of Trenchard Hall indicative site development plan

c) RAF CAM Capability User Requirements Document (URD);

d) Consultation with appropriate utility and services stakeholders at RAF Cranwell;

7.2 Findings of Utilities and Services Review

The table overleaf summarises the load requirements and connection points for the utilities and services considered by this assessment:

Utility	RAF CAM Estimated Requirement	Connection Point	Comment
Power	600 to 800kVA range	Substation DSS 'T' located to the east of the RAF CAM site.	New 1000kVA substation required to replace existing DSS 'T'. Dialogue to be maintained with the Station and DIO regarding the availability of power.
Gas	374kW / 47m3/hr	Gas main to south of Cranwell Avenue to north of RAF CAM site	Gas governor/meter required at connection point required. .
CIS	MoDNet (O&S), telephone/VOIP (O&S), non-MoD internet, VTC (O&S)	Existing CIS pit on western edge of site and/or new pit and duct connection to equipment rooms in Trenchard Hall.	CIS Specification to be developed by Air 38Gp CIS Infra prior to ITT/ITN. Surveys required to confirm connection points and any upgrades to existing equipment rooms.
Station Tannoy	Connection to Station broadcast system	Multi-pair control cable at DSS 'T'	
Alarms	Security and Fire	Cross site link via existing duct system to 24hr manned point on station.	Security alarm may require a direct wired link.
Water	5.5l/s domestic supply. 20l/s per fire hydrant	Existing 150mm dia water main on western side of site adjacent to Trenchard Hall and fire hydrant FH 142.	Pumped booster set required to provide required flow rates to new fire hydrants.
Foul Water	TBD at detail design	Existing foul system that crosses site to be diverted and upgraded for RAF CAM requirement.	Diversion includes new pumping station and pumping main.
Storm Water	TBD at detail design	New local piped system discharging to soakaways.	No connection to existing storm water systems required.

7.3 Recommendations

It is recommended that an ongoing dialogue is maintained with the key utility and services stakeholders and providers, including throughout the procurement process, in order to identify any changes in their capability to support the RAF CAM development.

In particular, the Station overall power consumption should be reviewed regularly to make sure that the spare capacity identified by this report, within the 5.2MVA limit, is still available to the RAF CAM development. If the situation should change and additional power is required from the network provider Western Power then negotiations to increase the power supply from Western Power should be instigated by through DIO.

8. Security Assessment

8.1 Introduction

A Security Assessment was undertaken for the proposed RAF CAM development, in July 2020. Full details of this security assessment are detailed in the RAF CAM Relocation to RAF Cranwell, Security Assessment Report provided under separate cover.

The purpose of this report is to assess the physical security requirements for the proposed RAF CAM development at RAF Cranwell including Counter Terrorism Measures (CTM).

The security assessment has been based on the following:

a) RAF CAM concept design prepared by GVA as part of the January 2019 Assessment Study titled RAF Centre of aviation Medicine;

b) East of Trenchard Hall indicative site development plan (See Appendix B)

c) RAF CAM Capability User Requirements Document (URD);

d) Consultation with RAF Police Protective Security team at RAF Cranwell;

e) DIO CTM guidance documents.

8.2 Assessment Summary

The CTM and Physical Security assessment has been developed and reviewed in conjunction with the RAF Police protective security team at RAF Cranwell and is based on the current understanding of the requirement as set out in the infrastructure annex to the URD.

The CTM requirement has been defined based on current DIO guidance for a site with a Classification of Risk of MODERATE and with stand-off ranges to the Station perimeter and internal vehicle parking areas of 50m and 25m respectively. If these distances were to reduce as the project develops then the risk balance would change and the physical measures required to meet the requirement would need to be enhanced with a corresponding increase in cost.

The physical security measures proposed have been developed in consultation with the RAF Police Flight at Cranwell and are sufficient to meet the current understanding of the security requirement as set out in the URD. At this stage the construction of the facility does not require to be enhanced to provide additional resistance to physical intrusion. However, measures are required to provide additional acoustic and visual privacy to areas containing secret installations (e.g. telephones and VTC).

Access control systems (ACS) and Intruder Detection Systems (IDS) have been proposed to provide control and protection to restricted access areas identified in the URD. It is proposed that these systems are extended to cover the overall facility rather than just the areas identified in the URD. This approach will provide future flexibility in the use and management of the facility. This approach has been endorsed, at this stage, by the RAF Police.

8.3 Recommendations

When the requirement has reached sufficient maturity, it is recommended that the RAF Police Protective Security Team at RAF Cranwell are tasked with developing the Operational Requirement Level 1 (OR1) and Operational Level 2 (OR2) documents. These will provide a statement of the overall security need and proposed security solutions to meet baseline standards for the protection of all assets in accordance with UK Security Policy. These documents will cover both the physical security and CTM requirements for the project. This process includes assurance by the RAF Security Consultancy Flight.

In parallel with the development of the OR1 and OR2 it is recommended that the Security Services Group (SSG) should be engaged by the project team to provide technical specifications for the ACS and IDS systems.

Appendix A

Site Location Plan

Appendix B

Indicative Site Development plan

Appendix C

Transport Assessment Figure 3.1

Appendix D

Site Survey Plan

February 2021
Doc Ref. 42438-00