Listers Geotechnical Consultants Ltd	Groundsure	GS-5615781
LISTERS GEOTECHNICAL CONSULTANTS LTD, BLAKESLEY ROAD, TOWCESTER, NN12 8QD	Your Reference:	P19_11_010-745
	Report Date	14 Nov 2018
	Report Delivery Method:	Email - pdf

Geo Insight

Address: 29 Broadwater Road, Welwyn Garden City, Hertfordshire, AL7 3BQ

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo 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.

Yours faithfully,

Managing Director Groundsure Limited

Enc. Groundsure Geo Insight

Geo Insight

	Address:	29 Broadwater Road, Welwyn Garden City, Hertfordshire, AL7 3BQ	
	Date:	14 Nov 2018	
	Reference:	GS-5615781	
	Client:	Listers Geotechnical Consultants Ltd	
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SW

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Overview of Findings

The Groundsure Geo Insight provides high quality geo-environmental information that allows geoenvironmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the 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: Geology 1:10,000 Scale

1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?	No
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	No
	1.2.2 Are there any records of landslip within 500m of the study site boundary at 1:10,000 scale?	No
1.3 Bedrock, Solid Geology and linear	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
features	1.3.2 Are there any records of linear features within 500m of the study site boundary at 1:10,000 scale?	No
Section 2: Geolo	gy 1:50,000 Scale	
2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	No
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	No
2.2 Superficial Geology and	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes
Landslips	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	Yes
	2.2.3 Are there any records of landslip within 500m of the study site boundary?	No
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No

Section 2: Geolc	gy 1:50,000 Scale							
2.3 Bedrock, Solid Geology and linear features	2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.							
	2.3.2 Are there any records relating to permo ground within the study site boundary?	eability of bec	drock		Yes			
	2.3.3 Are there any records of linear features study site boundary?	s within 500m	of the		No			
Section 3: Rado	n							
 3. Radon 3.1Is the property in a Radon Affected Are Protection Agency (HPA) and if so what pe above the Action Level? 		Area as defined by the Health The property is not in a t percentage of homes are Area, as less than 1% above the Acti		is not in a Ra than 1% of p e the Action I	don Affected roperties are Level.			
	3.2Radon Protection			No radon	protective me necessary.	easures are		
Section 4: Grour	nd Workings	On-site	0-50m	51-250	251-500	501-1000		
4.1 Historical Surface Scale Mapping	ce Ground Working Features from Small	1	0	5	Not Searched	Not Searched		
4.2 Historical Under	ground Workings from Small Scale Mapping	0	0	0	0	0		
4.3 Current Ground	Workings	0	0	0	0	4		
Section 5: Minin	g, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000		
5.1 Historical Mining	9	0	0	0	0	0		
5.2 Coal Mining		0	0	0	0	0		
5.3 Johnson Poole and Bloomer Mining Area		0	0	0	0	0		
5.4 Non-Coal Mining	j*	1	0	0	0	3		
5.5 Non-Coal Minin	g Cavities	0	0	0	0	0		
5.5 Natural Cavities		1	2	2	4	21		

Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0
Section 6: Natural Ground Subsidence	On-sit	e			
6.1 Shrink-Swell Clay	Low				
6.2 Landslides	Very Lo	W			
6.3 Ground Dissolution of Soluble Rocks	Very Lo	w			
6.4 Compressible Deposits	Negligik	ole			
6.5 Collapsible Deposits	Very Lo	w			
6.5 Running Sand	Very Lo	W			
Section 7: Borehole Records	On-si	te	0-50m	5	1-250
7 BGS Recorded Boreholes	0		0		3
Section 8: Estimated Background Soil Chemistry	On-si	te	0-50m	5	1-250
8 Records of Background Soil Chemistry	2		0		0
Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500	
9.1 Tunnels	0	0	0	Not Searched	1
9.2 Historical Railway and Tunnel Features	0	0	26	Not Searched	1
9.3 Historical Railways	0	0	1	Not Searched	1
9.4 Active Railways	0	0	0	Not Searched	1
9.5 Railway Projects	0	0	0	0	

1:10,000 Scale Availability



Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	No deposits are mapped	No coverage	No coverage	No coverage

Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

Geology	Full Coverage	ull Coverage Partial Coverage	
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage

1 Geology (1:10,000 scale). 1.1 Artificial Ground map (1:10,000 scale)



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1. Geology 1:10,000 scale

1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found.

