BURO HAPPOLD

Wethersfield Airfield

Geoenvironmental Desk Study

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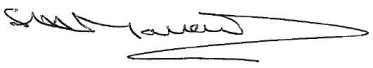
author	**Nina Sopp**
date	**18/04/2023**
approved	**Hugh Mallett**
signature	
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Executive summary

Background and objectives

This report presents the results of a Geoenvironmental Desk Study for Wethersfield Airfield, prepared by Buro Happold on behalf of Wethersfield Airfield Scrutiny Committee. The purpose of this study is to establish the ground conditions at the site that may result in potential ground contamination risks. It has been prepared to inform the Client regarding the potential nature and extent of contamination that could be present and to advise the necessary steps that a developer will be required to undertake to ensure safe and suitable redevelopment.

The principal sources of information for this study include: historical and current topographical maps, public register information, information obtained during a meeting with WASC, observations from a walkover of parts of the site perimeter, together with information from third party reports and online sources. It is understood that reports on the land quality of the site have been prepared for the Ministry of Defence which will contain relevant and detailed information, currently not in the public domain. Despite requests, currently no reports have been made available by the MoD for review. This gap in information in this current report is reflected the assessment of risk presented here and must be recognised by any reader.

Site setting

Wethersfield Airfield covers an area of about 330.5 ha and is located north of Wethersfield about 6 miles northwest of Braintree, Essex. The site is surrounded by security fencing and accessed via a series of gates. The area is rural with surrounding land mainly farmland and woodland.

History

Wethersfield Airfield was first developed by 1941 and occupied by the RAF before being handed to the USAF in 1943. The existing runways were constructed during WW2, including 50 'loops' for standing aircraft. Ancillary facilities included various stores / workshops (pyrotechnics, lubricants, inflammables), bulk fuel installations, accommodation and administrative buildings and firing ranges. A 'Bomb Dump' was constructed in the north of the site, used for conventional weapons storage. The site was under 'care and maintenance' from 1945 to 1952. In 1952 it was reactivated and upgraded by the USAF. The 'Victor Alert' area was constructed to enable the quick response of the USAF, armed with nuclear weapons. The existing Bomb Dump was also expanded to enable storage of nuclear weapons.

The site was returned to 'care and maintenance' from 1970 to 1979 and used as a standby deployment base. During this time, it was used for firefighting practice (weekly) which comprised release of hydrocarbons at the ground surface, setting alight, and extinguishing using firefighting foams. There were also controlled / demonstration explosions on the runways. Burning areas were also known to be present on the site and Park Wood was used as a USAF tip (disposal of drums of defoliant and USAF vehicles). The Ministry of Defence Police has been the main occupier since 1992 with buildings used for training purposes.

Due to this history of military use, there is a significant potential for the presence of further unknown and undocumented sources of contamination which may not have been recorded on any existing documents and which could be present at almost any location across this very large site.

Geological setting

The natural geology of the site is likely to be locally overlain by a discontinuous relatively limited thickness of Made Ground (Fill) and hardstanding associated with the former military activities. In some local areas, the thickness / depth of the Made Ground could be substantial (e.g. infilled former pits / waste disposal areas etc). Where Made Ground is absent, the natural geology will be overlain by topsoil and sub soils.

Beneath these surface deposits, is a substantial thickness (approx. 40m) of Boulder Clay (the base of which being described as glacial fluvial sands in places). The underlying bedrock comprises, in sequence, the London Clay, Lambeth Group, Thanet Sands and Chalk. These strata generally dip towards the south, so that the London Clay is present beneath superficial deposits in the south of the site only, with Lambeth Group and Thanet Sands present across the remainder of the area. These strata are all underlain by the Upper Chalk at some 40 to 60m depth, with the Chalk directly underlying the Boulder Clay to the north of the site.

Hydrogeology

The Boulder Clay is classified as a Secondary (Undifferentiated) Aquifer. The underlying London Clay is Unproductive, with the Lambeth Group and Thanet Sands a Secondary A Aquifer. The Chalk is a Principal Aquifer (provides a high level of water storage and may support water supply / river base flow on a strategic scale). The nearest groundwater abstraction is 80m north – a historical abstraction for general farming purposes. The nearest active abstraction is >1500m distant and relates to abstraction from Chalk for potable water supply.

Hydrology / drainage

The site is located within three operational catchments: River Pant (western part of site), Toppesfield Brook (northeast) and Bourne Brook (southeast). There are several unnamed streams located on and adjacent to the site, which receive surface water draining from Wethersfield Airfield which incorporate a series of oil traps / interceptors located around the perimeter (off-site). The River Pant is located about 1km southwest, Toppesfield Book 1km north and Bourne Brook adjacent to the south. The nearest registered surface water abstraction is about 1300m distant and associated with Bourne Brook.

Unexploded ordnance

A Preliminary UXO Risk Assessment was carried out as a part of this study. This considered the potential for aerial delivered UXO, along with mitigation factors (associated with the extent of post-war development, proposed level of intrusive works). The assessment concluded that the risk associated with UXO is Moderate / High. This means that a detailed UXO risk assessment will be required prior to ground investigation or earthworks.

Preliminary Risk Assessment

A large number of potential sources of contamination have been identified, based on third party accounts and the site's history. To facilitate assessment, these 20 sources were subdivided into three hazard 'classes'. These classes are summarised below and reflect the nature or potential severity of the hazard, their likely spatial distribution and the potential perception of risk associated with particular hazards.

Hazard 'Class'	Description	Contamination source
Class 1	Contamination widespread / gross concentrations / enhanced perception of risk	Bulk fuel storage; waste hydrocarbons; solvents; construction and demolition materials; radioactivity; firefighting; waste disposal.
Class 2	Gross contamination likely localised / difficult contaminants	Explosives and ordnance; runway materials; deicing materials; pyrotechnics and inflammables; spent ordnance; Bomb Dump (nuclear and conventional weapons storage); burning areas.
Class 3	Any gross contamination localised. "Common" contaminant types	Lubricants, oils and paints (aircraft maintenance); electricity substations, oil tanks, infilled ponds; photographic chemicals.
All Classes	Localised to areas of substantial fill / spillage	Ground gas (carbon dioxide, methane, trace gases), vapours / VOCs

An Initial Conceptual Site Model has been determined and a Preliminary Risk Assessment with respect to ground contamination has been carried out for each of the hazard classes. This assessment is based upon potential risks associated with the proposed redevelopment. A summary of this assessment where risks were assessed as above low is presented below.

Source	Receptor	Potential risk
Hazard Class 1	Future site users / visitors (residents, visitors, staff)	High
	Investigation and construction workers	
	Surface waters [River Pant, Toppesfield Brook or Bourne Brook])	Moderate
	Groundwater [Boulder Clay, Lambeth Group, Thanet Sand, Chalk]	Moderate / low
	Built infrastructure (potable water supply)	Moderate / low
Hazard Class 2	Future site users / visitors (residents, visitors, staff)	Moderate
	Investigation and construction workers	
	Surface waters [River Pant, Toppesfield Brook or Bourne Brook])	Moderate / low
Hazard Class 3	Investigation and construction workers	Moderate / low
	Future site users / visitors (residents, visitors, staff)	
	River Pant, Toppesfield Brook or Bourne Brook (via unnamed streams on / adjacent to the site)	
Hazardous ground gas	Future site users / visitors (residents, visitors, staff)	Moderate / low

Recommendations

The identified contamination sources represent potentially significant challenges to achieving safe development in particular areas but are capable of mitigation provided that the following actions / steps are taken by a potential developer.

1. Undertake a comprehensive detailed Desk Study on the basis of all available information (including from the MoD) that accurately identifies the location of potential contamination sources.
2. Commission a Detailed UXO Risk Assessment by an appropriate qualified specialist to inform the need for and scope of UXO mitigation measures.
3. Scope, specify and implement an appropriate ground investigation to enable assessment of each of the contaminant linkages relevant to the proposed development.
4. Consult with appropriately qualified specialists (in radioactivity and explosives) prior to and during implementation of ground investigation and development.
5. Ground investigation(s) or other surveys should be carried out in accordance with a detailed Health & Safety Plan that gives appropriate attention to both the known contaminant sources as well as the

potential for encountering unexpected / undocumented contamination or conditions, along with protocols to follow in such events.

6. Ensure that the chemical analyses undertaken (soils, waters and gas/vapour) reflect the wide range of potential contaminants of concern [listed in Table 5-1 of this report]. Not all samples will be tested for all possible determinands, but the Sampling and Analysis Plan must take account of the potential for all of these determinands to be present on the site either widespread or localised.
7. Report the findings of the ground investigation in an Interpretative Report(s), including a Generic / Detailed Quantitative Risk Assessment. Such a report must consider all the relevant source-pathway-receptor linkages identified in this report.
8. Determine a Remediation Strategy that takes full account of the identified contaminant sources [presence, location, nature and extent] and the proposals for development. The strategy should set out the measures necessary to mitigate the potential risks to people and the environment and to enable safe development. The Strategy must also pay particular attention to the need to address the potential risks associated with unknown / unforeseen contamination.
9. Prepare a Verification Plan that describes all of the lines of evidence necessary to demonstrate successful implementation of the Remediation Strategy. The Plan will also identify the parties responsible and describe how the evidence will be obtained, collated and reported.

1 Introduction

1.1 General

This report presents the results of a Geoenvironmental Desk Study for the Wethersfield Airfield site and has been prepared by Buro Happold on behalf of Wethersfield Airfield Scrutiny Committee (WASC). The site is located north of the village of Wethersfield, about 6 miles northwest of the Braintree, Essex, centred at NGR TL 72292 33504. The extent and layout are illustrated by Figure 1-1 below.

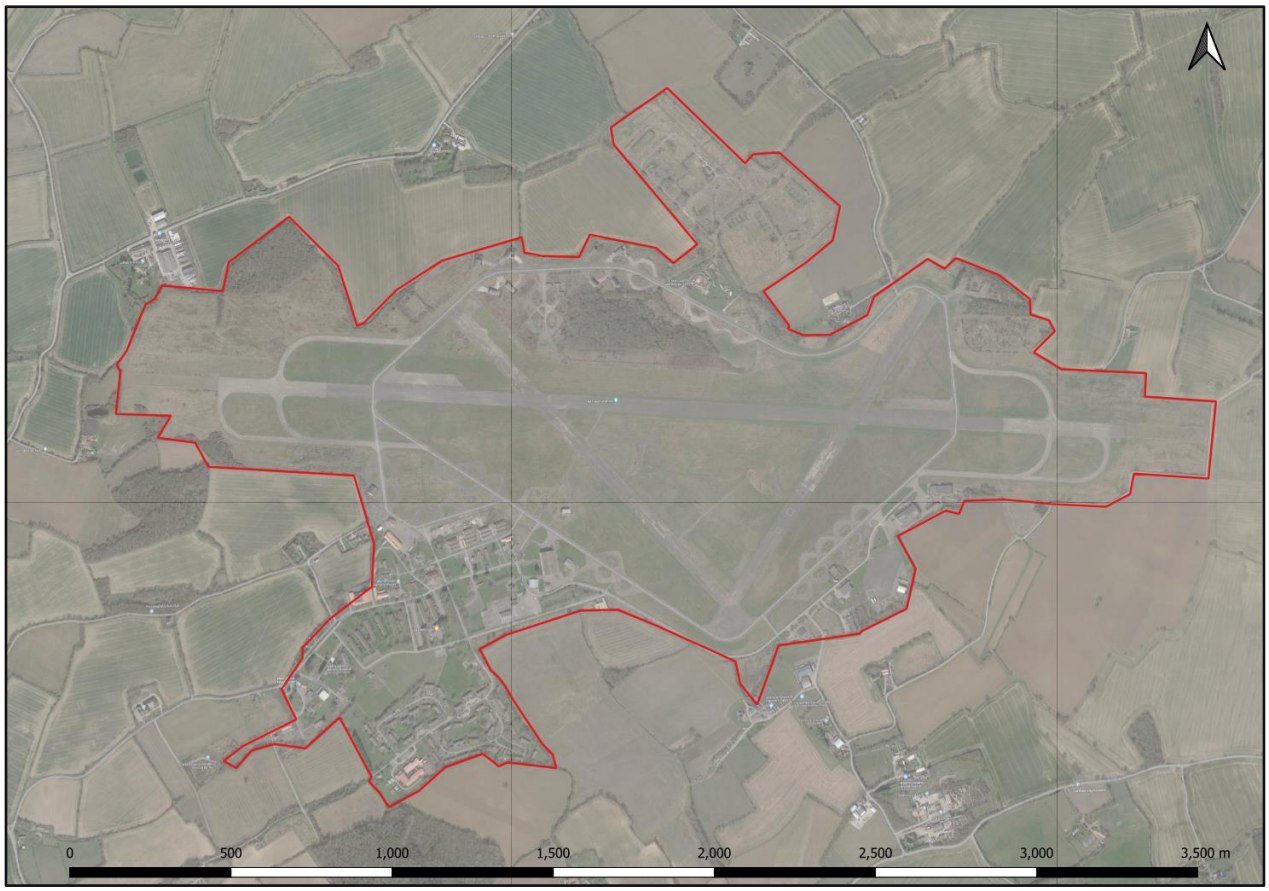

Figure 1-1 - Site layout.

1.2 Study aims and objectives

The overall aim of this study was to carry out a geoenvironmental assessment in order to inform the Client's understanding of potential ground-related risks associated with a proposed potential redevelopment of the site. Accordingly, the report establishes the environmental, geological, hydrological, and hydrogeological conditions present at the site. It presents a description of the potential nature and extent of contamination that could be present, assesses the potential ground-related risks, and provides a professional opinion as to the necessary steps that a developer will be required (with respect to ground contamination) to undertake to ensure safe redevelopment of the site.

This report provides information relevant to any future redevelopment in accordance with the requirements of the National Planning Policy Framework (NPPF) [1] and also with respect to any potential liability under Part 2A of the Environmental Protection Act 1990 [2]. The work was carried out in general accordance with current government guidance (LCRM [3], the relevant British Standard [4], the Environment Agency Guiding Principles [5] and other current good practice guidance. The particular objectives of the study were:

- To determine the historical and current use of the site and surroundings
- To determine the nature of the ground conditions and the environmental sensitivity
- To assess the potential location, nature and extent of any ground and groundwater contamination
- To construct an initial Conceptual Site Model in general accordance with LCRM
- To assess the potential risks to people and the environment (natural and built) associated with ground contamination (solid, liquid and gas) associated with the potential redevelopment
- To prepare a report based upon all of the above suitable to inform the Client about potential risks related to ground conditions
- To determine the status of the site with respect to Part 2A of the Environmental Protection Act 1990 and the nature and extent of any associated environmental liabilities, and
- To evaluate the potential need for and scope of any subsequent ground investigations and / or remedial action or design relevant to the proposed development
- To provide a checklist with respect to ground contamination to assist scrutiny of any such proposals.

1.3 Information sources

The principal sources of information for this Desk Study report include: historical and current topographical maps, public register information, information obtained during a meeting with WASC, observations from a walkover of parts of the site perimeter, together with information from third party reports and online sources. This report is therefore based upon information obtained from third party reports / accounts, which has been accepted at face value and has not been independently verified. Buro Happold can therefore give no warranty, representation, or assurance to the accuracy or completeness of such third party information.

It is also understood that reports on the land quality of the site have been prepared for the Ministry of Defence at some time in the past. Although requests for such reports have been made both by the Client and by Buro Happold, at the time of writing, no such reports have been made available for review. A similar request has also been made to the local authority (Braintree Council) for any information they may hold. Any such reports will contain much relevant and detailed information which is currently not in the public domain and is not known to Buro Happold or to WASC.

This gap in information in this current report is reflected the assessment of risk presented here and must be recognised by any reader. If or when that information becomes available / is published, this report should be revisited and the risk assessment up-dated as appropriate.

1.4 Competence

The work reported here was carried out by geoenvironmental scientists from Buro Happold. Buro Happold is a consulting engineering company that manages its work under various Quality Management Systems that are certified to ISO 9001. The work itself was carried out by staff with relevant qualifications, training, and experience. The overall technical responsibility for the work was held by a Technical Director with substantial experience in the assessment of land affected by contamination who is a Chartered Geologist and registered SiLC (Specialist in Land Condition) and SQP (Suitable Qualified Person).

2 Current land use

2.1 Site location

Wethersfield Airfield is approximately centred at NGR TL 72292 33504 and covers an area of about 330.5 ha – see Figure 2-1. It is located north of the village of Wethersfield, in Essex, about 6 miles northwest of the town of Braintree. The site is accessed via a series of 13 gates, mainly located on the southwest boundary. The site is surrounded by secure fencing and is not accessible to the public.

