

**Land West of Walberton Lane
Walberton,
Arundel
West Sussex
BN18 0QH**



**Combined Desk Study and Interpretative
Site Investigation Report with Remedial
Strategy Proposals**

Client



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Lane West of Westberton Lane Walberton, Arundel, West Sussex

Combined Desk Study and Interpretative Site Investigation Report with Remedial Strategy Proposals

REPORT WAL168.D/DSSI/001 CONTROL SHEET

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Lane West of Westberton Lane Walberton, Arundel, West Sussex

Combined Desk Study and Interpretative Site Investigation Report with Remedial Strategy Proposals

EXECUTIVE SUMMARY

Area of interest	Summary of main text
Introduction	This Combined Desk Study and Interpretative Site Investigation Report has been produced for the land west of West Walberton Lane. The purpose of this report is to establish the environmental conditions of the site and identify any remedial works considered necessary to make the site suitable for a proposed residential development based upon the results of an intrusive investigation.
Site Location & Description	The current proposed development site, which is roughly triangular in shape, occupies an area of approximately 2ha and is centred at National Grid Reference 496444 106181 on the western edge of the village of Walberton. The postal address is West Walberton Lane, Walberton, Arundel, West Sussex BN18 0QH. The site was generally level at c.15mAOD although the south-western corner was approximately 1m lower and flooded with c.100mm of water. The whole site was covered with rough grass with trees and hedges around the boundaries. The area to the west was in agricultural use while to the north-east, east and south were properties forming the western edge of the village.
Geology	The published BGS map indicates that the eastern part of the site is underlain with River Terrace Deposits (Undifferentiated) while the western is over Head. A band of Raised Beach Deposits may encroach onto the northern sections. The bedrock beneath the majority of the site is London Clay although the northern section crosses the boundary onto the Lambeth Group clays.
Hydrogeology	The shallow drift deposits and the Lambeth Group bedrock in the northern section of the site have been identified as a Secondary A Aquifers. The London Clay across the remainder the site is designated as Unproductive Strata. The site is not within a SPZ and the nearest licensed groundwater abstractions is 833m to the west for spray irrigation. The geology indicates that there may be at risk groundwater flooding, which as the south-western corner was flooded during the site walkover although this could be associated with the adjacent stream is considered to be a viable risk.
Hydrology	A stream flows along the western boundary and a ditch along the south-eastern boundary discharges into a large pond on the village green approximately 40m south of the site. The south-western corner of the site is within an area designated as being at high risk of flooding from the stream, which it was at the time of the visit.
Environmentally Sensitive Sites	The northern section of the site is within Nitrate Vulnerable Area. A number of ancient areas of wood land are in the vicinity of the site with the nearest being 122m to the north-east. The South Downs 982m to the north are designated as an Environmentally Sensitive Area and a National Park.
Radon	No radon protection measures are required in the construction of new dwellings.
Site History	From the first available map (1876) the site was undeveloped which is how it has remained since. The village of Walberton c.500m to the east and the hamlet of Walberton Green immediately to the south-east were also present and over the years have expanded until they are now combined.

Area of interest	Summary of main text
Preliminary Conceptual Site Model	Potential on-site contaminant sources include: PSC1 Unrecorded human activity that may have introduced contamination onto the site. PSC2 The site is underlain with clay bedrock, which if shallow could create an aggressive environment for buried concrete. No potential off-site sources of contamination were identified:
Site Investigation	Investigation works were undertaken by FEML between 28-29th November 2019 comprised the following: - Sinking of 6N^o window sample probe holes to depths ranging between 4 and 6m with standpipe installations for groundwater monitoring; - Chemical analysis of 6N^o soils samples for a standard suite, including PAH's and TPHCWG. - Undertake five months of groundwater level monitoring at monthly visits (November to March)
Identified Ground Conditions	No made ground was encountered with the strata sequence comprising a 0.15 to 0.2m thick layer of brown silty clay topsoil over bands of yellow/light brown soft to firm tending to firm with depth sandy CLAY with varying amounts of gravel. None of the probe holes extended deep enough to reach the bedrock, which was anticipated at around 5m.
Groundwater Level Monitoring	Monthly visits were undertaken between November 2019 and March 2020 to record the groundwater depths below the existing ground level, which revealed the low lying south-western area generally had standing water whilst on the higher areas the depth ranged from 0.225m to 1.500m begl.
Human Health Risk Assessment	Based upon the results from the site investigation the topsoil and shallow superficial deposits have been shown not to pose a risk to human and are suitable for use within the proposed residential development without any remedial measures.
Controlled Waters	Based upon the soils across the site being natural with no elevated levels of contamination the site is not considered to pose a risk to controlled waters.
Risk Assessment of other Environmental Receptors	- An elevated phototoxic zinc concentration was revealed within the topsoil but due to the absence of dieback or distress within the vegetation across the site this is not considered to be reflective of the general soil geochemistry. Therefore, the topsoil is not considered pose a risk to plant growth. - When compared against the BRE Special Digest 1 (2005) assessment levels this indicates a DS2 design mix concrete would be required for buried structures although the only value above the DS1 threshold was within the topsoil therefore consultation with the local Building Control Officer/NHBC may permit the use of a DS1 mix. - Based upon the WRAS Trigger Values PE and PVC pipework would be suitable for buried water supply mains:
Remedial Requirements	- Due to the localised elevated sulphate noted within one topsoil sample this would indicate a DS2 design mix for sub-surface concrete. However following consultation with Building Control/NHBC this may be relaxed as the sulphate levels in the superficial deposits ranged from <20mg/l to 110mg/l, which would only require a DS1 design mix. - The Local Water Authority should be consulted and confirm the specification they require for buried water supply pipework
Recommendations	- The relevant regulatory authorities should be forwarded a copy of this site investigation report for their assessment to confirm that they are in agreement with the conclusions and recommendations. - Consultation with Building Control/NHBC regarding the concrete design mix for subsurface structures and footings; and - Liaison with the statutory water supplier should be undertaken to determine the specification for underground water supply pipework across the site.

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1.0 INTRODUCTION

1.1 Contract Details

Following receipt of an instruction from Marca Ltd a series of investigations comprising a desk study followed by an intrusive site investigation were undertaken upon an area of land on the western side of West Walberton Lane to establish its likely environmental condition.

This report also includes recommendations for the scope of any remedial works that are considered necessary in order address any identified risk to human health, environment or services.

Currently there are only draft layout plans available for the proposed development, which as shown on the plan in Appendix A will comprise a number of residential properties with gardens arranged along an access road with areas of public open space.

1.2 Scope of Works

The scope of works undertaken by Forge Environmental Management Limited (FEML) was limited to:

- Review of GroundSure Data to provide historical and background environmental information;
- Sink 6N° window sample probe holes with standpipe installations;
- Preparation of engineering exploratory hole logs to record the observed ground conditions;
- Chemical testing on selected soil samples;
- Undertake groundwater monitoring visits at monthly intervals – still on going at the time of producing this report;
- Preparation of a report presenting the findings of the investigations and, if necessary, any recommendations for remedial measures to address any environmental issues identified. The groundwater monitoring results and any subsequent infiltration tests will be reported in a separate letter report once completed.

1.3 Report Limitations

The recommendations, interpretations and conclusions of this report are based solely on the observations made during the site investigation works (28th – 29th November 2019) in conjunction with the historical and third party information relating to the site condition. No responsibility can be accepted for the accuracy of third party information or reference data used including that contained within the GroundSure report.

2.0 CURRENT SITE DESCRIPTION AND LOCATION

2.1 Site Location

The proposed development site occupies an area of approximately 2ha and is centred at National Grid Reference 496444 106181. The postal is West Walberton Lane, Walberton, Arundel, West Sussex, BN18 0QH. A copy of a location plan is presented in Appendices A.

2.2 Site Description

2.2.1 General Setting

The proposed development area is roughly triangular shaped and located on the western side of the village of Walberton between West Walberton Lane to the east and Eastergate Lane to the south, on which the access gate is located near the western edge.

The site was generally level at c.15m AOD apart from the south-western corner, which was approximately 1m lower and at the time of the site visit (November 2019) with standing water around 100mm deep. The whole site was covered with uneven rough grass with hedges and trees around the boundaries apart from the section to the south-eastern corner, which was formed by the wooden fences to the gardens of the properties fronting onto Eastergate Lane.

A stream flowed along the western boundary beyond which were the fields associated with Brookfield Farm. Immediately adjacent the south-eastern corner there was a small green that is bisected by Eastergate Lane with a large pond in the southern section beyond which to the east, north-east and south there were the properties associated with the village of Walberton, which includes a school, a public house and a church.

2.3 Potential Sources or Signs of Contamination

2.3.1 On Site

From a site walkover the site appears not to being used at the current time, although anecdotal information, from the local residents, is that the site was last used for grazing horses. Based upon the absence of any contaminative usages of the site no potential sources of contamination were identified from the site walkover.

2.3.2 Surrounding Area

The surrounding area is either in agricultural use or developed with housing and therefore these are not considered likely to create any significant sources of contamination that could pose a risk to the site.

3.0 ENVIRONMENTAL SETTING

3.1 Published Geology

The 1:50,000 BGS scale Digital Geological Map, as reported in the GroundSure Data, indicates that the site underlain by a number of different superficial soils consisting of River Terrace Deposits, Raised Beach Deposits and Head over bedrock comprising the Lambeth Group or London Clay Formation.

A full copy of the GroundSure Data report is contained in Appendix B but a summary is detailed in Table 3.1.1 with further information provided in the following sub-sections.

Table 3.1.1: Summary Geology

Shallow depth soils anticipated	Topsoil
Superficial deposits within 50m	River Terrace Deposits (Undifferentiated) – sand, silt and clay; Raised Beach Deposits 1 – sand and gravel; Head – gravel, sand, silt and clay.
Solid Geology within 50m	Lambeth Group – clay, silt and sand; London Clay Formation – clay, silt and sand.

3.1.1 Artificial and Made Ground

The site is not within an area that is indicated as having been filled therefore it is not expected that the site will be underlain by any artificial or made ground.

3.1.2 Topsoil

As the area has been used as fields for grazing horses and is covered with grass it is anticipated that topsoil will be present across the site.

3.1.3 Superficial and Drift Ground

The GroundSure database information indicates that the site is within an area of geological boundaries with a range of different soil types although they are all predominantly granular sands and gravels.

From a review the on-line British Geological maps (www.bgs.ac.uk/geologyofbritain) as shown in Figure 1, overleaf, the eastern half of the site is indicated as being underlain by River Terrace Deposits (buff coloured) with the Head (light brown coloured) deposits below the western section. The Raised Beach Deposits are to the north and may just encroach onto the site.

The BGS Lexicon gives the following lithological descriptions for these categories of drift deposits:

River Terrace Deposits (undifferentiated)

“Sand and gravel, locally with lenses of silt, clay or peat. [Generic description]”

Head

“Head is poorly sorted and poorly stratified, angular rock debris and/or clayey hillwash and soil creep, mantling a hillslope and deposited by solifluction and

gelifluction processes. Solifluction is the slow viscous downslope flow of waterlogged soil and other unsorted and unsaturated superficial deposits. The term gelifluction is restricted to the slow flow of fluidized superficial deposits during the thawing of seasonally frozen ground. The flow is initiated by meltwater from thawing ice lenses. Polymict deposit: comprises gravel, sand and clay depending on upslope source and distance from source. Locally with lenses of silt, clay or peat and organic material."

Raise Beach Deposits

"Shingle, sand, silt and clay; may be bedded or chaotic; beach deposits may be in the form of dunes, sheets or banks - [generic description]; now above the level of the present shoreline as a result of earth movement or a general fall in sea level; older than 'Raised Beach Deposits' in the same map area."

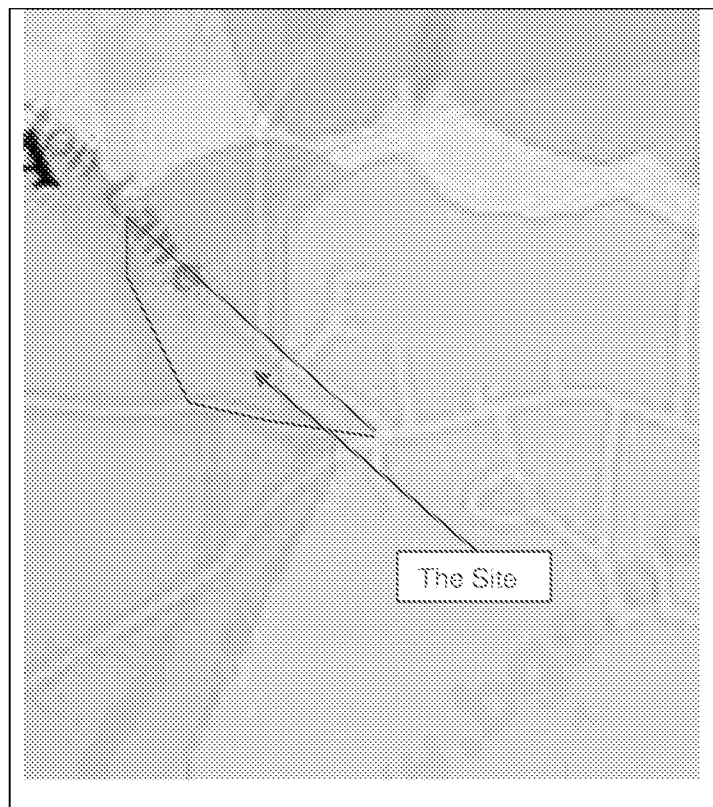


Figure 1 - Extract from the BGS 1:50,000 Superficial Deposits Map

3.1.4 Bedrock and Solid Geology

The on-line BGS geology of Britain viewer (www.bgs.ac.uk/geologyofbritain), an extract of which is shown in Figure 2, indicates there is also a bedrock geological boundary crossing the site with the majority of the area being over the London Clay Formation (buff coloured) except the northern edge, which cross over onto the Lambeth Group (dark yellow coloured) From the lithological descriptions of these soils, as detailed below they are both cohesive clay based soils.

The lithological description for the London Clay Formation is:

"The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few

thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occurs in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels."

The Lambeth Group soils beneath the northern section are described as:

"Vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels, minor limestones and lignites and occasional sandstone and conglomerate."

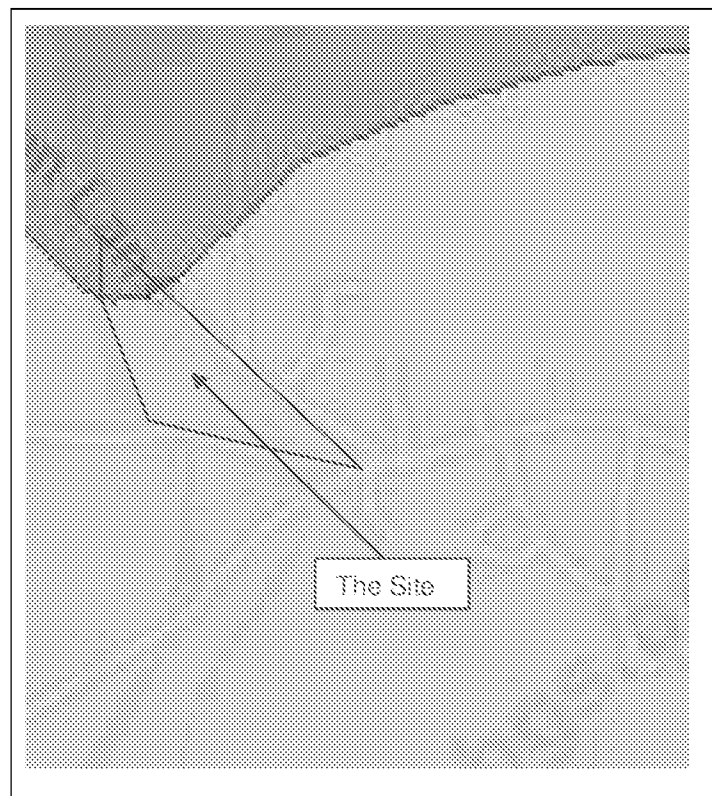


Figure 2 - Extract from the BGS 1:50,000 Bedrock Map

The BGS web site also includes copies of boreholes in the area, which has revealed c.1km to the south-west a borehole sunk in 1977 encountered topsoil over around 16' (c.5m) of head resting on London Clay to 184' (c.56m) below which it encountered chalk.

3.2 Hydrogeology

With reference to the GroundSure Data the superficial deposits have been classified by the Environment Agency as a Secondary A Aquifer the definition of which is:

"Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers".

The different shallow bedrocks have been given different classifications with the London Clay being designated as Unproductive Strata, which is defined as:

"These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow"

While the Lambeth Group soils under the northern section are also considered to be a Secondary A aquifer similar to the overlying drift deposits.

The site is not within a Source Protection Zone (SPZ) although there is the boundary of a Zone 2c (Outer catchment within Confined Aquifer) c.400m, which relates to the deeper chalk although this is protected by the overlying c.50m of clay.

The nearest licensed groundwater abstraction is 833m to the west, which is at Stoneyfields Nursery and for “spray irrigation” with an annual allowance of 22,730m³.

There are two licensed discharge consents to land within 500m of the site both of which are at Potwell Copse 338m to the north for the release of “final/treated effluent” on to the land.

The British Geology Society has determined that the site is within an area of potential risk of groundwater surfacing flooding from the shallow unconsolidated sedimentary aquifer overlying unproductive aquifers (Superficial Flooding). This potential is defined as:

“this means that although given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding”.

The BGS has a Moderate confidence in this rating and as the south-western corner of the site was flooded at the time of the site visit, although this could have been associated with the adjacent stream, it has to be considered as a potential issue on the site.

3.3 Hydrology

The nearest surface water feature identified within the Groundsure report and during the site walkover was a small water course running along the western boundary, which is part of the West Streams catchment area. A ditch was also shown on the watercourse maps along the eastern edge although this was not noted on the site walkover or shown on the ordnance survey map and therefore may now be culverted.

A large pond was also observed on the village green on the opposite side of Eastergate Lane about 40m from the south-eastern corner and into which the eastern ditch was shown to flow into via a culvert under the road.

The Environment Agency flood map identifies that the stream/ditch along the western and south-eastern boundaries are at a high risk of flooding the result of which is that the south-western corner and northern most tip are at a High risk of flooding (Zone 3 i.e. >1 in 100 chance of flooding (>1%)). This was confirmed in the south-western low lying area of the site which had stranding water during the site walkover. Immediately to the north of this area the risk of flooding is reduced to Medium (zone 2 i.e. between 1 in 1000 and 1 in 100 chance of flooding (0.1%-1%)). Therefore, a flood risk assessment will be required for this site to support any future planning application.

There are no licensed surface water abstractions within 1km of the site

There were two licensed discharge consents to surface water within 500m with the nearest was a historical one 136m to the west at Estate Development for surface water. The other was 411m north-west at Pencil Rough for “final/treated effluent” but it has lapsed.

3.4 Radon

The Health Protection Agency (HPA) considers that the site is within a radon affected area, where between 1% and 3% of homes are above the Action Level.

However, no radon protection measures are required in the construction of new properties or extensions.

3.5 Designated Environmentally Sensitive Sites

The GroundSure Data indicates that the northern area of the site is within a Nitrate Vulnerable Zone.

The only other environmentally sensitive sites within 2km of the site are areas of ancient woodland the nearest of which being Potwell Copse 122m north-east and the South Downs to the north-east (801- 982m), which are a designated Environmentally Sensitive Area and a National Park.

3.6 Environmental Searches

The GroundSure database search provides details of information collated from various regulatory bodies, local authorities and other organisations. The full GroundSure Data report is enclosed as Appendix B. However, in addition to the items discussed above Table 3.6.1 below summaries other salient points identified.

Table 3.6.1: Summary of the GroundSure Environmental Searches

Data Type	On Site	0m to 250m	251m to 500m	Discussion/Comments
Environmental Permits, Incidents and Registers				
<i>Records of Historic IPC Authorisations</i>	0	0	0	-
<i>Records of Part A(1) and IPPC Authorised Activities</i>	0	0	0	-
<i>Records of Red List Discharge Consents</i>	0	0	0	-
<i>Records of List 1 Dangerous Substances Inventory sites</i>	0	0	0	-
<i>Records of List 2 Dangerous Substances Inventory sites</i>	0	0	0	-
<i>Records of Part A(2) and Part B Activities and Enforcements</i>	0	0	0	-
<i>Records of Category 3 or 4 Radioactive Substances Authorisations</i>	0	0	0	-
<i>Records of Planning Hazardous Substance Consents and Enforcements</i>	0	0	0	-
<i>Record of COMAH and NIHHS sites</i>	0	0	0	-
<i>Environment Agency Recorded Pollution Incidents</i>	0	2	0	<i>These were both 8m to the north-east of the site for an incident that occurred on 16th Dec 2001 when crude sewage had a minor (category 3) impact upon water.</i>

Data Type	On Site	0m to 250m	251m to 500m	Discussion/Comments
<i>Sites Determined as Contaminated Land under Part IIA EPA 1990</i>	0	0	0	-
Landfill and Other Waste Sites				
<i>Environment Agency Registered Landfill Sites</i>	0	0	0	-
<i>Environment Agency Historic landfill Sites</i>	0	0	0	-
<i>BGS/DoE Landfill Site Survey</i>	0	0	0	-
<i>Records of Landfills in Local Authority and Historical Mapping Records</i>	0	0	0	-
<i>Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites</i>	0	0	0	-
<i>Environment Agency Licensed Waste Sites</i>	0	0	0	-
Current Land Uses				
<i>Current Industrial Sites</i>	0	2	-	<i>These both are electricity sub-stations located 38m north-east and 128m east of the site</i>
<i>Records of Petrol and Fuel Sites</i>	0	0	1	<i>There was a fuel station on The Street in Walberton 495m to the south-east but the entry is now obsolete</i>
<i>National Grid Underground Electricity Cables</i>	0	0	0	-
<i>National Grid Gas Transmission Pipelines</i>	0	0	0	-

Information supplied by the British Geological Survey relating natural hazards for a search area of 50m around site is included within the GroundSure Data. Again, full details are contained in Appendix B but the most pertinent points relating to the site are highlighted in Table 3.6.2 below.