1.2 Superficial Deposits and Landslips map (1:10,000 scale)



1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found.

1.2.2 Landslip

Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.3 Bedrock and linear features map (1:10,000 scale)



Bedrock and linear features Legend

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1.3 Bedrock and linear features

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

Database searched and no data found at this scale.

1.3.2 Linear features

Are there any records of linear features within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found at this scale.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2 Geology 1:50,000 Scale 2.1 Artificial Ground map



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2. Geology 1:50,000 scale

2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 239

2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary?

No

Database searched and no data found.

2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? No

Database searched and no data found.

2.2 Superficial Deposits and Landslips map (1:50,000 scale)



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2.2 Superficial Deposits and Landslips

2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	LOFT-DMTN	LOWESTOFT FORMATION	DIAMICTON
2	0.0	On Site	KGCA-XSV	KESGRAVE CATCHMENT SUBGROUP	SAND AND GRAVEL

2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? Yes

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	Moderate	Low
0.0	On Site	Intergranular	Very High	High

2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary?

No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary?

No

Database searched and no data found.

2.3 Bedrock and linear features map (1:50,000 scale)



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2.3 Bedrock, Solid Geology & linear features

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 239

2.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	LESE-CHLK	LEWES NODULAR CHALK FORMATION AND SEAFORD CHALK FORMATION (UNDIFFERENTIATED) - CHALK	TURONIAN

2.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site boundary? Yes

Distanc e	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Fracture	Very High	Very High

2.3.3 Linear features

Are there any records of linear features within 500m of the study site boundary?

No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/Solid Geology and linear features such as faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nation wide coverage.

3 Radon Data

3.1 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 property is not in a Radon Affected Area, as less than 1% 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.

3.2 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.

4 Ground Workings map



Ground Workings Legend

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4 Ground Workings

4.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on Groundsure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Use	Date
1	0.0	On Site	524289 212652	Unspecified Pit	1881
2A	90.0	SE	524338 212531	Pond	1951
3A	92.0	SE	524342 212531	Pond	1922
4A	92.0	SE	524342 212531	Pond	1897
5A	92.0	SE	524342 212531	Pond	1938
6	99.0	SE	524335 212510	Pond	1881

4.2 Historical Underground Working Features derived from Historical Mapping

This data is derived from the Groundsure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? No

Database searched and no data found.

4.3 Current Ground Workings

This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary? Yes

The following Current Ground Workings information is provided by British Geological Survey:

ID	Distanc e (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
Not shown	752.0	SW	523862 211947	Clay & Shale	Twentieth Mile Brick Works	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	823.0	NE	525006 213101	Chalk	Attimore Hall Chalk Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	839.0	SW	523756 211907	Clay & Shale	Twentieth Mile Brick Works	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	934.0	SW	523775 211787	Sand & Gravel	Twentieth Mile Gravel Workings	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased

5 Mining, Extraction & Natural Cavities map



5 Mining, Extraction & Natural Cavities

5.1 Historical Mining

This dataset is derived from Groundsure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

5.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary?

No

No

Database searched and no data found.

5.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary?

The following information provided by JPB is not represented on mapping: Database searched and no data found.

5.4 Non-Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary?

Yes

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

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
1	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

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
2	696.0	E	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
3	770.0	NE	Not available	Chalk	Small scale underground mining may have occurred; mine adits, shafts and tunnels may be present. Potential for localised difficult ground conditions are at a level where they should be considered
Not shown	834.0	NW	Not available	Chalk	Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered

5.5 Non-Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary?

No

Database searched and no data found.