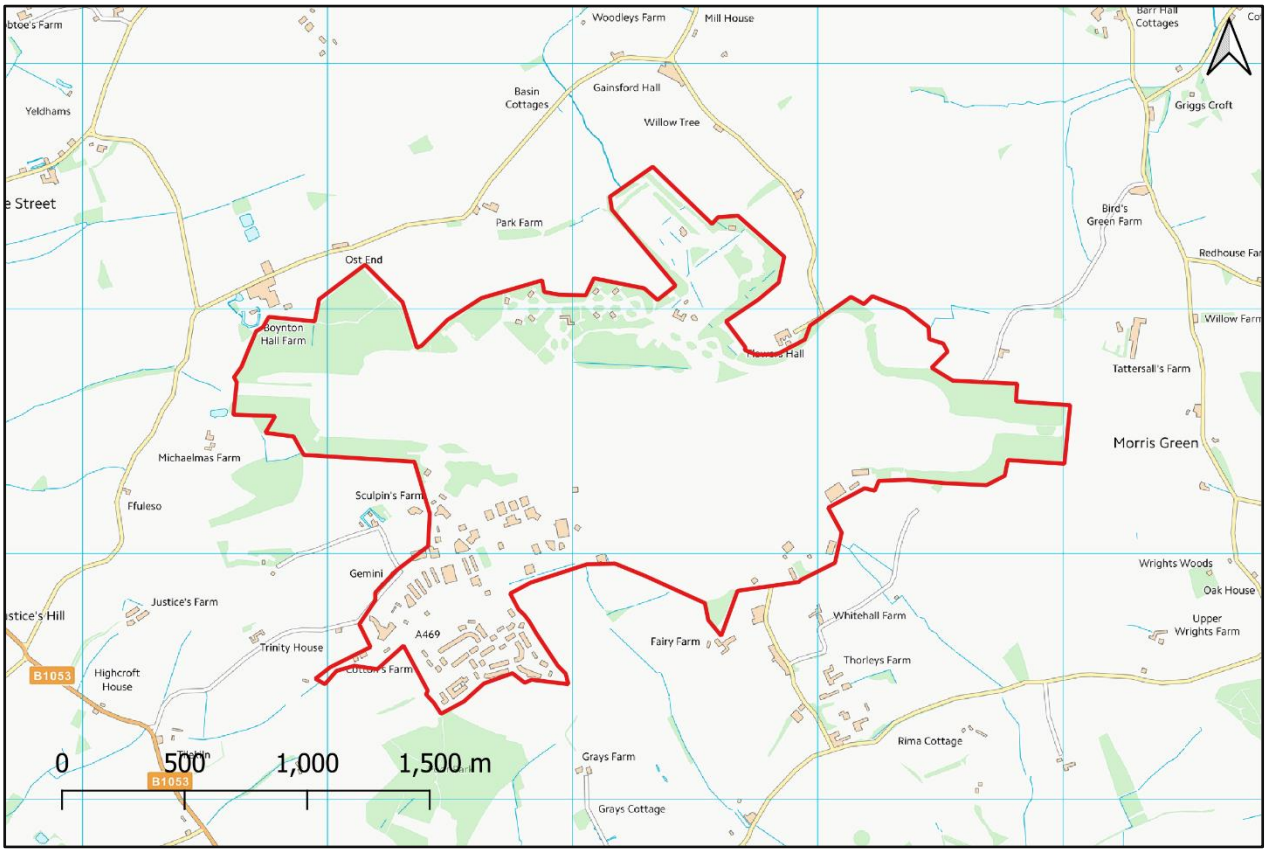

Figure 2-1 - Site location.

2.2 Topography

Most of the site is at an elevation of about 95m AOD. There are local high points close to the southern and northwest boundary where the elevation is about 100m AOD. Topography generally falls towards the site perimeter, to topographic lows of about 80m AOD. This correlates with presence of streams that drain the Airfield (see Section 3.3). The topography is illustrated by the Digital Terrain Model provided as Figure 2-2.

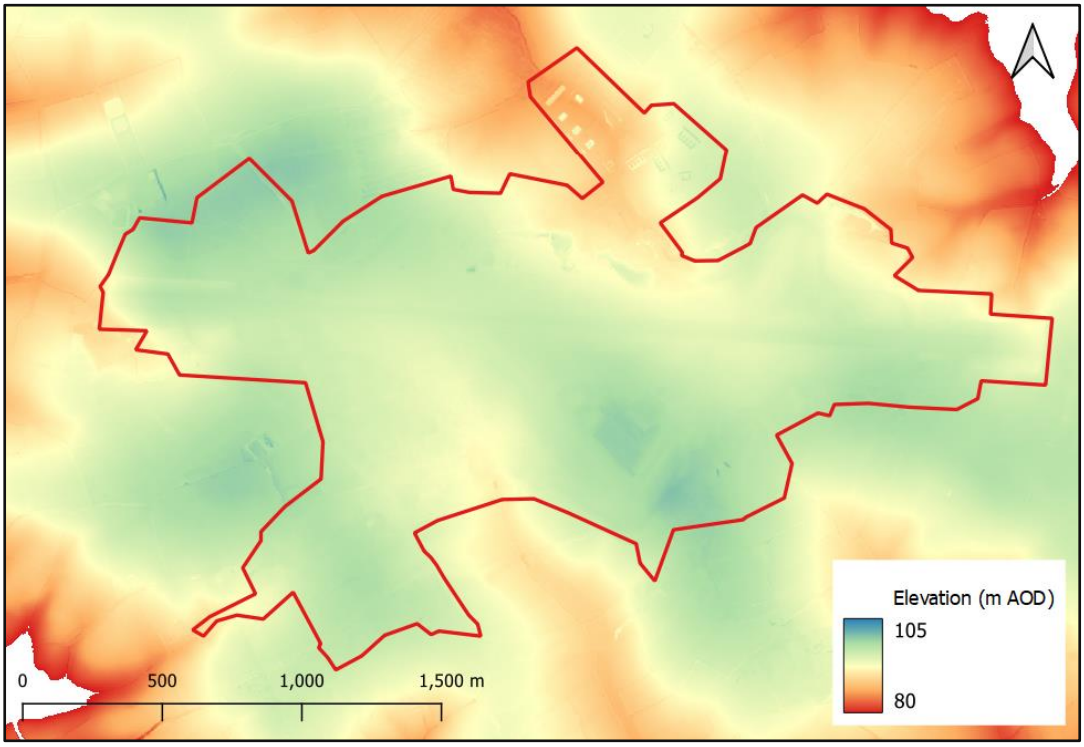

Figure 2-2 - Digital Terrain Model for the site and surroundings.

2.3 Current condition / activities

The site was not accessible as part of the preparation of this study. Buro Happold's understanding of the current condition is therefore based upon information obtained during a Client meeting, online sources and reports prepared by others. Parts of the site boundary and surrounding area were visited on 14th March 2023 – that account is presented in Section 2.4. It is understood that the site has been in a state of care and maintenance since the 1990s. The Ministry of Defence Police has been the primary occupier of the airfield since then, bringing together various training and national units into one central headquarters. All three wartime-era runways and connecting taxiways, as well as many wartime loop-type areas of hardstanding are still present. An area referred to as the 'Bomb Dump Area', which previously was used for storage of conventional WW2-era munitions and later Cold War nuclear weapons in 'igloo' structures, is still present. The igloo structures as well as administrative buildings and storage compounds are still present.

There is also an area referred to as the 'Victor Alert Area', located towards the northern boundary of the Airfield. This was established during the Cold War era as a series of hangar and dispersal pads for rapid response aircraft. This is still present and is comprised of several components, including concrete dispersal pads configured as a series of 'loops', a section of runway access road, eight 'dutch barn' hangars, and canteen and dormitory buildings. The dutch barn hangars are approximately 25m x 15m with Gambrel-shaped roofs, constructed of steel beams with corrugated sheet metal panels placed over the frame, to give a Dutch barn shape. The southwest of the Airfield was mainly used for accommodation of personnel, with ancillary facilities including the St Michael's Chapel. Some of these buildings as well as Nissen huts are reported to be used by the MOD police.

2.4 Activities in the surrounding area

The site is situated in a rural location and is surrounded mainly by farmland and associated buildings / homes and some areas of woodland. There are a series of oil traps / interceptors located around the perimeter (off-site) and streams that drain the Airfield. The nearest roads are the B1053 (southwest), Hudson's Hill (south) and private / unnamed roads that provide farm access. Two ponds for Great Crested Newts have been excavated adjacent to the southwest boundary. These have filled with infiltrating perched groundwater, which has a milky blue / turquoise colour. Photographs from the visit to parts of the site perimeter (14 March 2023) are presented below as Figure 2-3 to Figure 2-6.

Figure 2-3 - Oil interceptor located close to the southwest boundary (Sculpins Lane).

Figure 2-4 - View from western boundary, looking across farmland towards Victor Alert and Bomb Dump areas (facing northeast).

Figure 2-5 - Stream located adjacent to the southwest boundary.

Figure 2-6 - Pond adjacent to southwest boundary.

3 Environmental setting

3.1 Geology

The local geology has been determined with reference to the relevant 1:50,000 BGS Map (Sheet 223 – Braintree) [6] and BGS borehole logs (Appendix B). In summary, the natural geology of the Airfield site is likely to be locally overlain by a discontinuous relatively limited thickness of Made Ground (Fill) and hardstanding associated with the former military activities on the site. In some local areas, the thickness / depth of the Made Ground could be substantial (e.g. infilled former pits / waste disposal areas etc). Where Made Ground is absent, the natural geology will be overlain by topsoil and sub soils (typically <1m thickness).

Beneath these surface deposits is a substantial thickness of Boulder Clay (Glacial Till) up to about 40m thick. In some locations, the base of superficial deposits is described as glacial fluvial sands. The underlying bedrock comprises, in sequence, the London Clay, Lambeth Group, Thanet Sands and Chalk. These strata generally dip towards the south, so that the London Clay is present beneath superficial deposits in the south of the site only, with Lambeth Group and Thanet Sands present across the remainder of the area. These strata are all underlain by the Upper Chalk at depth, with the Chalk directly underlying the Boulder Clay to the north of the site.

Table 3-1 - Summary of site geology.

Strata	Description	Depth to top (m bgl)	Level of top (m AOD)	Thickness (m)
Made Ground / topsoil	Limited thickness of Made Ground and / or topsoil likely to be present.	0.0	99.2 to 90.0	<3.0
Boulder Clay	Stiff to hard, dark grey with brown, silty, with abundant fine gravel and occasional medium and coarse gravel sized rounded pieces of chalk.	0.0 to 3.0	99.2 to 87.0	Up to ~35
Fluvio-glacial deposits	***Described in a limited number of exploratory holes only.*** Dense to very dense, brown and dark brown, very silty fine sand, with abundant laminations of dark grey silt / clay.	10.0 to 38.0	87.9 to 52.0	1.6 to 25.8
London Clay	***Present in the south only.*** Blue clay.	37.0 to 39.6	59.0 to 54.9	6.7 to 9.3
Lambeth Group	Clay and pebbles. Green sand.	35.9 to 46.3	57.1 to 48.2	3.1 to 14.6
Thanet Sands	Green grey fine-grained sand.	39.0 to 60.9	54.0 to 33.5	3.3 to 11.0
Chalk	Firm white chalk.	39.6 to 64.3	50.4 to 31.7	Unproven, regionally >200

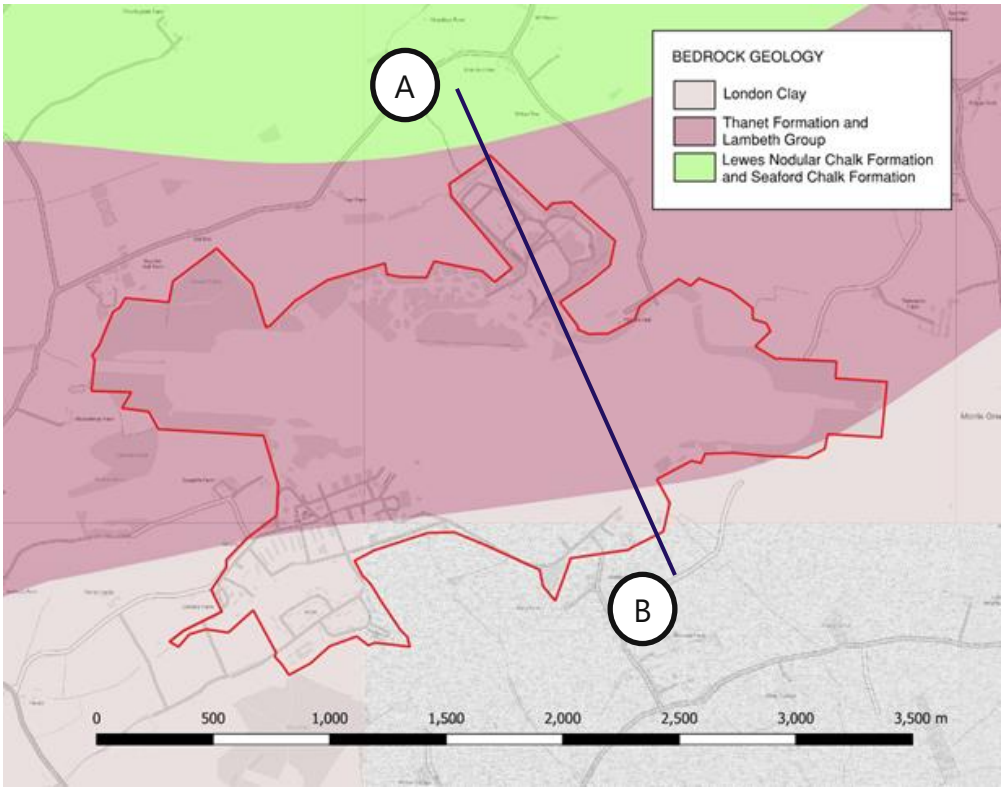

Figure 3-2 - Bedrock geology (cross section line shown).

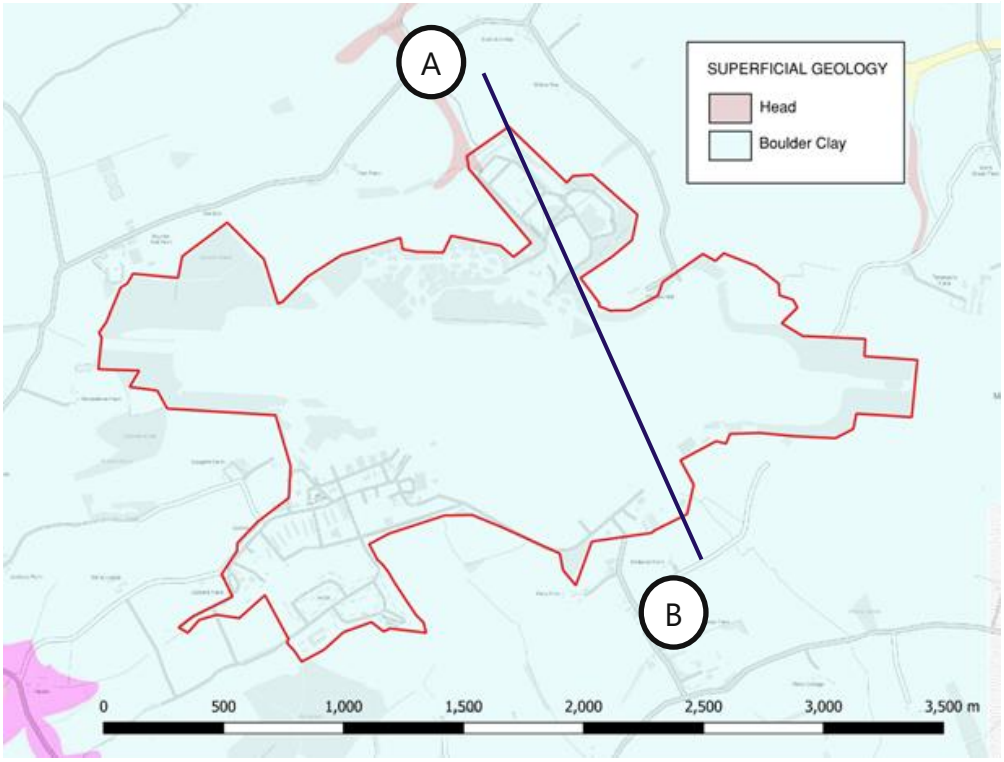

Figure 3-1 - Superficial geology (cross section line shown).