Table 3.6.2: Summary of the BGS Searches

Potential Hazard	Hazard Rating	Hazard Description and Comments
<i>Shrink-Swell</i>	<i>Moderate</i>	<i>Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.</i>
<i>Landslide</i>	<i>Very Low</i>	<i>Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.</i>
<i>Soluble Rocks</i>	<i>Negligible</i>	<i>Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.</i>
<i>Compressible Ground</i>	<i>Negligible</i>	<i>No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.</i>
<i>Collapsible Rocks</i>	<i>Low</i>	<i>Slight possibility for collapsible deposit problems after major changes in loading or groundwater conditions. Normal maintenance to avoid large amounts of water entering the ground through pipe leakage or soak-aways should reduce the likelihood of problems due to collapsible deposits. For new</i>

Potential Hazard	Hazard Rating	Hazard Description and Comments
		<i>build, assess the possibility of collapsible (loessic) deposits in ground investigation. For existing property, no significant increase in insurance risk from collapsible deposits is likely</i>
Running Sand	Low	<i>Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.</i>

The GroundSure report also contains information relating to mining in the area which is summarised in Table 3.6.3 below.

Table 3.6.3: Summary of the Mining Searches

Potential Hazard	Comments
Coal Mining	<i>The database search did not identify any coal mining areas within 75m of the site.</i>
Non-Coal Mining	<i>Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered</i>
Brine Affected Area	<i>There are no brine affected areas within 75m of the site.</i>

3.7 Summary Sources On and Off Site Determined From Environmental Setting

No landfills have been identified on the site or within a 250m radius therefore it is considered there are no sources for landfill gases that may migrate onto the site.

An electrical substation was identified 38m from the site for which the date of commission is unknown therefore if pre 1982 it is possible PCB's could have been used within the transforms and cables. However, it is considered unlikely that if PCB's have been leaked within the substation as they are not highly soluble that they would have the mechanism to migrate and impact the soils on the site.

In some areas of the UK the underlying natural soils are known to contain naturally occurring elevated levels of contamination, namely metals and radon gas, which could pose a risk to human health. However, from the HPA database it is known that the area does not have natural radon gas levels that require the inclusion of protection measures within properties. Also, from the BGS on-line Contamination Distribution in Soil maps it has been concluded that the natural background arsenic, cadmium, copper, nickel and lead concentrations are below the current published human health assessment criteria (LQM/CIEH S4UL and DEFRA C4SL) of a residential development

Resulting from the evaluation of the environmental setting of the site no potential sources of contamination have been identified.

4.0 SITE HISTORY

4.1 Historical Map Review

From a review of the available historic maps, copies of which are shown in Appendix C, it can be seen that the site area has not been developed and remained as agricultural land since the earliest available map (1876). The village of Walberton was present c.500m to the east and a small hamlet of buildings identified as Walberton Green were present immediately to the east and south-east which over the years expanded until they combined.

Table 4.1.1 below details the salient points noted on the available historic maps relating to the site and immediate surrounding area.

Table 4.1.1: Key points noted from the Historic Maps

Map edition & scale	Date	On Site	Surrounding area
<i>Country Series 1:10,560</i>	<i>1868</i>	<i>The site was divided into two fields with some trees along the eastern and western boundaries.</i>	<i>Although not named the roads along the alignments of West Walberton Lane and Eastergate Lane formed the eastern and southern boundaries respectively. To the east there were a number of buildings, included one abutting the south-eastern corner of the site, which were called "Walberton Green". Within this hamlet there was a "windmill" and a small orchard. A pond was present on the green c.40m to the south-east The larger village of Walberton was about 500m to the east and it already included a school, inn, school and a post office.</i>
<i>Country Series 1:10,560</i>	<i>1896</i>	<i>The site was no longer divided into two fields and the trees around the boundaries were no longer shown</i>	<i>Another small building was present abutting the south-eastern corner of the site. The "windmill" was no longer identified to the east but there was one shown in Walberton.</i>
<i>Country Series 1:10,560</i>	<i>1910</i>	<i>The site layout appeared to be unchanged</i>	<i>No major changes were noted in the vicinity of the site.</i>
<i>Country Series 1:10,560</i>	<i>1950</i>	<i>Again, no changes to the site layout were identified.</i>	<i>New large residential properties within large garden plots were shown to the north-east on the opposite side of West Walberton Lane. Also, a number of smaller semi-detached properties were shown to the south along "Barnham Lane"</i>
<i>Provisional 1:10,560</i>	<i>1961</i>	<i>The site had remained unaltered</i>	<i>A new rectangular building was present adjacent to the south-eastern corner of the site, which was labelled as a "hall". A "Nursey was also identified c.50m to the north-east. A proposed new development was indicated c. 250m to the east of the site, which would connect Walberton Green to Walberton.</i>

Map edition & scale	Date	On Site	Surrounding area
National Grid 1:10,000	1979-1980	The map does not indicate any changes within the site boundary	The nursery to the north-east had been developed for houses and the proposed development to the south-east had been completed joining the villages together. To the south-west a number of "nurseries" were present the nearest of which was "Stoneycroft Nursery" c.250m further along Eastergate Lane.
National Grid 1:10,000	1990-1991	The site had remained unaltered	No significant developments were identified within the vicinity of the site.
National Grid 1:10,000	2001	No changes were indicated to the site layout or use	From the map, which is not detailed, there was no evidence of any major changes or developments in the area.
National Grid 1:10,000	2010	There was nothing to indicate there had been any developments or changes to the site	The area did not appear to have undergone any development.
National Grid 1:10,000	2019	The site was still shown as open fields	The only change was that Stoneycroft nursery was no longer present.

4.2 GroundSure Historical Industrial Sites Search

Within the GroundSure report although it does not include historic plans but it does contain a summary of identified locations of potential contaminative past uses and historical tanks in the vicinity of the site. The full report is contained in Appendix B but Table 4.2.2 below contains details of the search results.

Table 4.2.2: Key historical features noted from the GroundSure database search

Description	Location	Date	Discussion
Potentially Contaminative Uses within 500m of the site boundary.	On site	1879	Flour mill – the historic maps indicated that this was to the east on the opposite side of West Walberton Lane and not on the site.
	27-30m NE	1950-1961	Nursery
	115m W	1977-1990	Nursery
	352m N	1977-1990	Engineering works
	386m W	1977-1990	Nursery
	424m SE	1876	Unspecified tank – not identified in the historical tank database search
	427-429m N	1896-1961	Gravel pit
Historical Tank Database within 500m of the site boundary	484m W	1950	Nursery
Historical Energy Features Database within 200m of the site boundary.	462m SE	1974-1994	Unspecified tank
	34m NE	1973-1989	Electricity substation
	121-124m E	1989-1994	Electricity substation
	318-319m SW	1984-1994	Electricity substation
Historical Petrol and Fuel Sites Database within 500m of the site boundary.	331m SW	1974	Electricity substation
	-	-	No data found However, the environmental permits identified a petrol station 495m east
Historical Garage and Motor Vehicle Repair Database within 500m of the site boundary.	476-489m E	1973-1992	Garage
Potentially Infilled Land within 250m of the site.	28-38m S	1876-1990	Pond
	178m N	1950-1961	Pond
	194m N	1977-1990	Pond
	298-302m N	1950-1961	Pond
	427-429m N	1896-1961	Gravel Pit

4.3 Potential Historical Contaminative Sources

Although the Groundsure summary identified a “flour mill” on the site from a review of the actual historical plans it has been concluded that this was actually located off site on the eastern side of West Walberton Lane. Therefore, it is not considered to pose a potential risk of having introduced made ground on the site during its construction and subsequent demolition.

No petrol and fuel station search were identified by the database search but the permit search (Section 3) identified a filling station 495m to the east in Walberton. However, due to distance from the site and the anticipated groundwater flow direction to the south it is considered any fuel spillages or leakages would not migrate onto the site. Therefore, this is not considered to be potential source of contamination.

The site is currently unused but it has previously been in agricultural or equestrian (anecdotal evidence) use. Therefore, past pest control practices may have involved the use of now known harmful substances being sprayed on the plants and therefore the soil when the area was last used for agricultural purposes. However, it is considered that even if used there will not be any residue compounds within the pesticides and herbicides present on the site as the active ingredients used within pesticides and herbicides were not designed to be persistent in the environment so they do not pose a long term risk as detailed in DEFRA publication CLAN4/04.

The identification of “gravel pits” 427m from the site are not considered to pose a risk of landfill gases if they have been infilled as they are too distance (>250m) to be a source of landfill gas that could migrate onto the site.

As previous noted the electricity substation identified 34m from the site boundary is also considered to be too distant from the site for the on-site migration of PCB's, if present, as these are known not to be highly mobile.

Therefore, based upon the historical searches no potential on or off site sources of contamination have been identified.

5.0 PRELIMINARY CONCEPTUAL SITE MODEL: POTENTIAL SOURCE-PATHWAY- RECEPTOR RELATIONSHIPS

5.1 General

Prior to commencing any intrusive site investigation works it is appropriate to undertake a qualitative risk assessment with respect to any potential sources, pathways and receptor relationships which may exist on site. A guide to Qualitative Risk Assessment is provided in '*Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008*', a copy of Annex 4 of this document is contained in Appendix D. This approach identifies where a potential pollutant linkage relationship exists and if present, an estimate of the risk that defined receptors will suffer harm.

The current preliminary development proposal is for the construction of around 28No properties with private gardens. Therefore, it is considered for the purposes of future assessment of the site it is appropriate to use the most sensitive end use of "residential with vegetable uptake".

5.2 Contaminant Sources

5.2.1 Site Sourced Contamination

From the Desk Study searches no sources of on site contamination have been identified, however it is possible that there may have been some human activity, pre the available historic maps or unrecorded that may have introduced possible contamination.

Therefore, as this cannot be discounted the following potential source of contamination PSC has been identified on the site:

- PSC 1. Unrecorded human activity that may have introduced contamination onto the site.

In addition, it is possible that the bedrock, which is a clay could contain elevated sulphate levels, which could create an aggressive environment that could be detrimental to buried concrete or footings. Therefore, this has been added as a potential source of contamination.

- PSC2. Naturally occurring elevated sulphate levels that could be detrimental to sub-surface concrete

5.2.2 Cross Boundary Contaminant Migration

No off-site sources of contamination have been identified that are considered to be near enough or have the mechanism to be a source of on-site leachate:

5.3 Potential Receptors

The likely receptors based upon the proposed development of an aggregate supplier and waste treatment facility are listed below

5.3.1 Human Health

- 0-6 year old child residing in new residential dwelling – **critical receptor**.
- Adult resident within proposed development.
- Site operatives during the construction phase.
- Neighbours (residents in properties around the site).

5.3.2 Controlled Waters

- **Surface water** – a stream and a ditch flow along the western and south-eastern boundaries, respectively, which flow into the West Streams catchment area plus the latter enters to village pond on the green c.40m to the south of the site. No river quality data is available in the vicinity of the site but based upon the general land use in the area and absence of grossly polluting industries it is considered likely to be good.

With reference to Annex 2 of the '*Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008*', although there is no information to indicate the quality of the water as the ditch on the eastern side of the site discharges into the village pond it is considered to have a Very High (H1) sensitivity.

- **Groundwater** - With reference to the GroundSure Data the superficial deposits and more granular bedrock (Lambeth Group) below the northern section of the site bedrock have been classified by the Environment Agency as a Secondary A Aquifer.

Although the London Clay beneath the majority of the site is designated as Unproductive Strata. The deeper chalk bedrock (c.56mbgl) is a Principal Aquifer but the nearest SPZ 2c is c.400m to the north-west. However, this is considered to be protected by c.50m of overlying cohesive London Clay and based upon the anticipated direction of groundwater flow it is upgradient of the site.

Therefore, based again upon Annex 2 of the '*Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008*', as there are no particular uses identified the sensitivity of the groundwater is considered to be Low (L1).

5.3.3 Other Environmental Receptors

- Flora – the development will include gardens and areas of soft landscaped public open space, therefore future planting will be a receptor if contamination is present on the site.

5.3.4 Structures and Services

- Building material, such as sub-surface concrete, could be at risk from contaminants contained within the soils across the site:
- Services, in particular water mains, could be impacted if the geochemistry of the soils create an aggressive environment.

5.4 Potential Pathways

5.4.1 Human Health

As the development will include private gardens the following potential pathways for human health have been considered:

- Soil ingestion.
- Dermal contact.
- Consumption of home grown vegetables and soil on them;
- Inhalation of contaminant vapours/dust.

5.4.2 Buildings and Services

- Direct contact with underlying contaminants.

5.4.3 Groundwater

- Migration of any contamination into the underlying Secondary A aquifer

5.4.4 Surface water

- Migration of contamination into the underlying aquifer and then laterally into the surface water courses to the west and south-east;
- Surface water runoff directly into the watercourse along the western and south-eastern boundaries.

5.4.5 Flora

- Plant root uptake

5.5 Summary of Source – Pathway – Receptor Relationship

Table 5.5.1, overleaf, highlights the source-pathway-receptor relationships that are considered viable across the site at this stage. This assessment forms the basis of the Tier 1 risk assessment that is detailed later in this report. Qualitative risk estimation has been included in the table below, the risk estimation as per Annex 4 of '*Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008*', (Appendix D).

Table 5.5.1: Potential Source – Pathway – Receptor Relationships

PSC Nº	Source	Pathway (s)	Receptor	Classification of Consequence	Classification of Probability	Classification of Risk
1	Unrecorded human activity that may have introduced contamination onto the site	Soil ingestion	Future site workers	Medium	Unlikely	Low Risk
		Dermal contact	Future site workers	Medium	Unlikely	Low Risk
		Vapour inhalation	Future site workers	Medium	Unlikely	Low Risk
		Landfill gases	Future site workers/buildings	Medium	Unlikely	Low Risk
		Downward migration	Groundwater	Medium	Unlikely	Low Risk
		Via groundwater/runoff	Surface Water	Medium	Unlikely	Low Risk
		Direct contact	Buildings and Underground Services	Medium	Unlikely	Low Risk
		Uptake via root system	On-site flora	Mild	Unlikely	Very Low Risk
2	Naturally occurring elevated sulphate levels that could be detrimental to sub-surface concrete	Direct contact	Buildings and Underground Services	Medium	Unlikely	Low Risk

5.6 Uncertainties and Assumptions

The results from the desk study searches did not identified any potential sources of contamination, however the possibility that unrecorded human activity has taken place on the site, which could have resulted in contaminating the soils, cannot be discounted. Also, the geochemistry of the soils, in particular sulphate, could create an aggressive environment that could be detrimental to buried concrete.

As these potential risks have been identified they will require some intrusive investigation to enable them to be fully assessed or discounted. Therefore, following discussions with Arun District Council Drainage Department (Appendix E) regarding the locations for the groundwater monitoring during the installation of these 6No window sample probe holes (location plan in Appendix A) selected soil samples were collected for chemical analysis. The findings from this investigation are discussed and assessed in the following Sections.

6.0 GROUND INVESTIGATION WORKS

6.1 Scope of the Investigations

An intrusive ground investigation was undertaken by FEML across the site between the 28th and 29th November 2019 comprised of:

- Sinking of 6N° window sample probe holes (WS1-WS6) at the locations shown on the drawing in Appendix A.

The drilling of the probe holes was overseen by an experienced geo-environmental engineer who logged the cores, copies of which are presented in Appendices F and photographs of the cores in Appendix G.

Selected disturbed samples were collected from the boreholes in plastic tubs and amber jars for geochemical testing.

All fieldwork was undertaken in general accordance with the guidance set out in “Code of Practice for Site Investigations” BS5930:1999, where applicable.

Table 6.1.1 Rationale/Targeting of the Exploratory Hole Locations

<i>Exploratory Hole</i>	<i>Target</i>
WS1	Northern end of the site – general coverage
WS2	Eastern boundary – general coverage
WS3	South-eastern corner – general coverage
WS4	South-western corner – general coverage
WS5	Western boundary – general coverage
WS6	LAP area – general coverage

6.2 Window Sample Probe Holes

FEML oversaw the driving of the probe holes to depths ranging from 4m to 6m bgl all probe holes were installed with standpipes although due to internal collapse of some of the holes not all reached the base, as shown in Table 6.2.1

Table 6.2.1 Standpipe installations within the Probe Holes

<i>Exploratory Hole</i>	<i>Depth to base</i>	<i>Depth to standpipe base</i>	<i>Installation</i>
WS1	5.0m	4.5m	0.5m plain over 4m slotted pipe
WS2	5.0m	4.5m	0.5m plain over 4m slotted pipe
WS3	5.0m	3.8m	0.8m plain over 3m slotted pipe
WS4	6.0m	6.0m	1.0m plain over 5m slotted pipe
WS5	4.0m	4.0m	1.0m plain over 3m slotted pipe
WS6	4.0m	2.6m	0.6m plain over 2m slotted pipe

6.3 Monitoring

As agreed with Arun District Council's Drainage Department (e-mail contained in Appendix E) five groundwater level monitoring visits were undertaken at monthly intervals between November 2019 and March 2020. The results of which are shown in Section 7.3.

6.4 Laboratory Testing

FEML scheduled chemical analysis upon a selection of samples recovered from the probe holes for a general suite of contaminants, based on the both the initial conceptual model and observations from the ground investigation. Soil samples from the investigation were forwarded to the UKAS/MCERTS accredited laboratory of The Environmental Laboratory and analysed in accordance with the suite presented in Table 6.5.1. The chemical analysis results are provided in Appendix H.

Table 6.5.1: FEML Schedule of Chemical Testing - Soils

Test Type	Number of Samples Tested
<i>Arsenic, Cadmium, Chromium, Hexavalent Chromium, Lead, Mercury, Nickel, Copper, Zinc, Selenium, Water Soluble Boron, Total Cyanide, Free Cyanide, pH, Water Soluble Sulphate, Sulphide, Elemental Sulphur, Total Monohydric Phenols, Organic Content, Speciated Polyaromatic</i>	<i>6 soils</i>
<i>TPH CWG & BTEX</i>	<i>6 soils</i>

7.0 SUMMARY OF GROUND CONDITIONS

7.1 Introduction

The ground conditions recorded across the site more cohesive than the anticipated geology detailed previously in Section 3.1. As beneath the layer of topsoil the superficial deposits consisted of a silty CLAY with gravelly bands. The boreholes did not extend deep enough to encounter the bedrock.

7.2 Recorded Ground Conditions - General

The site was covered with a layer of brown silty clay topsoil 0.15-0.2m thick, below which was generally a soft to firm tending to firm with depth sandy CLAY with bands containing varying amounts of gravel as summarised in Table 7.2.1 and described further in the following sub-sections.

Table 7.2.1: Summary of Strata Encountered

Depth (m bgl)		Exploratory Holes Identified	Soil Type	General Description/Comments
From	To			
GL	0.15-0.20	WS1, WS2, WS3, WS4, WS5 & WS6	Topsoil	Brown silty clay with roots
0.15	0.95	WS5	Superficial Deposits (Head)	Firm light brown/yellow gravelly silty clay
0.20-	0.60-0.80	WS1, WS2, WS3, WS4 & WS6	Superficial Deposits (Head)	Light brown/yellow locally light brown/light grey soft locally soft to firm silty clay
0.60-0.80	2.00-3.00	WS1, WS, WS3, WS4 WS5 & WS6	Superficial Deposits (Head)	Soft to firm yellow/light brown sandy gravelly to very gravelly clay. Gravel is subangular to angular flint
0.95-3.00	>4.0->6.0 Base of probe hole	WS1, WS2, WS3, WS4, WS5 & WS6	Superficial Deposits (Head)	Generally soft although locally Firm tending to firm to stiff with depth yellow/light brown very sandy clay

7.2.1 Topsoil

The upper 150-200mm layer in all boreholes below the grass comprised a brown silty clay topsoil with roots.

7.2.2 Superficial Deposits

Apart from WS5 (midway along western boundary) the superficial deposits were present in three discrete bands:

- the upper being c.600mm thick comprised a soft silty CLAY;
- below this was around 2.0m of firm sandy gravelly to very gravelly CLAY;
- resting upon a soft very sandy CLAY to the base of all the probe holes.

The upper silty CLAY layer in WS5 contained a proportion of gravelly and this rested directly on the very sandy CLAY with the sandy very gravelly middle stratum not being present.

7.2.3 Bedrock

None of the probe holes extended deep enough (>6m) to encounter the bedrock, however, from a historical log available on the BGS web site the London Clay bedrock in the area was anticipated at being around 5m below ground level.

7.2.4 Contamination Found

No made ground or evidence of contamination was noted within any of the boreholes.

7.3 Groundwater

Groundwater was encountered in all probe holes when they were sunk and during the subsequent monitoring visits, as shown in Table 8.3.1 below.

Table 8.3.1 Groundwater Monitoring Levels

Borehole	Groundwater level struck during drilling	Depth to Groundwater on the Monitoring Dates				
		29 th November 2019	17 th December 2019	12 th January 2020	18 th February 2020	11 th March 2020
WS1	2.200	0.580	0.400	0.885	0.390	0.660
WS2	1.100	1.060	1.065	1.500	0.940	1.320
WS3	0.800	0.430	0.225	0.490	0.310	0.380
WS4	Flooded	Flooded	Flooded	0.140	Flooded	Flooded
WS5	Flooded	Flooded	Flooded	0.040	Flooded	Flooded
WS6 - LAP	1.000	1.150	1.000	1.450	0.970	1.270

7.4 Chemical Test Results

7.4.1 Soils

The results of the contamination testing undertaken during the site works are summarised in the Table 8.5.1 below. A complete set of The Environmental Laboratories test results is presented in Appendix H.