5.6 Natural Cavities

This dataset provides information based on the Peter Brett Associates natural cavities database. The dataset is made up of points and polygons. Where polygons are used these represent an area in which it is expected the cavities could be found. It does not indicate that cavities are present everywhere within the polygon, and caution should be used in the interpretation of this data.

Are there any Natural Cavities within 1000m of the study site boundary?

Yes

ID	Distance (m)	Direction	NGR	Superficial Deposits	Bedrock Deposits	Cavity Type and Number
5	0.0	On Site	524240 212660	Glacial Sand & Gravel, Glacial Till and morainic drift	Chalk Group	Sinkhole x 1
6	11.0	SE	524280 212600	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
7	25.0	S	524210 212590	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
8	60.0	Ν	524260 212750	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
9	168.0	Ν	524300 212850	Glacial Till and morainic drift	Chalk Group	Sinkhole x 1
10	279.0	Ν	524320 212960	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
11	336.0	W	523900 212800	Glacial Till and morainic drift	Chalk Group	Sinkhole x 1
12	385.0	W	523840 212770	Glacial Till and morainic drift	Chalk Group	Sinkhole x 1

The following Natural Cavities information provided by Peter Brett Associates:

ID	Distance (m)	Direction	NGR	Superficial Deposits	Bedrock Deposits	Cavity Type and Number
13	406.0	W	523800 212700	Glacial Till and morainic drift	Chalk Group	Solution Pipe x 1
14	508.0	NW	523910 213100	Glacial Till and morainic drift	Chalk Group	Sinkhole x 1
15	536.0	NW	523890 213120	Glacial Till and morainic drift	Chalk Group	Sinkhole x 1
16	556.0	NE	524810 212900	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
17	586.0	NE	524630 213160	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
18	600.0	NE	524830 212960	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
19	622.0	NE	524860 212950	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
20	671.0	NE	524900 212980	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
21	676.0	NE	524920 212950	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
Not shown	684.0	NW	523830 213260	Glacial Till and morainic drift	Chalk Group	Sinkhole x 1
23	688.0	E	524970 212840	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
Not shown	721.0	NE	524660 213300	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
25	738.0	NE	524890 213120	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
26	754.0	E	525000 212960	Kesgrave Catchment Subgroup	Chalk Group	Solution Pipe x 1
27	770.0	NE	525000 213000	Kesgrave Catchment Subgroup	Chalk Group	Solution Pipe x 1
Not shown	841.0	E	525100 212940	Glacial Sand	Chalk Group	Sinkhole x 1
Not shown	895.0	S	524600 211770	Glacial Till and morainic drift, River Terrace Deposits	Chalk Group	Sinkhole x 1
Not shown	910.0	E	525200 212820	Glacial Sand	Chalk Group	Sinkhole x 1
Not shown	947.0	E	525180 213030	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
Not shown	962.0	SE	524770 211780	Glacial Till and morainic drift	Chalk Group	Sinkhole x 1
Not shown	965.0	NE	525020 213320	Glacial Sand & Gravel	Chalk Group	Sinkhole x 1
Not shown	995.0	E	525280 212860	Glacial Sand	Chalk Group	Sinkhole x 1

5.7 Brine Extraction

This data provides information from the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary?

Database searched and no data found.

5.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary?

No

No

Database searched and no data found.

5.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level.

Are there any Tin Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

5.10 Clay Mining

This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

Are there any Clay Mining areas within 1000m of the study site boundary?

No

Database searched and no data found.

6 Natural Ground Subsidence 6.1 Shrink-Swell Clay map



6.2 Landslides map



6.3 Ground Dissolution of Soluble Rocks map



6.4 Compressible Deposits map



6.5 Collapsible Deposits map



6.6 Running Sand map



6 Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site** boundary? Low

6.1 Shrink-Swell Clays

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
2	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. 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 possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

The following Shrink Swell information provided by the British Geological Survey:

6.2 Landslides

The following Landslides information provided by the British Geological Survey:

ID [Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	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.