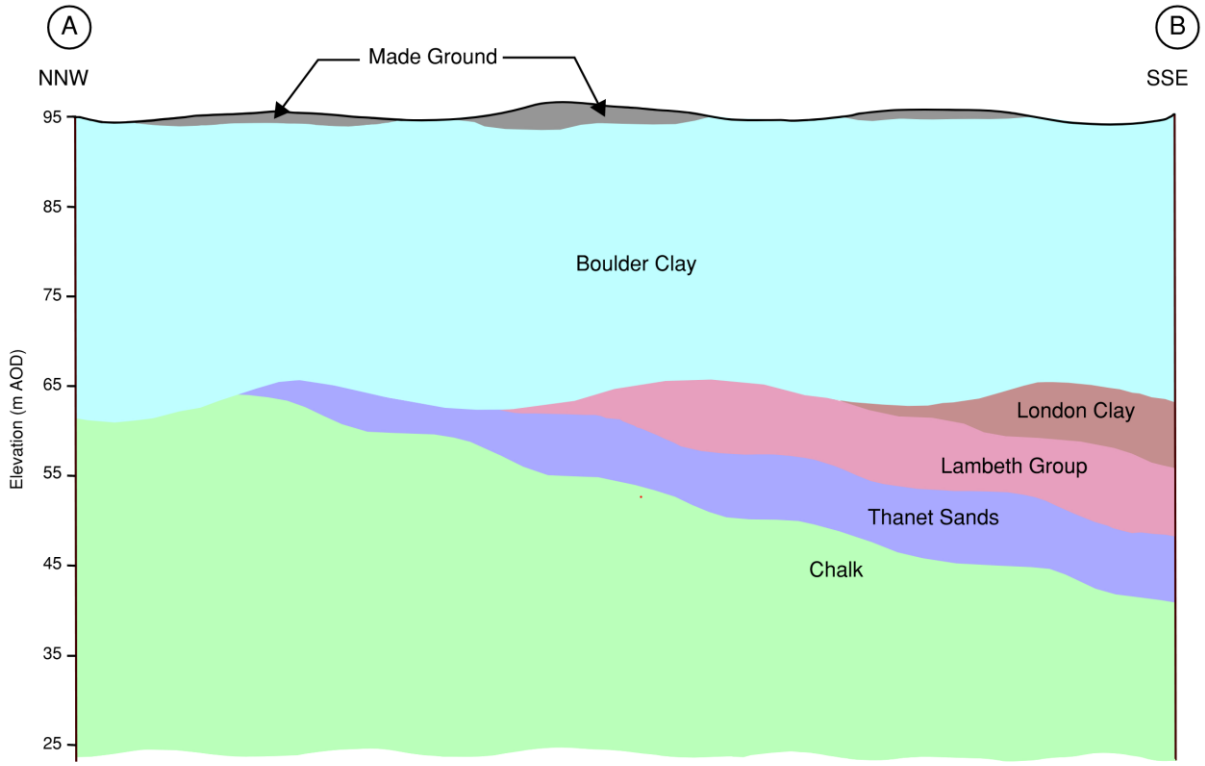

Figure 3-3 - Sketch geological cross section.

3.2 Hydrogeology

The Boulder Clay is classified as a Secondary (Undifferentiated) Aquifer, strata where it is not possible to attribute either A or B to a rock type due to its variable characteristics. The underlying London Clay is an Unproductive Aquifer, deposits with low permeability that have negligible significance for water supply or river base flow. The Lambeth Group and Thanet Sands are a Secondary A Aquifer. These are permeable layers capable of supporting water supplies on a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. The Chalk is a Principal Aquifer, which usually provides a high level of water storage and may support water supply / river base flow on a strategic scale.

BGS borehole logs recorded water ingress in shallow Boulder Clay deposits, at levels between about 95 to 85m AOD. Groundwater was also recorded in Thanet Sands or Chalk, at levels between about 33.5 and 25.9m AOD. The nearest groundwater abstraction is a historical license located about 80m north of the site and dated 1966. This abstraction was for general farming and domestic purposes. The nearest active groundwater abstraction is >1500m distant and relates to abstraction from Chalk by Anglian Water Services for potable water supply. The site is located in a Source Protection Zone 3 – total catchment.

3.3 Hydrology

Groundsure data shows a number several unnamed streams located on the site, mainly in the north of the Airfield within the 'Bomb Dump' area. There are also numerous unnamed streams and ponds located around the site perimeter, which are reported to receive surface water draining from Wethersfield Airfield (controlled by topography). The location of these water features is shown by thin blue and dashed blue lines in Figure 3-4. The Site is located

within three operational catchments; River Pant (western part of site), Toppesfield Brook (northeast) and Bourne Brook (southeast). The catchment boundaries are shown by the thick red lines in Figure 3-4. The various water features located on / around the site drain towards these rivers / brooks. The River Pant is located about 1km southwest, Toppesfield Book 1km north and Bourne Brook adjacent to the south. The nearest registered surface water abstraction is about 1300m distant and associated with Bourne Brook.

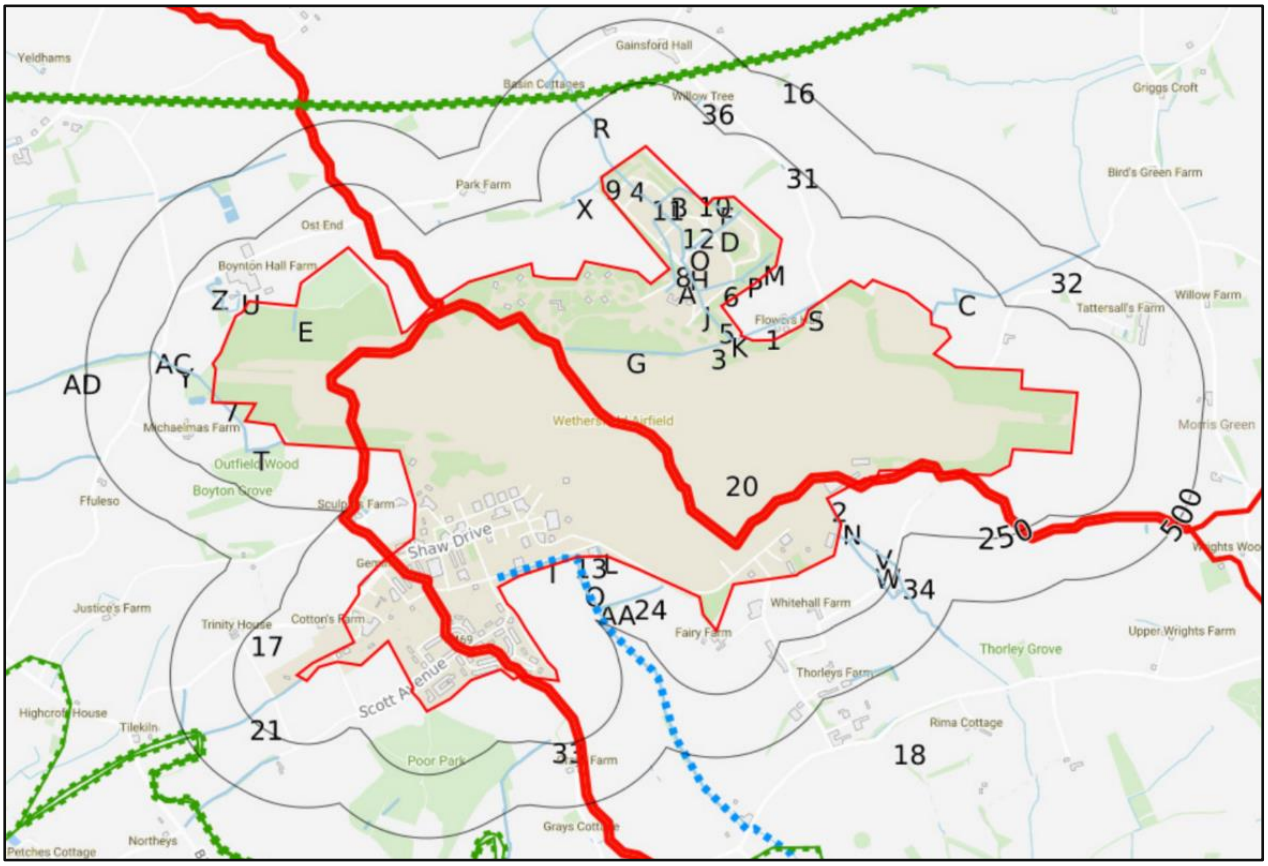

Figure 3-4 - Water network map. Surface water body catchment boundaries shown by red lines. Surface water features shown by thin pale blue and thick dashed blue lines. Bourne Brook is labelled.

3.4 Flood risk

The gov.uk 'Flood map for planning' resource indicates that the site falls within Flood Zone 1. This means that the land has a less than 1 in 1,000 annual probability of river flooding [7]. Ambiental Risk Analytics surface water (pluvial) flood map indicates that parts of the site are located in a 1 in 30 year, 0.3m to 1.0m flood risk area. Groundsure data locates the site in an area of Low risk of groundwater flooding.

3.5 Natural hazards

Regulatory data relating to ground stability is summarised in Table 3-2 with the full information presented in Appendix A.

Table 3-2 - Potential natural hazards based on BGS Geosure data.

Potential hazard	Hazard rating
Shrink swell clays	Very low to low
Running sands	Very low
Compressible deposits	Negligible
Collapsible deposits	Very low
Landslides	Very low
Ground dissolution of soluble rocks	Negligible

3.6 Radon

The Indicative Atlas of Radon for England and Wales and the Groundsure report indicates that the site is not located in a Radon Affected Area, as less then 1% of properties are above the Action Level. Therefore, no radon protective measures are necessary.

3.7 Mining, ground workings and natural cavities

Groundsure data indicates that surface workings on the site mainly relate to ponds and water bodies, with records dating between the 1870s and 1960s. There are also records of ground workings (very minor extent) on the north and south site boundary. Groundsure data also notes that the site is located in an area where small scale underground mining for chalk may have occurred although this seems most unlikely in the vicinity of the site, given the depth to the Chalk and the substantial thickness of overlying Boulder Clay.

3.8 UXO

A Preliminary UXO Risk Assessment has been carried out by Buro Happold in accordance with CIRIA C681 and is included as Appendix C. In addition to the consideration of the potential for aerial delivered UXO, consideration has also been given to mitigation factors, namely the extent of post-war development. Normally, a mitigating factor may be applied based on the proposed level of intrusive works, however as the development proposals are currently undefined no such factor has been applied. The Preliminary UXO Risk Assessment concluded that the risk associated with UXO is Moderate / High. This reflects that the site is a former RAF Airfield, that records of aerial bombardment to the site are currently unavailable and that the level of post-WW2 redevelopment is limited. Therefore, a detailed UXO risk assessment will be required prior to ground investigation or earthworks.

4 Site setting

4.1 History of development

The history of the site and the surrounding area has been determined using historic maps from 1876 to 2023, supplemented by information obtained during a Client meeting, as well as online sources and existing reports. These historical accounts are presented in Table 4-1 below and the following text. A Drawing summarising this historical information has also been prepared and is included at the end of this report [following the text and before the Appendices). The available historic maps are presented in Appendix A. A summary of all of this information is presented in Section 4.1.1.

4.1.1 Summary

The site was farmland and woodland prior to development of Wethersfield Airfield in 1941. The Airfield was first used by the RAF before being handed to the US Air Force in 1943. The existing runways were constructed during the WW2 era, laid out in a typical 'A' shape plan, with 50 loops for standing aircraft. The main ancillary facilities at this time were in the southwest, and included various stores and workshops (pyrotechnic stores, lubricants and inflammables stores, aircraft maintenance / decontamination etc.), bulk fuel installation, as well as administrative buildings. The 'Bomb Dump' area had also been established in the north, at this time used for storage of conventional WW2 weapons. There were also shooting practice areas and other areas of bulk fuel (vehicle and aviation) around the site. In 1945, RAF Wethersfield was put into a state of 'Care and Maintenance' and no other operational flying units were based there from 1945 to 1952.

In 1951, the UK provided RAF Wethersfield to the USAF, with work to upgrade the facilities also commencing that year (including new accommodation and administrative blocks). The site was reactivated in 1952 and became home to the 20th Fighter Bomber Wing. A 'Victor Alert' Area was constructed in the north of the Airfield and functioned to enable quick response of the USAF, with aircraft armed with intermediate range nuclear weapons. A new 'Bomb Dump' area was also constructed to the north of the conventional WW2 weapons storage area for storage of nuclear weapons. In 1970, RAF Wethersfied became a Standby Deployment Base, ready to support augmentation forces if required and from 1970 to 1979, the Airfield was returned to 'care and maintenance'.

Plane maintenance continued throughout the Cold War era, including bulk fuel storage (above and below ground) and use of solvents (TCE etc.). The site was also used for firefighting practice, which comprised release of hydrocarbons at the ground surface and extinguishing using firefighting foams. There were also some incidences of controlled explosions and plane crashes which resulted in fuel release and use of the same foams. "Burning areas" were also located on the site. During the 1980s, Park Wood is rumoured to have been used as a USAF tip, including suspected disposal of unlabelled drums (defoliant) and USAF lorries. This area was also used as a practice area for firefighting on old aircraft. Since 1992, the Ministry of Defence Police has been the primary occupier of the airfield, bringing together various training and national units into one central headquarters.

4.1.2 Ordnance Survey mapping

The first Ordnance Survey map is dated 1876 and shows the site to be comprised of farmland and woodland and no significant change to the land was recorded on published mapping until 1962 when Wethersfield Airfield is first shown. This 1962 map shows the Airfield to be comprised of three runways and associated taxi ways. Most of the builtdevelopment is in the southwest, which is occupied by a series of small unlabelled buildings (assumed to mainly be barracks and ancillary uses). Other buildings were also present along the northern and southwestern boundary.

Minor changes to the Airfield were shown during the 1980s and 1990s, with rearrangement to some structures, including presence of aircraft hangars in the north and labelling of some features such as electricity substations, tanks, water towers, playground etc.

The surrounding area is mainly agricultural and woodland, with Wethersfield village located about 1km southwest and Gainsford End about 1km north. These areas underwent minor expansion during the 20th century. 1960s mapping showed a series of settlements to the south and west of the Airfield (assumed barracks / quarters). Many of these were no longer shown by the 1990s.

Table 4-1 - Summary of site history and history of the surrounding area.

Date	Site history	History of the surrounding area
1876 *1:10,560*	Most of the site is comprised of farmland or woodland. Park Wood is present in the north, Ostend Wood on the northwest boundary and Lodge Wood on the northeast boundary. Hawkes Hall is present on the southeast boundary. Broad Farm, which includes a series of ponds, is shown in the west.	The site is in a rural location, with surrounding land mainly agricultural and woodland. Wethersfield is about 1km southwest. Gainsford End is about 1km north.
1876 *1:2,500*	No significant change	No significant change.
1896-1898 *1:10,560*	Bluegate Hall and Bluegate Hall Spring are present in the north.	No significant change.
1897 *1:2,500*	No significant change.	No significant change.
1919-1924 *1:10,560*	No significant change.	No significant change.
1921-1923 *1:2,500*	No significant change.	No significant change.
1946-1948 *1:10,560*	No significant change.	No significant change.
1952-1953 *1:10,560*	No significant change.	No significant change.
1962 *1:2,500*	Wethersfield Airfield is now shown on mapping. A series of unlabelled buildings are shown in the southwest (likely barracks and ancillary uses). Parts of Park Wood are no longer present and three runways and associated taxi ways cross the site. Hawke's Hall is no longer present, with the area instead occupied by military buildings. There are also a series of buildings along the northern boundary.	No significant change.
1967 *1:10,560*	No significant change.	Wethersfield has expanded. There are a series of other small settlements around the site perimeter, in part on areas previously labelled as farms.
1968 *1:2,500*	No significant change.	The settlements in the surrounding area appear to be barracks / quarters associated with Wethersfield Airfield.
1981-1984 *1:2,500*	There have been minor changes to structures within Wethersfield Airfield.	No significant change.
1982-1987 *1:10,000*	Some road names and site features are labelled in the southwest (water tower, play ground etc.). the	No significant change.

Date	Site history	History of the surrounding area
	remainder of Park Wood is no longer shown, with the area instead occupied by aircraft hangars.	
1990-1994 *1:2,500*	Some tanks, electricity substations and water towers are labelled within the Airfield site.	Some of the barracks / quarters are no longer present.
2001 *1:10,000*	A series of drains are shown in the north.	No significant change.
2010 *1:10,000*	No significant change.	No significant change.
2023 *1:10,000*	No significant change.	No significant change.

4.1.3 Reports by others

The following text presents an extract of information presented in a heritage report (Wethersfield Airfield – Designation Application for Historic England) prepared by Chris Blandford Associates in 2022 [8].