Table 7.5.1: Chemical Soils Results Summary

Determinant	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Number of Samples Tested
Arsenic	4	13.1	6
Cadmium	0.6	0.6	6
Chromium	20.3	37.5	6
Copper	12.9	40	6
Lead	14.9	81.5	6
Mercury	<0.5	<0.5	6
Nickel	14.3	36.1	6
Selenium	<1	<1	6
Zinc	52.6	580	6
Water Soluble Sulphate	0.06	0.89	6
Elemental Sulphur	<20	36	6
Free Cyanide	<1	<1	6
Hexavalent Chromium	<0.8	<0.8	6
Total Sulphide	<2	<2	6
Total Cyanide	<1	1.3	6

<i>Determinant</i>	<i>Minimum Concentration (mg/kg)</i>	<i>Maximum Concentration (mg/kg)</i>	<i>Number of Samples Tested</i>
Water Soluble Boron	<0.5	1.8	6
pH	5.4	7	6
Soil Organic Matter	0.2	12	6
Phenol	<1	<1	6
3,4-Dimethylphenol	<1	<1	6
2,3-Dimethylphenol	<1	<1	6
2,3,5-trimethylphenol	<1	<1	6
Total Monohydric Phenols	<5	<5	6
Naphthalene	<0.1	<0.1	6
Acenaphthylene	<0.1	<0.1	6
Acenaphthene	<0.1	<0.1	6
Fluorene	<0.1	<0.1	6
Phenanthrene	<0.1	0.3	6
Anthracene	<0.1	<0.1	6
Fluoranthene	<0.1	0.8	6
Pyrene	<0.1	0.8	6
Benzo(a)anthracene	<0.1	0.6	6
Chrysene	<0.1	0.6	6
Benzo(b)fluoranthene	<0.1	0.4	6
Benzo(k)fluoranthene	<0.1	0.7	6
Benzo(a)pyrene	<0.1	0.4	6
Indeno(1,2,3-cd)pyrene	<0.1	0.3	6
Dibenzo(a,h)anthracene	<0.1	<0.1	6
Benzo[g,h,i]perylene	<0.1	0.3	6
Total PAH(16)	<0.4	5.3	6
Benzene	<0.01	<0.01	6
Toluene	<0.01	<0.01	6
Ethylbenzene	<0.01	<0.01	6
Xylenes	<0.01	<0.01	6
MTBE	<0.01	<0.01	6
>C5-C6 Aliphatic	<0.01	<0.01	6
>C6-C8 Aliphatic	<0.01	<0.01	6
>C8-C10 Aliphatic	<1	<1	6
>C10-C12 Aliphatic	<1	<1	6
>C12-C16 Aliphatic	<1	<1	6
>C16-C21 Aliphatic	<1	<1	6
>C21-C35 Aliphatic	<1	<1	6
>C35-C40 Aliphatic	<1	<1	6
>C5-C7 Aromatic	<0.01	<0.01	6
>C7-C8 Aromatic	<0.01	<0.01	6
>C8-C10 Aromatic	<1	<1	6
>C10-C12 Aromatic	<1	<1	6
>C12-C16 Aromatic	<1	<1	6
>C16-C21 Aromatic	<1	<1	6
>C21-C35 Aromatic	<1	<1	6
>C35-C40 Aromatic	<1	<1	6
Total (>C5-C40) Ali/Aro	<1	<1	6

8.0 HUMAN HEALTH RISK ASSESSMENT

8.1 Introduction

Part IIA of the Environmental Protection Act 1990, inserted by Section 57 of the Environment Act, 1995 and the associated Contaminated Land (England) Regulations 2000 (SI 2000/227), was brought into full effect on 1 April 2000. This has created a new regime for the identification and remediation of contaminated land. Contaminated land is defined as:

'Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in on or under the land, that significant harm is being caused or there is significant possibility of such harm being caused'.

The human health risk assessment process is based upon a tiered system of risk estimation. It aims to identify significant risks that may require further investigation, be considered for remediation or indicate potential legal or financial liability. A tiered approach has been adopted within the UK risk assessment framework providing a series of steps, after each of which decisions are taken on whether or not more sophisticated assessment is required. By doing so a pragmatic approach to the assessment of human health risk is maintained.

8.2 Site Zones and Averaging Areas – Human Health Risk Assessment

Under current UK Legislation and Environment Agency guidance, consideration must also be given to the relevant averaging area and to the most appropriate method of grouping the data, both of which must relate to the conceptual model. For instance, the data can be grouped spatially (i.e. for individual zones within a site) or by particular strata. Zones can be used to delineate a site to facilitate cost effective site characterisation during the site investigation phase. The qualitative risk estimation with respect to contamination is 'very low' to 'low' for the geochemistry of the soil.

Based upon the proposed development for residential housing when considered in conjunction with the homogenous historic use of the site it is currently considered that it should be assessed as a single zone.

A zone can be further divided into "averaging areas" which will enable the site to be more accurately assessed based on soil/made ground type, current process operations and exposure pathways. These averaging areas can be used to assess different soil types revealed or different potential exposure pathways etc. for the purposes of accurately modelling the site conditions. Each averaging area can be considered independently of each other for human health exposure assessment.

Based on professional judgement following the findings of the site investigation, it is considered that two averaging areas should be used:

- General Site area – topsoil
- General Site area – natural superficial deposits

8.3 Defined Land Uses

Environment Agency Science Report SC050021/SR3 states that:

Generic land use scenarios have been used to derive assessment target criteria that are considered appropriate for generic quantitative risk assessments for contaminated land. They are based on the grouping of a range of typical activities according to land use and taken as a whole these scenarios represent a reasonable worst case that will be protective of human health for the majority of sites. However, it is extremely unlikely that every detail of the conceptual models presented here will accurately reflect the conditions found at any one specific site and the judgement on whether such differences are important must be made by the risk assessor. Such decision must take into account:

- *Whether the differences between actual site circumstances and assumptions within the generic land use scenario would mean that the estimated exposure or outcome decision would be vastly different;*
- *Whether site circumstances are based on robust observations and take into account reasonable foresight, given physical and other constraints on land use.*

Based upon a review of the anticipated development, which will comprise houses with private gardens, it is considered appropriate to use the published generic assessment criteria values based upon a “residential with the consumption of homegrown vegetables” end use.

8.4 Tier 1 Risk Assessment

Where chemical test data records contaminant concentrations which are beneath the laboratory detection limits these are excluded from further assessment as it is considered that this indicates that the source is absent from the pollutant linkage relationship. This forms the basis for the Tier 1 risk assessment and based upon the chemical test data recovered during the works, Table 8.4.1 details the results from the investigation divided into their respective averaging areas, with observed contaminant concentrations beneath the limits of detection highlighted in yellow with the remainder having recorded values that will require further consideration.

Table 8.4.1: Results Split into Averaging Areas and Identifying those above Detection

Determinant	Minimum Concentration (mg/kg)			
	Topsoil		Superficial Deposits	
	Min	Max	Min	Max
Arsenic	4	10.2	6.4	13.1
Cadmium	<0.5	0.6	<0.5	0.6
Chromium	20.3	36.4	25.6	37.5
Copper	12.9	40	14.9	16.8
Lead	33.5	81.5	14.9	22.5
Mercury	<0.5	<0.5	<0.5	<0.5
Nickel	14.3	19.2	15	36.1
Selenium	<1	<1	<1	<1
Zinc	63.8	580	52.6	91
Water Soluble Sulphate	0.06	0.89	0.06	0.11
Elemental Sulphur	<20	<20	<20	36
Free Cyanide	<1	<1	<1	<1
Hexavalent Chromium	<0.8	<0.8	<0.8	<0.8
Total Sulphide	<2	<2	<2	<2
Total Cyanide	<1	1.3	<1	<1
Water Soluble Boron	1	1.8	0.5	0.6
pH	5.5	6.2	5.4	7

Table 10.4.1: Results Split into Averaging Areas and Identifying those above Detection (cont.)

Determinant	Minimum Concentration (mg/kg)			
	Made Ground Capping		Landfill Waste Material	
	Min	max	Min	Max
Soil Organic Matter	4.5	12	0.2	2.6
Phenol	<1	<1	<1	<1
3,4-Dimethylphenol	<1	<1	<1	<1
2,3-Dimethylphenol	<1	<1	<1	<1
2,3,5-trimethylphenol	<1	<1	<1	<1
Total Monohydric Phenols	<5	<5	<5	<5
Naphthalene	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	<0.1	<0.1	<0.1	<0.1
Acenaphthene	<0.1	<0.1	<0.1	<0.1
Fluorene	<0.1	<0.1	<0.1	<0.1
Phenanthrene	<0.1	0.3	<0.1	<0.1
Anthracene	<0.1	<0.1	<0.1	<0.1
Fluoranthene	0.1	0.8	<0.1	<0.1
Pyrene	0.1	0.8	<0.1	<0.1
Benzo(a)anthracene	<0.1	0.6	<0.1	<0.1
Chrysene	<0.1	0.6	<0.1	<0.1
Benzo(b)fluoranthene	<0.1	0.4	<0.1	<0.1
Benzo(k)fluoranthene	<0.1	0.7	<0.1	<0.1
Benzo(a)pyrene	<0.1	0.4	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	<0.1	0.3	<0.1	<0.1
Dibenzo(a,h)anthracene	<0.1	<0.1	<0.1	<0.1
Benzo[g,h,i]perylene	<0.1	0.3	<0.1	<0.1
Total PAH(16)	<0.4	5.3	<0.1	<0.1
Benzene	<0.01	<0.01	<0.01	<0.01
Toluene	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	<0.01	<0.01	<0.01	<0.01
Xylenes	<0.01	<0.01	<0.01	<0.01
MTBE	<0.01	<0.01	<0.01	<0.01
>C5-C6 Aliphatic	<0.01	<0.01	<0.01	<0.01
>C6-C8 Aliphatic	<0.01	<0.01	<0.01	<0.01
>C8-C10 Aliphatic	<1	<1	<1	<1
>C10-C12 Aliphatic	<1	<1	<1	<1
>C12-C16 Aliphatic	<1	<1	<1	<1
>C16-C21 Aliphatic	<1	<1	<1	<1
>C21-C35 Aliphatic	<1	<1	<1	<1
>C35-C40 Aliphatic	<1	<1	<1	<1
>C5-C7 Aromatic	<0.01	<0.01	<0.01	<0.01
>C7-C8 Aromatic	<0.01	<0.01	<0.01	<0.01
>C8-C10 Aromatic	<1	<1	<1	<1
>C10-C12 Aromatic	<1	<1	<1	<1
>C12-C16 Aromatic	<1	<1	<1	<1
>C16-C21 Aromatic	<1	<1	<1	<1
>C21-C35 Aromatic	<1	<1	<1	<1
>C35-C40 Aromatic	<1	<1	<1	<1
Total (>C5-C40) Ali/Aro	<1	<1	<1	<1

In addition to those identified in the Table 8.3.1, as being below their limit of detection the following determinants have also not been assessed further with regard to human health. The justification for this is detailed below.

- Total PAH
- Soil Organic matter.
- pH
- Water soluble Sulphate
- Elemental Sulphur

Total PAH values have not been considered as, in accordance with current best practice, the individual PAH species or TPH aliphatic/aromatic carbon range bands have been assessed in accordance with their differing toxicological properties.

Organic matter and pH have been recorded in order to provide information to complete quantitative human health risk assessment should it be needed but do not pose any identified human health based risks under normal circumstances.

Research on sulphate toxicology has revealed the major health effect with sulphate ingestion is laxative action. In general, the toxicity of sulphate alone is not considered to pose a significant risk to human health and has therefore been excluded from the exposure assessment.

A search for toxicity data for elemental sulphur has been unsuccessful. This has included the DEFRA/EA sources, WHO Environmental Health Criteria documents, Risk Assessment Information System (RAIS) database and the USEPA IRIS database. A Holly Industries material safety data sheet identifies that sulphur is essentially non-toxic either through ingestion, inhalation, skin or eye contact. Irritant effects have been reported when sulphur is in dust form. As a result of these searches, elemental sulphur has not been considered as a determinant that is potentially hazardous to human health.

8.5 Tier 2 Risk Assessment

The Tier 2 risk assessment utilises published and authoritative generic assessment criteria to determine the likelihood of harm being caused to human health. The anticipated proposed development will comprise houses with private gardens. Therefore, as noted in Section 8.3 it has been deemed appropriate to adopt the assessment criteria for a “residential with the consumption of homegrown vegetables” end use.

Table 8.5.1, below, compares the determinants with concentrations recorded above the limit of detection against their published assessment criteria, the source of which has been detailed, with any failures highlighted in blue.

Table 8.5.1 Tier 2 Assessment for a Commercial End Use

Determinant	Minimum Concentration (mg/kg)				Assessment Criteria (mg/kg)	
	Topsoil		Superficial Deposits			
	Min	Max	Min	Max	Value	Source
Arsenic	4	10.2	6.4	13.1	37	LQM
Cadmium	<0.5	0.6	<0.5	0.6	11	LQM
Chromium	20.3	36.4	25.6	37.5	910	LQM
Copper	12.9	40	14.9	16.8	2400	LQM
Lead	33.5	81.5	14.9	22.5	200	DEFRA
Nickel	14.3	19.2	15	36.1	180	LQM
Zinc	63.8	580	52.6	91	3700	LQM
Total Cyanide	<1	1.3	-	-	34	ATKINS
Water Soluble Boron	1	1.8	0.5	0.6	290	LQM
Phenanthrene	<0.1	0.3	-	-	95	LQM
Fluoranthene	0.1	0.8	-	-	280	LQM
Pyrene	0.1	0.8	-	-	620	LQM
Benzo(a)anthracene	<0.1	0.6	-	-	7.2	LQM
Chrysene	<0.1	0.6	-	-	15	LQM
Benzo(b)fluoranthene	<0.1	0.4	-	-	2.6	LQM
Benzo(k)fluoranthene	<0.1	0.7	-	-	77	LQM
Benzo(a)pyrene	<0.1	0.4	-	-	2.2	LQM
Indeno(1,2,3-cd)pyrene	<0.1	0.3	-	-	27	LQM
Benzo(a,h,i)perylene	<0.1	0.3	-	-	320	LQM

Key: LQM = LQM/CIEH Suitable 4 Use Levels (S4UL) published 2015
 DEFRA = Category 4 Screening Levels (C4SL) published 2014
 ATKINS = there is no published target value for cyanide therefore the Atkins SSV derived using CLEA for 1% SOM published in 2011 based on acute exposure for a 0-6 year old child using 5th percentile bodyweight from CLR10.

8.6 Presentation of Results of Tier 2 Risk Assessment across the Study Area

As can be seen from Table 8.5.1 above none of the recorded determinants within soils exceeded the assessment criteria.

8.7 Summary Findings of the Human Health Risk Assessment and Recommendations

Based upon the chemical test results from the site investigation it has been shown that the topsoil and shallow superficial deposits do not pose a risk to human health. Therefore, no remedial measures based upon the geochemical properties of the soils are necessary to make the site suitable for the proposed residential development.

9.0 CONTROLLED WATERS RISK ASSESSMENT

9.1 Receptors

As discussed previously in Section 5.3.2 the controlled waters receptors were identified as:

- **Surface water** – a stream and a ditch flow along the western and south-eastern boundaries, respectively, which flow into the West Streams catchment area plus the ditch feeds into the village pond on the green c.40m to the south of the site. No river quality data is available in the vicinity of the site but based upon the general land use in the area and absence of grossly polluting industries it is considered likely to be good.

With reference to Annex 2 of the *'Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008'*, although there is no information to indicate the quality of the water as the ditch on the eastern side of the site discharges into the village pond it is considered to have a Very High (H1) sensitivity.

- **Groundwater** - With reference to the GroundSure Data the superficial deposits and more granular bedrock (Lambeth Group) below the northern section of the site bedrock have been classified by the Environment Agency as a Secondary A Aquifer.

Although the London Clay beneath the majority of the site is designated as Unproductive Strata. The deeper chalk bedrock (c.56mbgl) is a Principal Aquifer but the nearest SPZ 2c is c.400m to the north-west. However, this is considered to be protected by c.50m of overlying cohesive London Clay and based upon the anticipated direction of groundwater flow it is upgradient of the site.

Therefore, based again upon Annex 2 of the *'Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008'*, as there are no particular uses identified the sensitivity of the groundwater is considered to be Low (L1).

9.2 Controlled Waters Risk Evaluation

Although groundwater was encountered in all boreholes no samples were collected for testing as part of the site investigation as the soils encountered were all natural and there was no evidence of contamination (visual or olfactory) within the soil or groundwater.

From the chemical analysis results discussed previously it has been shown that no elevated levels of contamination are present within the soils, especially the most mobile petroleum hydrocarbons contaminant, which were shown to be below the limit of detection (<1mg/kg) in all samples.

Therefore, the natural soils across the site are not considered to pose a risk to controlled waters and no remedial measures are proposed.

10.0 RISK ASSESSMENT OF OTHER RECEPTORS

10.1 General

The other environmental receptors identified earlier in this report were buildings, services and flora. This chapter identifies each class of receptor and assesses the risk to them based upon the results of the chemical analysis and the proposed development.

The assessment criteria used are detailed in Table 10.1.1.

Table 10.1.1: Assessment Criteria for other Environmental Receptors

Analysis	Generic Assessment Criteria		Source
Buildings			
Sulphate (2:1) as SO ₄ (g/l)	0.5		BRE Special Digest 1 : 2005
Phytotoxic Contaminants			
Selenium	10		SGV9 Document – phytotoxic reference
Boron	3		
Copper	130		
Nickel	70		
Zinc	300		
Cadmium	8		ICRCL 59/83 – Phytotoxic risk only
Chromium	154		
Mercury	28		
Potable Water Supply			
	PE pipework	PVC pipework	
VOC	0.5	0.125	Water Regulations Advisory Scheme Report 10/WM/03/21 – Table 3.1
BTEX + MTBE	0.1	0.03	
SVOCs	2	1.4	
Phenols	2	0.4	
Cresols and chlorinated phenols	2	0.04	
Mineral Oils C11-C20	10	Suitable	
Mineral Oils C21-C40	500	Suitable	

10.2 Phytotoxic Risk Estimation for the Study Area

Where considering phytotoxic risks, the contaminants selected are those listed within Annex 3 of 'Guidance for the Safe Development of Housing on Land Affected by Contamination. R&D66: 2008 Volume 2' as being 'phytotoxic'. Where available, assessment values have been chosen based on the criteria within, (in priority order), SGV Documents, ICRCL 59/83 phytotoxic threshold levels, Dutch RIVM Serious Risk Concentrations (SRC) for ecological receptors (amended for a UK soil of 10% clay and 2% soil organic matter) and US EPA Soil Screening Levels for plants.

The chemical test results are presented in Table 10.2.1, overleaf, to illustrate the distribution of potentially phytotoxic contaminant concentrations revealed by the site investigation works. Exceedences of the phytotoxic assessment criteria are highlighted in blue.

Table 10.2.1: Elevated Concentrations of Phytotoxic Contaminants within All Soils

Phytotoxic Metals	Ass't Criteria	Maximum recorded concentrations (mg/kg)	
		Topsoil (mg/kg)	Superficial Deposits (mg/kg)
Selenium	10	<1	<1
Boron	3	0.6	1.8
Copper	130	40	16.8
Nickel	70	19.2	36.1
Zinc	300	580	91
Cadmium	8	0.6	0.6
Chromium	154	36.4	37.5
Mercury	28	<0.5	<0.5

Based on a review of the chemical test results presented within Table 10.2.1 it would appear that Zinc is present in the topsoil at a level that is considered to be phytotoxic. From a review of the three topsoil results in the full laboratory report (Appendix H) it has been determined there was only a single elevated zinc, which was present in WS3 with the other two values were significantly lower at 63.8mg/kg and 72.6mg/kg.

However, there was no evidence of dieback or distress noted within the vegetation across the site therefore it is considered that this result is not representative of the levels across the site generally and the topsoil has been deemed not to pose a risk to future plant growth.

10.3 Materials and Services Risk Estimation for the Study Area

Recorded soil pH values from the analysis of the samples indicated that the soils were shown to be slightly acidic with recorded values of between 5.4 and 7 units and the associated water soluble sulphate concentrations ranged between 60 and 890mg/l.

When compared against the BRE Special Digest 1 (2005) assessment levels, this indicates a DS2 design mix concrete would be required for buried structures. Although consultation with Building Control/NHBC may allow this specification to be relaxed as the only value above 500mg/l was recorded and this was in the topsoil.

Contaminants in the ground can pose a risk to potable water supply by permeating plastic water supply pipes. Therefore in order to fulfil their statutory obligation, UK water supply companies require robust evidence from developers to demonstrate either that the ground in which new plastic supply pipes will be laid is free from specific contaminants, or that the proposed remedial strategy will mitigate any existing risk. If these requirements cannot be demonstrated to the satisfaction of the relevant water company, it becomes necessary to specify an alternative pipe material on the whole development or specific zones.

In 2010, UK Water Industry Research (UKWIR) published *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (Report Ref. No. 10/WM/03/21). This report reviewed previously published industry guidelines and threshold concentrations adopted by individual water supply companies. The focus of the UKWIR research project was to develop clear and concise procedures, which provide consistency in the pipe selection decision process. It was intended to provide guidance that can be used to ensure compliance with current regulations and to prevent water supply pipe failing prematurely due to the presence of contamination.

Report 10/WM/03/21 concluded that in most circumstances only organic contaminants pose a potential risk to plastic pipe materials and Table 3.1 of the report provides threshold concentrations for PE and PVC pipes for the organic contaminants of concern.

The potential risks to water supply pipes have therefore been assessed against the threshold concentrations for PE and PVC pipe specified in Table 3.1 of Report 10/WM/03/21, which have been adopted as the GAC for this project. Table 10.3.1 below summaries the results

Table 10.3.1: Assessment of Results against WRAS Criteria

Determinant	WRAS criteria		Recorded Concentrations	
	PE pipe	PVC pipe	Minimum	Maximum
<i>VOC</i>	0.5	0.125	Not tested	Not tested
<i>BTEX + MTBE</i>	0.1	0.03	All below limit of detection (<0.01)	All below limit of detection (<0.01)
<i>SVOCs</i>	2	1.4	Not tested	Not tested
<i>Phenols</i>	2	0.4	<1	<1
<i>Cresols and chlorinated phenols</i>	2	0.04	Not tested	Not tested
<i>Mineral Oils C11-C20</i>	10	Suitable	<1	<1
<i>Mineral Oils C21-C40</i>	500	Suitable	<1	<1

Notes:

Mineral Oils C11-C20 is a combination of TPH aliphatic and aromatic ranges C10 to C21
Mineral Oils C21-C40 is a combination of TPH aliphatic and aromatic ranges C21 to C35

The results presented within Table 10.3.1 indicate that PE and PVC pipework would be suitable for use for buried water supply mains. However, it is recommended that liaison with the statutory water suppliers be undertaken with a view to obtaining confirmation as to their requirements for the specification for buried portable water supply pipework used on the site.

11.0 REFINED CONCEPTUAL SITE MODEL

11.1 General

Chapter 5 presented the preliminary conceptual site model that utilised desk based information to present a qualitative assessment of potential source-pathway-receptor relationships across the site. Following completion of the ground investigation works and Tier 2 risk assessment for human health and other environmental receptors a refined conceptual site model has been developed as detailed below.

11.2 Sources

The site investigation works and associated chemical testing have revealed the following:

- The investigations did not reveal any elevated levels of contamination when compared against the published residential with consumption of homegrown vegetable end use assessment criteria. Therefore, the topsoil and shallow superficial deposits are not considered to pose a risk to human health.
- As the soils are natural across the site with no elevated levels of contamination they have been deemed not to pose a risk to controlled waters.
- The maximum water-soluble sulphate concentration revealed within the topsoil based upon the BRE Special Digest 1 (2005) would indicate a DS2 design mix will be required for buried concrete structures and footings. However, the sulphate levels within the underlying natural superficial deposits ranged from <20mg/l to 110mg/l, which would only require a DS1 concrete design mix.
- The WRAS Trigger Values show that PE and PVC pipework would be suitable for water supply pipework.
- The topsoil has been shown to have a localised elevated phytotoxic zinc concentration although due to the absence of distress or die back noted in the vegetation across the site this is not considered to be critical.