^{*} This includes an automatically generated 50m buffer zone around the site

6.3 Ground Dissolution of Soluble Rocks

Significant soluble rocks are present. Problems unlikel	Details
surface or subsurface water flow. No special actions r 1 0.0 On Site Very Low due to soluble rocks. No special ground investigatio construction costs are likely. An increase in financial ris with soluble rocks is unlikely	t. Problems unlikely except with considerable No special actions required to avoid problems ground investigation required or increased ease in financial risk due to potential problems ble rocks is unlikely.

The following Ground Dissolution information provided by the British Geological Survey:

6.4 Compressible Deposits

The following Compressible Deposits information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	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.

6.5 Collapsible Deposits

The following Collapsible Rocks information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

6.6 Running Sands

The following Running Sands information provided by the British Geological Survey:

0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
0.0 C	Dn Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
(0.0 (0.0 On Site	0.0 On Site Very Low

7 Borehole Records map



7 Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary:

3

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
1	59.0	W	524140 212630	TL21SW22/B	91.44	ROCHE PRODUCTS LTD BROADWATER ROAD
2	129.0	W	524090 212710	TL21SW211	30.0	FORMER POLYCELL FACTORY BROAD WATER LANE WELWYN GARDEN CITY
3	243.0	SW	524000 212480	TL21SW22/A	91.44	ROCHE PRODUCTS LTD, BROADWATER ROAD

The borehole records are available using the hyperlinks below: Please note that if the donor of the borehole record has requested the information be held as commercial-in-confidence, the additional data will be held separately by the BGS and a formal request must be made for its release.

#1: scans.bgs.ac.uk/sobi_scans/boreholes/533334

#2: scans.bgs.ac.uk/sobi_scans/boreholes/18726905

#3: scans.bgs.ac.uk/sobi_scans/boreholes/533333

8 Estimated Background Soil Chemistry

Records of background estimated soil chemistry within 250m of the study site boundary:

For further information on how this data is calculated and limitations upon its use, please see the Groundsure Geo Insight User Guide, available on request.

Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

2

9 Railways and Tunnels map



9 Railways and Tunnels

9.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary?	No
Have any underground railway lines been identified within 250m of the study site boundary?	No
Database searched and no data found.	
Any records that have been identified are represented on the Railways and Tunnels map.	
This data is derived from Ordeance Current meaning and provides information on the possible location	a of

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary?	No
Have any other railway tunnels been identified within 250m of the site boundary?	No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels map.

9.2 Historical Railway and Tunnel Features

This data is derived from Groundsure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? No

Have any historical railway or tunnel features been identified within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Details	Date
1C	98	NW	524057 212741	Railway Sidings	1946
6A	100	NW	524070 212764	Railway Sidings	1938
7	101	NW	n/a	Railway	1938
2	161	W	523546 211560	Railway Sidings	1959
3	162	W	524063 212794	Railway Sidings	1938
8A	162	W	524010 212755	Railway Sidings	1960

ID	Distance (m)	Direction	NGR	Details	Date
4	164	W	523927 212744	Railway Sidings	1974
9	177	W	n/a	Railway	1938
10B	207	NW	524116 212933	Railway Sidings	1991
11B	207	NW	524116 212933	Railway Sidings	1986
12C	216	W	523995 212708	Railway Sidings	1965
13C	216	W	523995 212708	Railway Sidings	1961
14C	216	W	523995 212708	Railway Sidings	1980
15C	216	W	523995 212712	Railway Sidings	1970
16E	222	SW	523993 212497	Railway Sidings	1970
17F	231	W	523932 212667	Railway Sidings	1970
18D	232	W	523937 212675	Railway Sidings	1965
19D	232	W	523937 212675	Railway Sidings	1980
20D	232	W	523937 212675	Railway Sidings	1961
21E	234	SW	523992 212487	Railway Sidings	1961
5	236	W	523996 213025	Railway Sidings	1988
22F	236	W	523936 212698	Railway Sidings	1991
23F	236	W	523936 212698	Railway Sidings	1986
24	238	NW	524001 212860	Railway Sidings	1991
25	240	NW	524004 212802	Railway Sidings	1986
26D	249	W	523937 212696	Railway Sidings	1993

Any records that have been identified are represented on the Railways and Tunnels map.