RAF Wethersfield was first established in 1941 as a satellite station to RAF Ridgewell. It started as a grass runway used by Spitfires. Construction of the concrete runways began in 1941 and the base was handed to the US Air Force (USAF) in 1943. The main runway was 1800m in length with ancillary runways at 1300m, laid out in a typical 'A' shaped runway plan. There were also 50 loops for standing aircraft. The original Airfield included two T2 Hangars and Nissen Huts south of the flight line providing accommodation for personnel. A control tower was constructed in 1944 and modified several times, before being demolished in 2009. In 1945, RAF Wethersfield was put into a state of 'Care and Maintenance' and no other operational flying units were based there from March 1945 to 1952.

In 1951 the UK provided RAF Wethersfield to the USAF, with work to upgrade the facilities also commencing that year. In the summer of 1952, RAF Wethersfield was reactivated and became home of the 20th Fighter Bomber Wing. The USAF constructed numerous new buildings, including new accommodation blocks and social and administrative buildings. An on-site chapel, St Michael's Chapel, was also built at the same time. A 'Victor Alert' was constructed in the north of the Airfield and functioned to enable quick response of the USAF, with aircraft armed with intermediate range nuclear weapons. A new 'Bomb Dump' area was also constructed in the northern part of the WWII conventional weapons storage area, just north of the Victor Alert Area. The new Bomb Dump included reinforced blast proof structures used for the storage of nuclear weapons. These structures remain largely intact.

From 1970 to 1979 the Airfield was returned to 'care and maintenance'. In 1970, RAF Wethersfield became a Standby Deployment Base, ready to support augmentation forces if directed. Since 1992, the Ministry of Defence Police has been the primary occupier of the airfield, bringing together various training and national units into one central headquarters.

4.1.4 Historical account from Client meeting

Buro Happold attended a meeting with some of the WASC (including the former curator of the Wethersfield Airfield Museum and local residents/ farmers). This subsection presents a summary of information obtained from verbal accounts and photographic and map records. Historical features and incidents are illustrated on a Drawing provided at the end of this report. This information is also summarised in Table 4-2.

Table 4-2 - Summary of historical features / incidents from information provided by Client.

Feature number	Date	Description
1	1980s-2005	Waste from perimeter oil traps (approx. 10) and oil bunds associated with oil-fired heating systems spread at western end of runway. Approx. every 3 months.
2	1961	Plane crash with explosion, fuel release and use of fire-fighting foam.
3	Unknown until 2011	Jet fuel storage, removed in 2011.
4	1980 to 1981	US Air Force tip. Suspected disposal of unlabelled drums (defoliant?). Also used as a practice area for firefighting on old aircraft.
5	1980s	General waste disposal along tree line. Rumoured to include USAF lorries and civilian cars.
6	1980s	Burning ground. Reported to include waste oils / fuels.
7	1945 to 1960	Hawks Hall. Shooting practice area from WW2 aircaft. Sand stop butts.
8	Unknown to present	Perimeter oil pit / interceptor.
9	1950s to 1960s	Oil filled ditches intermittently set on fire (as a means of disposal). Reported to include all ditches exiting southern and eastern side of Airfield. Impact reported to extend to Gosfield Lake.
10	1952 to 1970	Plane maintenance and dismantling area. Included use of solvents such as TCE.
11	Unknown	Runway previously subject to planned explosions with follow-up repair.
12	Unknown	Demolition debris from two buildings spread at ground surface. Reported likely to include ACMs.
13	1980s	Fire-fighting practice / burning on runways and surrounding grassland. Hydrocarbons spread and extinguished using firefighting foams. Air show demonstration explosions also undertaken here.
14	1940s to 2009	Control tower demolished in 2009 (contained ACMs). Demolition materials spread at the ground surface.
15	1960s	Ponds associated with Broad Farm were infilled by the 1960s.
16	2022	Great Crested Newt ponds were excavated for Ground Control. Cloudy water with milky blue colour noted.
17	Unknown to present	Perimeter oil pit / interceptor.
18	Unknown	Below ground vehicle fuel tanks present.
19	Unknown	De-icing materials used on runways.
20	Unknown	Firefighting demonstration area used by helicopters.
21	1940s	Main area of Airfield buildings. Bulk petrol and fuel storage, aircraft maintenance/ decontamination, stores, pyrotechnic stores, lubricants stores, maintenance units (cameras, battery charging), substations, photographic block.
22	1945	Bulk aviation petrol installation. Aircraft armament and decontamination stores.
23	1950s to 1960s	'Victor Alert' area. 8 'Dutch Barn' hangar and dispersal pads for rapid response aircraft. US jets reported to leak fuel when stationary.

4.2 Regulatory data

Regulatory data relating to potentially contaminative uses is summarised in Table 4-3 below. This information was obtained from the Groundsure Report, presented in full in Appendix A.

Table 4-3 - Summary of regulatory data.

Item	Location	Information	Potential to impact
Past land use			
Historical industrial land uses	On site	Unspecific tank, unspecified heap, airfield	Yes
	100 to 250m	Corn windmill, smithy, forge, unspecified commercial / industrial	No
	250 to 500m	Smithy, windmill, unspecified commercial / industrial	No
Historical tanks	On site	Four records of tanks, dated 1962 to 1990.	Yes
Historical energy features	On site	Four records of electricity substations, dated 19833 to 1990.	Yes
Historical military land	On site	MDP Wethersfield, dated 1944 to present. Military Airfield since 1944. Originally an RAF station, also used by USAFF and now owned by the Ministry of Defence Police.	Yes
No records of the following within 500m: historical petrol stations, historical garages.			
Waste and landfill			
Waste exemptions	On site	12 records. Related to: treatment of waste wood and plant matter; use of mulch; spreading waste on non-agricultural land; aerobic composting prior to treatment; treatment of waste toner cartridges; crushing waste fluorescent tubes.	Yes
	Within 100m	22 records. Related to: deposit of waste from dredging inland waters; burning waste in the open; storage of sludge; deposit of agricultural waste consisting of plant tissue; storage of waste in a secure place; cleaning, washing, spraying or coating relevant waste; treatment of waste wood and waste plant matter by chipping, shredding, cutting or pulverising; use of waste in construction; burning of waste in a small appliance.	No
	100 to 250m	31 records. Exemptions relate to disposing of waste, treating waste, using waste and storing waste on a farm.	No
	250 to 500m	37 records. Exemptions relate to: using waste, storing waste, disposing of waste on a farm / for agricultural use.	No
No records of the following within 500m: active or recent landfill, historical landfill (BGS records, LA records or EA records), historical waste sites, licensed waste sites.			
Current industrial land use			
Recent industrial land uses	On site	10 records of electricity substations, Wethersfield Airfield, 8 records of tanks, MOD Police Headquarters, pylon, mast.	Yes
	Within 100m	Electricity substation located 2m east.	Yes
	100 to 250m	Animal foodstuffs, sewage services.	No
Control of Major Accident Hazards	100 to 250m	Castle Liquid Fuels located 112m southwest. Historical NIHHS Site.	No

Item	Location	Information	Potential to impact
Licensed discharges to controlled waters	250 to 500m	Four records related to sewage discharges, unspecified agricultural and sewage and trade combined. Nearest 230m distant.	No
List 2 dangerous substances	250 to 500m	M Kamper Services Ltd located 485m south, related to release of pH.	No
Pollution incidents	250 to 500m	One record located about 400m east and dated 2003. Related to release of silage liquors. Category 4 (no impact) to land and air. Category 3 (minor) impact to water.	No
No records of the following within 500m: current or recent petrol stations, electricity cables, gas pipelines, sites determined as Contaminated Land, regulated explosive sites, hazardous substance storage / usage, historical licensed industrial activities (IPC), licensed industrial activities (Part A[1]), licensed pollutant release (Part 2A[2}/B), radioactive substance authorisations, pollutant release to surface waters (red list), pollutant release to public sewer, list 1 dangerous substances, pollution inventory substances, pollution inventory waste transfers, pollution inventory radioactive waste.			
Environmental designations			
Designated Ancient Woodland	On site	Park Wood and Ostend Wood are areas of ancient and semi-natural woodland.	No
	Within 100m	Outfield Wood is located adjacent to the west. Poor Park is adjacent to the southwest.	No
	250 to 500m	Poor Park is mapped to extent to about 400m south.	No
Nitrate Vulnerable Zones (NVZ)	On site	The site is located in the River Blackwater and Colne NVZ for surface waters, and Sandlings and Chelmsford NVZ for groundwater.	No
	Within 100m	Colne NVZ and Sandlings and Chelmsford NVVZ are recorded 63m east.	No
	>1km	Colne NVZ and Sandlings and Chelmsford NVVZ are recorded 14400m north.	No
None of the following were recorded within 2km: Sites of Special Scientific Interest, Ramsar sites, Special Areas of Conservation, Special Protection Areas, National Nature Reserves, Local Nature Reserves, Biosphere Reserves, Forest Parks, Marine Conservation Zones, Green Belt, Proposed Ramsar Sites, Possible Special Areas of Conservation, Potential Special Protection Areas, Nitrate Sensitive Areas			
Visual and cultural designations			
Listed buildings	Within 100m	2 records. Boyton Hall Farmhouse (Grade II) located 67m west and associated barn (Grade II) located 955m west.	No
	100 to 250m	4 records. Nearest is Welcome Slough Farm (Grade II).	No
None of the following were recorded within 250m: World Heritage Sites, Areas of Outstanding Natural Beauty, National Parks, Conservation Areas, Scheduled Ancient Monuments, Registered Parks and Gardens,.			
Agricultural designations			
Agricultural Land Classification	On site	Site is designated part Grade 2 (very good quality agricultural land) and part non-agricultural.	No
Countryside Stewardship Schemes	On site	The site is part of a middle tier Countryside Stewardship scheme.	No
	Within 100m	Middle tier Countryside Stewardship Scheme recorded 50m southwest.	No
	1000 to 250mm	Middle tier Countryside Stewardship Scheme recorded 200m east.	No
None of the following were recorded within 250m: Open Access Land, Tree Felling Licenses, Environmental Stewardship Schemes,			
Habitat designations			

Item	Location	Information	Potential to impact
Priority Habitat Inventory	On site	Deciduous woodland identified.	No
	Within 100m	Deciduous woodland identified.	No
	100 to 250m	Deciduous woodland and traditional orchard identified.	No
None of the following were recorded within 250m: Habitat Networks, Open Mosaic Habitat, Limestone Pavement Orders.			

5 Preliminary geoenvironmental risk assessment

5.1 General approach

In the UK, the assessment of risk from contamination is based on consideration of the conceptual site model and follows the "source-pathway-receptor" approach. If one of these three elements (source, pathway or receptor) is absent, it is considered that there is no risk of harm. If, however, there is considered to be a linkage between any given source and any given receptor, then a risk-based approach is used to assess the significance or impact of the linkage. Risks are defined as the probability of an event occurring combined with the severity of the consequence of that event. Particularly, to assess the risks to site end users posed by any given source, the sensitivity of each receptor is considered. For example, the concentration of contamination acceptable at a site to be developed as a residential property with a garden used to grow vegetables and accessible to young children is set lower than that for a commercial site where soil is exposed only in minor areas of landscaping and the only long-term users of the site are adults. Similarly, a site overlying a Principal Aquifer supplying potable water will be considered more stringently than a site overlying an impermeable geology with only minor seepages of groundwater.

5.2 Climate change

It is accepted that the climate is changing and that this will affect future weather patterns. The Environment Agency [5] requires factoring climate change into risk assessments and remedial solutions. The British Standard, 'Adaptation to Climate Change – Principles, Requirements and Guidelines' [9] states that 'climate change impacts shall be assessed comprehensively…including…contamination' and should focus 'upon understanding the implications of future climate change trends and climate events over the full lifespan of a decision'. The National Planning Policy Framework [1] requires new development to contribute to 'mitigating and adapting to climate change' and to 'minimise vulnerability and increase resilience' to the range of impacts arising from climate change.

The changes to weather patterns in the UK may include: an increase in warmer weather; an increase in the frequency and intensity of rainfall events; and an increase in the duration or frequency of dry spells in the summer. Such events are also likely to become more extreme. There is the potential for these scenarios to impact upon potential contaminant migration pathways in particular with respect to both hazardous ground gas and contaminated groundwater via permeable strata, during both construction and operation of any proposed development. As ground conditions at the proposed development may be vulnerable to extreme weather events due to climate change during the demolition, construction and operation phases, these potential impacts have been considered in the risk assessment.

5.3 Conceptual site model

The potential risks posed to human health and the environment by ground contamination at this site have been evaluated by a generic quantitative risk assessment which incorporates the 'source-pathway-receptor' identification and assessment methodology in accordance with the Land Contamination Risk Management [10]. The risk assessment process therefore involves the identification of each source based on the information in this report, together with the identification of relevant exposure pathway(s) and receptors. The potential risks to the receptors have been assessed by considering the potential effect of the source on the receptor as well as the likelihood of a pathway linking the two, i.e., a contaminant linkage as discussed above.

5.4 Sources

The potential contamination sources at the site have been identified from the review of regulatory data, historical maps, previous reports and other information provided by the client are summarised in Table 5-1. The 'Contaminants of Concern' in this risk assessment are based primarily on information from this review of historical information and by reference to relevant Industry Profile reports (Airports [11], Industrial activities which have used materials containing radioactivity [12], Explosives, propellants and pyrotechnics manufacturing works [13], Profile of miscellaneous industries [14]) and R&D 66 [15]. The identified sources have been divided according to the site occupant – i.e., RAF, USAF, as well as relevant to both forces. Due to the history of military use, there is also a significant potential for the presence of further unknown and undocumented sources of contamination which may not have been recorded on any existing documents and which could be present at almost any location across this very large site. This potential for encountering such unforeseen contamination should be reflected, not only in any risk assessment, but also in any future health and safety planning, ground investigation design, implementation of remediation and development.

Table 5-1 Summary of potential sources of contamination

Potential source	Location	Likely age	Potential contaminants of concern
RAF and USAF			
1. Bulk fuel storage – vehicle and aviation	Refuelling installations. Above and below ground tanks.	1940s to 1990s	Oils, TPH, kerosene, diesel
2. Waste hydrocarbons	Oil interceptors / drains. Waste disposal locations. Burning grounds.	1980s to present	Oils, TPH, kerosene, diesel, PFAS / PFOS
3. Lubricants, oils and paints (aircraft maintenance)	Stores and maintenance areas	1940s to 1990s	Oils, VOCs, hydraulic fluids, potassium hydroxide, polyurethanes, xylene, toluene, methyl ethyl ketone, methyl isobutyl ketone, phosphoric acid, aluminium paints, chromic acid.
4. Solvents (aircraft maintenance)	Stores, maintenance areas, aircraft standing areas, above ground tanks	1940s to 1990s	Ketones (acetone), methanol, aliphatic hydrocarbons (heptane), aromatic hydrocarbons (xylene), esters, chlorinated compounds (trichloroethane, methylene chloride), other VOCs.
5. Explosives and ordnance	Bomb Dump area. Explosives store	1940s to 1990s	Lead, antimony, copper, zinc. UXO / UXBs. Explosives (TNT, RDX, HMS, Tetryl, PETN, Nitroguandine, NG, Picric Acid).
6. Construction and demolition materials (buildings, Nissen huts)	Potentially site-wide. Former locations of buildings (mainly around site perimeter)	1940s to present	Asbestos, metals, sulphate, alkaline pH
7. Runway materials (subject to deicing, repairs, firefighting and fuel spillages, demonstration explosions)	Runways	1940s to present	Coal tars, PAHs, monoethylene glycols, diethylene glycols, propylene glycols, urea, calcium acetates, magnesium acetates, oils, TPH, kerosene, diesel, PFAS / PFOS, Explosives (TNT, RDX, HMS, Tetryl, PETN, Nitroguandine, NG, Pitric Acid).
8. Electricity substations	Numerous across Airfield. Located in proximity to other buildings.	1940s to present	TPH, PCBs
9. Oil tanks	Heating oil tanks associated with each block of buildings	1940s to 1990s	Oils

Potential source	Location	Likely age	Potential contaminants of concern
10. Infilled ponds	Former Broad Farm	1960s	Various waste materials – metals, PAHs, asbestos, TPH, biodegradable materials
11. Deicing materials	Runways and hardstanding	1940s to present	Monoethylene glycols, diethylene glycols, propylene glycols, urea, calcium acetates, magnesium acetates
RAF			
12. Pyrotechnics and inflammables	Stores and maintenance areas	1940s to 1990s	Metals and metal compounds, boron, phosphorous, nitrates, chlorates, chromates. Nitric, sulphuric and acetic acids. Explosives (TNT, RDX, HMS, Tetryl, PETN, Nitroguandine, NG, Pitric Acid).
13. Spent ordnance	Firing ranges	1940s to 1990s	Lead, antimony, copper, zinc.
14. Radioactivity	Burning and dumping areas	1940s to 1990s	Radium-226, promethium, tritium, miscellaneous beta-emitters. Radionuclides associated with nuclear weapons storage.
15. Photographic chemicals	Photographic block	1940s to 1990s	Metals and metalloids (including silver halides), sodium hydroxide, acetic acid, cinnamic acid disulphide, potassium sulphite, ascorbic acid, benzotriazole, potassium bromide, cationic wetting agents.
USAF			
16. Bomb dump (nuclear and conventional weapons storage)	'Bomb Dump' Area	1950s to 1970s	Explosives (TNT, RDX, HMS, Tetryl, PETN, Nitroguandine, NG, Picric Acid). Radionuclides.
17. Firefighting – fuel and foams	Runways and surrounding grassed areas	1950s to 1990s	PFAS / PFOS, allophanates, carbamates, hydrolysed proteins, glycols, ether alcohols.
18. Burning areas	Localised areas around Airfield	1940s to 1990s	Radium-226, promethium, tritium, miscellaneous beta-emitters, asbestos, defoliant, oils and fuels, biodegradable materials.
19. Waste disposal – domestic and military	Former Park Wood	1980s	Radium-226, promethium, tritium, miscellaneous beta-emitters, asbestos, defoliant, oils and fuels, vehicles / scrap metals, biodegradable materials.