11.3 Pathway and Receptor

The proposed development will include residential properties with private gardens therefore for the purpose of this assessment the critical receptor will be a 0-6 year old female child living in one of the new houses. When considering this end use the following exposure pathways for human health are viable

- Outdoor/indoor ingestion of soil.
- Consumption of homegrown vegetables and soil attached to them;
- Outdoor/indoor exposure to soil through skin contact.
- Outdoor/indoor inhalation of fugitive dust.
- Outdoor/indoor inhalation of vapour

The site is underlain by a Secondary (A) Aquifer but is not within a designated Source Protection Zone.

The nearest surface water receptor are a stream and ditch running along the western and south-eastern boundaries respectively.

The proposed development will include private gardens and soft landscaped areas of public open space therefore viable floral receptors could be impacted upon by the underlying phototoxic contaminants via plant root uptake.

Underground services associated with the proposed development may also be affected by the chemical characteristics of the soil.

11.4 Risk Evaluation

A revised site specific risk evaluation updating the details presented in Section 5 has been carried out the results of which are described below. As summary of this qualitative assessment has been included in Table 11.4.1 overleaf, the risk estimation as per '*Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008*'.

11.5 Risk Evaluation for the Proposed Development

The following evaluation of risk is based upon the current development proposal using the residential with plant uptake after use assessment criteria. Viable pollutant linkages were identified earlier.

11.5.1 Risk to Human Health: Soils/Gases

All the determinants tested were shown to be at concentrations below the published assessment criteria for a residential end use with private gardens. Therefore, the shallow soils are considered to pose a **Low Risk** to future site occupiers.

Radon gas levels are not at levels that will require protection measures also no sources for landfill gases have been identified. Therefore, gases are considered pose a **Low Risk** to future site occupiers.

11.5.2 Risk to Building Materials and Services

The results of the sulphate and pH testing indicate that the topsoil could potentially pose a **Moderate Risk** to sub-surface concrete structures and footings. However, the underlying superficial deposits in which any footings or structures will be founded were shown to have low sulphate levels and these would be considered to only pose a **Low Risk** of creating an aggressive environment. Therefore, it is recommended that building control/NHBC are consulted to determine if an upgraded concrete design is required for buried structures and foundations.

The geochemistry of the soils, when considered against the WRAS guidelines, suggests that PE and PVC pipework would be suitable for potable water supplies. Therefore, buried mains and pipework have been deemed to be at **Low Risk** of damage. However, discussions with the Local Water Authority will be necessary to confirm their assessment of the site conditions and subsequent pipework specification.

11.5.3 Risk to Flora/Fauna

Based on the chemical test results due to an elevated phototoxic zinc in the topsoil this would indicate that the soil poses a potential risk to plant growth. However, due to the absence of distress and dieback noted in the vegetation across the site it has been deemed that the poses a **Low Risk** to vegetation and plant growth.

11.5.4 Risk to Surface and Groundwater

Due to the absence of any contamination being present within the natural soils across the site (TPH <1mg/kg) and the absence of any major usages of the groundwater or surface water in the vicinity it has been deemed that the site poses a **Low Risk** to Controlled Waters.

12.0 REFINED CONCEPTUAL SITE MODEL

Table 13.4.1 below presents the summary risk evaluation associated with each source-pathway-receptor linkage related to the proposed development of the site.

Table 13.1.1: Potential Source – Pathway – Receptor Relationships

APC No.	Source	Comments	Pathway (s)	Receptor	Classification of Consequence	Classification of Probability	Classification of Risk
1	Unrecorded human activity that may have introduced contamination onto the site	The testing did not reveal any levels of contamination that will pose a risk to human health. The soils do not pose a risk to Controlled Waters Buried water mains are not considered to be at risk from the soils across the site An elevated phototoxic zinc within the topsoil has, based upon the healthy vegetation on the site been deemed not to pose a risk to plant growth.	Soil ingestion	Future site residents	Medium	Unlikely	Low Risk
			Dermal contact	Future site residents	Medium	Unlikely	Low Risk
			Vapour inhalation	Future site residents	Medium	Unlikely	Low Risk
			Landfill gases	Future site residents /buildings	Medium	Unlikely	Low Risk
			Downward migration	Groundwater	Medium	Unlikely	Low Risk
			Via groundwater/runoff	Surface Water	Medium	Unlikely	Low Risk
			Direct contact	Buildings and Underground Services	Medium	Unlikely	Low Risk
			Uptake via root system	On-site flora	Medium	Unlikely	Low Risk
2	Naturally occurring elevated sulphate levels that could be detrimental to sub-surface concrete	The maximum localised sulphate level within the topsoil may pose a risk to buried concrete	Direct contact	Buildings	Medium	Likely	Moderate Risk

13.0 RISK MANAGEMENT AND REMEDIATION

13.1 Summary of Findings and Recommendations

Based upon the assessment of the chemical analysis results for the soil samples obtained during the site investigations it has been shown that:

- The soils do not contain any elevated concentrations that pose a risk to human health and therefore no remedial works are proposed;
- Due to the absence of any made ground our elevated levels of contamination controlled waters are not considered to be at risk from the site and therefore no remedial measures are required;
- PE and PVC pipework have been shown to be suitable for buried water mains. However, discussions should be held with the Local Water Authority so they can review the findings and determine the specification of the pipework they require to be used on the site;
- Based upon the maximum sulphate level recorded within the topsoil a DS2 design mix would be required for foundations however, it is recommended that Building Control/NHBC should be consulted as the sulphate levels within superficial deposits were significantly lower ranging from 20mg/l to 110mg/l, which would only require a DS1 design mix for subsurface concrete.
- The topsoil was shown to contain an elevated phototoxic zinc, which may have the potential to be detrimental to plant growth. However, as the site is currently open field with no evidence of dieback it is considered that the geochemistry of the topsoil does not pose a risk to vegetation.

Table 13.1.1 below details the revised risk evaluation for identified contamination issues following the completion of the intended remedial works.

Table 13.1.1 Revised Risk Evaluation Post Remedial Works

APC N ^o	Source	Pathway(s)	Receptor	Current Risk Rating	Remedial Measures	Revised Risk Rating
2	<i>Naturally occurring elevated sulphate levels that could be detrimental to sub-surface concrete</i>	Direct contact	buildings	Moderate	Liaise with Building Control/NHBC to determine the level of sulphate protection they require for sub-surface concrete	Low

14.0 CONCLUDING DISCUSSION

14.1 Conclusions

From the investigations based upon the proposed residential development with private gardens the following conclusions have been made:

- The British Geological Survey (BGS), National Geoscience Information Service states that no radon protective measures are necessary in the construction of new dwellings or extensions.
- The chemical analysis did not identify any elevated concentrations within the soils and therefore no remedial measures are proposed;
- As only natural soils were revealed with no elevated levels of contamination the site is not considered to pose a significant risk to controlled waters and as such no remedial works will be required;
- No sources of landfill gases were identified therefore no gas protection measures will be required within the new properties;
- The underlying soils conditions would be suitable for PE or PVC buried water supply pipework. However, the actual specification for any water mains will need to be confirmed with the Local Water Authority;
- Based upon the sulphate concentrations the topsoil has the potential to create a detrimental environment for buried concrete that would require a DS2 sulphate resistant design mix. However, the underlying superficial sandy, locally gravelly, CLAY has lower sulphate levels for which a DS1 design mix would be suitable. Therefore, Building Control/NHBC should be consulted with a view to relaxing the design mix, although they may require further testing to provide a higher confidence level in the assessment data.
- Zinc was revealed locally in the topsoil at a concentration that may potentially be detrimental to plant growth, however due to the absence of any dieback noted in the vegetation across the site this is not considered to be a significant risk..

14.2 Recommendations

In line with the concluding remarks above the following recommendations are made:

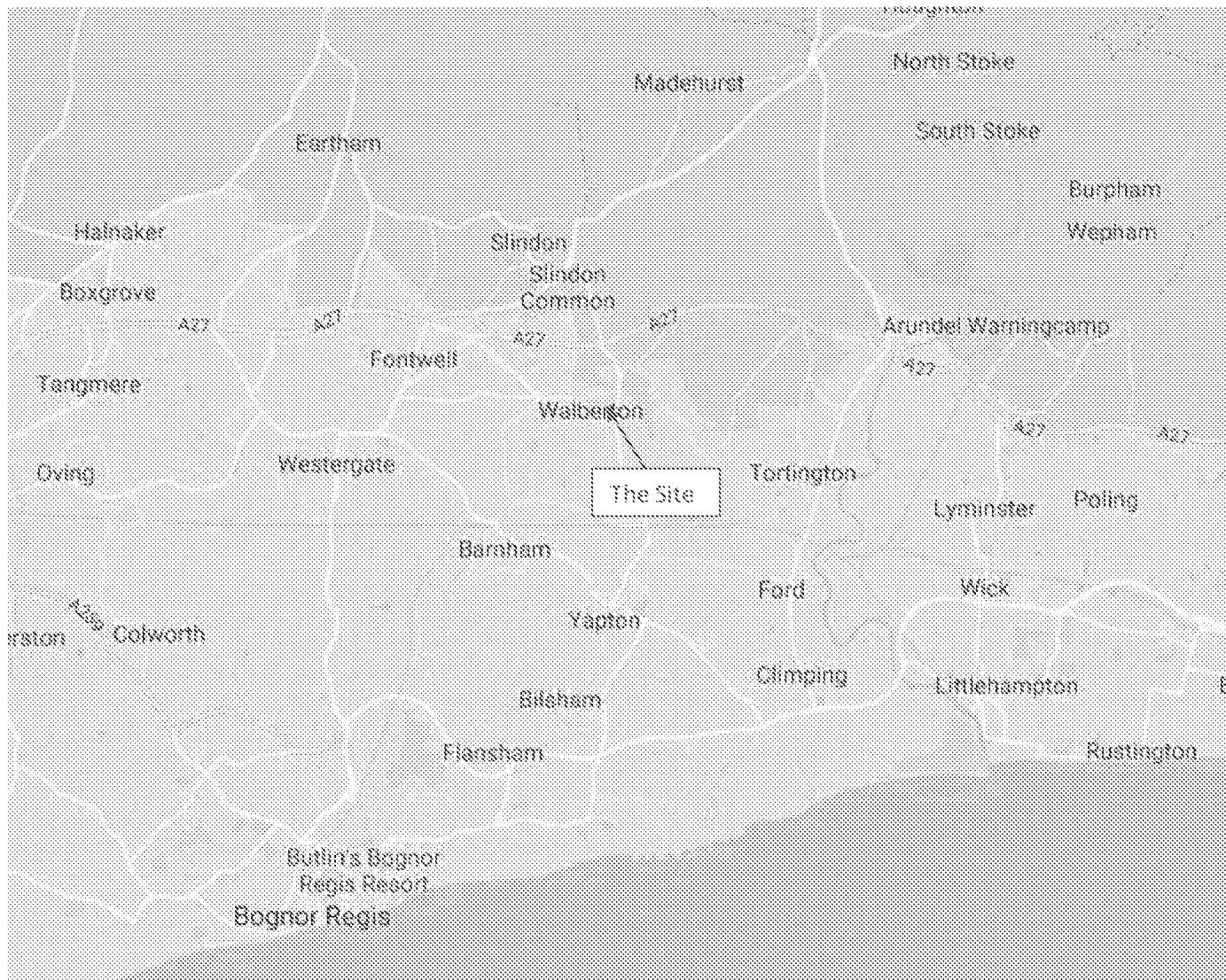
- Arun District Council's Environmental Health Officer should be forwarded a copy of the site investigation report for their assessment and to confirm whether they are in agreement with the conclusions and recommendations.
- Liaison with the statutory water supplier should be undertaken to determine the specification for underground water supply pipework across the site;

-
- Arun District Council Building Control/NHCBC should be consulted regarding the concrete design mix required for subsurface structures and foundations.

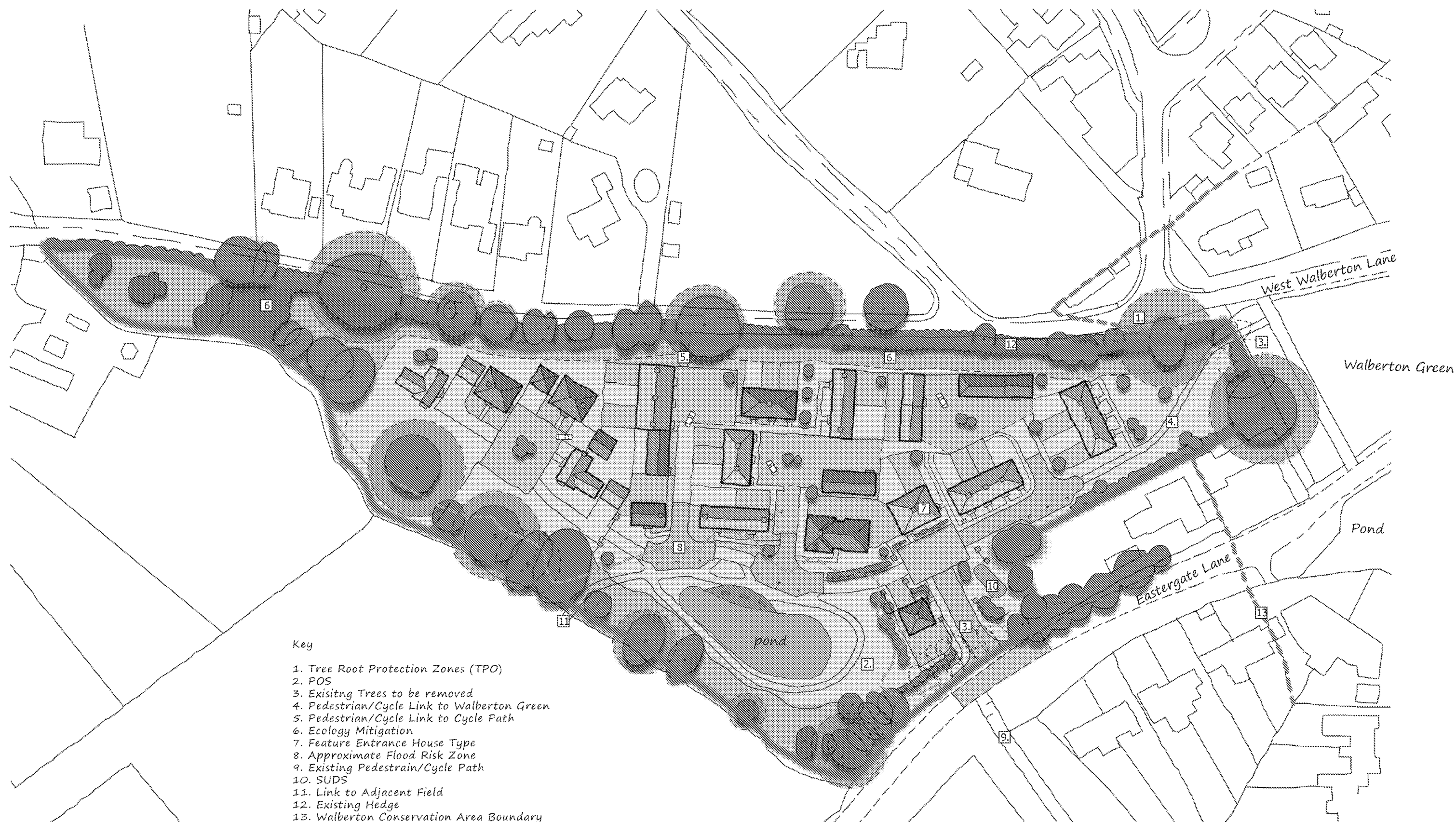
APPENDICES

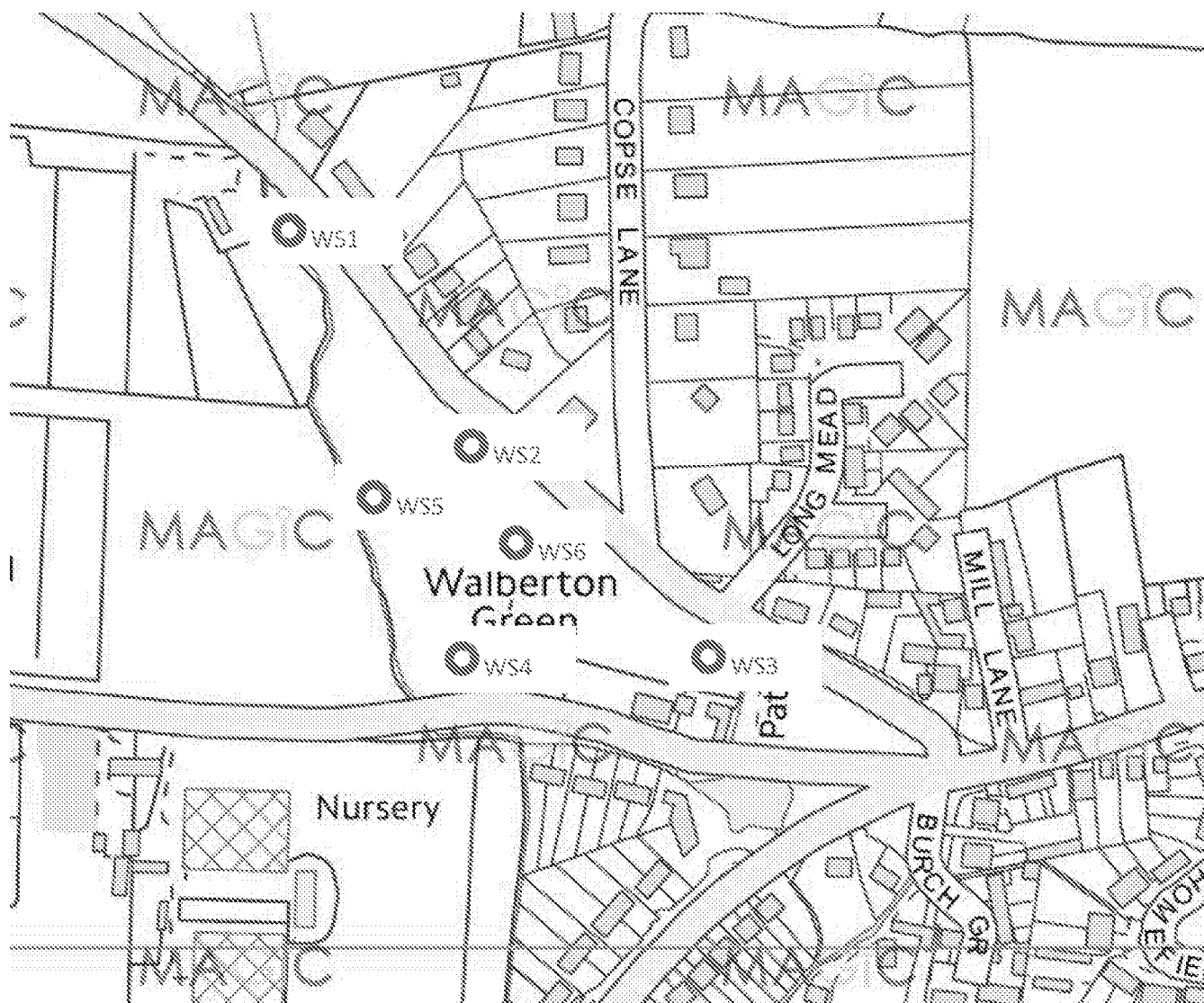
- A DRAWINGS**
- B GROUNDSURE DATA**
- C HISTORICAL MAPS**
- D ANNEX 4 OF R&D66: 2008**
- E CORRESPONDENCE WITH ARUN DISTRICT COUNCIL**
- F PROBE HOLE LOGS**
- G SITE PHOTOGRAPHS**
- H CHEMICAL ANALYSIS RESULTS REPORT**

APPENDIX A - Drawings



PROJECT	CLIENT	Date : 18 th December 19	 FORGE Architectural Services Ltd The Forge Lower Vagg Chilthorne Damer Yeovil Somerset BA21 3PY Tel : 01935 840 346
Westbarton Lane, Walbarton	Macra Ltd	Scale : Not To Scale	
DRAWING TITLE		DRAWING No.	
Site Location Plan		WAL168/001	





KEY



Window sampler probe hole
with standpipe installation

PROJECT

Westberton Lane, Walberton

CLIENT

Macra Ltd

Date : 15th December 19

Scale : Not To Scale



FORGE

The Forge
Lower Vagg
Chillthorne Damer
Yeovil
Somerset
BA21 3PY
Tel : 01935 840 346

DRAWING TITLE

GW Level Monitoring Borehole Plan

DRAWING No.

WAL168/003

APPENDIX B – Groundsure Data



Forge Environmental Management Ltd
The Forge, Lower Vagg,
Yeovil, BA21 3PY

Groundsure Reference: GS-6517304

Your Reference: WAL168

Report Date 13 Dec 2019

Report Delivery Method: Email - pdf

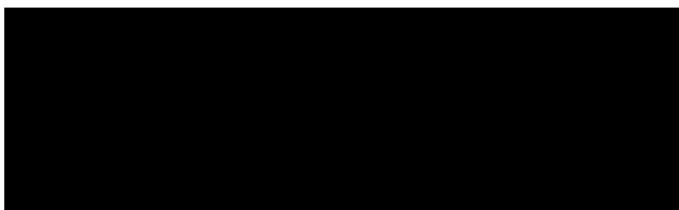
Enviro Insight

Address: LAND ON WEST OF WEST WALBARTON LANE, WALBERTON, BN18 0QH

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.