9.3 Historical Railways

This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary? No

Have any historical railway lines been identified within 250m of the study site boundary? Yes

Distance (m)	Direction	Status
242	W	Disused

Multiple sections of the same track may be listed in the detail above Any records that have been identified are represented on the Railways and Tunnels map.

9.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway lines been identified within the study site boundary? No

Have any active railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above Any records that have been identified are represented on the Railways and Tunnels map.

9.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail 1.

Is the study site within 5km of the route of the High Speed 2 rail project? No

Is the study site within 500m of the route of the Crossrail 1 rail project?

Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a Groundsure HS2 and Crossrail 1 Report.

The route data has been digitised from publicly available maps by Groundsure. The route as provided relates to the Crossrail 1 project only, and does not include any details of the Crossrail 2 project, as final details of the route for Crossrail 2 are still under consultation.

Please note that this assessment takes account of both the original Phase 2b proposed route and the amended route proposed in 2016. As the Phase 2b route is still under consultation, Groundsure are providing information on both options until the final route is formally confirmed. Practitioners should take account of this uncertainty when advising clients.

No

Contact Details

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British Geological Survey Enquiries

Kingsley Dunham Centre Keyworth, Nottingham NG12 5GG Tel: 0115 936 3143. Fax: 0115 936 3276. Email:**enquiries@bgs.ac.uk** Web:**www.bgs.ac.uk**

BGS Geological Hazards Reports and general geological enquiries

British Gypsum

British Gypsum Ltd East Leake Loughborough Leicestershire LE12 6HX

The Coal Authority

200 Lichfield Lane Mansfield Notts NG18 4RG Tel: 0345 7626 848 DX 716176 Mansfield 5 www.coal.gov.uk

Public Health England

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

https://www.gov.uk/government/organisations/public-health-

england Email: enquiries@phe.gov.uk

Main switchboard: 020 7654 8000

Johnson Poole & Bloomer Limited

Harris and Pearson Building, Brettel Lane Brierley Hill, West Midlands DY5 3LH Tel: +44 (0) 1384 262 000

Email:**enquiries.gs@jpb.co.uk** Website: **www.jpb.co.uk**

Ordnance Survey

Adanac Drive, Southampton SO16 0AS

Tel: 08456 050505 Website: http://www.ordnancesurvey.co.uk/

Getmapping PLC

Virginia Villas, High Street, Hartley Witney, Hampshire RG27 8NW Tel: 01252 845444 Website:**http://www1.getmapping.com/**

Report Reference: GS-5615781 Client Reference: P19_11_010-745

Peter Brett Associates

Caversham Bridge House Waterman Place Reading Berkshire RG1 8DN Tel: +44 (0)118 950 0761 E-mail:**reading@pba.co.uk** Website:**http://www.peterbrett.com/home**

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Client Ref: Report Ref: Grid Ref:	P19_11_010-745 GS-5615782 524252, 212650	
Map Name:	National Grid	Ν
Map date:	1960	
Scale:	1:1,250	
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Map Name:	National Grid	Ν
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Client Ref: Report Ref: Grid Ref:	P19_11_010-745 GS-5615782 524252, 212650	
Map Name:	National Grid	Ν
Map date:	1985-1988	
Scale:	1:1,250	
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Map Name:	National Grid	Ν
Map date:	1986-1991	
Scale:	1:1,250	
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Client Ref: Report Ref: Grid Ref:	P19_11_010-745 GS-5615782 524252, 212650	
Map Name:	National Grid	Ν
Map date:	1993	
Scale:	1:1,250	··· -
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Client Ref: Report Ref: Grid Ref:	P19_11_010-745 GS-5615782 524252, 212650	
Map Name:	County Series	Ν
Map date:	1884	
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Map Name:	County Series	Ν
Map date:	1897	
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Client Ref: Report Ref: Grid Ref:	P19_11_010-745 GS-5615782 524252, 212650	
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