5.5 Pathways and receptors

Proposals for redevelopment are currently unconfirmed but it is understood that Wethersfield Airfield is being considered for development of a prison or as housing for asylum seekers. Although patterns for development are not finalised, it is anticipated that residential development will be provided in blocks or temporary structures (i.e., not private low-rise housing with gardens), with areas of hardstanding and soft landscaped areas. Given the size of the site, areas of soft landscaping are likely to be a mix of formal planted areas and informal grassland etc. The presence of contamination (in soils, liquids or gases) has the potential to impact upon human and environmental receptors both in the short term (during construction) and in the long term (during use and occupation). Those receptors, the pathways that could link them to the sources identified in Table 5-1, and the receptors' sensitivity are summarised below.

Table 5-2 Summary table of receptors and potential pathways

Receptor		Receptor sensitivity	Pathway
Human Health	Investigation and construction workers	High	Direct / dermal contact. Ingestion / inhalation of dusts. Inhalation of gas / vapour.
	Future site users / visitors (residents, visitors, staff)	High	Direct / dermal contact. Ingestion / inhalation of dusts. Inhalation of gas / vapour.
			Gas / vapour migration via shallow permeable strata with potential for accumulation to hazardous concentrations in enclosed spaces.
	Offsite occupiers / visitors of neighbouring land	Moderate	Inhalation of contaminated dusts.
Controlled Waters	River Pant, Toppesfield Brook or Bourne Brook (via unnamed streams on / adjacent to the site)	Moderate	Migration via surface water drainage / surface water features, permeable strata and preferential pathways (e.g. earthworks / piling)
	Secondary Undifferentiated Aquifer (Boulder Clay)	Low	Migration via surface water drainage / surface water features, permeable strata and preferential pathways (e.g. earthworks / piling)
	Secondary A Aquifer (Lambeth Group and Thanet Sands) Principal Aquifer (Chalk)	High	Migration via permeable strata and preferential pathways (e.g. piling)
Built Environment	Buried concrete foundations	Low	Aggressive attack
	Buildings / structures	Low	Gas / vapour migration via shallow permeable strata with potential for accumulation to hazardous concentrations in enclosed spaces.
	Potable water supply	Low	Direct contact.
Ecology	Flora	Low	Direct contact and root uptake

5.6 Hazard classification

To facilitate the risk assessment, the potential contamination sources described in Section 5.4 have been divided into hazard 'classes'. These classes reflect the nature or potential severity of the hazard, their likely spatial distribution (i.e., whether there is the potential for the hazard to exist site-wide or on a local basis) and the potential perception of risk associated with particular hazards. Class 1 reflects the most severe hazard and Class 3 the least severe.

- Class 1 hazard – presence of contamination likely to be widespread and / or potentially at high / gross concentrations. Likely to be an enhanced perception of risk to human health / environment due to the particular nature of the contaminant (e.g. radionuclides, carcinogens, contaminants "in the news"). Advice by specialists / experts with respect to such determinands likely to be required.
- Class 2 – presence of contamination is likely to be localised. However, potential health impacts could be severe and pose potentially significant challenges to ground investigation and development. Advice by specialists / experts likely to be required.

- Class 3 – contamination could be present at high / gross concentrations but if so, only on a localised basis. Sources of contamination are relatively common and not necessarily unique to military uses. May be relatively widespread. Generally accepted experience in managing / mitigating any such contamination-related risks.

It should be noted that all of the identified sources will require a degree of ground investigation and assessment and are capable of mitigation. The division of the contamination sources into these Classes is shown in Table 5-3 and is also reflected in the preliminary risk assessment in Table 5-4. In addition, the potential for hazardous ground gases is considered applicable to each of the hazard classes and so is listed as a separate row within the Table.

Table 5-3 - Hazard 'classes' for contaminant sources.

Hazard 'Class'	Contamination source
Class 1	1. Bulk fuel storage – vehicle and aviation
	2. Waste hydrocarbons
	4. Solvents (aircraft maintenance)
	6. Construction and demolition materials (buildings, Nissen huts)
	14. Radioactivity
	17. Firefighting – fuels and foams
	19. Waste disposal – domestic and military
Class 2	5. Explosives and ordnance
	7. Runway materials (subject to deicing, repairs, firefighting and fuel spillages, demonstration explosions)
	11. Deicing materials
	12. Pyrotechnics and inflammables
	13. Spent ordnance
	16. Bomb dump (nuclear and conventional weapons storage)
	18. Burning areas
Class 3	3. Lubricants, oils and paints (aircraft maintenance)
	8. Electricity substations
	9. Oil tanks
	10. Infilled ponds
	15. Photographic chemicals
Applicable to Class 1, 2 and 3	20. Ground gas (carbon dioxide, methane, trace gases), vapours / VOCs

5.7 Assessment of risk

The assessment of the level of risk for each of the potential contaminant linkages identified above is summarised in Table 5-3. The table lists the potential sources and hazard classes identified above. For each source, an assessment is made, receptor by receptor as to the magnitude of the potential consequence (reflecting the potential severity of the hazard associated with that source and the sensitivity of the receptor). The assessment is based upon the scenario that development could take place without the particular mitigation necessary to ensure safe development on such a site (and a brief comment on the mitigation necessary is included in the Table).

Consideration has also been given to the level of uncertainty associated with each of these potential sources. For example, much of the information is based upon historical records which are likely to be partial and will not be

complete, together with the absence of site investigation data and the fact that a site walkover has not been completed. Because of this uncertainty, the identification of the sources is based upon a conservative assessment of the potential location, nature and extent of the source. The probability or likelihood of the hazard being realised is then assessed by consideration of the directness / integrity of the exposure pathway that could link the receptor to the source. The assigned level of risk is determined by the terms of consequence, probability and risk in accordance with C552 [16] (which also sets out definitions for these terms). The final column describes all of the factors considered in the assessment and presents the justification for the assessed level of risk

Table 5-4 - Preliminary risk assessment.

Source		**Receptor** / Pathway	**Risk assessment** (following CIRIA C552)			Comment on hazard realisation *Comment on risk mitigation*
Hazard Class / Origin	Contaminants of concern		Consequence	Probability	Risk	
Hazard Class 1 1. Bulk fuel storage – vehicle and aviation 2. Waste hydrocarbons 4. Solvents (aircraft maintenance) 6. Construction and demolition materials (buildings, Nissen huts) 14. Radioactivity 17. Firefighting – fuels and foams 19. Waste disposal – domestic and military	Oils, TPH, kerosene, diesel, PFAS / PFOS, ketones, alcohols, aromatic hydrocarbons, esters, asbestos, metals, radioactivity, allophanates, carbonates, VOCs, defoliant, biodegradable materials, physical hazards associated with waste disposal	**Description of the source: Wethersfield Airfield was developed by 1941. First occupied by RAF before being handed to USAF in 1943. Existing runways constructed during WW2, including 50 loops for standing aircraft. Site was under 'care and maintenance' from 1945 to 1952. Reactivated in 1952 and upgraded by USAF. Returned to 'care and maintenance' from 1970 to 1979 and used as a standby deployment base. Occupied by the Ministry of Defence Police since 1992. Bulk fuel storage for vehicles and planes likely to have taken place over duration of Airfield's operation at various locations around the site (above and underground tanks). Potentially significant volumes required. Solvents (reportedly TCE) also used for aircraft maintenance. Stored in tanks and potentially maintenance stores. Site is served by oil interceptors. Between at least 1980s and 2005, oil interceptors and bunds from oil tanks were emptied with contents spread along western end of runway. Unclear whether interceptors are still maintained. Known historical issues with hydrocarbons entering local water courses with burning of hydrocarbons (1960s). Potential for presence of fuels / solvents on widespread basis and at gross concentrations. Various phases of construction and demolition likely to have taken place. Potential for uncontrolled / undocumented management of construction and demolition materials, which could contain asbestos. Potential for radioactivity across the site, associated with dismantling, disposal or burning of WW2 aircraft (radium dials) and storage of nuclear weapons (contamination of building fabric and hardstanding in storage areas). Site was used for weekly firefighting training by USAF. Comprised releasing fuel at ground surface, setting alight and extinguishing using firefighting foams. Also some known plane crashes / accidents which resulted in fuel losses and use of firefighting foams. Park Wood area reported rumoured to have been used as a USAF tip during 1980s. Disposal of drums of defoliant and USAF lorries. Potential for further undocumented disposal locations and disposal of a range of very hazardous materials. Considerable uncertainty regarding contamination sources as mainly based on third party accounts and not been supported by a site walkover or any ground investigation information.**			
		Investigation and construction workers Direct / dermal contact. Ingestion / inhalation of dusts.	Severe	Likely	**High**	Potential for exposure to soil contamination within Made Ground or natural soils during investigation / excavations. Potential for indirect exposure to radioactivity in particular areas. High degree of uncertainty regarding potential location and nature of contaminant sources. Development proposals undefined but will require some demolition and earthworks. Period of exposure relatively limited. Standard health and safety precautions will be used but enhanced health and safety mitigation measures likely to be required. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation. A radiation protection supervisor should be appointed for works involving potential radioactivity and all soil samples screened for radioactivity. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Future site users / visitors (residents, visitors, staff) Direct / dermal contact. Ingestion / inhalation of dusts.	Severe	Likely	**High**	Exact development proposals are undefined but planned end-uses are currently a prison or for housing of asylum seekers. Development therefore likely to comprise buildings (temporary or permanent) with surrounding areas of hardstanding and soft landscaped areas. Potential for uncontrolled access to some parts of the site, dependent on end-use. Children may use areas of the site for play etc. Potential for indirect exposure to radioactivity in particular areas. High degree of uncertainty regarding potential location and nature of contaminant sources. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation. A radiation protection supervisor should be appointed for works involving potential radioactivity and all soil samples screened for radioactivity. Soils in soft landscaped areas should be chemically and physically suitable for the intended end-use (potentially using imported topsoils and subsoils). Dependent on hazards identified by ground investigation, access to parts of the site may need to be restricted / controlled.*
		Offsite occupiers / visitors of neighbouring land Inhalation of contaminated dusts.	Medium	Unlikely	**Low**	Surrounding land use is mainly agricultural with isolated residential properties (nearest ~100m distant). Development proposals undefined but will require some demolition and earthworks. Potential for generation of dusts during construction. No plausible potential for exposure during operation. Due to size of the site, likelihood of impact to site neighbours is very remote. Standard health and safety precautions will be used but enhanced health and safety mitigation measures likely to be required. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation. A radiation protection supervisor should be appointed for works involving potential radioactivity and all soil samples screened for radioactivity. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards. Dust controls etc. should be employed in vicinity to site boundary.*

Source		**Receptor** / Pathway	**Risk assessment** (following CIRIA C552)			Comment on hazard realisation *Comment on risk mitigation*
Hazard Class / Origin	Contaminants of concern		Consequence	Probability	Risk	
		River Pant, Toppesfield Brook or Bourne Brook (via unnamed streams on / adjacent to the site) Migration via surface water drainage / surface water features, permeable strata and preferential pathways (e.g. earthworks / piling)	Medium	Likely	**Moderate**	Site is located in three catchments: for River Pant, Toppesfield Brook, Bourne Brook. Various water features located on / around the site and topography drain towards these rivers / brooks. River Pant is about 1km southwest, Toppesfield Brook 1km north and Bourne Brook adjacent to the south. Nearest surface water abstraction is about 1.3km distant, from Bourne Brook. Considerable thickness of superficial geology (Boulder Clay) which is unlikely to act as a preferential pathway. Main potential for impact is during earthworks / construction, via site drainage / runoff. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation and remediation. An appropriate surface water drainage strategy will be required during operation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Secondary Undifferentiated Aquifer (Boulder Clay) Migration via surface water drainage / surface water features, permeable strata and preferential pathways (e.g. earthworks / piling)	Mild	Likely	**Moderate / low**	Site is located over a Secondary Undifferentiated Aquifer in Boulder Clay (30m+ thick). Little / no Made Ground cover to inhibit downward migration of contamination. Boulder Clay likely to be relatively impermeable. No registered local or current abstractions from Secondary Undifferentiated Aquifer. Main potential for impact is during earthworks / construction, due to mobilisation of contamination. *Mitigation can be achieved by completed of a detailed Desk Study and a programme of appropriate investigation and remediation. Selection of appropriate foundation solution will be required during construction. An appropriate surface water drainage strategy will be required during operation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Secondary A Aquifer (Lambeth Group and Thanet Sands). Principal Aquifer (Chalk) Migration via permeable strata and preferential pathways (e.g. piling)	Medium	Low likelihood	**Moderate / low**	Secondary A Aquifer (Lambeth Group and Thanet Sands) and Principal Aquifer (Chalk) are present beneath a substantial thickness of Boulder Clay. Boulder Clay likely to be relatively impermeable and will inhibit downward migration of contamination. Nearest active groundwater abstraction is >1500m distant. Main potential for impact is during earthworks / construction, due to mobilisation of contamination / soakaway. *Selection of appropriate foundation solution will be required during construction. An appropriate surface water drainage strategy will be required during operation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Buried concrete foundations Aggressive attack	Mild	Low likelihood	**Low**	Potential for exposure (and degradation) of below ground concrete due to direct contact with aggressive ground conditions (Made Ground or natural soils). Potential for presence of high sulphate or other aggressive contaminants currently unknown. *Mitigation of potential risks can be achieved by undertaking appropriate investigation, design and specification of suitable concrete class for below ground concrete.*
		Potable water supply Direct contact.	Medium	Low likelihood	**Moderate/ low**	Potential for direct contact and permeation of potable water supply pipework by particular contaminants (hydrocarbons) in shallow soils. Potential for presence of such determinands in shallow soils currently unknown. *Mitigation of potential risks can be achieved by appropriate investigation, design and material selection.*
		Flora Direct contact and root uptake	Minor	Unlikely	**Very low**	Exact development proposals are undefined but planned end-uses are currently a prison or for housing of asylum seekers. Development therefore likely to comprise buildings (temporary or permanent) with surrounding areas of hardstanding and soft landscaped areas. High degree of uncertainty regarding potential location and nature of contaminant sources. Potential for direct contact and root uptake off residual contamination. *Mitigation of potential risks can be achieved by use of soils in soft landscaped areas that are chemically and physically suitable for the intended end-use (potentially using imported topsoils and subsoils).*