Managing Director
Groundsure Limited

Enc.
Groundsure Enviroinsight

Address: LAND ON WEST OF WEST WALBARTON LANE, WALBERTON, BN18 0QH
Date: 13 Dec 2019
Reference: GS-6517304
Client: Forge Environmental Management Ltd

NW

N

NE

W

E



SW

S

SE

Aerial Photograph Capture date: 28-Jun-2018
Grid Reference: 496444,106181
Site Size: 2.0272ha

Report Reference: GS-6517304
Client Reference: WAL168

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Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Historical Industrial Sites	On-site	0-50	51-250	251-500
1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping	1	2	2	10
1.2 Additional Information – Historical Tank Database	0	0	0	3
1.3 Additional Information – Historical Energy Features Database	0	2	3	3
1.4 Additional Information – Historical Petrol and Fuel Site Database	0	0	0	0
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	0	0	0	7
1.6 Historical military sites	0	0	0	0
1.7 Potentially Infilled Land	0	5	4	6

Section 2: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
2.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
2.1.1 Records of historic IPC Authorisations	0	0	0	0
2.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
2.1.3 Records of Red List Discharge Consents	0	0	0	0
2.1.4 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
2.1.5 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
2.1.6 Records of Part A(2) and Part B Activities and Enforcements	0	0	0	0
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
2.1.8 Records of Licensed Discharge Consents	0	0	1	3
2.1.9 Records of Water Industry Referrals	0	0	0	0
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	0	0	0	0
2.2 Records of COMAH and NIHHS sites	0	0	0	0
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	0	2	0	0
2.3.2 National Incidents Recording System, List 1	0	0	0	0
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

Section 3: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-1500
3.1 Landfill Sites						
3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites	0	0	0	0	0	Not searched
3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites	0	0	0	0	4	3
3.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0
3.1.4 Records of Landfills in Local Authority and Historical Mapping Records	0	0	0	0	0	0
3.2 Landfill and Other Waste Sites Findings						
3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	Not searched	Not searched
3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites	0	0	0	0	0	0

Section 4: Current Land Use	On-site	0-50m	51-250	251-500
4.1 Current Industrial Sites Data	0	1	1	Not searched
4.2 Records of Petrol and Fuel Sites	0	0	0	1
4.3 National Grid Underground Electricity Cables	0	0	0	0
4.4 National Grid Gas Transmission Pipelines	0	0	0	0

Section 5: Geology	
5.1 Records of Artificial Ground and Made Ground present beneath the study site	None identified
5.2 Records of Superficial Ground and Drift Geology present beneath the study site	Identified
5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 6: Hydrogeology and Hydrology		0-500m				
6.1 Records of Strata Classification in the Superficial Geology within 500m of the study site		Identified				
6.2 Records of Strata Classification in the Bedrock Geology within 500m of the study site		Identified				
	On-site	0-50m	51-250	251-500	501-1000	1000-2000
6.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	3	9
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	2
6.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	2
6.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
6.7 Source Protection Zones within Confined Aquifer	0	0	0	1	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	2	0	0	2	Not searched	Not searched

Section 6: Hydrogeology and Hydrology

0-500m

	On-site	0-50m	51-250	251-500	501-1000	1000-1500
6.9 Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site	No	No	No	No	No	No
6.10 Ordnance Survey MasterMap Water Network entries within 500m of the site	4	10	34	46	Not searched	Not searched
6.11 Surface water features within 250m of the study site	Yes	Yes	Yes	Not searched	Not searched	Not searched

Section 7: Flooding

7.1 Environment Agency Zone 2 floodplains within 250m of the study site	Identified					
7.2 Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	Identified					
7.3 Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site	High					
7.4 Flood Defences within 250m of the study site	None identified					
7.5 Areas benefiting from Flood Defences within 250m of the study site	None identified					
7.6 Areas used for Flood Storage within 250m of the study site	None identified					
7.7 Maximum BGS Groundwater Flooding susceptibility within 50m of the study site	Potential at Surface					
7.8 BGS confidence rating for the Groundwater Flooding susceptibility areas	Moderate					

Section 8: Designated Environmentally Sensitive Sites

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
8.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
8.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
8.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
8.5 Records of Ramsar sites	0	0	0	0	0	0
8.6 Records of Ancient Woodlands	0	0	1	1	5	31
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
8.8 Records of World Heritage Sites	0	0	0	0	0	0
8.9 Records of Environmentally Sensitive Areas	0	0	0	0	1	1

Section 8: Designated Environmentally Sensitive Sites	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
8.11 Records of National Parks	0	0	0	0	1	0
8.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
8.13 Records of Nitrate Vulnerable Zones	1	0	1	0	0	0
8.14 Records of Green Belt land	0	0	0	0	0	0

Section 9: Natural Hazards	
9.1 Maximum risk of natural ground subsidence	Moderate
9.1.1 Maximum Shrink-Swell hazard rating identified on the study site	Moderate
9.1.2 Maximum Landslides hazard rating identified on the study site	Very Low
9.1.3 Maximum Soluble Rocks hazard rating identified on the study site	Negligible
9.1.4 Maximum Compressible Ground hazard rating identified on the study site	Negligible
9.1.5 Maximum Collapsible Rocks hazard rating identified on the study site	Low
9.1.6 Maximum Running Sand hazard rating identified on the study site	Low
9.2 Radon	
9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The site is in a Radon Affected Area, as between 1 and 3% of properties are above the Action Level.
9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary.

Section 10: Mining	
10.1 Coal mining areas within 75m of the study site	None identified
10.2 Non-Coal Mining areas within 50m of the study site boundary	Identified
10.3 Brine affected areas within 75m of the study site	None identified

Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

2. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

3. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

4. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

5. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

6. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licences, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

7. Flooding

Provides information on river and coastal flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

9. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence and radon.

10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

11. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

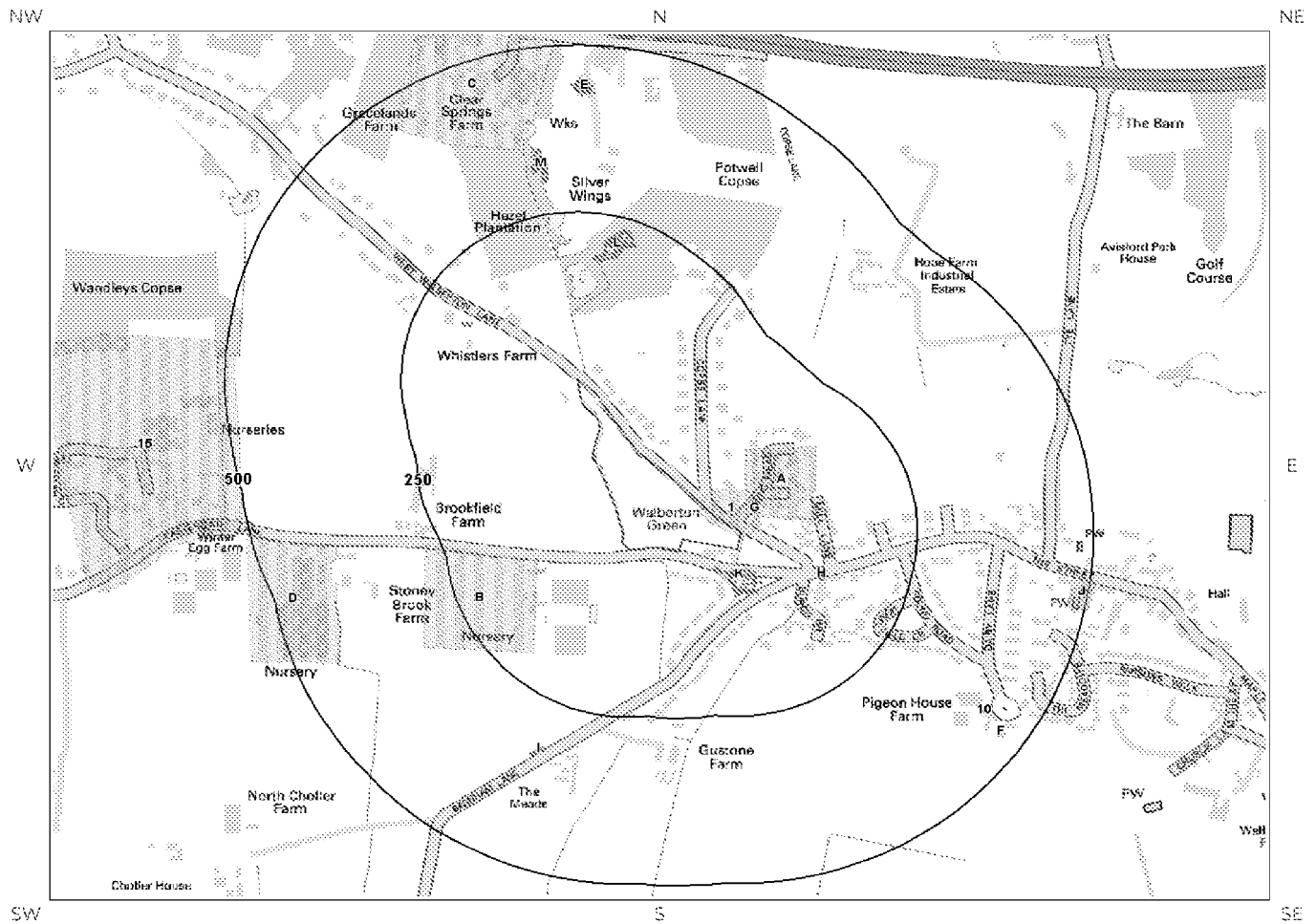
Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

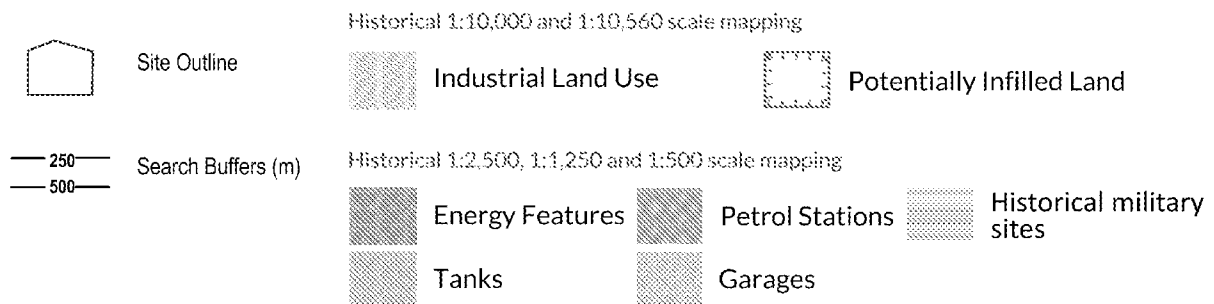
Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. Historical Land Use



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1. Historical Industrial Sites

1.1 Potentially Contaminative Uses Identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 15

ID	Distance [m]	Direction	Use	Date
1	0	On Site	Flour Windmill	1876
2A	27	NE	Nursery	1961
3A	30	NE	Nursery	1950
4B	115	W	Nursery	1977
5B	115	W	Nursery	1990
6C	352	N	Engineering Works	1977
7C	352	N	Unspecified Works	1990
8D	386	W	Nursery	1990
9D	386	W	Nursery	1977
10	424	SE	Unspecified Tank	1876
11E	427	N	Unspecified Pit	1961
12E	428	N	Gravel Pit	1896
13E	429	N	Unspecified Pit	1950
14E	429	N	Unspecified Pit	1910
15	484	W	Nursery	1950

1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical tanks within 500m of the search boundary: 3

ID	Distance (m)	Direction	Use	Date
16F	462	SE	Unspecified Tank	1984
17F	462	SE	Unspecified Tank	1994
18F	462	SE	Unspecified Tank	1974

1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary:

8

ID	Distance (m)	Direction	Use	Date
19G	34	NE	Electricity Substation	1973
20G	34	NE	Electricity Substation	1989
21H	121	E	Electricity Substation	1989
22H	124	E	Electricity Substation	1994
23H	125	E	Electricity Substation	1973
24I	318	SW	Electricity Substation	1984
25I	319	SW	Electricity Substation	1994
26I	331	SW	Electricity Substation	1974

1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary:

0

Database searched and no data found.

1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary:

7

ID	Distance (m)	Direction	Use	Date
27J	476	E	Garage	1989
28J	476	E	Garage	1992
29J	476	E	Garage	1992
30J	476	E	Garage	1990
31J	476	E	Garage	1990
32J	489	E	Garage	1994
33J	489	E	Garage	1973

1.6 Historical military sites

Certain military installations were not noted on historic mapping for security reasons. Whilst not all military land is necessarily of concern, Groundsure has researched and digitised a number of Ordnance Factories and other military industrial features (e.g. Ordnance Depots, Munitions Testing Grounds) which may be of contaminative concern. This research was drawn from a number of different sources, and should not be regarded as a definitive or exhaustive database of potentially contaminative military installations. The boundaries of sites within this database have been estimated from the best evidence available to Groundsure at the time of compilation.

Records of historical military sites within 500m of the search boundary: 0

Database searched and no data found.

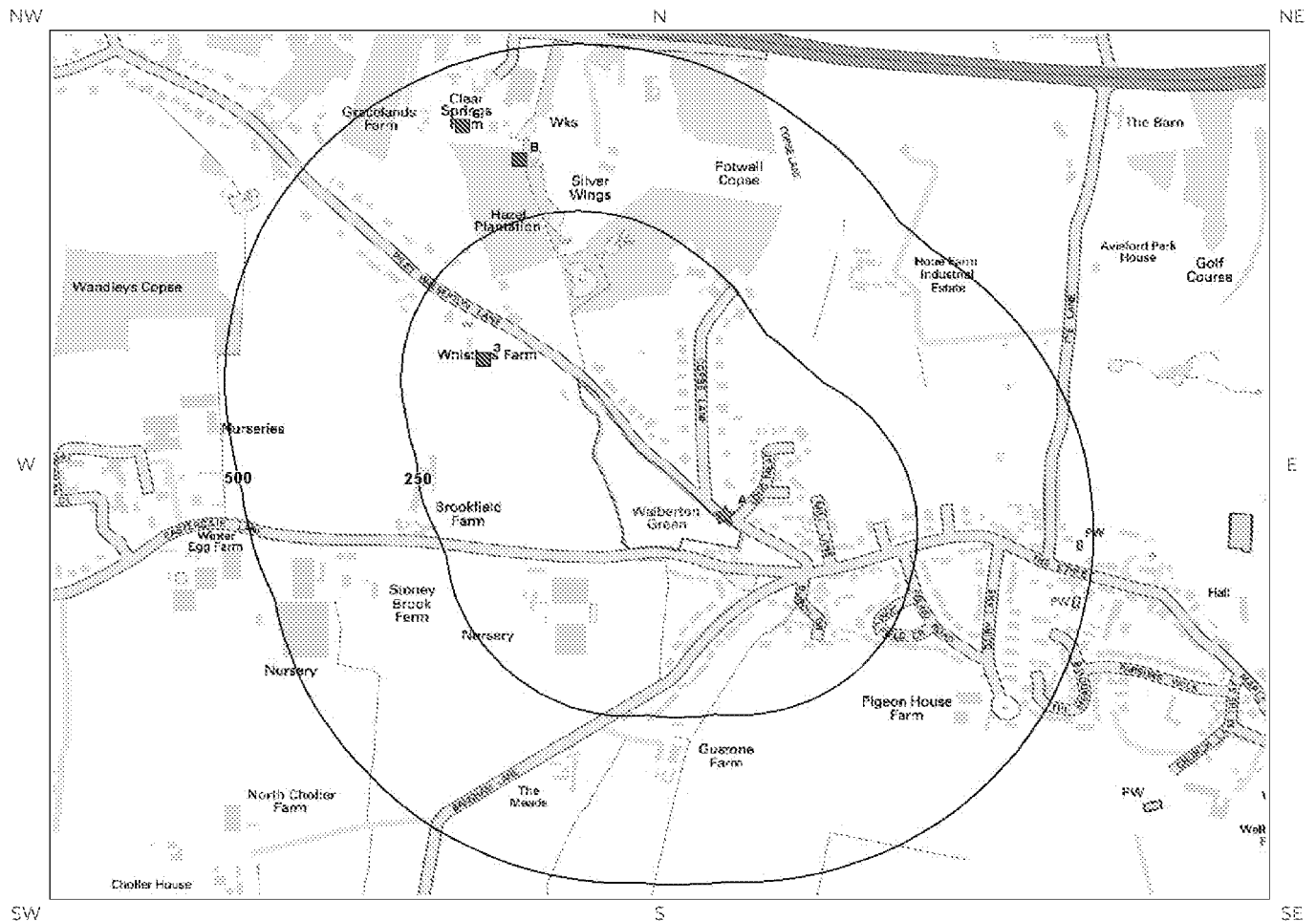
1.7 Potentially Infilled Land

Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 15

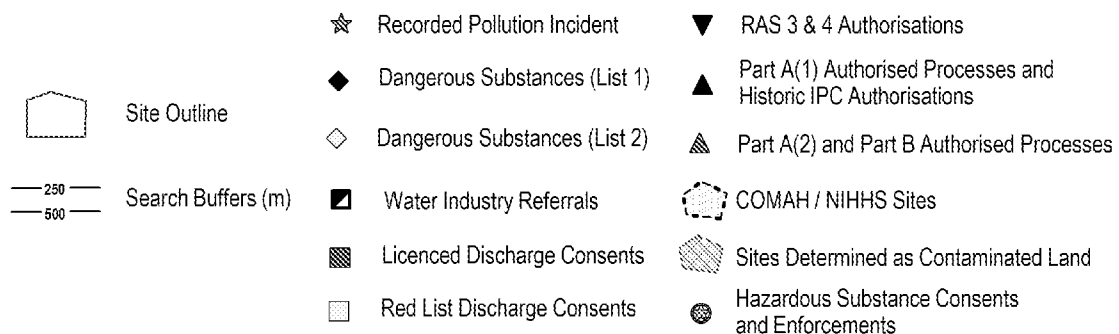
The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

ID	Distance(m)	Direction	Use	Date
34K	28	S	Pond	1876
35K	33	S	Pond	1950
36K	37	S	Pond	1990
37K	37	S	Pond	1977
38K	38	S	Pond	1961
39L	178	N	Ponds	1961
40L	178	N	Ponds	1950
41L	194	N	Pond	1990
42L	194	N	Pond	1977
43M	298	N	Pond	1961
44M	302	N	Pond	1950
45E	427	N	Unspecified Pit	1961
46E	428	N	Gravel Pit	1896
47E	429	N	Unspecified Pit	1950
48E	429	N	Unspecified Pit	1910

2. Environmental Permits, Incidents and Registers Map



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2. Environmental Permits, Incidents and Registers

2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

2.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

0

Database searched and no data found.

2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

0

Database searched and no data found.

2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.

2.1.8 Records of Licensed Discharge Consents within 500m of the study site:

4

The following Licensed Discharge Consents records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details
3	136	W	496200 106400	Address: ESTATE DEVELOPMENT, WEST WALBERTON LANE Effluent Type: MISCELLANEOUS DISCHARGES - SURFACE WATER Permit Number: S01403 Permit Version: 1 Receiving Water: FRESHWATER RIVER Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 03/09/1965 Effective Date: 03-Sep-1965 Revocation Date: 01/07/1991
4B	338	N	496250 106700	Address: POTWELL COPSE, ARUNDEL ROAD, WALBERTON, ARUNDEL WEST SUSSEX Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: P02335 Permit Version: 2 Receiving Water: INTO LAND Status: VARIED UNDER EPR 2010 Issue date: 21/12/2012 Effective Date: 21-Dec-2012 Revocation Date: -
5B	338	N	496250 106700	Address: POTWELL COPSE, ARUNDEL ROAD, WALBERTON, ARUNDEL WEST SUSSEX Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: P02335 Permit Version: 1 Receiving Water: INTO LAND Status: PRE NRA LEGISLATION WHERE ISSUE DATE < 01-SEP-89 (HISTORIC ONLY) Issue date: 16/06/1989 Effective Date: 16-Jun-1989 Revocation Date: 20/12/2012
6	411	NW	496170 106750	Address: PENCIL ROUGH, FONTWELL, WEST SUSSEX Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: N02647 Permit Version: 1 Receiving Water: FRESHWATER RIVER Status: LAPSED UNDER SCHEDULE 23 ENVIRONMENT ACT 1995 Issue date: 02/04/1984 Effective Date: 02-Apr-1984 Revocation Date: 31/03/1997

2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

Database searched and no data found.

2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

0

Database searched and no data found.

2.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site:

0

Database searched and no data found.

2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

2

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
1A	8	NE	496542.0 106168.0	Incident Date: 16-Dec-2001 Incident Identification: 48396.0 Pollutant: Sewage Materials Pollutant Description: Crude Sewage	Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
2A	8	NE	496542.0 106168.0	Incident Date: 16-Dec-2001 Incident Identification: 48396.0 Pollutant: Sewage Materials Pollutant Description: Crude Sewage	Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)

2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

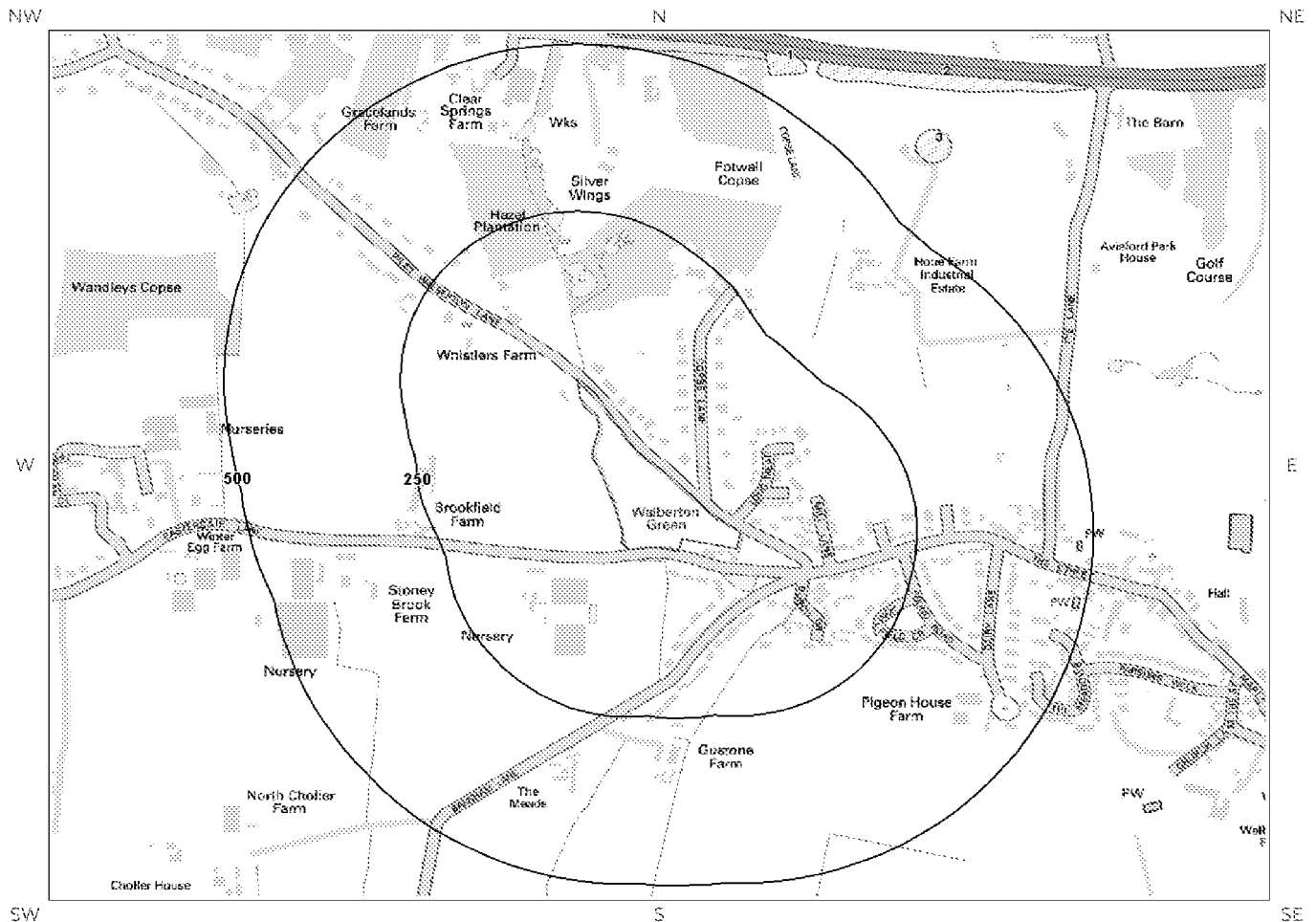
Database searched and no data found.