Source		**Receptor** / Pathway	**Risk assessment** (following CIRIA C552)			Comment on hazard realisation *Comment on risk mitigation*
Hazard Class / Origin	Contaminants of concern		Consequence	Probability	Risk	
Hazard Class 2 5. Explosives and ordnance 7. Runway materials (subject to deicing, repairs, firefighting and fuel spillages, demonstration explosions) 11. Deicing materials 12. Pyrotechnics and inflammables 13. Spent ordnance 16. Bomb dump (nuclear and conventional weapons storage) 18. Burning areas	Metals, metal compounds, UXO / UXBs, explosives, PAHs, coal tars, oils, fuels, glycols, urea, PFAS / PFOS, boron, phosphorous, nitrates, chlorates, chromates, physical hazards associated with waste materials	**Description of the source: Wethersfield Airfield was developed by 1941. First occupied by RAF before being handed to USAF in 1943. Existing runways constructed during WW2, including 50 loops for standing aircraft. Site was under 'care and maintenance' from 1945 to 1952. Reactivated in 1952 and upgraded by USAF. Returned to 'care and maintenance' from 1970 to 1979 and used as a standby deployment base. Occupied by the Ministry of Defence Police since 1992. Potential for presence of UXOs / UXBs both due to undetected aerial bombardment and onsite storage. Explosives, inflammables, and pyrotechnics stored on site and potentially used as part of training exercises etc. Also potential for presence of spent ordnance in former firing ranges and other discreet areas. Former burning areas have been identified and potential for further undocumented locations. Waste materials subject to burning unknown. Runway likely to have been subject to periodic deicing with unknown products. Also subject to demonstration explosions, repairs, and firefighting exercises. Sources of contamination unlikely to give rise to widespread issues or gross concentrations. Explosives, pyrotechnics, inflammables and UXO / UXB represent a severe hazard to human health. Understanding of contamination sources is mainly based on third party accounts and has not been supported by a site walkover or any ground investigation information.**				
		Investigation and construction workers Direct / dermal contact. Ingestion / inhalation of dusts.	Severe	Low likelihood	**Moderate**	Potential for exposure to soil contamination within Made Ground or natural soils during investigation / excavations. Potential for encountering / contact with explosives, ordnance etc. in particular areas. High degree of uncertainty regarding potential location and nature of contaminant sources. Development proposals undefined but will require some demolition and earthworks. Period of exposure relatively limited. Standard health and safety precautions will be used but enhanced health and safety mitigation measures likely to be required. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation. Consultation with an explosives expert should be undertaken. A Detailed UXO assessment and potentially supplementary mitigation during investigation / construction will be required. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Future site users / visitors (residents, visitors, staff) Direct / dermal contact. Ingestion / inhalation of dusts.	Severe	Low likelihood	**Moderate**	Exact development proposals are undefined but planned end-uses are currently a prison or for housing of asylum seekers. Development therefore likely to comprise buildings (temporary or permanent) with surrounding areas of hardstanding and soft landscaped areas. Potential for uncontrolled access to some parts of the site, dependent on end-use. Children may use areas of the site for play etc. Potential for encountering / contact with explosives, ordnance etc. in particular areas. High degree of uncertainty regarding potential location and nature of contaminant sources. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation. Consultation with an explosives expert should be undertaken. A Detailed UXO assessment and potentially supplementary mitigation during investigation / construction will be required. Soils in soft landscaped areas should be chemically and physically suitable for the intended end-use (potentially using imported topsoils and subsoils). Dependent on hazards identified by ground investigation, access to parts of the site may need to be restricted / controlled.*
		Offsite occupiers / visitors of neighbouring land Inhalation of contaminated dusts.	Medium	Unlikely	**Low**	Surrounding land use is mainly agricultural with isolated residential properties (nearest ~100m distant). Development proposals undefined but will require some demolition and earthworks. Potential for generation of dusts during construction. No plausible potential for exposure during operation. Due to size of the site, likelihood of impact to site neighbours is very remote. Standard health and safety precautions will be used but enhanced health and safety mitigation measures likely to be required. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation. Consultation with an explosives expert should be undertaken. A Detailed UXO assessment and potentially supplementary mitigation during investigation / construction will be required. Soils Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards. Dust controls etc. should be employed in vicinity to site boundary.*

Source		**Receptor** / Pathway	**Risk assessment** (following CIRIA C552)			Comment on hazard realisation *Comment on risk mitigation*
Hazard Class / Origin	Contaminants of concern		Consequence	Probability	Risk	
		River Pant, Toppesfield Brook or Bourne Brook (via unnamed streams on / adjacent to the site) Migration via surface water drainage / surface water features, permeable strata and preferential pathways (e.g. earthworks / piling)	Medium	Low	**Moderate / Low**	Site is located in three catchments: for River Pant, Toppesfield Brook, Bourne Brook. Various water features located on / around the site and topography drain towards these rivers / brooks. River Pant is about 1km southwest, Toppesfield Brook 1km north and Bourne Brook adjacent to the south. Nearest surface water abstraction is about 1.3km distant, from Bourne Brook. Considerable thickness of superficial geology (Boulder Clay) which is unlikely to act as a preferential pathway. Main potential for impact is during earthworks / construction, via site drainage / runoff. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation and remediation. An appropriate surface water drainage strategy will be required during operation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Secondary Undifferentiated Aquifer (Boulder Clay) Migration via surface water drainage / surface water features, permeable strata and preferential pathways (e.g. earthworks / piling)	Mild	Low likelihood	**Low**	Site is located over a Secondary Undifferentiated Aquifer in Boulder Clay (30m+ thick). Little / no Made Ground cover to inhibit downward migration of contamination. Boulder Clay likely to be relatively impermeable. No registered local or current abstractions from Secondary Undifferentiated Aquifer. Main potential for impact is during earthworks / construction, due to mobilisation of contamination / soakaway. *Mitigation can be achieved by completed of a detailed Desk Study and a programme of appropriate investigation and remediation. Selection of appropriate foundation solution will be required during construction. An appropriate surface water drainage strategy will be required during operation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Secondary A Aquifer (Lambeth Group and Thanet Sands). Principal Aquifer (Chalk) Migration via permeable strata and preferential pathways (e.g. piling)	Medium	Unlikely	**Low**	Secondary A Aquifer (Lambeth Group and Thanet Sands) and Principal Aquifer (Chalk) are present beneath a substantial thickness of Boulder Clay. Boulder Clay likely to be relatively impermeable and will inhibit downward migration of contamination. Nearest active groundwater abstraction is >1500m distant. Main potential for impact is during earthworks / construction, due to mobilisation of contamination / soakaway. *Mitigation can be achieved by completed of a detailed Desk Study and a programme of appropriate investigation and remediation. Selection of appropriate foundation solution will be required during construction. An appropriate surface water drainage strategy will be required during operation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Buried concrete foundations Aggressive attack	Mild	Low likelihood	**Low**	Potential for exposure (and degradation) of below ground concrete due to direct contact with aggressive ground conditions (Made Ground or natural soils). Potential for presence of high sulphate or other aggressive contaminants currently unknown but likely to be localised. *Mitigation of potential risks can be achieved by undertaking appropriate investigation, design and specification of suitable concrete class for below ground concrete.*
		Potable water supply Direct contact.	Medium	Unlikely	**Low**	Potential for direct contact and permeation of potable water supply pipework by particular contaminants (hydrocarbons) in shallow soils. Potential for presence of such determinands in shallow soils currently unknown but likely to be localised. *Mitigation of potential risks can be achieved by appropriate investigation, design and material selection.*
		Flora Direct contact and root uptake	Minor	Unlikely	**Very low**	Exact development proposals are undefined but planned end-uses are currently a prison or for housing of asylum seekers. Development therefore likely to comprise buildings (temporary or permanent) with surrounding areas of hardstanding and soft landscaped areas. High degree of uncertainty regarding potential location and nature of contaminant sources. Potential for direct contact and root uptake of residual contamination. *Mitigation of potential risks can be achieved by use of soils in soft landscaped areas that are chemically and physically suitable for the intended end-use (potentially using imported topsoils and subsoils).*

Source		**Receptor** / Pathway	**Risk assessment** (following CIRIA C552)			Comment on hazard realisation *Comment on risk mitigation*
Hazard Class / Origin	Contaminants of concern		Consequence	Probability	Risk	
Hazard Class 3 3. Lubricants, oils and paints (aircraft maintenance) 8. Electricity substations 9. Oil tanks 10. Infilled ponds 15. Photographic chemicals	Oils, VOCs and SVOCs, hydraulic fluids, BTEX, ketones, acids, aluminium paints, PCBs, TPH, asbestos, metals and metalloids, PAHs, silver halides, sodium hydroxide, potassium bromide, cationic wetting agents.	**Description of the source: Wethersfield Airfield was developed by 1941. First occupied by RAF before being handed to USAF in 1943. Existing runways constructed during WW2, including 50 loops for standing aircraft. Site was under 'care and maintenance' from 1945 to 1952. Reactivated in 1952 and upgraded by USAF. Returned to 'care and maintenance' from 1970 to 1979 and used as a standby deployment base. Occupied by the Ministry of Defence Police since 1992. Historic plans (1940s) show that lubricants, paints etc. for maintenance of aircraft were stored in dedicated buildings. Buildings dedicated to photographic development were also present at this time. Electricity substations were located in main parts of site occupied by buildings (some likely to still be present). Heating oil tanks were also positioned in vicinity of each building / block. Contents of bunds reported to have been emptied on western end of runway between at least 1980s and 2005. Pond associated with Broad Farm (located within Airfield) were infilled by 1960s with unknown materials. Understanding of contamination sources is mainly based on third party accounts and has not been supported by a site walkover or any ground investigation information. Contamination associated with these sources could be present at gross concentrations but likely only on a very localised basis.**				
		Investigation and construction workers Direct / dermal contact. Ingestion / inhalation of dusts.	Medium	Low likelihood	**Moderate / low**	Potential for exposure to soil contamination within Made Ground or natural soils during investigation / excavations. High degree of uncertainty regarding potential location and nature of contaminant sources. Development proposals undefined but will require some demolition and earthworks. Period of exposure relatively limited. Standard health and safety precautions will be used but enhanced health and safety mitigation measures likely to be required. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Future site users / visitors (residents, visitors, staff) Direct / dermal contact. Ingestion / inhalation of dusts.	Medium	Low likelihood	**Moderate / low**	Exact development proposals are undefined but planned end-uses are currently a prison or for housing of asylum seekers. Development therefore likely to comprise buildings (temporary or permanent) with surrounding areas of hardstanding and soft landscaped areas. Potential for uncontrolled access to some parts of the site, dependent on end-use. Children may use areas of the site for play etc. High degree of uncertainty regarding potential location and nature of contaminant sources. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation. Soils in soft landscaped areas should be chemically and physically suitable for the intended end-use (potentially using imported topsoils and subsoils). Dependent on hazards identified by ground investigation, access to parts of the site may need to be restricted / controlled.*
		Offsite occupiers / visitors of neighbouring land Inhalation of contaminated dusts.	Mild	Unlikely	**Very low**	Surrounding land use is mainly agricultural with isolated residential properties (nearest ~100m distant). Development proposals undefined but will require some demolition and earthworks. Potential for generation of dusts during construction. No plausible potential for exposure during operation. Due to size of the site, likelihood of impact to site neighbours is very remote. Standard health and safety precautions will be used but enhanced health and safety mitigation measures likely to be required. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards. Dust controls etc. should be employed in vicinity to site boundary.*
		River Pant, Toppesfield Brook or Bourne Brook (via unnamed streams on / adjacent to the site) Migration via surface water drainage / surface water features, permeable strata and preferential pathways (e.g. earthworks / piling)	Medium	Low likelihood	**Moderate / low**	Site is located in three catchments: for River Pant, Toppesfield Brook, Bourne Brook. Various water features located on / around the site and topography drain towards these rivers / brooks. River Pant is about 1km southwest, Toppesfield Brook 1km north and Bourne Brook adjacent to the south. Nearest surface water abstraction is about 1.3km distant, from Bourne Brook. Considerable thickness of superficial geology (Boulder Clay) which is unlikely to act as a preferential pathway. Main potential for impact is during earthworks / construction, via site drainage / runoff. *Mitigation can be achieved by completion of a detailed Desk Study and a programme of appropriate investigation and remediation. An appropriate surface water drainage strategy will be required during operation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*

Source		**Receptor** / Pathway	**Risk assessment** (following CIRIA C552)			Comment on hazard realisation *Comment on risk mitigation*
Hazard Class / Origin	Contaminants of concern		Consequence	Probability	Risk	
		Secondary Undifferentiated Aquifer (Boulder Clay) Migration via surface water drainage / surface water features, permeable strata and preferential pathways (e.g. earthworks / piling)	Mild	Low likelihood	**Low**	Site is located over a Secondary Undifferentiated Aquifer in Boulder Clay (30m+ thick). Little / no Made Ground cover to inhibit downward migration of contamination. Boulder Clay likely to be relatively impermeable. No registered local or current abstractions from Secondary Undifferentiated Aquifer. Main potential for impact is during earthworks / construction, due to mobilisation of contamination / soakaway. *Mitigation can be achieved by completed of a detailed Desk Study and a programme of appropriate investigation and remediation. Selection of appropriate foundation solution will be required during construction. An appropriate surface water drainage strategy will be required during operation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Secondary A Aquifer (Lambeth Group and Thanet Sands). Principal Aquifer (Chalk) Migration via permeable strata and preferential pathways (e.g. piling)	Medium	Unlikely	**Low**	Secondary A Aquifer (Lambeth Group and Thanet Sands) and Principal Aquifer (Chalk) are present beneath a substantial thickness of Boulder Clay. Boulder Clay likely to be relatively impermeable and will inhibit downward migration of contamination. Nearest active groundwater abstraction is >1500m distant. Main potential for impact is during earthworks / construction, due to mobilisation of contamination / soakaway. *Mitigation can be achieved by completed of a detailed Desk Study and a programme of appropriate investigation and remediation. Selection of appropriate foundation solution will be required during construction. An appropriate surface water drainage strategy will be required during operation. Any ground investigations and construction should be undertaken in accordance with a Health & Safety plan which contains appropriate contingency / plans commensurate with working on a military site and reflects the potential for encountering unexpected contamination or other hazards.*
		Buried concrete foundations Aggressive attack	Mild	Low likelihood	**Low**	Potential for exposure (and degradation) of below ground concrete due to direct contact with aggressive ground conditions (Made Ground or natural soils). Potential for presence of high sulphate or other aggressive contaminants currently unknown but likely to be localised. *Mitigation of potential risks can be achieved by undertaking appropriate investigation, design and specification of suitable concrete class for below ground concrete.*
		Potable water supply Direct contact.	Medium	Unlikely	**Low**	Potential for direct contact and permeation of potable water supply pipework by particular contaminants (hydrocarbons) in shallow soils. Potential for presence of such determinands in shallow soils currently unknown but likely to be localised. *Mitigation of potential risks can be achieved by appropriate investigation, design and material selection.*
		Flora Direct contact and root uptake	Minor	Unlikely	**Very low**	Exact development proposals are undefined but planned end-uses are currently a prison or for housing of asylum seekers. Development therefore likely to comprise buildings (temporary or permanent) with surrounding areas of hardstanding and soft landscaped areas. High degree of uncertainty regarding potential location and nature of contaminant sources. Potential for direct contact and root uptake of residual contamination. *Mitigation of potential risks can be achieved by use of soils in soft landscaped areas that are chemically and physically suitable for the intended end-use (potentially using imported topsoils and subsoils).*

Source		**Receptor** / Pathway	**Risk assessment** (following CIRIA C552)			Comment on hazard realisation *Comment on risk mitigation*
Hazard Class / Origin	Contaminants of concern		Consequence	Probability	Risk	
Hazard Class 1, 2 and 3	20. Ground gas (carbon dioxide, methane, trace gases), vapours / VOCs	**Description of the source: Wethersfield Airfield was developed by 1941. First occupied by RAF before being handed to USAF in 1943. Existing runways constructed during WW2, including 50 loops for standing aircraft. Site was under 'care and maintenance' from 1945 to 1952. Reactivated in 1952 and upgraded by USAF. Returned to 'care and maintenance' from 1970 to 1979 and used as a standby deployment base. Occupied by the Ministry of Defence Police since 1992. Made Ground associated with previous development likely to be present on a relatively localised basis. Additional potential for areas of infilled land. Contents unknown but could include biodegradable or hazardous materials. Potential for presence of hydrocarbons (fuels, solvents etc.) or VOCs to be present at high / gross concentrations which could give rise to vapours in some parts of the site.**				
		Future site users / visitors (residents, visitors, staff) Gas / vapour migration via shallow permeable strata with potential for accumulation to hazardous concentrations in enclosed spaces.	Severe	Unlikely	**Moderate / low**	Exact development proposals are undefined but planned end-uses are currently a prison or for housing of asylum seekers. Development therefore likely to comprise buildings (temporary or permanent) with surrounding areas of hardstanding and soft landscaped areas. High degree of uncertainty regarding potential location and nature of contaminant sources. Actual risk will be dependent on location of buildings relative to hazardous ground gas sources. Near surface geology dominated by low permeability Boulder Clay and not likely to be favourable to lateral migration. *Mitigation can be achieved by appropriate ground gas investigation and assessment and specification of hazardous ground gas protection measures if required.*
		Buildings / structures Gas / vapour migration via shallow permeable strata with potential for accumulation to hazardous concentrations in enclosed spaces.	Medium	Unlikely	**Low**	Exact development proposals are undefined but planned end-uses are currently a prison or for housing of asylum seekers. Development therefore likely to comprise buildings (temporary or permanent) with surrounding areas of hardstanding and soft landscaped areas. High degree of uncertainty regarding potential location and nature of contaminant sources. Actual risk will be dependent on location of buildings relative to hazardous ground gas sources. Near surface geology dominated by low permeability Boulder Clay and not likely to be favourable to lateral migration. *Mitigation can be achieved by appropriate ground gas investigation and assessment and specification of hazardous ground gas protection measures if required.*

6 Conclusions and recommendations

6.1 Summary of risk assessment

An Initial Conceptual Site Model has been determined and a Preliminary Risk Assessment with respect to ground contamination has been carried out for each of the 20 identified contamination sources, which have been divided into 'Hazard Classes' as set out in Section 5.6. At this preliminary stage of the project, the main sources of potential contamination have been identified and the potential risks have been qualitatively assessed with due account taken of the potential hazards associated with the large number of potential contaminants and of the uncertainty regarding their potential presence, location, volume and nature. This assessment is based upon potential risks associated with redevelopment, where current proposals include use as a prison or as accommodation for asylum seekers. Consideration has also been given to the potential risks associated with any below ground works, e.g., ground investigation or earthworks / foundation construction. A summary of this assessment, where risks were assessed as above 'low', is presented below in **Error! Reference source not found.** and briefly described in the following text.

Table 6-1 - Summary of potential risks.

Source	Receptor	Potential risk
Hazard Class 1		
1. Bulk fuel storage – vehicle and aviation 2. Waste hydrocarbons 4. Solvents (aircraft maintenance) 6. Construction and demolition materials (buildings, Nissen huts) 14. Radioactivity 17. Firefighting – fuels and foams 19. Waste disposal – domestic and military	Future site users (residents, visitors, staff)	High
	Investigation and construction workers	
	Surface waters - River Pant, Toppesfield Brook or Bourne Brook	Moderate
	Groundwater [Shallow -Boulder Clay] [Deep - Lambeth Group, Thanet Sands, Chalk]	Moderate / low
	Built infrastructure-potable water supply	
Hazard Class 2		
5. Explosives and ordnance 7. Runway materials (subject to deicing, repairs, firefighting and fuel spillages, demonstration explosions) 11. Deicing materials 12. Pyrotechnics and inflammables 13. Spent ordnance 16. Bomb dump (nuclear and conventional weapons storage) 18. Burning areas	Future site users (residents, visitors, staff)	Moderate
	Investigation and construction workers	
	Surface waters - River Pant, Toppesfield Brook or Bourne Brook	Moderate / Low
Hazard Class 3		
3. Lubricants, oils and paints (aircraft maintenance) 8. Electricity substations 9. Oil tanks 10. Infilled ponds 15. Photographic chemicals	Future site users (residents, visitors, staff)	Moderate / low
	Investigation and construction workers	
	Surface waters - River Pant, Toppesfield Brook or Bourne Brook	
Hazard Class 1, 2 and 3		
20. Ground gas (carbon dioxide, methane, trace gases), vapours / VOCs	Future site users / visitors (residents, visitors, staff)	Moderate / low

6.2 Discussion of potentially significant risks (above Low)

The potentially significant risks to people (future site users, investigation and construction workers) are assessed as between High (Hazard Class 1) to Moderate and Moderate / low (Hazard Classes 2 and 3). This is driven by the potential for human contact (both during construction and during operation) with high / gross concentrations of some particularly hazardous determinands (e.g. hydrocarbons, solvents, asbestos), including the potential presence of radioactivity, explosives, ordnance and unknown wastes.

The potentially significant risks to surface waters are assessed as Moderate (Hazard Class 1) and Moderate / low (Hazard Classes 2 and 3). This risk is driven by the potential for the presence of fuels, oils, solvents etc. to be present as gross contamination, associated with former fuel installations, bulk solvent storage, poor waste disposal practises and firefighting training and the potential for migration via site drainage, particularly during construction.

The risks to groundwater (Secondary Aquifer at shallow depth and Secondary A / Principal Aquifers in bedrock) are assessed as Moderate / low (for Hazard Class 1). This reflects the potential for presence of mobile contaminants at gross concentrations, but also the relatively low sensitivity of the receptor and the long / indirect migration pathway to the more sensitive deeper aquifer.

The potentially significant risks to built infrastructure (potable water supply) were assessed Moderate/ low for Hazard Class 1. This reflects the sensitivity of the receptor and the potential for relevant contaminants at relevant depths.

There are also Moderate / Low risks to future site users associated with the potential for evolution of gas / vapour from Made Ground or contaminated natural soils, with subsequent migration and accumulation to hazardous concentrations in enclosed spaces.

6.3 Part 2A statutory designation

6.3.1 Introduction

There is an important distinction between land which is contaminated (as a result of past commercial / industrial activities) and land which is "determined" as Contaminated Land under Part 2A of the Environmental Protection Act 1990. The following text (Section 6.3.2) summarises that distinction and briefly describes how remediation of contamination takes places under the planning or Part 2A regulatory regimes. The text in Section 6.3.3 then presents our opinion as to the status of the site under Part 2A for its current vacant use. The need for investigation, assessment and remediation associated with any proposals for change of use / redevelopment of the site (or parts of it) are then set out in Section 6.4.

6.3.2 Contamination in the Part 2A and planning regimes

Over the last 200 years or so, the commercial / industrial activities of people in the UK (and elsewhere) have resulted in a legacy of ground contamination. Typically, that contamination is the result of leaks or losses from the processes, of from the disposal of process wastes and residues, either on or off site. The contamination can be solid, liquid or gas/ vapour.

Evidence of such past contaminative activities or land uses can be either desk based (e.g. historic maps, plans photos etc.) or site specific (e.g. data from chemical analysis of samples of soil, water or gas/ vapour). In circumstances where there is evidence of the presence of contaminants, the site will be termed "land affected by contamination".

As a result of concerns about contamination and the environment, in the 1970s the Government introduced the Control of Pollution Act, which aimed to address this issue for current and future industrial activities. The concern for the legacy of contamination associated with historic commercial / industrial activities was addressed in the Part 2A of the Environmental Protection Act 1990 and associated guidance (current version published in 2012). The objectives of the Part 2A regime can be summarised as;

i. To identify and remove unacceptable risks to people and the environment
ii. To ensure that land is suitable for its current use and
iii. To ensure that the costs of addressing (i) and (ii) are proportionate and compatible with sustainability principles

Part 2A placed the duties for implementation of the Part 2A regime with local authorities who had to inspect their land and to determine whether any of it was presenting unacceptable risks to people or the environment. If, when carrying out this inspection, the local authority identified such an unacceptable risk, they would "determine" the site to be "Contaminated Land" under Part 2A and also identify the "appropriate person" responsible for its remediation (so that at the conclusion of that remediation, the risks were no longer unacceptable).

For risks to be considered unacceptable, significant harm would be being caused to people of the environment, or there would be a significant possibly of such harm. Significant harm to people is defined as, for example, death, cancer, serious health impacts / injury etc. [the Guidance also defines significant harm to the various environmental resources].

The large majority of land affected by contamination in the UK is not capable of being determined as Contaminated Land under Part 2A. This is because, even though the land may contain some contaminants, that under its current use, the contamination is not causing significant harm (or presenting a significant possibility of such harm).
[For example, a tarmac car park may be located on the site of a former chemical works with a legacy of ground contamination, but the underlying geology is a substantial thickness of clay. Under such circumstances, even though contamination may be present, for this current use, it does not pose a significant risk to people or the environment as the contaminant source cannot migrate or come into contact with people or environmental receptors].

However, if such land is then subject to proposals for redevelopment to a new and more sensitive use (e.g. for housing) then the presence of that contamination must be considered by the developer, whose responsibility it is (under the Planning Act and planning guidance) to ensure that the development takes place safely and that following development, people and the environment are also safe from any harm associated with that legacy of contamination. That is, the contamination would have to be remediated as a part of the redevelopment to ensure this safe development. The relevant planning guidance further reinforces this, by stating that "as a minimum" the redeveloped site must not be capable of being determined as Contaminated Land under Part 2A.

In other words, the planning regime looks forward (to a proposed future use) and the Part 2A regime looks back (to the legacy of contamination and current land use) and under the planning regime, Part 2A acts as a safety net. It ensures that developers must remediate any historic contamination so that the land is suitable for its new use and that people (on site and neighbours) and the environment (flora, fauna, groundwater, rivers and buildings) are not harmed as a result of that contamination. It also makes sure that following development, because the land has been remediated, it cannot then be determined as Contaminated Land and there can be no legacy requiring retrospective action by the local authority under Part 2A.

In summary, many sites in the UK are land affected by contamination as a result of historic commercial / industrial activity (and this includes military uses). Although contamination is (or may be) present in the ground, for the current use it may not be giving rise to significant harm (or the significant possibility of such harm) to people or the

environment. Only if that contamination is causing significant harm (or presenting the significant possibility of such harm), can the site be determined as Contaminated Land under Part 2A and the local authority will then require remediation to be carried out by the appropriate person. If significant harm is not being caused (or there is no significant possibility of such harm) then no determination can be made, or remediation required to be undertaken under Part 2A. However, when proposals for such a site are brought forward, for a change of use or for redevelopment, then under the planning regime, the developer will have to carry out the appropriate investigation, assessment and remediation to ensure safe development, mitigating the risks to people and the environment in both the short and long term.

6.3.3 Opinion

In our opinion, and based upon the available preliminary information, it is unlikely that the Wethersfield airbase site in its current status (disused and closed to the public), would be determined as Contaminated Land under the provisions of Part 2A of the Environmental Protection Act 1990. An enquiry has been made to the local authority with respect to their categorisation of the site on their register of potentially contaminated land, but at the time of writing, no response has been received. [Note: If "Determined" as Contaminated Land, as a former military site, the relevant regulator would be the Environment Agency]

In a redevelopment / repurposing scenario, under the planning regime, it is the developer's responsibility to ensure that, as a minimum, the redeveloped / repurposed site could not be determined as Contaminated Land under Part 2A of the Environmental Protection Act 1990. That responsibility is likely to require adherence to the recommendations given below.

6.4 Recommendations

Although much of the site area may not have been subject to potentially contaminative use / activities, the contamination sources identified in this report represent potentially significant challenges to achieving safe development in particular areas of the site. The potential risks assessed above, are capable of mitigation provided that the following actions / steps are taken.

1. A comprehensive and detailed Desk Study must be carried out and published prior to any intrusive ground investigation or earthworks / development. That study must identify the location of all potential contamination sources, based on historical site plans, information held by the Ministry of Defence / Defence Infrastructure Organisation and site walkover observations. It must also take account of the potential for unforeseen contamination.
2. A Detailed UXO Risk Assessment should be carried out by an appropriately qualified specialist company to inform the need for and scope of UXO mitigation measures during any ground investigation, earthworks, or construction.
3. Appropriate ground investigation(s) should be designed and implemented. The ground investigation would consider the development plan / pattern but also aim to characterise geoenvironmental conditions across the site. Such investigation should be undertaken in phases to accord with recommended good practice and ensure the work is appropriately targeted. The investigations should combine geotechnical and geoenvironmental objectives. Those geoenvironmental objectives would be to gain an understanding of:
    a. The presence, extent and nature of any Made Ground.
    b. The chemistry (inorganic, organic, radiological) of the Made Ground and any natural soils demonstrating evidence of contamination.

   c. The potential presence of contamination associated with suspected point sources of contamination (e.g., former fuel storage areas, firefighting areas, burning areas, waste disposal) and also disseminated sources of contamination (e.g. radionuclides).
   d. The shallow and deep groundwater regime and chemistry.
   e. The chemistry of surface waters (on and adjacent to the site).
   f. The hazardous ground gas / vapour regime(s).
4. Appropriately qualified specialists should be involved prior to and during implementation of ground investigation (and in its subsequent interpretation), including:
   a. Radioactivity specialists – to advise on need to radioactivity surveys of ground surface or building fabrics / hardstanding, including potential screening of soil samples obtained during investigation. Also, to advise in case of encountering suspicious or unexpected artefacts / conditions.
   b. Explosives specialists – to advise on potential for presence of explosives in soils etc. and implementation of appropriate mitigation measures during investigation.
5. Ground investigation(s) or other surveys should be carried out in accordance with a detailed Health & Safety Plan that gives appropriate attention to both the known contaminant sources as well as the potential for encountering unexpected / undocumented contamination or conditions, along with protocols to follow in such events.
6. Ensure that the chemical analyses undertaken (soils, waters and gas/vapour) reflect the wide range of potential contaminants of concern listed in Table 5-1. Not all samples will be tested for all possible determinands, but the Sampling and Analysis Plan must take account of the potential for all of these determinands to be present on the site either widespread or localised).
7. Report the findings of the ground investigation in a Geoenvironmental Interpretative Report(s), including a Generic / Detailed Quantitative Risk Assessment. Such a report should consider all the source-pathway-receptor linkages identified in this report.
8. Determine a Remediation Strategy that takes full account of the identified contaminant sources [presence, location, nature and extent] and the proposals for development. The strategy should set out the measures necessary to mitigate the potential risks to people and the environment and to enable safe development. The Strategy must also pay particular attention to the need to address the potential risks associated with unknown / unforeseen contamination.
9. Prepare a Verification Plan that describes all of the lines of evidence necessary to demonstrate successful implementation of the Remediation Strategy. The Plan will also identify the parties responsible and describe how the evidence will be obtained, collated and reported.

7 References

[1] Ministry of Housing, Communities and Local Government, "National Planning Policy Framework," Ministry of Housing, Communities and Local Government, 2021.

[2] HM Government, Part 2A Environmental Protection Act, 1990.

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[7] gov.uk, "Flood map for planning service.," gov.uk, [Online]. Available: https://flood-map-for-planning.service.gov.uk/. [Accessed 20 March 2023].

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[9] British Standards Institute, "Adaptation to Climate Change - Principles, Requirements and Guidelines (BS EN ISO 14090:2019)," 2019.

[10] Environment Agency, "Land Contamination Risk Management (LCRM)," Environment Agency, 2021.

[11] Department of the Environment, "Industry Profile. Airports.," 1995.

[12] Department for Environment, Food and Rural Affairs, "Industry Profile. Industrial activities which have used materials containing radioactivity.," 2006.

[13] Department of the Environment, "Industry Profile. Chemical works. Explosive, propellants and pyrotechnics manufacturing works.," 1995.

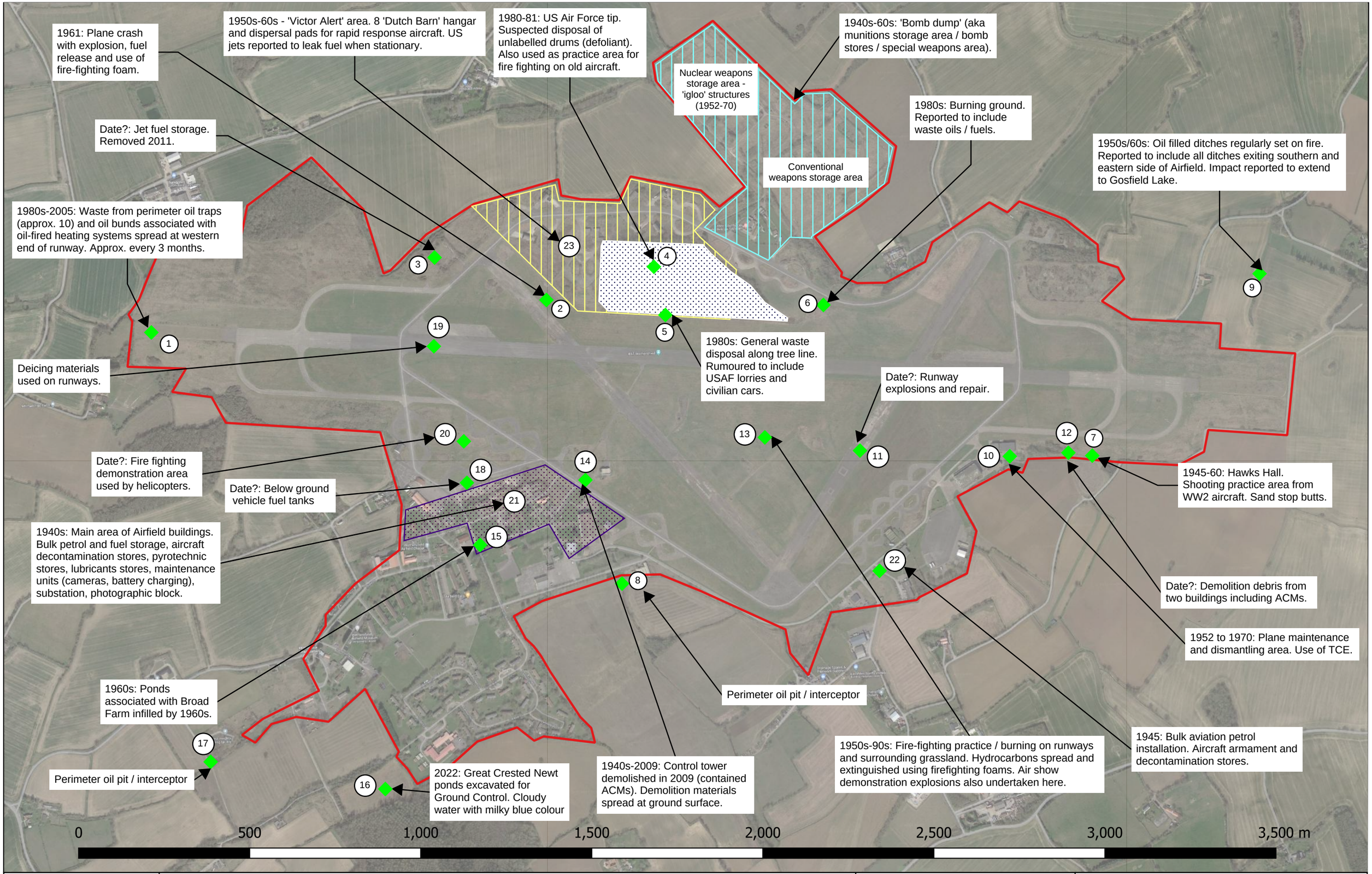
[14] Department of the Environment, "Profile of miscellaneous industries, incorporating charcoal works, dry-cleaners, fibreglass and fibreglass resins manufacturing works, glass manufacturing works, photographic processing industry, printing and bookbinding works.," 1996.