2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

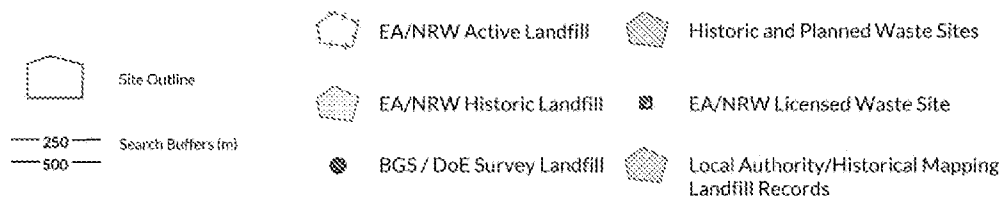
Records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site 0

Database searched and no data found.

3. Landfill and Other Waste Sites Map



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3. Landfill and Other Waste Sites

3.1 Landfill Sites

3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

0

Database searched and no data found.

3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

7

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details
1	530	NE		Site Address: Days, Fontwell, Sussex Waste Licence: Yes Site Reference: WD27/110, WA/10/87 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 27-Apr-1988 Licence Surrendered: 30-Sep-1988 Licence Holder Address: - Operator: - Licence Holder: Wyatt of Snetterton Limited First Recorded: 03-May-1988 Last Recorded: 15-Jul-1988
2	569	NE		Site Address: Days, Fontwell, Sussex Waste Licence: Yes Site Reference: WD27/110, WA/10/87 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 27-Apr-1988 Licence Surrendered: 30-Sep-1988 Licence Holder Address: - Operator: - Licence Holder: Wyatt of Snetterton Limited First Recorded: 03-May-1988 Last Recorded: 15-Jul-1988
3	580	NE		Site Address: Hooe Farm, Tye Lane, Walberton, Sussex Waste Licence: Yes Site Reference: WD27/223 Waste Type: Inert, Commercial, Household Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 01-Jan-1976 Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: 31-Dec-1955 Last Recorded: 31-Dec-1960
Not shown	952	NE		Site Address: Woodlands Farm, Slindon, Sussex Waste Licence: - Site Reference: WD27/192 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: - Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: - Last Recorded: -

ID	Distance (m)	Direction	NGR	Details
Not shown	1132	NE		Site Address: Slindon, Slindon, Sussex Waste Licence: Yes Site Reference: 7-058, WD27/191, WD13/34 Waste Type: Inert, Industrial Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 10-Sep-1985 Licence Surrendered: 05-Sep-1987 Licence Holder Address: - Operator: - Licence Holder: J I Geall First Recorded: 10-Sep-1985 Last Recorded: 20-Oct-1986
Not shown	1156	NE		Site Address: Mill Farm, Mill Road, Slindon, Sussex Waste Licence: Yes Site Reference: WD27/190 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 01-Jan-1976 Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: 31-Dec-1985 Last Recorded: 31-Dec-1985
Not shown	1160	W		Site Address: Eastergate Lane, Eastergate, Sussex Waste Licence: Yes Site Reference: 27-153, WD27/099 Waste Type: Inert, Commercial, Household Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 01-Jan-1976 Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: - First Recorded: 31-Dec-1949 Last Recorded: 31-Dec-1963

3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

0

Database searched and no data found.

3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

0

Database searched and no data found.

3.2 Other Waste Sites

3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

0

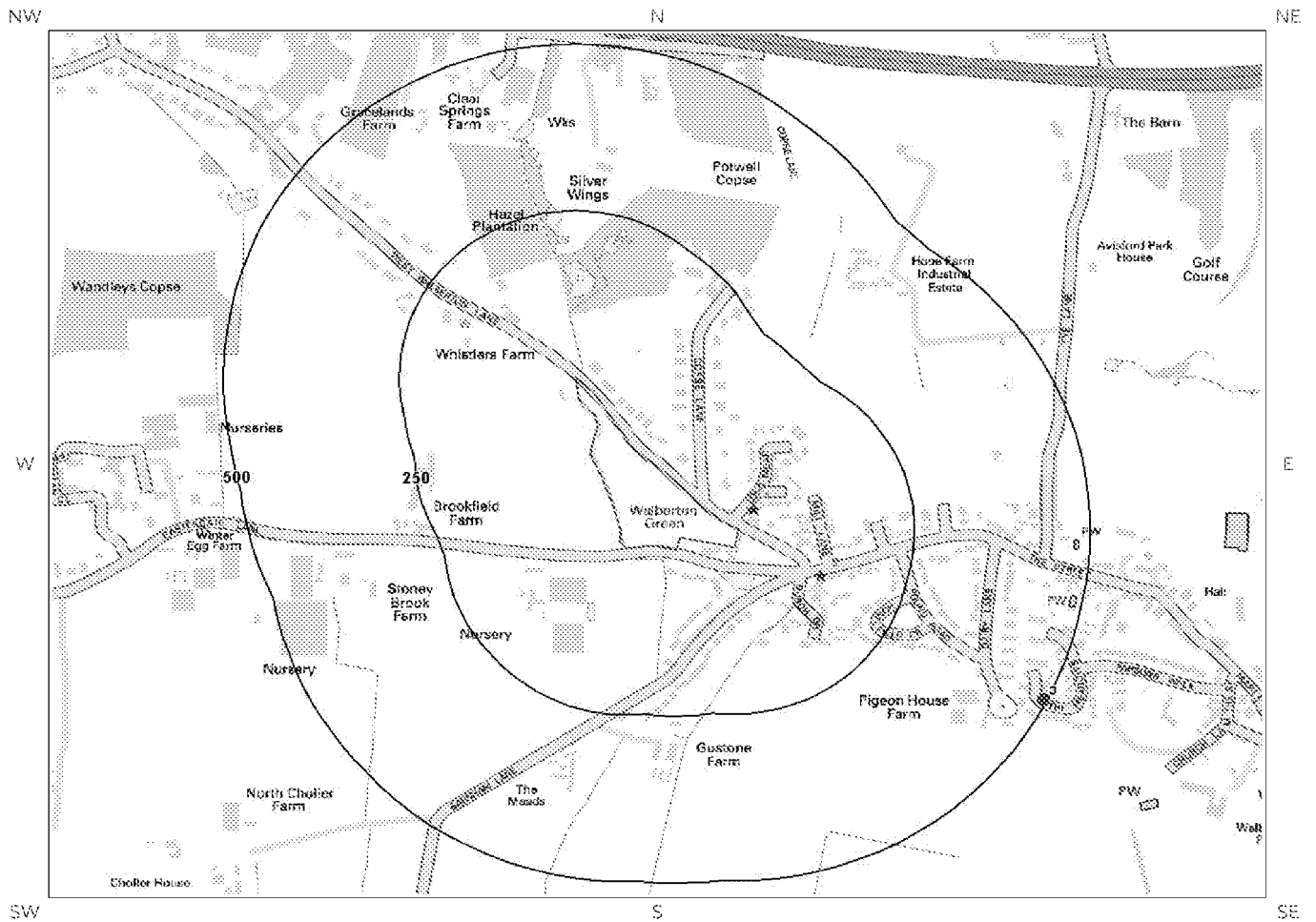
Database searched and no data found.

3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

0

Database searched and no data found.

4. Current Land Use Map



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4. Current Land Uses

4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 2

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	38	NE	Electricity Sub Station	496586 106176	West Sussex, BN18	Electrical Features	Infrastructure and Facilities
2	128	E	Electricity Sub Station	496681 106077	West Sussex, BN18	Electrical Features	Infrastructure and Facilities

4.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: 1

The following petrol or fuel site records provided by Catalist are represented as points on the Current Land Use map:

ID	Distance (m)	Direction	NGR	Company	Address	LPG	Status
3	495	SE	496999 105890	OBSOLETE	The Street, Walberton, Arundel, West Sussex, BN18 0PG	Not Applicable	Obsolete

4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site: 0

Database searched and no data found.

4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site: 0

Database searched and no data found.

5. Geology

5.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

5.2 Superficial Ground and Drift Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
RTDU-XSZC	RIVER TERRACE DEPOSITS (UNDIFFERENTIATED)	SAND, SILT AND CLAY
RBD1-XSV	RAISED BEACH DEPOSITS, 1	SAND AND GRAVEL
HEAD-XVSZC	HEAD	GRAVEL, SAND, SILT AND CLAY

5.3 Bedrock and Solid Geology

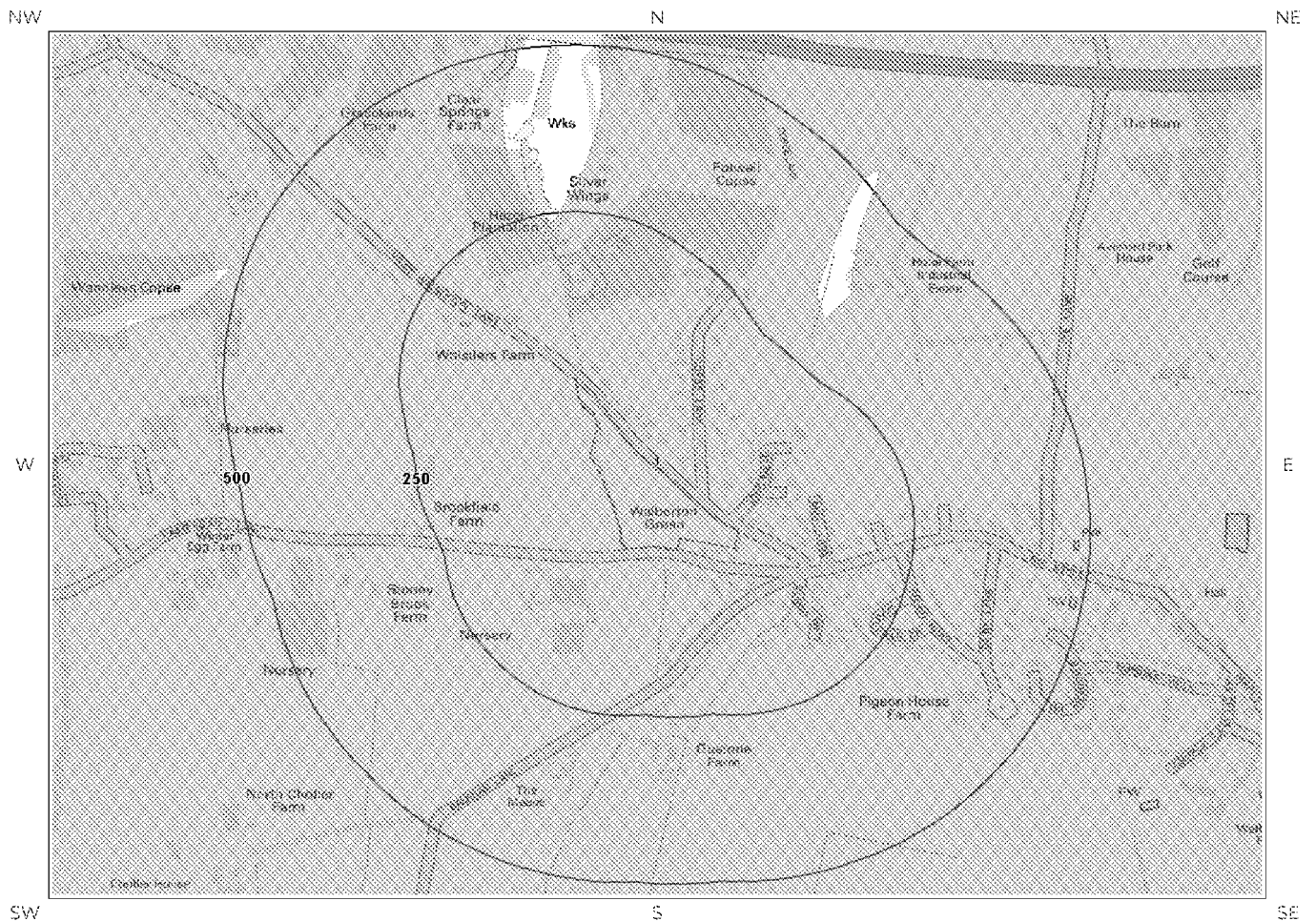
The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
LMBE-XCZS	LAMBETH GROUP	CLAY, SILT AND SAND
LC-XCZS	LONDON CLAY FORMATION	CLAY, SILT AND SAND

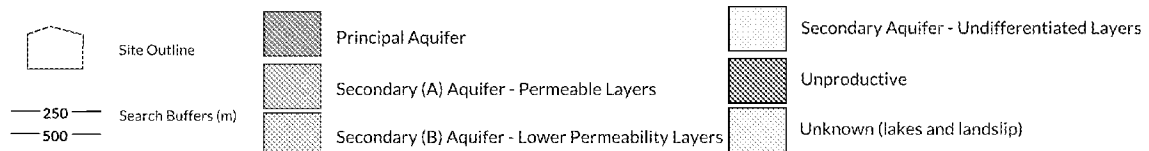
(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

6 Hydrogeology and Hydrology

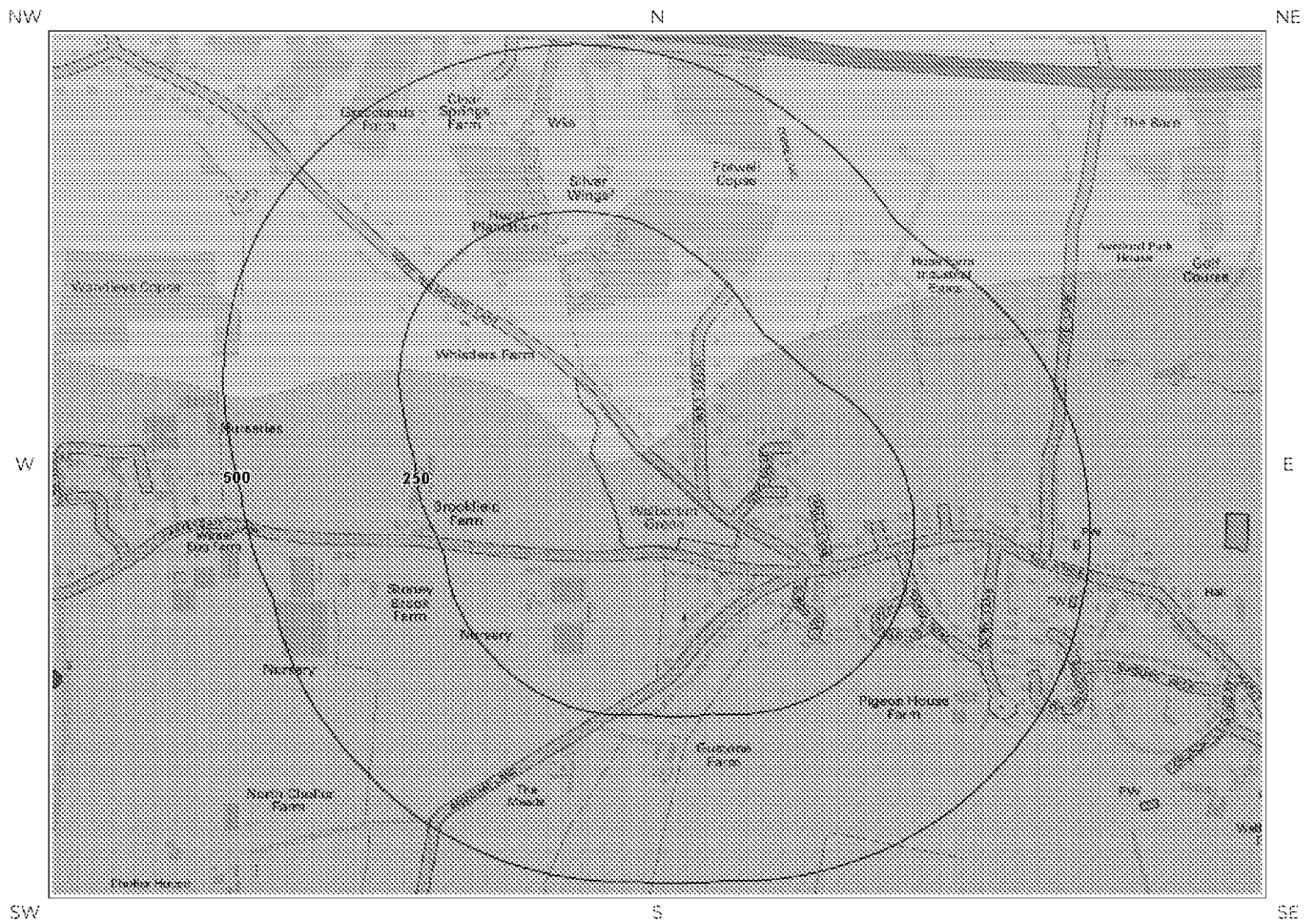
6a. Aquifer Within Superficial Geology



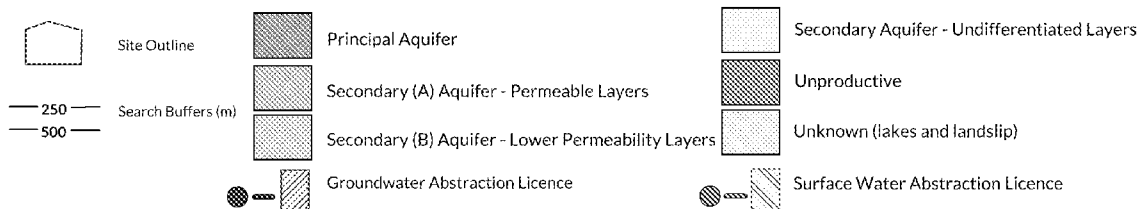
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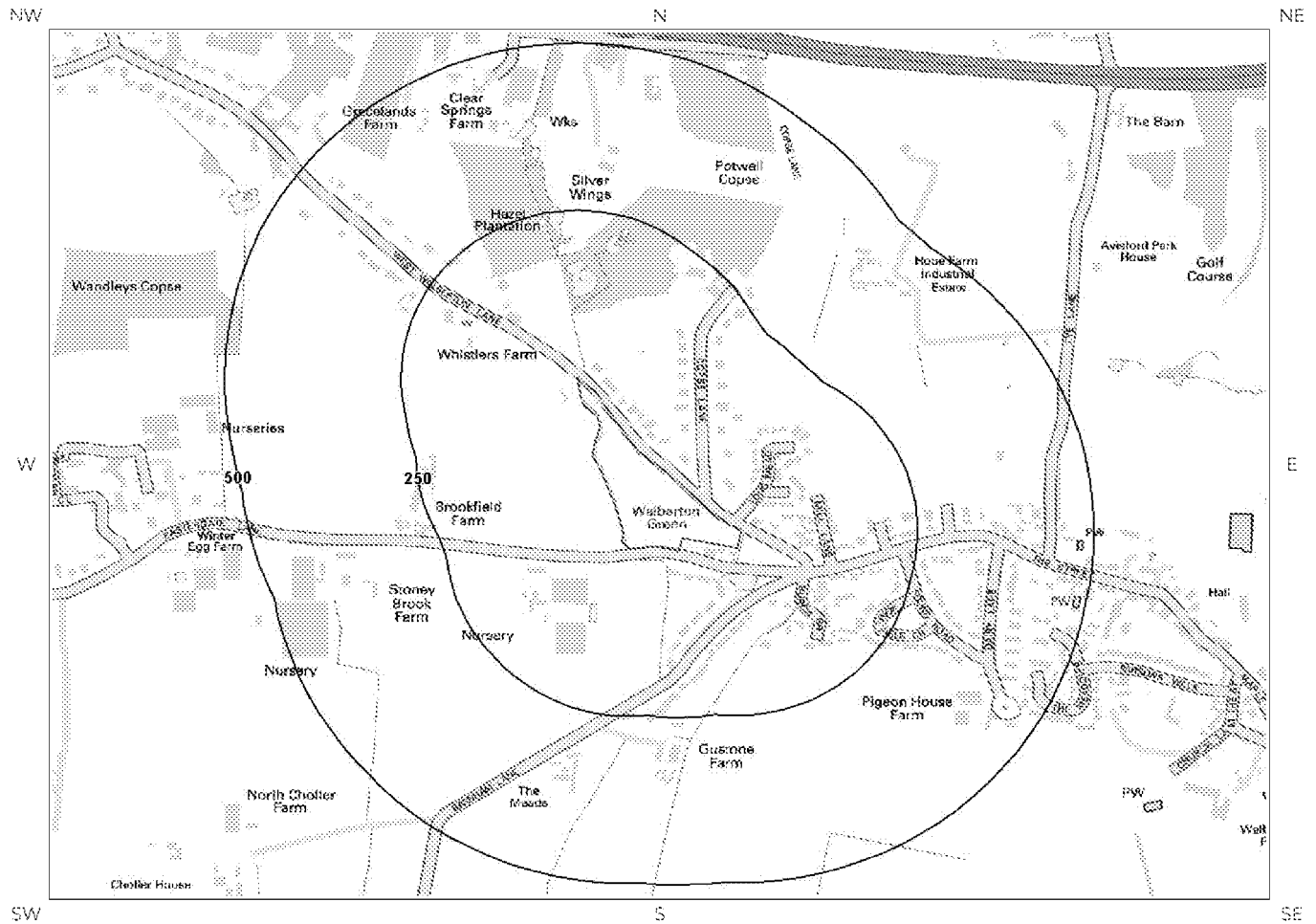
6b. Aquifer Within Bedrock Geology and Abstraction Licences