[15] NHBC, Environemant Agency and Chartered Institute of Environmental Health, Guidance for the safe development of housing on land affected by contamination. R&D 66:2008, 2008.

[16] CIRIA, "Contaminated Land Risk Assessment. A guide to good practice. C552," CIRIA, 2001.

[17] Department of the Environment Industry Profile, "Chemical Works - coating (paints and printing inks), manufactoring works," 1995.

Drawings



BURO HAPPOLD

Project: Wethersfield Airfield		*Project Number:* 0056628	*Status:* Draft	
Sketch Title: Historical incidents / features plan		*Sketch Number:* 01	*Date:* 15/03/2023	*Initials:* NS	*Revision:* P03

Appendix A Groundsure

Appendix B BGS borehole logs

Appendix C Preliminary UXO risk assessment

This Preliminary UXO Risk Assessment has been carried out by Buro Happold in accordance with CIRIA C681. The purpose of the preliminary risk assessment is a qualitative screening exercise to assess the likelihood of finding UXO at the site. This can then be used to make an informed decision if further UXO specific risk management is required.

The assessment is based on data obtained from a desktop review of information, including site location, bombing records, historical uses, historical development and proposed development.

Item	Comments	Score
Site setting	The site is in a rural setting, located about 1km north of Whethersfield and 6 miles northwest of the town of Braintree. Surrounding land use is mainly agricultural farmland and small areas of woodland.	1
Site description and historical land usage	The site is a former Airfield that was first established in 1941 and used by the RAF and US Air Force throughout the WW2 and Cold War eras. The Airfield accommodated various operations units over this time and also included areas for conventional and nuclear weapons storage.	8
Record of bombing	No bomb maps or records of aerial bombardment have been found for the site. However, Braintree was subject to aerial attack during WW2. https://www.braintreemuseum.co.uk/wwi-wwii/	8
Level of post war development	Ordnance Survey mapping shows the site generally undeveloped in both 1924 and 1946. However, Wethersfield Airfield was operational by 1941 and underwent expansion during the Cold War era. Likely that most of the site has remained unchanged since WW2. Considered that <10% of the area has undergone post-WW2 redevelopment.	0
Level of proposed intrusive works	Development proposals are currently undefined, therefore no mitigating factor applied.	0
Assessed risk	**Moderate / High risk**	17
Recommendations	The assessment found the risk associated with UXO to be Moderate / High. This risk should be reassessed once the development proposals are defined. A detailed UXO risk assessment will be required prior to ground investigation or below ground works.	
Attachments	**Table C-2 -** Potential aerial delivered UXO hazards **Table C-3 -** Mitigation factors **Table C-4 -** Final score summary **Attachment 1 –** Pre- WWII Historical Map **Attachment 2 –** Post – WWII Historical Maps	

Table C-2 Scoring process for indicators of potential aerial delivered UXO hazards

Data Item	Increasing Potential for aerial delivered UXO Hazards			
	1	**2**	**4**	**8**
A - Site Setting	Rural	Small towns	Cities Large Towns	
B - Site description and historical land usage	Greenfield site only Agricultural land only	Residential only Within 10 mile radius of site of previous military use Within 5 mile radius of wartime[1] for following: Railway marshalling yard Power station Gas works Port Industrial centre	Within 5 mile radius of site of previous military use Within 1 mile radius of wartime[1] for following: Railway marshalling yard Power station Gas works Port Industrial centre On wartime[1] flight paths	Within 1 mile radius of site of previous military use Former wartime[1]: Railway marshalling yard Power station Gas works Port Industrial centre
C – Record of bombing	No history of WWII bombing	Within 10 mile radius of area of known WWII bombing	Within 5 mile radius of area of known WWII bombing	Area of known WWII bombing

[1]Wartime refers to the site being in use at the time of WWI and WWII when its significance may have caused it to be the target of an enemy attack.

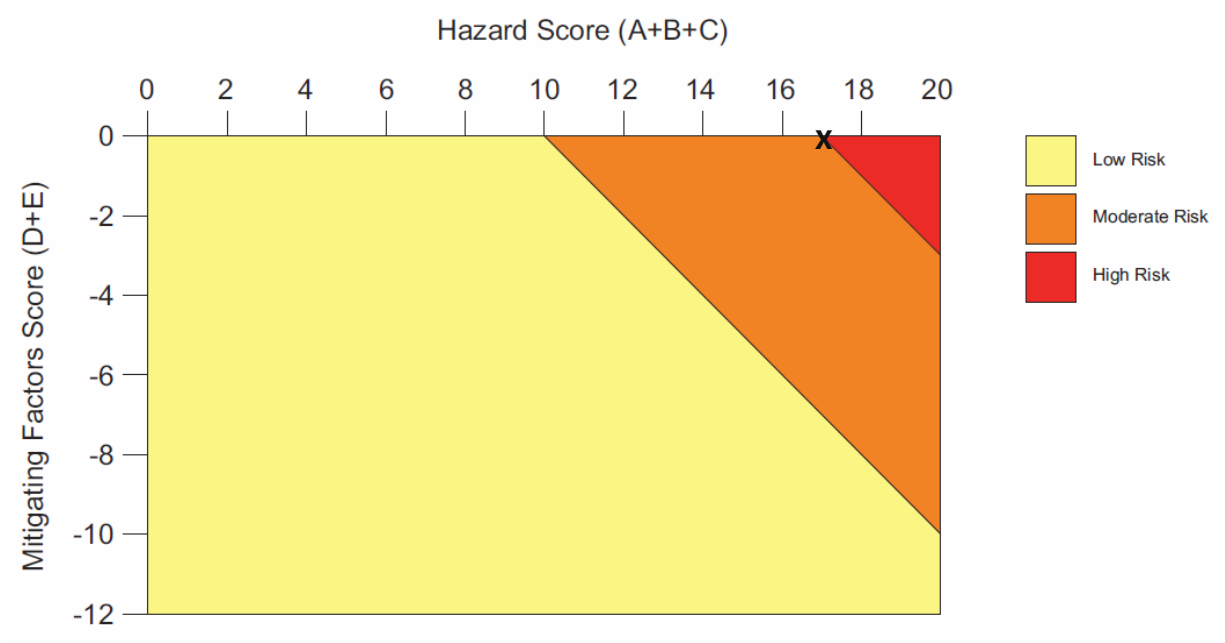
Table C-3 Scoring process for considering mitigation factors

Data Item	Decreasing Potential for aerial delivered UXO Hazards				
	-6	**-5**	**-3**	**-1**	**0**
D - Level of post war development	Whole site redevelopment (100% of the site)	Significant post war development (>80% of the site)	Moderate level of post war development (<80% and ≥45% of the site)	Some post war development (<45% and ≥10% of the site)	Minimal post war development (<10% of the site)
E - Level of proposed intrusive works in areas not subject to post war development[1]	Very Small (<5%)	Small (<10%)	Some (<45% and ≥10%)	Moderate (<80% and ≥45%)	Significant (>80%)

[1]Only if the level of post-war development is known and can be quantified in terms of site area and an approximation of depth should a mitigation factor be applied.

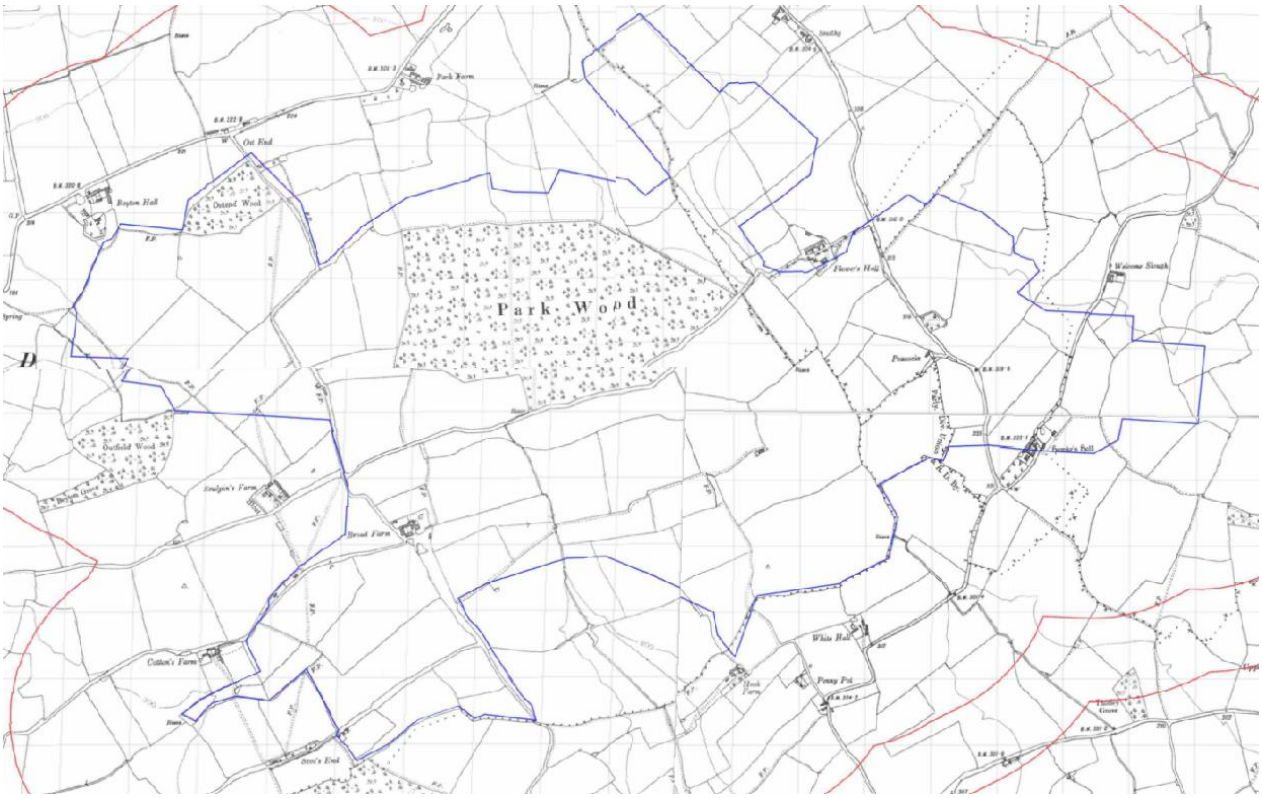
Table C-4 Final score is based on the sum of rows A, B, C, D and E in Table C-2 and Table C-3.

Final Hazard Score	Risk of encountering an Aerial dropped UXO	Implication
-9 - 9	Low Risk	No further UXO risk assessment likely to be required
10 - 17	Moderate Risk	Detailed UXO Risk Assessment required
17 - 20	High Risk	Detailed UXO Risk Assessment required.

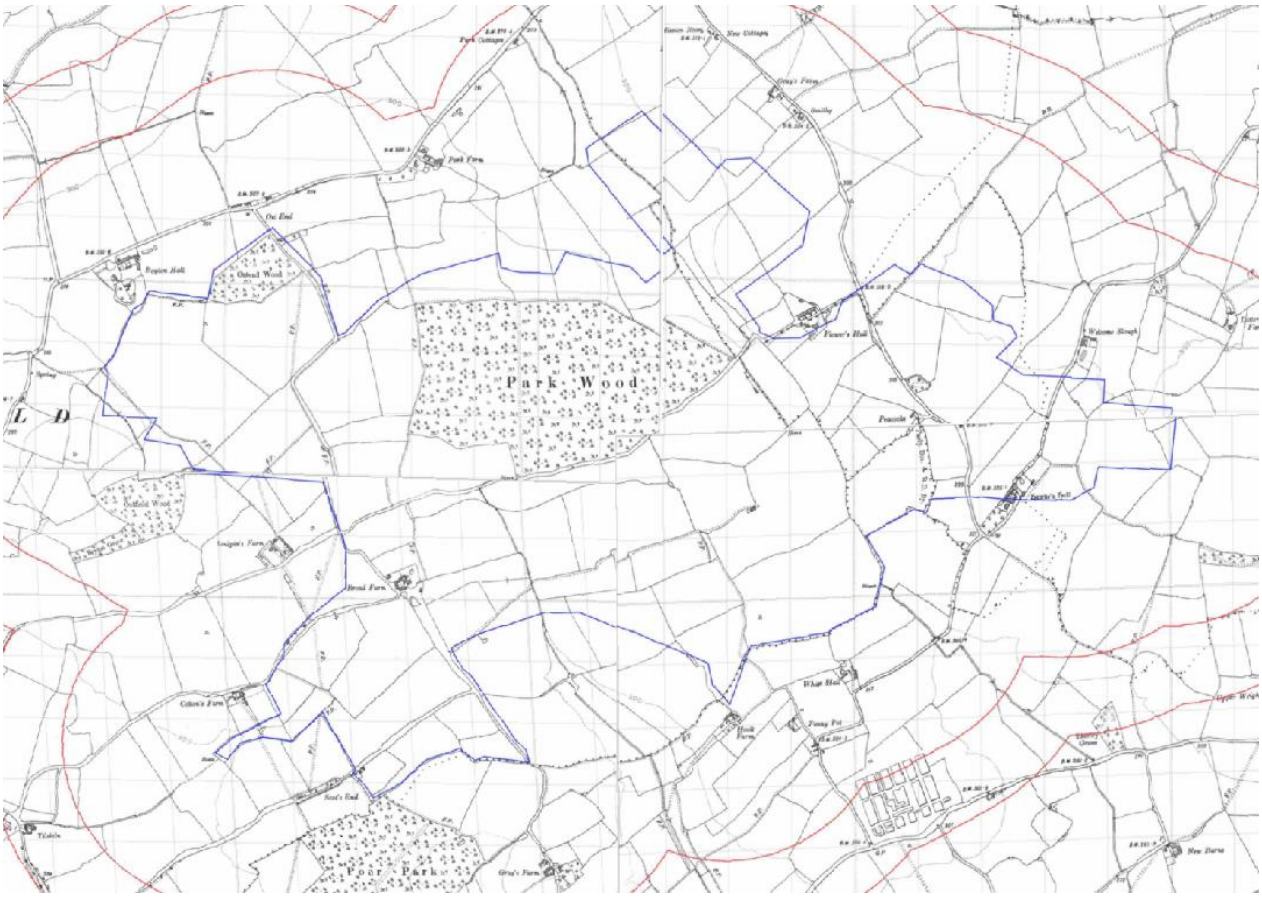


This risk assessment methodology is intended as a generic tool. A small number of sites with unusual site-specific conditions may require additional consideration of the hazard scoring.

Attachment 1. Pre-WWII Historical Map, 1919-1924



Attachment 2. Post-WWII Historical Map, 1946



Nina Sopp
Buro Happold Limited
17 Newman Street
London
W1T 1PD
UK

T: +44 (0)207 927 9700
F: +44 (0)870 787 4145
Email: nina.sopp@burohappold.com