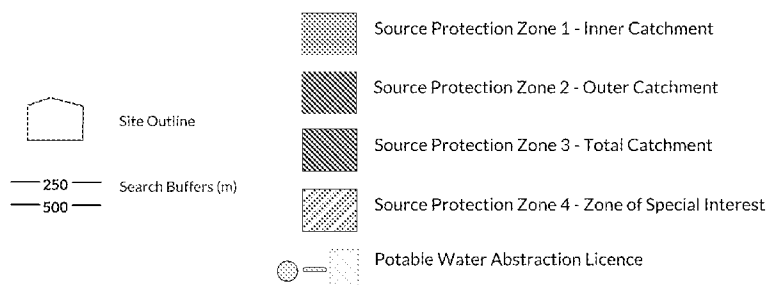
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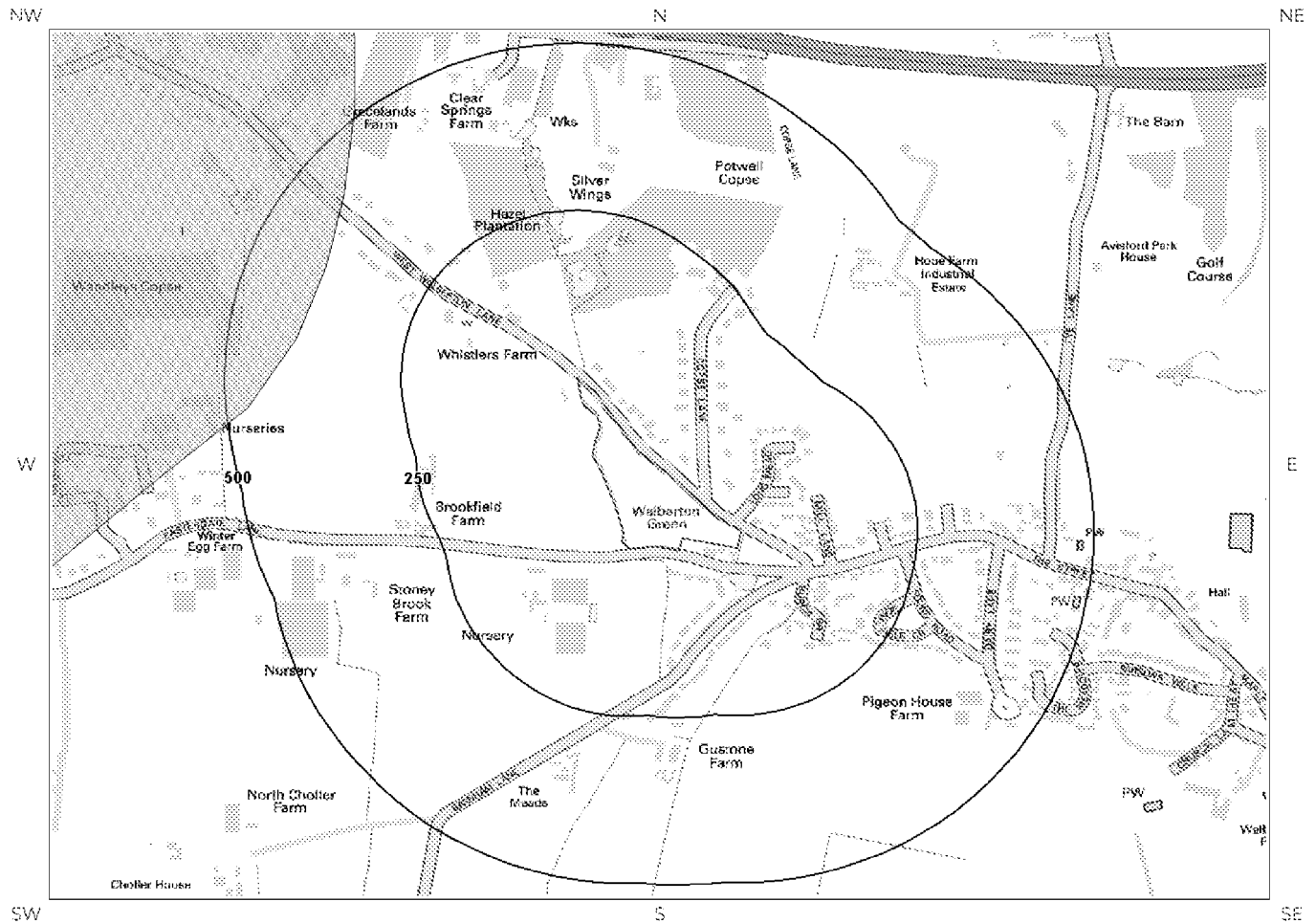
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licences



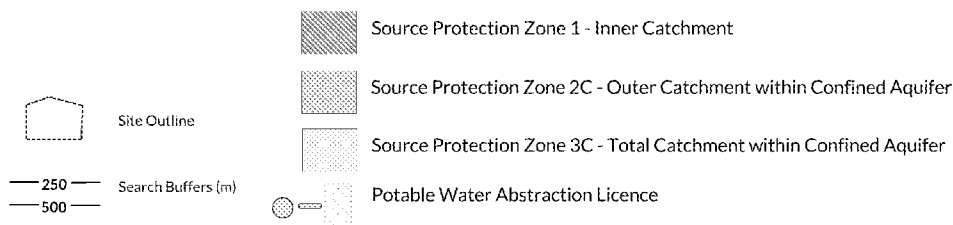
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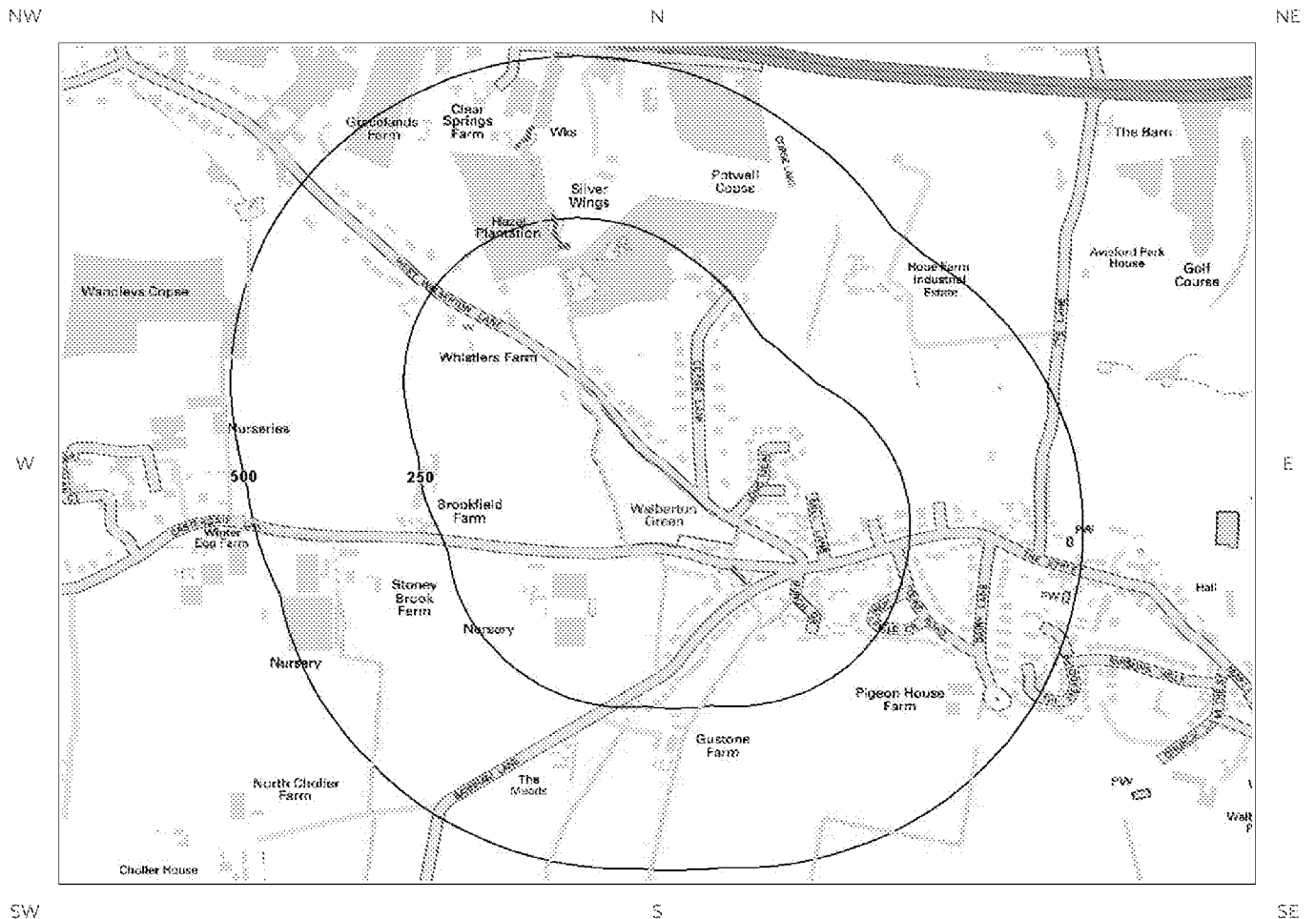
6d. Hydrogeology – Source Protection Zones within confined aquifer



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6e. Hydrology – Watercourse Network and River Quality



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Watercourse type		Watercourse level	
	Tidal River		On ground surface
	Inland River		Underground or Elevated
	Canal		Level unknown
	Lock or Flight of Locks		General Quality Assessment: Biology
	Lake, Reservoir, or Marsh		General Quality Assessment: Chemistry
	Foreshore		
	Drain or Transfer		

6. Hydrogeology and Hydrology

6.1 Aquifer within Superficial Deposits

Records of strata classification within the superficial geology at or in proximity to the property Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

6.2 Aquifer within Bedrock Deposits

Records of strata classification within the bedrock geology at or in proximity to the property Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	Designation	Description
3	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
4	0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

6.3 Groundwater Abstraction Licences

Groundwater Abstraction Licences within 2000m of the study site

Identified

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details
5	833	W	495590 105920	Status: Active Licence No: 10/41/542211 Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A AT STONEYFIELDS NURSERIES, EASTERGATE LANE, WALBERTON Data Type: Point Name: Fuente Annual Volume (m³): 9,092 Max Daily Volume (m³): 102 Original Application No: - Original Start Date: 03/01/1978 Expiry Date: - Issue No: 101 Version Start Date: 31/03/2016 Version End Date:
Not shown	945	NE	496840 107170	Status: Historical Licence No: 10/41/542212 Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A AT WOODLANDS FARM, SLINDON Data Type: Point Name: Wyatt & Son Annual Volume (m³): 22,730 Max Daily Volume (m³): 2,909 Original Application No: - Original Start Date: - Expiry Date: - Issue No: 101 Version Start Date: 10/06/2009 Version End Date:
Not shown	975	S	496740 105160	Status: Active Licence No: 10/41/542209 Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: AT LAKE LANE, BARNHAM Data Type: Point Name: Toddington Nurseries Limited Annual Volume (m³): 36,368 Max Daily Volume (m³): 682 Original Application No: - Original Start Date: 11/11/1966 Expiry Date: - Issue No: 102 Version Start Date: 09/09/2013 Version End Date:
Not shown	1431	SE	497640 105180	Status: Historical Licence No: 27/194A Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A AT WALBERTON NURSERIES, WALBERTON Data Type: Point Name: Walberton Nursery LLP Annual Volume (m³): 42,000 Max Daily Volume (m³): 288 Original Application No: - Original Start Date: 10/10/2005 Expiry Date: 31/03/2016 Issue No: 2 Version Start Date: 17/04/2014 Version End Date:
Not shown	1431	SE	497640 105180	Status: Historical Licence No: 27/194 Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A AT WALBERTON NURSERIES, WALBERTON Data Type: Point Name: D Tristram T/A Walberton Nurseries Annual Volume (m³): 42,000 Max Daily Volume (m³): 288 Original Application No: - Original Start Date: - Expiry Date: 01/04/2008 Issue No: 100 Version Start Date: 02/04/1998 Version End Date:
Not shown	1431	SE	497640 105180	Status: Active Licence No: 27/194A/R01 Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A AT WALBERTON NURSERIES, WALBERTON Data Type: Point Name: Walberton Nursery LLP Annual Volume (m³): 42,000 Max Daily Volume (m³): 288 Original Application No: - Original Start Date: 01/04/2016 Expiry Date: 31/03/2028 Issue No: 1 Version Start Date: 01/04/2016 Version End Date:

ID	Distance (m)	Direction	NGR	Details
Not shown	1531	W	494807 106492	Status: Active Licence No: 10/41/542108 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: POINT A EASTERGATE PUMPING STATION Data Type: Point Name: Portsmouth Water Ltd Annual Volume (m³): 10,357,800 Max Daily Volume (m³): 41,000 Original Application No: - Original Start Date: 31/03/1974 Expiry Date: - Issue No: 103 Version Start Date: 01/04/2016 Version End Date:
Not shown	1538	W	494800 106500	Status: Historical Licence No: 10/41/542108 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: POINT A EASTERGATE PUMPING STATION Data Type: Point Name: Portsmouth Water Ltd Annual Volume (m³): 10,357,800 Max Daily Volume (m³): 41,000 Original Application No: - Original Start Date: 31/03/1974 Expiry Date: - Issue No: 102 Version Start Date: 10/06/2009 Version End Date:
Not shown	1556	SE	497610 104970	Status: Active Licence No: 10/41/412006 Details: Horticultural Watering Direct Source: Southern Region Groundwater Point: TODHURST BARN, YAPTON LANE, WALBERTON Data Type: Point Name: Walberton Nursery LLP Annual Volume (m³): 4,546 Max Daily Volume (m³): 91 Original Application No: - Original Start Date: 11/03/1966 Expiry Date: - Issue No: 101 Version Start Date: 24/01/2014 Version End Date:
Not shown	1558	S	496740 104570	Status: Active Licence No: 10/41/542208 Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A, LAKE LANE, BARNHAM Data Type: Point Name: Eric Wall Holdings Ltd Annual Volume (m³): 100,000 Max Daily Volume (m³): 545 Original Application No: - Original Start Date: 17/03/1966 Expiry Date: - Issue No: 100 Version Start Date: 10/06/2009 Version End Date:
Not shown	1634	S	497110 104580	Status: Active Licence No: 10/41/542208 Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT B, LAKE LANE, BARNHAM Data Type: Point Name: Eric Wall Holdings Ltd Annual Volume (m³): 100,000 Max Daily Volume (m³): 545 Original Application No: - Original Start Date: 17/03/1966 Expiry Date: - Issue No: 100 Version Start Date: 10/06/2009 Version End Date:
Not shown	1687	N	496510 108050	Status: Active Licence No: 10/41/542210 Details: Spray Irrigation - Direct Direct Source: Southern Region Groundwater Point: POINT A AT GASTON FARM, SLINDON Data Type: Point Name: Sercombe Annual Volume (m³): 13,638 Max Daily Volume (m³): 273 Original Application No: - Original Start Date: 16/05/1977 Expiry Date: - Issue No: 100 Version Start Date: 16/04/2019 Version End Date:

6.4 Surface Water Abstraction Licences

Surface Water Abstraction Licences within 2000m of the study site

Identified

The following Surface Water Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details
Not shown	1820	SE	497700 104700	Status: Active Licence No: 27/176 Annual Volume (m³): 20,000 Max Daily Volume (m³): 214

ID	Distance (m)	Direction	NGR	Details
				Details: Spray Irrigation - Spray Irrigation Definition Order Direct Source: Southern Region Surface Waters Point: TODHURST RIFE AT STAR NURSERIES, BARNHAM Data Type: Point Name: Fleurie Nursery Limited Application No: - Original Start Date: 11/02/1993 Expiry Date: - Issue No: 102 Version Start Date: 25/06/2019 Version End Date:
Not shown	1933	SE	497730 104580	Status: Historical Licence No: 10/41/412002 Details: Spray Irrigation - Direct Direct Source: Southern Region Surface Waters Point: TODHURST RIFE AT YAPTON LANE, WALBERTON Data Type: Line Name: Fresh Acres Nurseries Ltd Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: - Expiry Date: - Issue No: 100 Version Start Date: 29/06/1998 Version End Date:

6.5 Potable Water Abstraction Licences

Potable Water Abstraction Licences within 2000m of the study site Identified

The following Potable Water Abstraction Licences records are represented as points, lines and regions on the SPZ and Potable Water Abstraction Licences Map (6c):

ID	Distance (m)	Direction	NGR	Details
Not shown	1531	W	494807 106492	Status: Active Licence No: 10/41/542108 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: POINT A EASTERGATE PUMPING STATION Data Type: Point Name: Portsmouth Water Ltd Annual Volume (m³): 10,357,800 Max Daily Volume (m³): 41,000 Original Application No: - Original Start Date: 31/03/1974 Expiry Date: - Issue No: 103 Version Start Date: - Version End Date:
Not shown	1538	W	494800 106500	Status: Historical Licence No: 10/41/542108 Details: Potable Water Supply - Direct Direct Source: Southern Region Groundwater Point: POINT A EASTERGATE PUMPING STATION Data Type: Point Name: Portsmouth Water Ltd Annual Volume (m³): 10,357,800 Max Daily Volume (m³): 41,000 Original Application No: - Original Start Date: 31/03/1974 Expiry Date: - Issue No: 102 Version Start Date: - Version End Date:

6.6 Source Protection Zones

Source Protection Zones within 500m of the study site None identified

Database searched and no data found.

6.7 Source Protection Zones within Confined Aquifer

Source Protection Zones within the Confined Aquifer within 500m of the study site

Identified

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

The following Source Protection Zones records are represented on the SPZ within Confined Aquifer and Potable Water Abstraction Map(6d):

ID	Distance	Direction	Type	Description
1	392	W	2c	Outer catchment within confined aquifer

6.8 Groundwater Vulnerability and Soil Leaching Potential

Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site

Identified

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	Minor Aquifer/Intermediate Leaching Potential	I1	Soils which can possibly transmit a wide range of pollutants.
0	On Site	Minor Aquifer/High Leaching Potential	H1	Soils which readily transmit liquid discharges because they are shallow or susceptible to rapid flow directly to rock, gravel or groundwater.
331	N	Minor Aquifer/Low Leaching Potential	L	Soils in which pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants.
452	NW	Minor Aquifer/Intermediate Leaching Potential	I1	Soils which can possibly transmit a wide range of pollutants.

6.9 River Quality

Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site

None identified

6.9.1 Biological Quality:

Database searched and no data found.

6.9.2 Chemical Quality:

Database searched and no data found.

6.10 Ordnance Survey MasterMap Water Network

Ordnance Survey MasterMap Water Network entries within 500m of the study site

This watercourse information is provided by Ordnance Survey MasterMap Water Network. The data provides a detailed centre line following the curve of the waterway precisely, so all distances provided in the report should be understood as measurements to the centreline rather than a measurement to the nearest point of the watercourse. Underground watercourses are inferred from entry and exit points so caution is advised in using these to indicate precise locations of underground watercourses when planning site investigation and development.

The following Ordnance Survey MasterMap Water Network records are represented on the Hydrology Map (6e):

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
1	0 On Site	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
2	0 On Site	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
12	0 On Site	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
13	0 On Site	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
3	3 E	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
4	3 E	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
14	3 E	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
15	3 E	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions)

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
				conditions) Average Width in Watercourse Section (m): Not Provided
5	21 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
16	21 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
6	24 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
17	24 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Underground Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
7	33 S	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 14.0
18	33 S	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 14.0
8	65 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
19	65 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
9	83 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
20	83 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
10	100 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
11	100 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
21	100 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
22	100 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
12	119 SE	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.1
23	119 SE	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.1
13	131 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
24	131 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
14	145 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
25	145 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
15	182 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
26	182 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
16	184 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
17	184 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
27	184	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
	N			Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
28	184 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
18	186 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 4.3
29	186 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 4.3
19	189 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
20	189 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
30	189 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
31	189 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
21	199 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
32	199 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
22	204 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.4
33	204 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.4
23	206 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions)

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
				Average Width in Watercourse Section (m): 4.1
34	206 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 4.1
24	208 N	-- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 10.0
35	208 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 10.0
25	259 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
36	259 N	-- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
26	277 S	-- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	277 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
27	281 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	281 S	-- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
28	282 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	282 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
29	289 NE	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
40	289 NE	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
30	305 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.9
Not shown	305 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.9
31	326 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 3.6
32	326 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 5.1
Not shown	326 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 3.6
Not shown	326 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 5.1
33	350 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	350 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
34	356 NE	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
45	356 NE	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
35	370 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 8.9
36	370	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
	N			Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	370 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 8.9
Not shown	370 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
37	373 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 13.3
Not shown	373 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 13.3
38	374 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 8.0
Not shown	374 N	- Alternative Name: -	Lake, loch or reservoir.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 8.0
39	396 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
40	396 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
50	396 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
51	396 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: Not provided Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
41	397 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
42	397 SW	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions)

ID	Distance/ Direction	Name	Type of Watercourse	Additional Details
				Average Width in Watercourse Section (m): Not Provided
Not shown	397 N	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
53	397 SW	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
43	400 NE	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
54	400 NE	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
44	424 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.8
55	424 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): 2.8
45	443 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	443 S	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
46	488 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
47	488 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	488 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided
Not shown	488 W	- Alternative Name: -	Inland river not influenced by normal tidal action.	Catchment Area: West Streams Relationship to Ground Level: On ground surface Permanence: Watercourse contains water year round (in normal conditions) Average Width in Watercourse Section (m): Not Provided

6.11 Surface Water Features

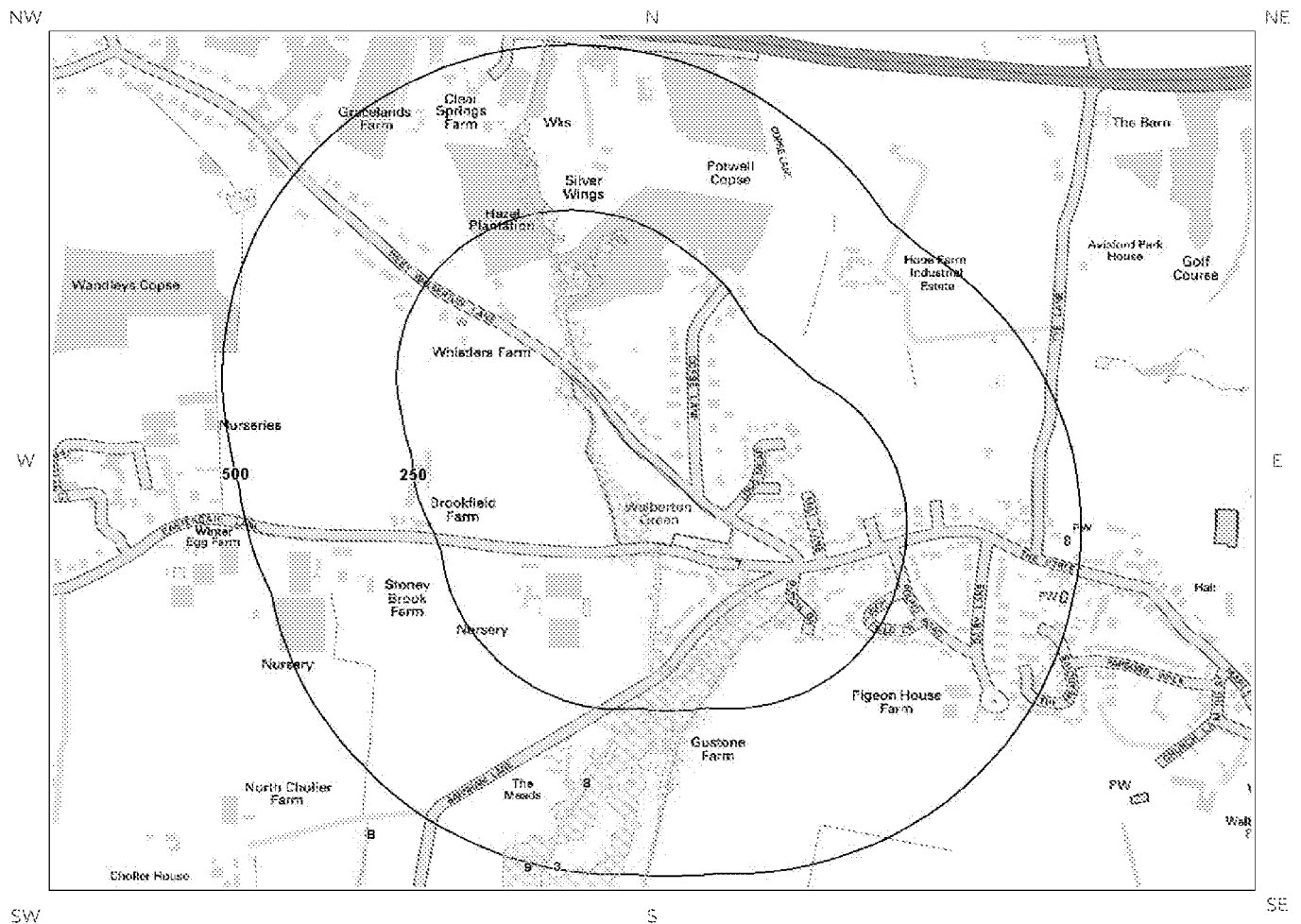
Surface water features within 250m of the study site

Identified

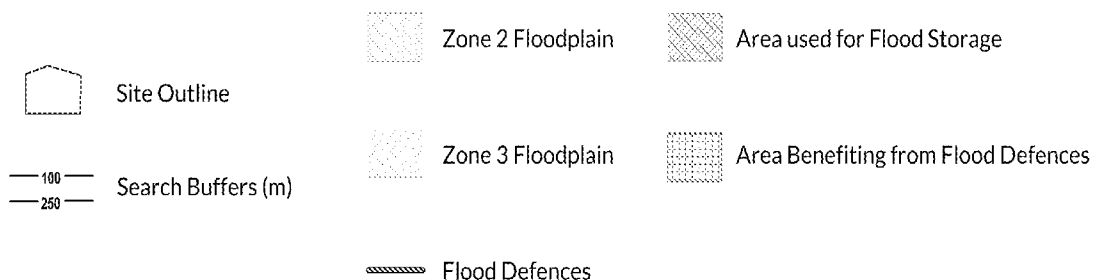
The following surface water records are not represented on mapping:

Distance (m)	Direction
0	On Site
3	E
7	NE
11	S
32	S
121	N
131	S
184	N
184	N
189	N
189	N
193	N
208	N
216	N

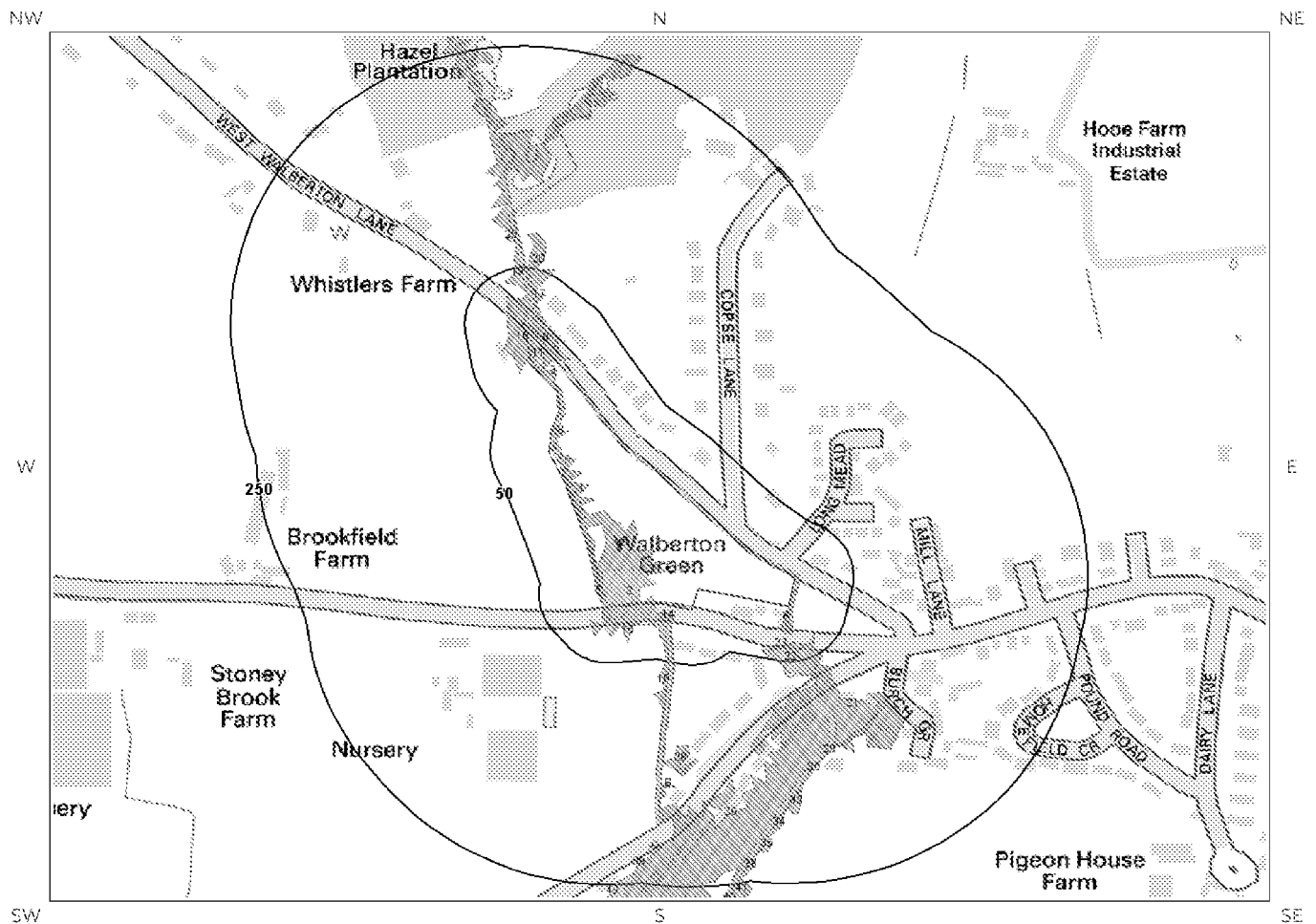
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)



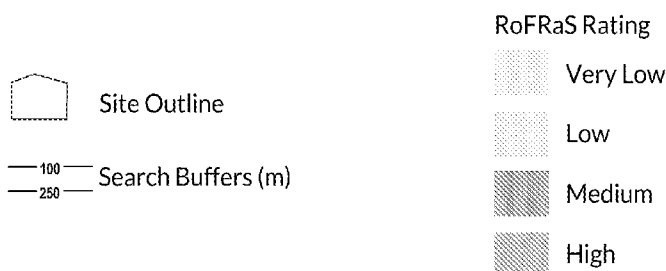
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7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



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7 Flooding

7.1 River and Coastal Zone 2 Flooding

Environment Agency/Natural Resources Wales Zone 2 floodplain within 250m Identified

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

ID	Distance (m)	Direction	Update	Type
1	0	On Site	19-Nov-2019	Zone 2 - (Fluvial /Tidal Models)
2A	0	On Site	19-Nov-2019	Zone 2 - (Fluvial /Tidal Models)

7.2 River and Coastal Zone 3 Flooding

Environment Agency/Natural Resources Wales Zone 3 floodplain within 250m Identified

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

ID	Distance (m)	Direction	Update	Type
1	0	On Site	19-Nov-2019	Zone 3 - (Fluvial Models)
2A	0	On Site	19-Nov-2019	Zone 3 - (Fluvial Models)
	33	S	19-Nov-2019	Zone 3 - (Fluvial Models)

7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

Highest risk of flooding onsite

High

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a High (1 in 30 or greater) chance of flooding in any given year.

Any relevant data within 250m is represented on the RoFRaS Flood map. Data to 50m is reported in the table below.

ID	Distance (m)	Direction	RoFRaS flood Risk
1	0.0	On Site	Medium
2	0.0	On Site	High
3	0.0	On Site	Medium
4	0.0	On Site	Medium
5	0.0	On Site	Medium
6	0.0	On Site	Medium
7	0.0	On Site	High
8	0.0	On Site	Medium
9	0.0	On Site	Medium
10	0.0	On Site	Medium
11	0.0	On Site	High
12	0.0	NE	High
13A	0.0	SE	Medium
14	4.0	S	Medium
15A	10.0	S	Medium
16	20.0	S	Medium
17	21.0	NE	Medium
18	22.0	S	Medium
19	30.0	N	Medium
20	30.0	N	Medium
21	32.0	SE	Medium
22	33.0	S	High
23	37.0	S	Medium

7.4 Flood Defences

Flood Defences within 250m of the study site

None identified

Database searched and no data found.

7.5 Areas benefiting from Flood Defences

Areas benefiting from Flood Defences within 250m of the study site	None identified
--	-----------------

7.6 Areas benefiting from Flood Storage

Areas used for Flood Storage within 250m of the study site	None identified
--	-----------------

7.7 Groundwater Flooding Susceptibility Areas

7.7.1 British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site	Identified
--	------------

Clearwater Flooding or Superficial Deposits Flooding	Superficial Deposits Flooding
--	-------------------------------

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

7.7.2 Highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions	Potential at Surface
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Where potential for groundwater flooding to occur at surface is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

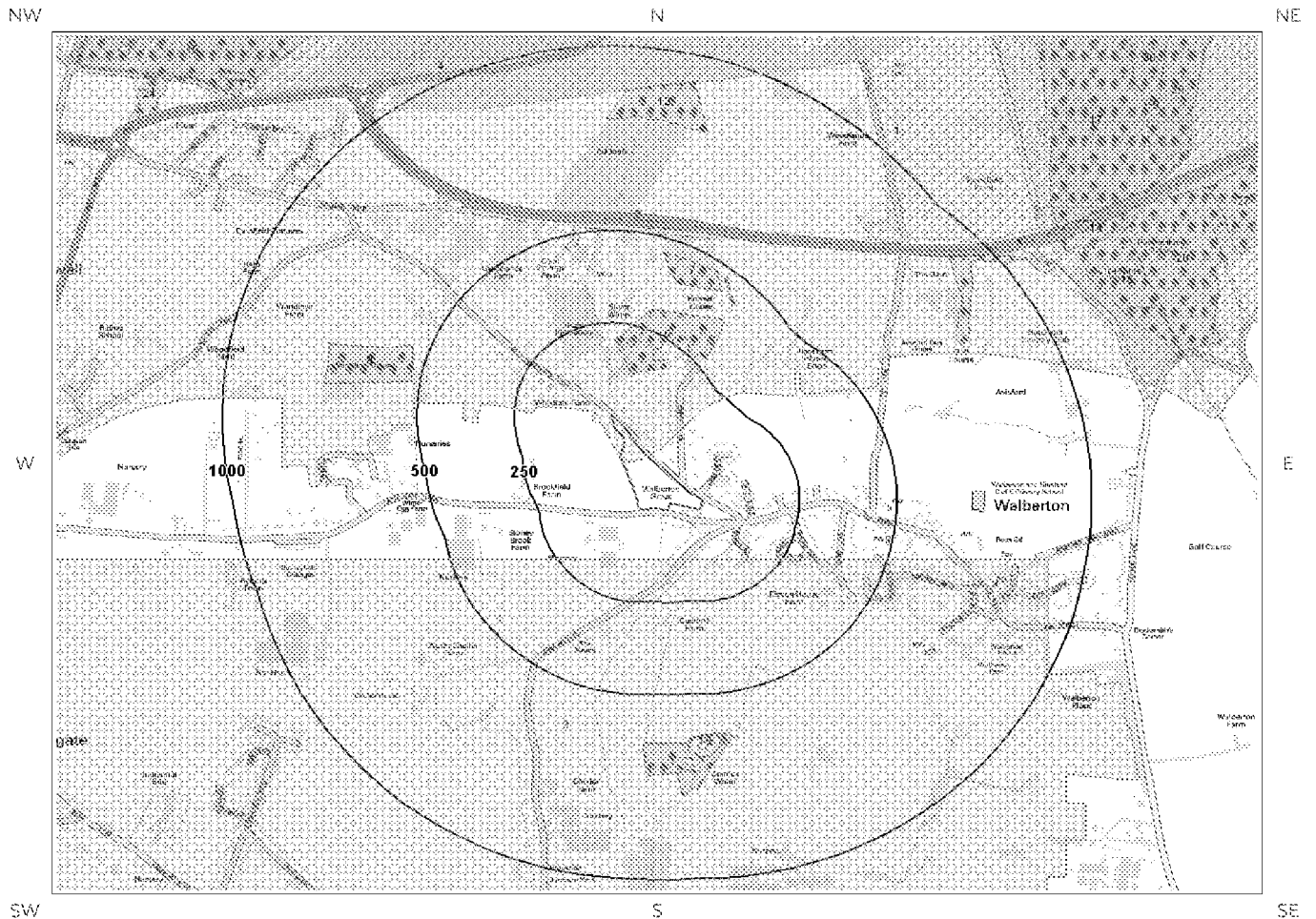
7.8 Groundwater Flooding Confidence Areas

British Geological Survey confidence rating in this result	Moderate
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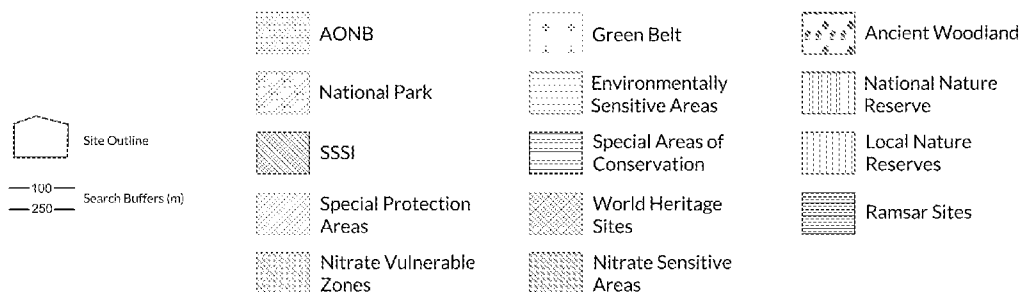
Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

8. Designated Environmentally Sensitive Sites Map



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8. Designated Environmentally Sensitive Sites

Designated Environmentally Sensitive Sites within 2000m of the study site	Identified
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8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

0

Database searched and no data found.

8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

8.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

8.6 Records of Ancient Woodland within 2000m of the study site:

38

The following records of Designated Ancient Woodland provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	Ancient Woodland Name	Data Source
6	122	NE	potwell copse	Ancient & Semi-Natural Woodland
7	395	NE	potwell copse	Ancient & Semi-Natural Woodland
8	522	W	wanley's copse	Ancient & Semi-Natural Woodland
9	607	S	Unknown	Ancient & Semi-Natural Woodland
10	624	S	Unknown	Ancient & Semi-Natural Woodland
11	785	NE	Unknown	Ancient & Semi-Natural Woodland
12	800	N	Unknown	Ancient & Semi-Natural Woodland
Not shown	1076	S	Unknown	Ancient & Semi-Natural Woodland
14	1151	NE	dane's wood, great deans, west stubbs copse	Ancient & Semi-Natural Woodland
15	1159	NE	Unknown	Ancient & Semi-Natural Woodland
Not shown	1166	S	Unknown	Ancient & Semi-Natural Woodland
17	1172	NE	great deans	Ancient & Semi-Natural Woodland
Not shown	1275	NW	slindon wood & common	Ancient & Semi-Natural Woodland
19	1280	NW	slindon wood	Ancient & Semi-Natural Woodland
20	1285	E	hundredhouse copse	Ancient & Semi-Natural Woodland
Not shown	1308	NW	butcher's copse	Ancient & Semi-Natural Woodland
Not shown	1368	N	butcher's copse	Ancient & Semi-Natural Woodland
Not shown	1411	N	butcher's copse	Ancient Replanted Woodland
24	1435	NW	Unknown	Ancient & Semi-Natural Woodland
Not shown	1466	NE	dane's wood, shilbridge wood, upper & lower furze*	Ancient Replanted Woodland
26	1474	NE	goblestubbs copse	Ancient Replanted Woodland
27	1528	NE	high wood	Ancient & Semi-Natural Woodland
28	1534	NW	slindon wood	Ancient Replanted Woodland
Not shown	1558	N	Unknown	Ancient & Semi-Natural Woodland
30	1562	NE	west stubbs copse	Ancient Replanted Woodland
Not shown	1656	N	butchers copse	Ancient & Semi-Natural Woodland
Not shown	1681	NE	Unknown	Ancient & Semi-Natural Woodland
Not shown	1776	NE	great deans	Ancient Replanted Woodland

ID	Distance (m)	Direction	Ancient Woodland Name	Data Source
Not shown	1794	NW	slindon wood	Ancient & Semi-Natural Woodland
Not shown	1795	NE	danesh wood	Ancient Replanted Woodland
Not shown	1839	NE	danesh wood	Ancient Replanted Woodland
Not shown	1888	E	pedlars croft	Ancient & Semi-Natural Woodland
Not shown	1923	NW	slindon wood	Ancient Replanted Woodland
Not shown	1932	E	Unknown	Ancient & Semi-Natural Woodland
Not shown	1939	NE	threecorner copse	Ancient & Semi-Natural Woodland
Not shown	1949	NE	danesh wood	Ancient & Semi-Natural Woodland
Not shown	1962	NE	rewell wood	Ancient Replanted Woodland
Not shown	1973	NE	brickkiln copse	Ancient & Semi-Natural Woodland

8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

0

Database searched and no data found.

8.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

2

The following Environmentally Sensitive Area records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	ESA Name	Data Source
4	982	N	South Downs	Natural England
5	1194	NE	South Downs	Natural England

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

8.11 Records of National Parks (NP) within 2000m of the study site:

1

The following National Park records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	NP Name	Data Source
1	801	NE	South Downs	Natural England

8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

2

The following Nitrate Vulnerable Zone records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	NVZ Name	Data Source
2	0	On Site	Changed	DEFRA
3	132	S	Existing	DEFRA

8.14 Records of Green Belt land within 2000m of the study site:

0

Database searched and no data found.

9. Natural Hazards Findings

9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a Groundsure Geo Insight, available from our [website](#). The following information has been found:

9.1.1 Shrink Swell

Maximum Shrink-Swell** hazard rating identified on the study site Moderate

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.

9.1.2 Landslides

Maximum Landslide* hazard rating identified on the study site Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

9.1.3 Soluble Rocks

Maximum Soluble Rocks* hazard rating identified on the study site Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

* This indicates an automatically generated 50m buffer and site.

9.1.4 Compressible Ground

Maximum Compressible Ground* hazard rating identified on the study site

Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

9.1.5 Collapsible Rocks

Maximum Collapsible Rocks* hazard rating identified on the study site

Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slight possibility for collapsible deposit problems after major changes in loading or groundwater conditions. Normal maintenance to avoid large amounts of water entering the ground through pipe leakage or soak-aways should reduce the likelihood of problems due to collapsible deposits. For new build, assess the possibility of collapsible (loessic) deposits in ground investigation. For existing property, no significant increase in insurance risk from collapsible deposits is likely.

9.1.6 Running Sand

Maximum Running Sand** hazard rating identified on the study site

Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.

* This indicates an automatically generated 50m buffer and site.

9.2 Radon

9.2.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The site is in a Radon Affected Area, as between 1 and 3% of properties are above the Action Level.

The radon data in this report is supplied by the BGS/Public Health England and is the definitive map of Radon Affected Areas in Great Britain and Northern Ireland. The dataset was created using long-term radon measurements in over 479,000 homes across Great Britain and 23,000 homes across Northern Ireland, combined with geological data. The dataset is considered accurate to 50m to allow for the margin of error in geological lines, and the findings of this report supercede any answer given in the less accurate Indicative Atlas of Radon in Great Britain, which simplifies the data to give the highest risk within any given 1km grid square. As such, the radon atlas is considered indicative, whereas the data given in this report is considered definitive.

9.2.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

10. Mining

10.1 Coal Mining

Coal mining areas within 75m of the study site

None identified

Database searched and no data found.

10.2 Non-Coal Mining

Non-Coal Mining areas within 50m of the study site boundary

Identified

The following non-coal mining information is provided by the BGS:

Distance (m)	Direction	Name	Commodity	Assessment of likelihood
0.0	On Site	Not available	Chalk	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered

Past underground mine workings are uncommon, localised and of limited area. The rock types present in this area are such that minor mineral veins may be present within them on which it is possible that there have been attempts to work these by underground methods and/or it is possible that small scale underground extraction of other materials may have occurred. All such occurrences are likely to be restricted in size and infrequent. It should be noted, however, that there is always the possibility of the existence of other sub-surface excavations, such as wells, cess pits, follies, air raid shelters/bunkers and other military structures etc. that could affect surface ground stability but which are outside the scope of this dataset. However, if in a coalfield area you should still consider a Coal Authority mining search for the area of interest.

10.3 Brine Affected Areas

Brine affected areas within 75m of the study site

None identified

Guidance: No Guidance Required.

Contact Details

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info@groundsure.com



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Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 2143
[Redacted]
BGS Geological Hazards enquiries:



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National Customer Contact Centre, PO Box 544
Bathampton, S60 1BY
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Em



Public Health England
Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
[Redacted]



The Coal Authority
200 Lichfield Lane
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Notts NG18 4RG
[Redacted]



Ordnance Survey
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[Redacted]



Local Authority
Authority: Arun District Council
Phone: 01903 737 500
Web: <http://www.arun.gov.uk/>
Address: Maltavers Road, Littlehampton, West Sussex, BN17 5LF

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